A PRACTICAL TREATISE

ON

ARTIFICIAL CROWN-, BRIDGE-, AND PORCELAIN-WORK

BY

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To

William Carr, M.D., D.D.S.,

in acknowledgment of his professional eminence and his services for dental legislation and its enforcement in the State of New York, this volume is respectfully inscribed by

THE AUTHOR.

PREFACE TO THE SEVENTH EDITION.

In this seventh edition of "Artificial Crown-, Bridge-, and Porcelain-Work" the endeavor has been, as in each of those which preceded it, to better meet the requirements of a practical treatise for college and post-graduate study and as well of a reference book for the practitioner. To effect this in the present state of the art has involved a revision so extensive as to make the present edition almost a new work. Like all books of its kind it is largely a compilation of the regularly accepted methods of practice. Recent innovations inserted as worthy of credit and recognition I have in most cases practically tested. In this I have been guided by an experience of nearly forty years as a general practitioner, the last twenty of which have been specially devoted to Crown- and Bridge-Work, supplemented in the more recent years by Porcelain-Work, in the last named of which I have been assisted by a previous knowledge of the properties and manipulation of porcelain bodies.

The discussion of pathological conditions, surgical operations, and of therapeutic indications, metallurgy, and the mechanical processes involved in the construction of appliances, has been limited to their direct relationship to the work in hand. Dental students and, still more so, practitioners are supposed to be generally informed respecting them, with facilities for ready reference to works specially devoted to those subjects.

The endeavor in this treatise has always been to make the text comprehensive without bulkiness, concise without the sacrifice of clearness to brevity of statement, and to avoid repetition except where it conduced to better understanding. Methods which permit the attainment of the desired results without the devitalization of pulps, and with the least mutilation of teeth, and the least exposure of metal, are given prominence. So also, in cases where practicable, constructions are advocated which permit the work to be removed and replaced by the patient, or when cemented to place, by the dentist.

Acknowledgment is made generally throughout the text to those who have been identified with or prominent in advocating or introducing methods of procedure which are novel or which tend to facilitate the performance of better operations in a practical way.

GEORGE EVANS.

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INTRODUCTION TO FIRST EDITION.

Of the origin of the art of dentistry no one can speak with certainty, as its early history is shrouded in the mists of antiquity; but dental operations are recorded in very remote times.

References are made to the art in the writings of Hippocrates, in the fifth century B.C. Martial, the Latin poet, in the first century B.C., says that a Roman dentist "Cascellius is in the habit of fastening as well as extracting the teeth." To Lelius he says, "You are not ashamed to purchase teeth and hair;" and adds that "the toothless mouth of Egle was repaired with bone and ivory;" also, that "Galla, more refined, removed her artificial teeth during the night."

Horace, in the same century, cites the case of the "sorceresses Canidia and Sagana running through the city and losing the one her false hair, the other her false teeth."

Galen, the celebrated physician, in the second century A.D., also speaks of the art of dentistry as being then practiced.

These early operations were limited to the extraction of offending teeth and the replacement of those which had been lost with substitutes which were retained in position by means of narrow bands or ligatures attaching them to the adjoining natural teeth, and without the use of plates. Crude as they were, they formed the first expression of the art of dentistry, a beneficent art from the beginning, in that it sought to remedy pathological or accidental defects. Confined to the simplest operations, it existed for centuries, and then was apparently lost during the Dark Ages, to reappear when the more general diffusion of knowledge ushered in the modern era of science and invention.

After its revival, dentistry, so much of it as was known, was in a measure a secret art, the practice of which even within the memory of men now living, was involved in mystery; but recent progress has lifted the veil, and dentistry, in the treatment of the teeth on correct, scientific, rational principles, has developed an art and a science which have given it honorable rank among the professions. In its twofold evolution it has absorbed from every available source whatever would broaden its science or perfect its art. It calls to its aid anatomy, physiology, pathology, chemistry, therapeutics, metallurgy, sculpture, and mechanics, with each of which it stands in closer or more remote relation; and the practitioners of dentistry who have become the most eminent and useful have been men of broad attainments and great versatility of talent.

In the history of all progress, movements apparently of a more or less reactionary character are recorded. In the useful arts especially it is not uncommon to find a return to forms and methods formerly used, but long since discarded and forgotten. So in dentistry we find methods of treatment and modes of practice once in vogue but long fallen into disuse, revived with improvements and modifications that stamp them as practically rediscoveries.

These movements are not to be regarded as retrogressive, because the modifications which accompany the reintroduction of practical ideas and inventions attest them as real advances, and indicate clearly that the cycle of knowledge is ever widening with experience. This volume demonstrates how modern dentistry has utilized the principles of some of the simplest original operations, and by "proving all things, holding fast that which is good," has attained its present honorable position in both its scientific and artistic departments.

The history of dentistry of later years is, in brief, a recital of progress and improvement. The medical profession has officially recognized it as closely allied to medicine by inviting its representatives to take part in the International Medical Congresses on the footing of professional equality.

Such is the position which dentistry has attained. Much of the progress which has made its present elevation possible must be credited to the dental profession of the United States, which has been justly termed the cradle of modern dentistry. Here the validity of the idea that scientific knowledge should form the basis of training for practice was first demonstrated by the successful establishment of dental schools; here the first journal for the interchange among dentists of thought and experience was founded; here the first association having for its object the uplifting and upholding of dentistry by the mutual helpfulness of its practitioners had its origin; here, in a word, dentistry was first divorced from mystery, here it first passed the narrow confines of a mere handicraft and earned for itself the right to be classed among the learned and liberal professions.

ARTIFICIAL CROWN- AND BRIDGE-WORK.

MODERN artificial crown- and bridge-work belongs to the department of dentistry formerly termed "mechanical;" but the judgment, skill, and scientific information required place it far above ordinary mechanical dentistry, which has sunk to a low estate since the introduction of vulcanite. To such an extent has vulcanite, by reason of its cheapness and ease of manipulation, superseded other materials demanding greater knowledge and skill in their manipulation, as to retard the higher development of prosthetic dentistry, and indeed to divest it, in the hands of those who depend upon vulcanite, of the dignity which should belong to dentistry as a profession.

But modern crown- and bridge-work, properly understood and properly performed, takes high rank in dental art, and offers wide scope for versatility of talent and inventive genius. The varied and complicated cases presenting for treatment frequently suggest to the expert novel contrivances and methods of construction and application. Successful practice of crown- and bridge-work depends upon a thorough mastery of the underlying principles, and expertness in the processes involved, governed by sound judgment and perfect candor. The interests of the patient should be paramount to every other consideration, and after a careful examination he should be given an accurate statement of the applicability of the system to his case, in respect to usefulness, appearance, durability, and comfort, as compared with other processes and appliances in use.

Surgical and mechanical operations of the most delicate nature are required. Nothing, indeed, in dentistry demands finer manipulation. A practical consideration of the subject will show that a knowledge of anatomy, pathology, and therapeutics, and as well mechanical and artistic skill, are necessary to the correct treatment of cases and the proper performance of the operations indicated. Among the principal steps in an operation may be named, first, the preparatory treatment of the natural roots and teeth for the final process, involving the diagnosis of present or probable lesions and the prescription of whatever remedial or prophylactic measures may be needful; second, in crown-work, the adaptation of the artificial crowns to the cervical portion of the natural roots and the contiguous membranes, and the restoration of the articulation and the anatomical contour; and, in bridge-work, the selection of suitable teeth or roots for foundation piers or abutments, and the choice and adaptation in constructive practice of the forms which will insure the highest degree of stability and best sustain the force of occlusion, thereby avoiding abnormal positions and conditions.

In no branch of dentistry will lack of knowledge and skill or the exhibition of carelessness in constructive details be more plainly evidenced or result in greater proportion of injury instead of benefit. Many failures are to be attributed to attempts to perform bridge-work operations with about the same expenditure of time on the part of the dentist and of money on the part of the patient as in plate-work. There is no such relationship between these two methods of procedure.

The practice of crown- and bridge-work by dentists possessing the requisite attainments and governed by correct ethical principles gives results which have gradually established its value, removing erroneous impressions and insuring a wide professional and public indorsement of this important branch of prosthetic dentistry. Its extraordinary facilities for preserving and replacing teeth have made for it a high position in dental art.

PART I.

PREPARATORY TREATMENT OF TEETH AND ROOTS FOR CROWN-WORK.

PREPARATORY TREATMENT OF TEETH AND ROOTS FOR CROWN-WORK.

GENERAL CONSIDERATIONS.

Preparatory treatment of teeth and roots for crown-work includes, in addition to the shaping required to fit them for the reception of the crowns, the bringing about of the healthiest possible condition in the teeth and roots and the adjacent parts, as the cure of existing lesions, the removal of calculus where necessary, and the adoption of such measures as shall prevent the recurrence of old troubles or the inception of new.

Notwithstanding all that advanced knowledge of therapeutic agents and skill in their use permit, there are many teeth and roots which cannot be rendered suitable for the successful application of crown- or bridge-work. Roots which are permeated and softened by decay, exposed or loosened from absorption of the gums and alveoli, or affected with irremediable disease of the investing membranes, should be thus classed. Cases in which abscess with necrosis has extensively impaired the walls of the alveoli are equally intractable.

Experience shows that the results in this department of dentistry depend largely upon diathesis or constitutional tendency and upon the attention given to the preservation of the health of the mouth; and these conditions should be carefully estimated in the selection of a system of treatment and the method of its application.

PART I.

CHAPTER I.

The Pulps of Teeth.

THEIR PRESERVATION OR DEVITALIZATION— DISINFECTION OF DENTIN AND PULP-CAPPING.

The preservation of the vitality of the pulps of the teeth is as essential in crown- and bridge-work as in any other operation.

The excision of natural crowns for the purpose of utilizing their roots as abutments for bridge-work is extensively practiced, and is defended on the theory that the vitality of the dentin is to an extent maintained by the cementum after the extirpation of the pulp, or that the pulp, being the formative organ, is of no further value in a fully developed tooth when root-canal treatment is properly conducted. That this practice is fallacious and to be followed only in exceptional cases is readily made evident.

The pulp after going through the progressive changes which constitute its original function assumes a fixed anatomical character as the source of the vascular and nervous supply from which the dentin derives and maintains its vitality. The protoplasmic bodies of the pulp unite with the living matter of the tubuli, which anastomose to a limited extent with those of the cementum through the intervening protoplasmic bodies in the interzonal layer.

This distribution and relative connection of living matter refers to an existing state of perfect vitality of all the parts. When the pulp loses its vitality, an entirely different condition results. The tubuli are then deprived of vital circulation, except along the line of the outer portion of the dentin, where, in the interzonal layer, the fibrillæ anastomose with the living matter of the cementum. The vitality supported by this anastomosis is almost entirely confined to this part, the nutrient supply being insufficient to take over the functions of the pulp and maintain circulation in the main body of the dentin. (See Plates I, II, III.)

[1] PLATE I.—Longitudinal section of the root of a superior bicuspid, at junction of dentin with cementum. C, cementum; D, dentin; I, interzonal layer; L, lacunæ of cementum. × 175.

PLATE II.—A field taken from Plate I in position marked A. L, lacunæ of cementum; C, canaliculi of dentin; I, interzonal layer. × 210.

PLATE III.—A field taken from Plate I in position marked B. L, L, L, lacunæ of cementum; I, interzonal layer; D, dentinal tubes and their nearest approach to the lacunæ. × 210.

A study of these plates demonstrates the limited nature of the anastomosis of the fibers of living matter of the dentin and cementum.

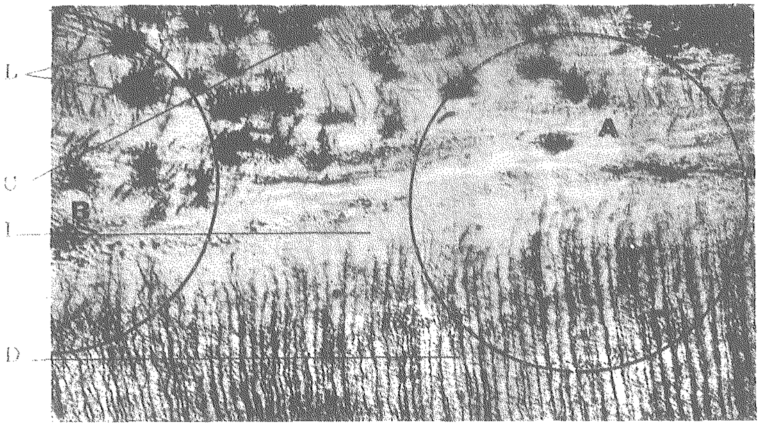


PLATE II.

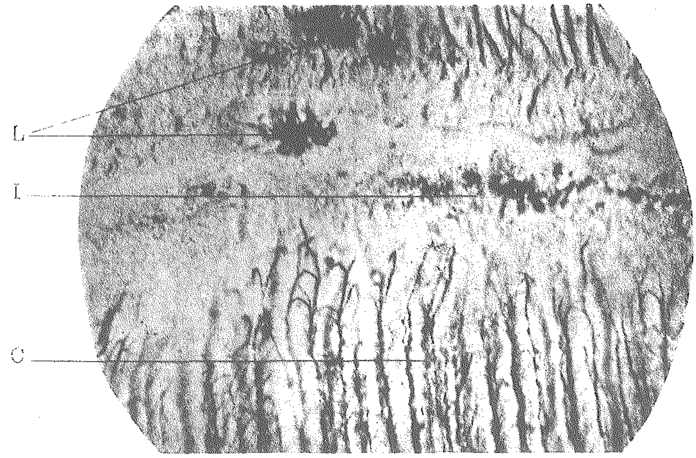
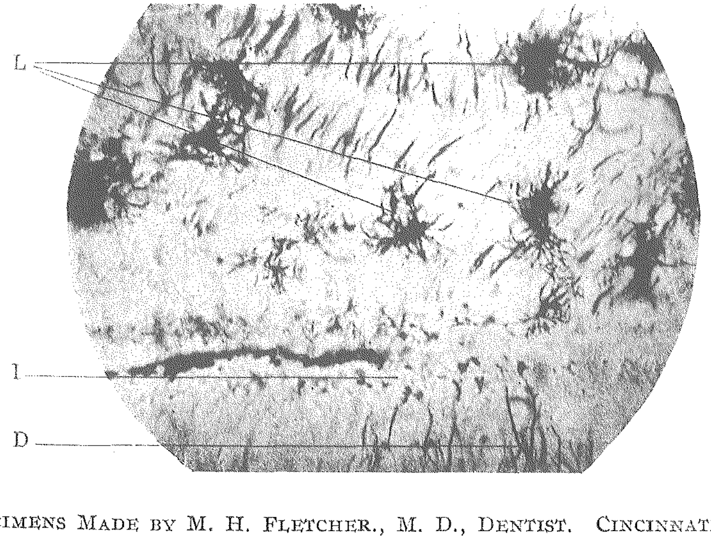


PLATE III.



FROM SPECIMENS MADE BY M. H. FLETCHER., M. D., DENTIST. CINCINNATI, OHIO.

E. MOEBIUS. CAMDEN. N. J.

Chemical analysis of the dentin shows that the organic matter, consisting principally of the fibrillæ, exists in the proportion of nearly 25 per cent. to 64 per cent. of lime-salts.[1]

When the pulp has been removed, the devitalized fibrillæ still remain, and, unless antiseptic root-canal treatment is thoroughly carried out, their disintegration generates septic gases capable of producing irritation of the cementum and pericementum. An examination of the investing membranes of pulpless teeth as treated usually shows the existence of a percentage of abnormal conditions, by which their firmness is to an extent impaired, their susceptibility to acute inflammation increased, and their reliability as foundations for crown- or bridge-work greatly lessened as compared with teeth which have living pulps. Frequently such conditions, when found in evidence in connection with the work of some of our best operators, are attributable more to the difficulties which interfered with the perfect performance of root treatment than carelessness or lack of skill. Observation also has shown the author that the dentin of gold-capped pulpless natural teeth in the course of years gradually softens sufficiently to impair their strength.

Cap-crown work frequently furthers the preservation of pulps in the posterior teeth. Thus, in a case verging on exposure, only partial removal of the decay is often necessary, as, when the operation is completed, the natural crown will be hermetically inclosed by the artificial one. In bridge-work, proper methods of practice will also, in a large percentage of cases, permit the anterior teeth to be used as abutments without the extirpation of their pulps or the excision of their crowns.

Preparatory Processes.

That extirpation of the pulp and excision of the natural crown or crowns, especially of incisors or cuspids, will at times simplify the work and permit better forms of construction is undeniable. Be-

[1] The analysis of dentin by Dr. G. V. Black gives an average of—

Lime-salts	63.54
Organic matter	25.36
Water	11.06

Age slightly lessens the proportion of living matter and increases the percentage of lime-salts.

sides, the question of root-canal treatment is not to be as seriously considered in relation to front as to back teeth, where its perfect performance is not so easy of accomplishment. A few operators contend that the removal of the entire enamel and a portion of the dentin of a bicuspid or molar tooth is usually necessary to properly shape it for a collar or cap-crown; that consequently the removal of the pulp is demanded and should precede the operation. This is undoubtedly true if a tooth is to be divested or "barked" of its enamel in the manner mentioned; but such extreme methods in the preparation of teeth for crowns are not generally accepted as necessary, especially if the teeth are sound and are to be used as piers to support bridge-work.

Extirpation is demanded only for those pulps whose permanent preservation cannot be placed beyond doubt, as failure involves more serious consequences in crown- and bridge-work than in filling operations.

The lesions of the pulp which seem to require its extirpation, according to generally expressed opinion, are exposure with hypertrophy or rupture of the pulp-sac, congestion, and pulpitis which does not yield promptly to remedial treatment. Pulps actually exposed by decay are seldom found in a normal condition otherwise, and they are only rarely proper or hopeful subjects for remedial treatment. Atrophy of the *membrana eboris*, or investing membrane, which comprises the layer of odontoblasts, usually exists at the part exposed, and, as any subsequent calcification must depend on the activity of the odontoblasts, it is evident that the existence of the condition referred to affords a strong argument against the advisability of capping pulps with extensive or even slight exposure. The difficulty of securing a condition of asepsis of the exposed and diseased parts so perfect as to assure them against the invasion of micro-organisms subsequent to capping is an additional argument against the operation.

Pulps which are in a normal condition, still protected by a layer of even decomposed or partly decomposed dentin, usually admit of successful treatment. In such cases the decayed dentin may be excavated from the side-walls of the cavity, but that in the region of the pulp should be only superficially removed; in some cases this portion may be allowed to remain undisturbed.

Disinfection of Dentin and Pulp-Capping.—The capping of a pulp should include, as a necessary precaution against subsequent irritation, the thorough disinfection of any remaining decomposed dentin. An excellent method of disinfection is to first thoroughly wash the cavity several times with tepid water thrown gently from the large point of a syringe around the sides of the cavity; then, taking measures to prevent the entrance of saliva, wipe the cavity with absorbent cotton and pass over its surface a light current of hot air from a hot-air syringe. The heat should be sufficient to cause some discomfort to the patient, but not enough to produce irritation of the pulp. The dried cavity is then immediately saturated with carbolic acid previously warmed[1] to the normal temperature of the body by holding the pellet of cotton on which it is applied over the flame of a lamp for a moment. The carbolic acid relieves any pain caused by the evaporation of moisture, and disinfects and sterilizes any decomposed matter in proximity to the pulp. The object of the application of the carbolic acid having been accomplished, the surplus may then be removed from the surface. To this end the cavity should first be wiped with absorbent cotton, and hot air again introduced to evaporate the carbolic acid sufficiently to give a dry appearance to the surface. This second application of hot air, owing to the effect of the drug, will cause little or no pain.

This method, if practiced early in the preparation of the cavity, will be found to considerably obtund sensation, and, through the dryness secured, to materially facilitate the removal of the decomposed dentin. A reasonable amount of the decayed portion should be cut away, as it lessens the difficulty of proper disinfection. For excavating in the region of the pulp-chamber, spoon-shaped excavators should be used invariably. For the thorough disinfection of dentin and removal of hypersensitive conditions, the author practices the method of previously placing and sealing in the cavity for from two days to a week a mixture of precipitated chalk and carbolic acid and oil of cloves in equal parts. A small quantity of aristol may also be added.[2]

The disinfected dentin over the pulp is then varnished with

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[1] Thermal shock to the pulp is as unwarranted from the application of cold carbolic acid as if produced in any other manner.

[2] The chalk is placed in a mortar, and the carbolic acid and oil of cloves gradually introduced and thoroughly incorporated with the chalk by trituration until the mixture becomes a plastic mass.

chloro-gutta-percha, or some other preparation suitable for the purpose, and capped with oxyphosphate or oxychlorid, as preferred. When the capping is set, the remainder of the cavity is filled with the same cement as the capping, or with amalgam.

Some preference is given to zinc oxychlorid as a pulp-capping over the oxyphosphate, because of its antiseptic properties; but its use invariably requires a thorough application of chloro-gutta-percha to thin areas of dentin over the pulp.

Pulp-capping, when necessary, should precede any other operation, and no subsequent procedure is admissible until the success of that operation is assured, the time allowed for this purpose being governed by the requirements of each case. A non-vital condition of the pulp in one root of a tooth contraindicates any attempt to preserve it in any of the other roots, in connection with crown- and bridge-work.

The rubber-dam, when its use is practicable, will be found a material aid in pulp-capping operations.

CHAPTER II.

Devitalization of the Pulp.

INSTANTANEOUS DEVITALIZATION—CATAPHORESIS—EXCISION OF THE CROWN AND INSTANTANEOUS EXTIRPATION OF THE PULP—DEVITALIZATION WITH ARSENIC.

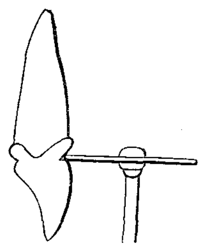
When devitalization of a pulp is necessary in preparation for crown-work two methods are practiced: the heroic,—instantaneous devitalization, or extirpation,—and gradual devitalization, by arsenical treatment.

Instantaneous Devitalization.—This can be accomplished by first administering to the patient sufficient nitrous oxid to produce partial anesthesia, then with a drill quickly opening into the pulp-chamber, and lacerating the pulp well up the canal with a probe or smooth broach. Instantly afterward a pellet of cotton, saturated with carbolic acid, should be forced up the canal, and, if possible, left until the next day, when the pulp will be found in a coagulated mass that is easily removed entire.

Devitalization of the pulp as just described is practicable only in teeth in normal condition. In acute inflammation, after laceration of the pulp, warm water should be gently injected into the pulp-chamber, and sedative agents then applied. The devitalization of the pulp should subsequently be completed by whatever method is preferred and the pulp extirpated.

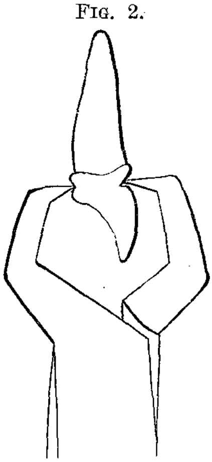
Cataphoresis.—In cases of actual exposure the rubber-dam can be applied, the exposed pulp obtunded with hydrochlorate of cocain, applied in saturated solution; the diffusion may be hastened by electrolysis. As soon as the action of the cocain is manifest, the pulp may be extirpated.

Fig. 1.



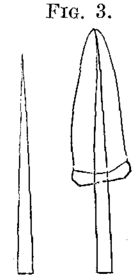
Excision of the Crown and Instantaneous Extirpation of the Pulp is practiced as follows: Two parallel grooves are cut opposite to each other, through the enamel, deep into the dentin, one on the labial portion of the tooth and the other on the palatal or lingual wall, close to the gum, with a rapidly revolving corundum or vulcarbo disk (Fig. 1). Then with excising forceps, the cutting-edges of which are inserted in these grooves, the crown is quickly severed from the root (Fig. 2). The pulp either adheres to the excised crown, leaving the canal empty, or remains in the root, fully exposed. In the latter case, a pointed piece of orange-wood, previously cut to fit the canal, and saturated with carbolic acid, is driven with a quick blow into the pulp toward the apex of the root (Fig. 3). When the wood is withdrawn, the pulp usually adheres to it; if not the wood is instantly reinserted, cut off, and drilled out with the pulp, using Gates-Glidden drills in the upper portion of the canal.

FIG. 2.



Expertly performed, this operation is advantageous, though it should be confined to teeth the pulps of which are in *normal* condition. Practical experience shows that in such cases it is attended with the most satisfactory general and final results.

FIG. 3.



Only trifling pain is felt by the patient, as the pulp is paralyzed by shock in the excision of the crown, or by being forced upward toward the foramen and against the walls of the canal. The subsequent vitality of the cementum is assured by the instantaneous procedure, and discoloration of dentin and enamel to a noticeable extent seldom occurs when the natural crown is utilized in bridge operations.

The objections to the procedure are, that if the pulp is not successfully extracted entire with the wood the canal becomes filled with clotted blood, which is difficult to remove from the extreme end; also that the root and socket are jarred by the forceps in excising the crown.

In cases of actual exposure in which excision of the crown cannot be safely practiced—as, for instance, in a bicuspid—a portion of the walls and grinding-surface may be removed to the line of the root-canal, the pulp obtunded with carbolic acid, and the wood point then forced up the root-canal in the same manner as when the crown is excised.

Devitalization with Arsenous Acid.—The methods of devitalizing previously described are applicable principally to the pulps of incisors and cuspids. In the posterior teeth, which do not so well permit the heroic treatment, recourse is had to arsenous acid, notwithstanding the numerous objections to its use. Two theories as to the mode of its action in devitalizing are widely entertained: First, that its toxic effects produce hyperemia, which stops circulation; the other is thrombosis.[1]

This theory of thrombosis might account for the gradual devitalization of the pulp toward the foramen.

Whatever the action of arsenic on the pulp may be, it always causes an infiltration of the tubuli of the dentin with certain constituents of the blood, probably the liquor sanguinis. To an extent the residue of the infiltration, after the devitalization of the pulp, remains in the tubuli, increasing the difficulty of producing an aseptic condition of the dentin. It is asserted that arsenic sometimes affects the vitality of the cementum.

Arsenic, when used, should be applied directly to the pulp in the smallest quantity possible to effect its devitalization, and securely sealed in the cavity.

In cases of non-exposure requiring its application, a small opening into the pulp-chamber should be made. This can be accomplished with but little pain to the patient with a very small, sharp, spear-headed drill, rapidly revolved by the engine. The drill should be held steadily under gentle pressure at one point in the line of the intended exposure, until the pulp is slowly and gradually reached, and not suddenly punctured with the drill-point. The drill should be occasionally removed and the cavity flooded with carbolic acid during the operation. Cataphoresis may also be practiced.

Arsenic, combined with agents which are non-coagulants of albumin, may be used in preference to the same drug combined with creasote or carbolic acid. Dr. Harlan's method is to apply an anodyne, such as wine of opium, for a minute or two, and then the following paste:

℞—Arsenous acid, ʒi;
Muriate of cocain, ʒij;
Lanolin in quantity sufficient to make a stiff paste.

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[1] See Dr. L. C. Ingersoll's "Dental Science, Questions and Answers," page 96.

The application should be kept in position no longer than is necessary to effect the devitalization of the pulp, twelve to forty-eight hours being sufficient. The pulp is then punctured, a saturated solution of tannin in glycerin applied and securely sealed in the cavity, and the patient dismissed for several days, when, in favorable cases, the pulp can be removed entire. The saliva should be entirely excluded, the rubber-dam being applied when practicable, and hydrogen peroxid or absolute alcohol, instead of water, used in the treatment.

When creasote or carbolic acid is used in combination with arsenic, the same method of subsequent treatment may be practiced.

When the position of the tooth or root makes the application of the rubber-dam extremely difficult or impracticable, the operation can be successfully conducted without its aid in this way: At short intervals during operative procedures, at each sitting of the patient, thoroughly syringe the pulp-cavity with hydrogen peroxid, preventing the entrance of the saliva by at once inserting a pellet of cotton saturated with the peroxid, oil of cloves, or some other antiseptic. The tooth can then be protected from the saliva by any of the usual methods practiced, and the treatment proceeded with.

CHAPTER III.

Pulpless Teeth.

REQUIREMENTS OF TREATMENT—PREPARATION OF ROOT-CANALS—TREATMENT AND DISINFECTION—CLOSURE OF THE APICAL FORAMEN AND FILLING OF THE CANAL—USE OF ANTISEPTICS.

Requirements of Treatment.—The treatment of pulpless teeth or roots consists in as thorough performance as possible of the following operations:

First. Enlargement of the canal and removal of the contents.

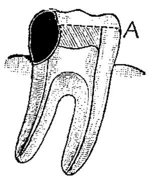
Second. Disinfection of the root-canal and the dentin, and the establishment of permanent aseptic conditions by mummification of the contents of the tubuli.

Third. Closure of the apical foramen and prevention of future infection from the oral cavity by hermetical closure of the entrance to the canal.

Preparation of Root=Canals.—A knowledge of the usual positions of the root-canals in the different teeth is essential for a generally successful performance of this operation, which is greatly facilitated by the ease with which direct access to the root-canals is obtained in crown-work.

In all cases in the preliminary removal of tooth-structure sufficient of the crown should be left to easily permit application of rubber-dam and the retention of dressings with gutta-percha seals. When teeth are broken down or extensively decayed below the gum-margin and hypertrophied gum-tissue invades the cavity, the diseased tissue should be first cut out, the cervical section of the margin of the cavity trimmed, and an antiseptic dressing applied. The cavity should then be packed with gutta-percha well anchored either against the adjoining tooth or in the orifice of the pulp-cavity, in such way as to stop the hemorrhage and press back the tissue by the time for the next treatment. In the preliminary treatment of a pulpless tooth a probe can be inserted in the root-canal, to be withdrawn when the packing is completed, leaving a vent for the escape of gases in such cases as suggest it. In the anterior teeth, the removal of the coronal section directly exposes the pulp-chamber. In bicuspids and molars, for all-gold crowns, the leveling of the occluding surface (see Fig. 4) and removal of a portion of the side most involved by decay should be preliminary. A sufficient opening is first made into the center of the pulp-chamber in a line with the root-canals to give free and direct access to them, and any remaining portion of the pulp is removed with broaches. A few fibers of cotton twisted around the serrated portions of the broach will admit of its easy removal in case of breakage. The canals are then, guided by frequent explorations with a fine probe, carefully enlarged with Gates-Glidden drills (Fig. 5). At least three sizes—large, medium, and small—of drills each for the right-angle and the direct hand-piece are required. Very little, if any, pressure should be put upon them when in motion. Under pressure in a curved root a small drill might be broken off or forced through the apical foramen with disastrous consequences, where alveolar abscess did not exist. Neither should drills be forced into canals closed by calcification, nor beyond the line of the zone of cementum at the end of the root, nor through a constriction which a fine, flexible probe cannot enter, nor around a curve sharp enough to be unsafe to pass. A slight pain is usually experienced should they enter the zone of sensibility formed by the cementum which composes the end of the root, of the slightest symptom of which the patient should be instructed to instantly inform the operator. The probe-like points of these drills do not cut, but simply guide the drills and confine them to the line of the

Fig. 4.



Sectional view of an inferior molar decayed on the posterior approximal side. A, the line to which the crown should be removed to facilitate entrance to the pulp-chamber.

Fig. 5.

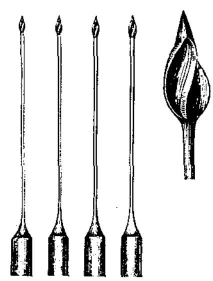
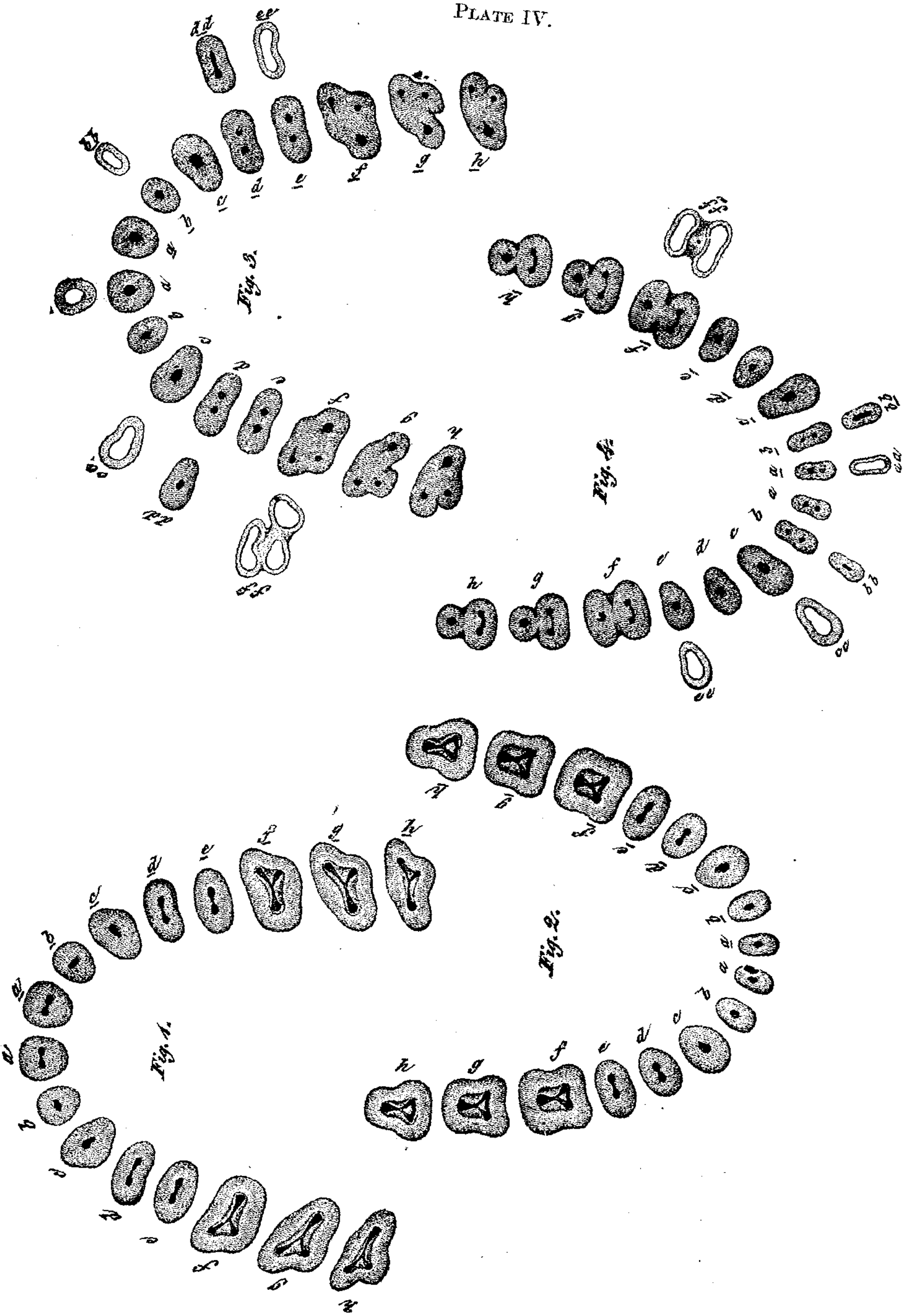


Plate IV.—Figs. 1 and 2 represent the superior and inferior teeth in transverse section through the base of the pulp-chamber in the crown, showing the entrance to the root-canals.

Figs. 3 and 4 represent the superior and inferior teeth in transverse section through the root-canals as they diverge from the pulp-chamber.

aa, bb, cc, dd, ff, dd, and ee, Figs. 3 and 4, show the relative shapes, whether circular, oval, or flattened, of the root-canals in the teeth they severally represent.

PLATE IV.



canal. They should be gently given a slight forward and quick backward motion in the canal, and treated more as reamers than drills. The occasional quick withdrawal of the drill from the canal during the process of drilling will aid removal of the *débris*. The depth to which a canal may be enlarged or reamed is regulated by its actual length and the above-mentioned conditions, and the diameter of the enlargement by the shape and dimensions of the root.

The use of these drills is condemned by some for reasons which are fairly attributable to their careless or improper employment, but they are indorsed, in experienced hands, for their adaptability to the work under consideration. They should be frequently sharpened with a suitably shaped piece of Arkansas stone.

The Palmer root-canal excavators also will be found serviceable to open up a canal and enlarge it in accordance with its original shape. While the Gates-Glidden drills are serviceable for the work described, the use of Donaldson broaches is safest and most effective in the upper portion of the canal, especially in those of very small caliber.

A 75 per cent. aqueous solution of sulfuric acid carried on a platinum probe, then placed in the canal and at first pumped into it with a smooth broach, is most effective as an aid in opening up very small canals or those partly closed by calcification. In the former case the acid softens the dentin of the sides of the canal so that the friction of a smooth broach will materially enlarge it; in the latter, in addition to this effect, it decomposes the calcified contents of the canal. This enlargement of the canal with the smooth broach will usually admit of the introduction of a Donaldson barbed broach, first small, then large, by which the canal can be much more rapidly enlarged. Canals by this method can almost invariably be safely opened and enlarged to the apex, and when so opened they are thoroughly divested of organic matter by the action of the acid.

The moderate reaming of a root-canal not only simplifies the operation of filling, but also opens up the ends of the tubuli and facilitates the permeation of antiseptic agents.

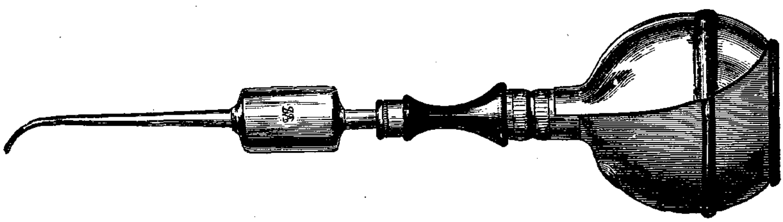
Treatment and Disinfection.—Pulpless teeth are presented for treatment in one of the four following conditions:

1. Where healthy or non-putrescent pulps have just been extirpated from the canals.

2. Where on opening into the pulp-chamber it is found empty and dry, with the pulp mummified or calcified in the root-canals, and the root externally in a healthy condition.

3. Where the pulp is found diseased or in a putrescent condition.

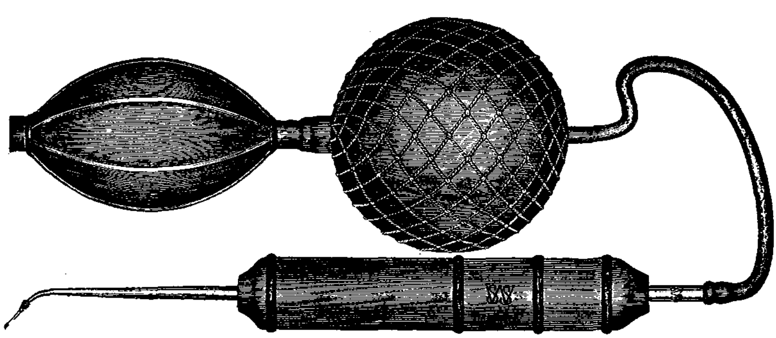
FIG. 6.



4. Where alveolar abscess is present and a septic condition of the canals and dentin exists.

In the first and second classes the treatment should be directed to assuring a continuance of the existing aseptic condition, and as immediately as possible the filling of the canal; in the third and fourth classes, to bringing about an aseptic condition by disinfection and sterilization, and making certain of its future main-

FIG. 7.



tenance, including incidentally the cure of any existing disease of the external membrane or of the alveolus.

In cases of the first and second classes, if possible, saliva should be excluded from the pulp-chamber and canals during their entire preparation and filling. If necessary, hydrogen peroxid can be used instead of water. The instruments should be sterilized, and the broaches, if serrated, had better be new. In the third and fourth classes, exclusion of saliva or water is not necessary in the preliminary work on the canal; water may be freely used until the process of disinfection and sterilization is commenced. Then and thereafter its entrance must be prevented. To this end the rubber-dam should be applied if practicable. When it is not, as frequently occurs with roots and teeth badly affected with cervical decay, other means of keeping out moisture should be resorted to. In such cases, during each interruption in the operation the entrance to the canal should be filled with absorbent cotton saturated with a suitable essential oil or antiseptic fluid, the saliva being thus excluded.

After the canal has been properly opened up and its contents removed, it may be washed out with hydrogen peroxid, and wiped out with absorbent cotton. The use of sodium peroxid is recommended by Dr. Kirk at this stage to open up the ends of the tubuli. The next procedure is to secure as thorough a state of dryness in the pulp-chamber as is possible by forcing into it with a hot-air syringe (Fig. 6 and Fig. 7), air at a temperature higher—as it leaves the nozzle—than is comfortable for the finger. A root-canal drier, with the end tapered as fine as a broach at the point, is then introduced into the canal. The writer prefers the form in which the point is made of silver and the bulb portion of copper (Fig. 8). As silver possesses remarkable properties as a thermal conductor, the heat is transmitted to the point of the probe very rapidly. The probe being inserted as far as possible up the canal (Fig. 9), the patient is directed to raise the hand as a signal should the heat cause pain, when the probe must be moved up and down or withdrawn for a moment. This procedure, following the previous application of the hot air with the syringe, evaporates the moisture and aids the

FIG. 8.

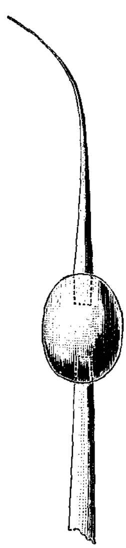
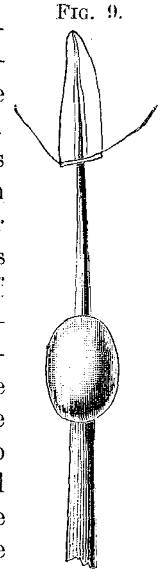


FIG. 9.



escape of any gases present in the root-canals and the open ends of the tubuli. The point of the root-canal drier acts as a sterilizer, and may be applied so hot as to carbonize any organic matter which it reaches in the end of the canal, and a portion of this can be removed each time on its point. As the silver point can be tapered as small as the finest broach, canal-contents impossible to remove may be reached and rendered inert.

In cases of the third or fourth class, sepsis being present, the heat is very serviceable, as it aids the escape of gases from the canal and dentin and acts as a germicide. When in this dry and heated condition, the dentin is in the best possible state for the application of antiseptic agents.

Use of Antiseptics.—Great diversity of opinion exists as to the suitability of various antiseptics to the needs in treating tooth-structure, their effectiveness and permanency when so used, singly or in combination, and their adaptability to various conditions. Many of the antiseptics in common use being coagulants of albumin obstruct the dentinal tubuli, and their diffusibility through the dentin is consequently self-limited. To this class belong carbolic acid, creasote, and the like. They are not entirely non-diffusible in devitalized dentin or cementum, as decomposition effects elementary changes in the contents of the tubuli, but their action is slow and limited as compared with that of some other agents, as the essential oils. They are also irritant, and unsuitable in cases where an acute or chronic inflammation of the peridental membranes is to be treated.

The essential oils, which are non-coagulative in their action, have greater diffusibility, and, according to Miller, Harlan, and others, possess much greater antiseptic power than was formerly attributed to them. Acidulated solutions of mercury bichlorid, hydrogen peroxid, sodium peroxid,—especially in preliminary treatment,—and preparations of iodin that exert a chemical action and retain their antiseptic properties for a great length of time are the most suitable.

The selection of antiseptic agents is therefore important, and the choice is indicated by the conditions presented in a pulpless tooth. Teeth from which a healthy pulp has just been extracted, or in which the canal is aseptic, differ in their requirements from those in which sepsis of dentin or diseased or putrescent pulps are present.

In the first-mentioned conditions, favorable results usually follow root-filling, with or without antiseptic treatment, the advantage of the antiseptic agent in the canal being only to better assure the continuance of the state of asepsis. When a healthy pulp has just been extirpated, and immediate root-filling is practiced, the use of carbolic acid, creasote, or solution of zinc chlorid is indicated. The minute fibrous connections with the walls of the canal and the vessels at the apical foramen are severed, and the action of an escharotic antiseptic agent is in fact required, as it acts as a coagulant and instantly seals up the ends of the tubuli. If immediate root-filling is not to be practiced, then the prescription of such agents as the essential oils, with aristol or iodoform, seems more suitable, as by their action a sort of mummification of the non-vital organic matter follows. Moreover, the oils possess advantages over the coagulants in that they are not miscible in water, and are less easily eliminated. Their use will tend better to perpetuate an aseptic condition.

In the second class of cases,—teeth with sepsis of dentin or having diseased or putrescent pulps,—we need the intervention of agents which will not only destroy ptomains, but which will exert a chemical action on sulfuretted hydrogen and ethereal ammoniacal gases, the products of putrefaction, and entirely eliminate them. On this depends the successful treatment of such cases, as the expansion and pressure of these gases are a certain cause for constant peridental inflammation, and so long as they are present in the slightest degree in a canal it is in an unsuitable condition to be closed. Carbolic acid, creasote, or the essential oils, under such circumstances exert no chemical action on these gases, merely disguising their odor, though it is true that by repeated dressings of cotton saturated with one of these agents the gases are absorbed by the cotton and slowly eliminated.

What is required is the action of an agent whose elements possess an affinity for the gases, and so will immediately decompose them, forming new combinations and entirely changing their character.

In accordance with these principles, iodin is indicated as preferable in practice to the other agents mentioned. Its effects are best obtained from some one of the preparations now in use,—aristol, for instance,—whose odor is entirely unobjectionable, in a strong solution in one of the essential oils. In the writer's practice the oils of cloves, cassia, and eucalyptus are favored for this purpose, the first named being reckoned more sedative in its action than the others. He makes it a point to flood the canal with the solution, thereby to some extent permeating the dentin as well as the cementum at the apex. A more complete saturation can be accomplished by drying and heating the dentin and applying the solution a second time, or by filling the canal with cotton saturated with it, hermetically inclosing it, and letting it so remain for a day or two.

As aristol, oil of cloves, and cassia have a tendency to slightly discolor dentin, their use should be confined to the extremity of the root-canal, and plain oil of eucalyptus or myrtol used in the orifice and coronal section of the tooth where maintenance of the natural color of the crown has to be considered in an operation.

The disadvantage of immediate root-filling is that, should some fragment of the pulp remain in the extremity of the canal, it fails to receive the benefit accruing from the reapplication of antiseptics, which would better assure its inertness by mummification.

There is such a thing as over-treatment,—an unnecessarily frequent renewal of antiseptic dressing in root-canals, thereby aggravating or producing irritation of the pericementum at the apex of the root. Such cases may be relieved by washing out the canal with alcohol and then applying the alcohol on the dressing, instead of the agents previously employed, until the inflammation subsides.

The dressing of root-canals is best performed with the aid of the ordinary smooth, flexible rectangular broaches; also root-canal dressers, such as the How. The form of these instruments permits fibers of cotton to be easily wound around them lengthwise and over the point in one connected mass. When the cotton is introduced in the canal, it is retained on and carried forward by the instrument, which, when withdrawn, leaves the cotton in position in the canal in the form of a cone or tampon that will favor the escape of gases, and it may still be easily removed at any time. After one or more treatments in the manner described, between which, if interspersed by intervals of time, the antiseptic agents must be hermetically sealed in the cavity with gutta-percha, the canal is dried and the foramen closed.

Closure of the Apical Foramen and Filling of the Canal.—The object of root-canal filling is the maintenance of an aseptic condition in a sterilized root-canal by hermetically closing it at both the apical foramen and the orifice, and thus preventing its infection by the entrance of either fluids or gases. Gutta-percha and zinc oxychlorid are generally accepted as most suitable for the purpose. Either gutta-percha in the form of chloro-gutta-percha, or zinc oxychlorid mixed thin, can be pumped or placed in the extreme end of the canal with the aid of a broach or fine-pointed probe. This is one of the advantages that commend the use of these materials. When the chloro-gutta-percha has been placed in the apex, the remainder of the canal can be filled with the prepared cones of solid gutta-percha until no more can be inserted. A current of hot air should then be thrown on the protruding ends of the cones at a temperature sufficient to soften them and warm the dentin, when they should be gently pressed, but not suddenly pushed, up in the canal. A slight twinge of pain to the patient will usually be the signal of their complete impactment in the canal. The solid gutta-percha absorbs what little chloroform was present in the chloro-gutta-percha, and the heat also aids its evaporation, so that the shrinkage so often urged as an objection against the use of chloro-gutta-percha is reduced to a minimum.

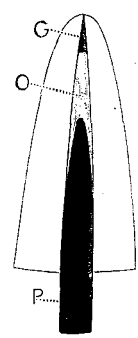
An advantage possessed by zinc oxychlorid over other materials is its antiseptic qualities; its disadvantage, the difficulty attending its removal from the extremity of the canal should supervening conditions require it. For this reason the apex and extremity of the canal may be filled with gutta-percha, and then the orifice and pulp-chamber with oxychlorid. This combination forms an ideal root-canal filling, as the oxychlorid hermetically closes the orifice of the canal and prevents its infection from the oral cavity. When metallic points of lead and copper shaped to fit are used to fill root-canals, unless a small quantity of zinc oxychlorid is placed in the extremity or on the point used, the complete closure of the canal is doubtful. The use of cotton as a filling in root-canals is to be condemned, unless it is sterilized[1] or iodoformized and saturated with chloro-gutta-percha or zinc oxychlorid previous to insertion. Asbestos is given preference to cotton by some. Tin or gold foil is difficult to insert without

[1] Cotton may be sterilized by immersing it for a time in a saturated solution of iodoform in ether, and then drying. It should be kept in a tightly-corked bottle. When this plan is followed, the odor of iodoform is avoided in the operating-room.

leaving vacuoles. Paraffin combined with a small quantity of aristol, as a material to fill root-canals, has been suggested by Dr. Kirk, especially after the use of sodium peroxid. This agent, being a most active solvent of albuminous matter, in a measure frees the ends of the tubuli or a canal of their organic contents, a condition favorable for the use of paraffin. Paraffin is aseptic and melts at a low temperature, and with a heated root-canal drier can be flowed into the ends of the tubuli or into a minute canal not considered safe to open up extensively. Balsamo del Deserto can be used in the same manner.

Ordinary gutta-percha should be used to close a foramen when an abscess has just been treated by injecting through it. The length of the canal should be measured with a probe, and gaged with a small perforated disk of rubber-dam slipped upon the instrument. The gutta-percha should then be carried to position on the point, allowance being made for the displacement of the instrument. As oil of eucalyptus is a solvent of gutta-percha, the application of this oil, alone or in combination with iodoform or aristol to the surface of the gutta-percha, is recommended in the final treatment, as better adhesion to the walls of the canal is thus obtained.

FIG. 10.



G, Gutta-percha.
O, Oxychlorid.
P, Post.

Ample room should be left in any root-canal which is to receive the post of a crown, as any part of the canal not occupied by the post will be filled by the retaining material.

When a post has been fitted to a canal previous to the closure of the foramen, the point of it may often be utilized to aid in the final pressing of the gutta-percha to place by warming the post and wiping the point with oil of cloves to prevent adhesion of the gutta-percha.

When zinc oxychlorid is used, the foramen should preferably be first closed with a small quantity of either solid gutta-percha or the chloroform solution of it, to avoid the accidental protrusion of the oxychlorid, which is then pumped up the canal, and the post inserted. When the cement is about half set, the post is seized with pliers and withdrawn and not again inserted until the cement is perfectly set. In this manner an oxychlorid socket is formed into which the post will accurately fit.

(See Fig. 10.) The same can be done with the post of a finished crown.

A pulpless tooth presented for crowning, the roots of which have been treated and filled in some previous operation, should be carefully examined. If any doubt is entertained as to its hygienic condition it should receive the antiseptic treatment above described, as the ultimate success of crown-work depends largely upon the thoroughness of these preliminary operations.

CHAPTER IV.

Chronic Alveolar Abscess.

THE USUAL FORMS—ALVEOLAROTOMY—AMPUTATION OF THE APEX OF A ROOT.

Many teeth and roots presented for crown-work are affected with chronic alveolar abscess. A general description of an effective method of treatment is therefore properly associated with a discussion of the subject.

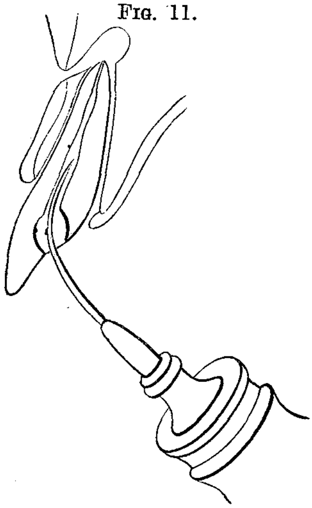
The cause of chronic alveolar abscess will be found in a continuation of those conditions which originally produced the acute form. The tooth or root being pulpless, septic gases, generated by the decomposition of organic matter in the root-canal and in the tubuli of the dentin, find an outlet through the open foramen into the apical space, causing pericementitis and formation of pus. The general treatment consists in the removal of all septic matter and gases from the root-canal and dentinal tubuli, the destruction of the pus-sac, the application of suitable therapeutic agents, and the adoption of measures to prevent further formation of pus.

The Usual Forms.—Chronic alveolar abscess is usually found in the following forms: First, abscess with a fistulous opening in the gum, and accessible through the root-canal and foramen of the root. Second, abscess with fistulous opening, but not accessible through the apical foramen. Third, abscess from which pus discharges through the apical foramen and root-canal, with no opening through the gum.

In the treatment of abscess of the first form, the canal should be enlarged as described in the treatment of pulpless teeth, and the foramen opened, if possible, with a smooth broach without the use of a drill. Aromatic sulfuric acid, on cotton, placed in the end of the canal for a day, will usually open up the finest foramen. A small quantity of 75 to 90 per cent. aqueous solution of sulfuric acid pumped into the extremity of the canal will often enable a broach to instantly effect a passage. Tepid water is then forced through the foramen with a fine-pointed syringe (Fig. 11) introduced well up the canal, and packed in with gutta-percha; or it may be pumped up with cotton on a broach until it passes into the abscess and out through the fistula. Hydrogen peroxid is next used in the same manner. Aromatic sulfuric acid may also be injected through the fistulous opening into the abscess.

In abscesses of the second form, where it is impracticable to treat through the foramen, the canal should be thoroughly disinfected, and a direct opening into the abscess effected by the track of the fistula, enlarging it when necessary. The abscess should then be thoroughly injected with hydrogen peroxid, and afterward with aromatic sulfuric acid, by introducing the fine point of a syringe into its deepest parts. The fistula must be kept open while treatment is conducted by inserting in it, at each injection, a strand of twisted cotton saturated with oil of cloves, the patient being directed to remove it in a few hours, or the next day, for which purpose the end should be left protruding. When the apical foramen is open, one injection through it is frequently sufficient to cure an abscess; but when the foramen is closed and the abscess is treated through the gum, several injections are generally necessary and the result not positive.

FIG. 11.



In case of "blind abscess," the third form, first open, clean, and disinfect the canal, and enlarge the foramen with sulfuric acid and Donaldson broaches, so that the largest sizes will pass freely into the abscess. Through the enlarged foramen inject and wash out the cavity of the abscess—at first daily—with hydrogen peroxid. Insert a small probe in the canal, pack the orifice with gutta-percha, press on the gutta-percha, and withdraw the probe. The aperture left by the probe furnishes a small vent. Continue this line of treatment until evidence of suppuration ceases, then temporarily pack the canal with cotton slightly moistened with oil of cloves or any other of the suitable essential oils, seal the orifice of the canal, and temporarily fill the cavity. Should the indications appear favorable on the removal of this dressing, or any subsequent one similarly inserted, close the foramen with a cone of gutta-percha, placed in position gently so as to avoid protrusion into the apical space or causing pressure.

This method, if skilfully practiced, will usually effect a cure of this troublesome form of abscess. Should this treatment fail, an opening through the gum into the abscess must be obtained, with a lance and drill, and the same course pursued as in the first form of abscess.

Alveolarotomy.—For this operation the length of the root and position of the apex should be first accurately determined. This is best done by introducing a broach with a hook point through the canal and foramen into the abscess and then slowly withdrawing it. In the withdrawal, the hook by catching on the apex shows both the position and the length of the root (Fig. 12).

FIG. 12.

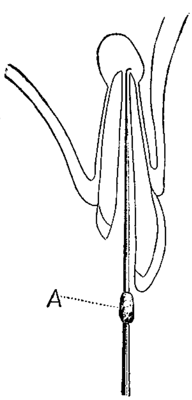
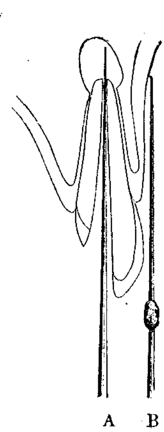
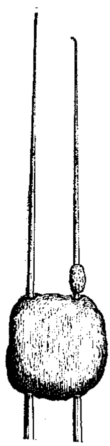


FIG. 13.



A small pellet of gutta-percha or a little disk of heavy rubber-dam placed on the broach at the point where it enters the root or tooth, as shown at A, Fig. 12, will form an accurate gage. After the withdrawal of the broach a straight fine probe is passed up the canal through the foramen into the abscess and left there in position, the exposed portion (A, Fig. 13) fairly indicating the direction in which the root points, and should no considerable curve exist toward the apex, the line in which the abscess cavity is most likely to be found. The marked broach is then placed externally with its shank exactly parallel with the probe in the canal (see B, Fig. 13), and the line of the broach and more especially the location of the hook point marked on the gum with carbolic acid. A few shreds of cotton closely twisted around the broach, especially at the point, will aid in carrying and holding the acid. In this manner the line of the root and the position of the end, allowing for a slight curve toward the apex, can be located within a small fraction of an inch, and the cavity of the abscess, which may be a little to the right or left of the point, determined with sufficient accuracy. The membrane at the spot marked as over the end of the root is then punctured and entrance to the end of the root and apical space and abscess effected through the bone with a small spear-shaped bur and spoon-shaped excavators. The fine probe protruding through the foramen into the abscess will aid in locating the abscess cavity and apex of the root. The membranes may be anesthetized with an injection of a 5 per cent. solution of eucain previous to the operation. A more definite method practiced by the author, in cases of very long roots, is, after getting the length of the root with the broach as previously described, to introduce a flexible straight probe up the canal, through the foramen into the abscess. The probe is removed, warmed, and again introduced, with a film of gutta-percha placed on the shank to steady and indicate its exact position. The broach indicating the length of the root is placed externally against the surface of the gum, over the root, with its shank and handle parallel to the shank and handle of the probe in the canal. Shanks and handles are then connected with a piece of softened impression-compound, the compound is slightly chilled, and the instruments removed. (See Fig. 14.) If on removal the broach and probe are found not to be exactly parallel, they are made so.

FIG. 14.



B

By this means on the reinsertion of the probe in position in the canal doubt is removed as to the location of the apex of the root, as it is not possible to always positively parallel the broach and probe while the latter is hidden in the root-canal, where also it is often far from being steadily fixed.

In these cases, curetting of the cavity of the abscess and apex of the root is most effective, but the removal of healthy bone tissue should be avoided as much as possible, as the stability of the root is proportionately impaired thereby.

An entrance into the apical space can be made almost painlessly in the following manner, as described by Dr. G. V. Black:[1] "The mucous membrane is first dried at the point at which it is desired to make the opening, and napkins are so placed as to keep it dry. Then a plugging-instrument with fairly sharp ser-

[1] "American System of Dentistry," vol. i, page 928.

rations and of convenient shape is selected. The point of this is dipped into a 95 per cent. solution of carbolic acid, and a drop conveyed to the mucous membrane; this will at once produce a white eschar. Then a slight scratching motion with the serrated point is begun, with a view of removing the tissue that is whitened. This is continued until the carbolic acid is thick with the *débris* of the tissue torn up, then it is dried out and another drop added, as before, and the process continued. This is repeated as often as may be necessary, going deeper and deeper into the tissue in the desired direction until the bone is laid bare. Then a fresh drop of the acid is placed on the bone, and the periosteum carefully raised over a sufficient space; then with a sharp chisel cut through to the peridental membrane. This will generally cause some pain and some bleeding, but after giving a little time for this to cease, and adding more of the acid, the apical space can usually be reached without difficulty. No blood should be drawn at any time during the operation, except in penetrating the wall of the alveolus. In doing this no tissue is removed until it is anesthetized by the carbolic acid. This is a little tedious, but it is almost painless, and the general effect is usually better than by other modes of penetrating the apical space. The carbolic acid has the effect of modifying the pain, and the opening left does not close so readily."

A period of entire cessation of discharge of pus is to be considered the most favorable indication of successful treatment.

Thorough disinfection and sterilization of the dentin and root-canals are included in the preliminary treatment of alveolar abscess. As soon as the treatment is followed by favorable indications, the foramen should be closed while the fistula is yet open. Any further treatment considered necessary can be conducted externally through the fistula. This may be facilitated by enlarging the orifice with tents of cotton saturated with oil of cloves. Enlargement of the fistula tends to encourage the process of granulation in the region which has been occupied by the abscess, especially when a more than usual necrosed condition of the bone requires its removal.

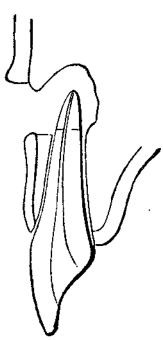
After the abscess has been cured, the root-canals are filled as described on page 23.

Aromatic sulfuric acid is a powerful astringent and germicide. It will be found most useful in cases where a slightly necrosed state of the wall of the alveolus exists. Its use should, however, be limited, and in subsequent external treatment through the fistula some of the other therapeutic agents should be employed, as the hydrogen peroxid, or the essential oils or carbolic acid, alone or combined with one of the preparations of iodin.[1]

Injections of sulfuric acid in the region of the mental foramen should be made cautiously, and it should not be applied to an abscess bordering on the antrum until the operator is positively assured that the abscess does not open into that cavity.

Amputation of the Apex of a Root.—In long-neglected alveolar abscess, the pus-cavity occasionally involves the alveolus in such a way as to destroy a considerable portion of the pericementum of the end of the root. The cementum of that part is consequently devitalized, and the portion of the root affected becomes degenerated in structure, and saturated with septic matter. In this condition it acquires the character of a foreign substance, proves a constant source of irritation, and defies all efforts of the membranes to perfectly inclose or encyst it.

FIG. 15.



In such cases, when curetting of the abscess cavity and end of the root has failed, amputation of the portion of the root which is denuded of pericementum is the best course to pursue. An opening is made in the soft tissues over the affected part in the manner described on page 29, and gradually enlarged with a tent of lint or cotton until the diseased territory is fully exposed (Fig. 15), when the devitalized end of the root and any necrosed bone in the territory are removed, and the end of the root smoothed. Only enough of the end of the root should be excised to thoroughly remove the affected part, as an excess will proportionally lessen its stability and usefulness. The canal should be filled solidly with gutta-percha or preferably zinc oxychlorid previous to the amputation, so that when the end of the root is excised the stump will be left smoothly and snugly filled. Cocain can be used in this operation.

[1] For an extended consideration of this subject the reader is referred to Dr. J. N. Farrar's articles on "Sulphuric Acid *v.* Creasote in Treatment of Alveolar Abscess," commencing in *Dental Cosmos*, vol. xx, No. 7, and Dr. G. V. Black's article in the "American System of Dentistry," vol. i, page 929.

The orifice of the cavity in the gum should be kept open and injected daily with a mild antiseptic solution by the dentist or patient until the cavity is filled by granulation. In cases where extensive necrosis of the alveolar process has existed, in addition to the daily injection the cavity should be packed with a suitable antiseptic dressing. Balsam Peru has been found by the author to be a suitable agent for the purpose, as it assists the process of granulation. When the healing process is completed, crown-work can be proceeded with.

The amputation of roots requires skill and experience, and had better be confined to the front teeth or those with a single root, except in the hands of experts. The performance of this operation without preliminary treatment, by making a transverse incision across the line of the end of the root, is to be condemned. The hemorrhage obstructs the view of the parts and renders liable the removal of an unnecessary amount of tissue, besides it increases the severity of the operation.

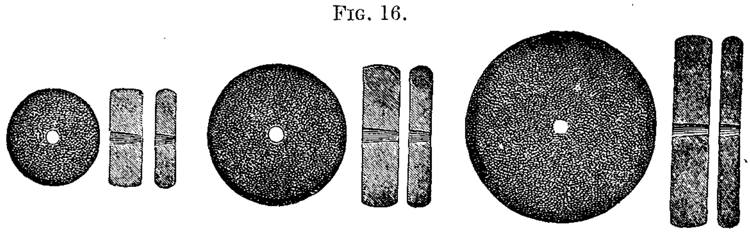
CHAPTER V.

Shaping Teeth and Roots for Crown-Work.

PRINCIPLES INVOLVED—PREPARATION OF TEETH OR ROOTS FOR COLLAR CROWNS, AND INSTRUMENTS USED—FOR READY-MADE PORCELAIN CROWNS—SPECIAL PREPARATION OF BADLY DECAYED TEETH OR ROOTS.

Principles Involved.—The principles governing the shaping of the surface of a natural crown or root for any style of artificial crown with a collar attachment require that the cervical portion of the natural crown and root shall be given a form that has longitudinally parallel sides gaged to the line of the periphery of that part, and that any of the coronal section present below it shall be reduced at least sufficiently in size to come within this line. Such a form is necessary to admit of a perfect adaptation of the collar.

Fig. 16.



Preparation of Teeth or Roots for Collar Crowns, and Instruments Used.—The coronal section of a natural crown to be prepared is usually first ground on the occluding surface with as large a corundum-wheel as the case will conveniently admit (Fig. 16). Molars and bicuspids for all-gold crowns should have enough substance removed to make a small space between them and the antagonizing teeth. The approximal sides of the cervix should be reduced sufficiently to allow a free space between the gold collar when adjusted and the cervices of approximal natural teeth or artificial crowns, to make room for the gum-septa. The approximal surfaces are removed straight from the cervical border to the occluding surface, using corundum or carborundum and rubber disks (Fig. 17), straight-sided or cup-shaped, to get the angle, and occasionally thin separating files; and last of all, as injury to the approximal teeth is then more easily avoided, the labial and palatal portions, for which small corundum-points (Fig. 18) and wheels are best adapted. The corners are then rounded. The

FIG. 17.

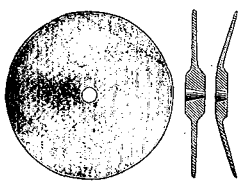
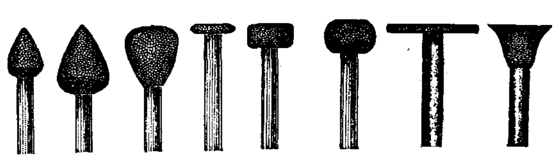


FIG. 18.



cervical portion of roots for collar crowns, which includes the junction of the dentin and enamel, is trimmed so that the sides as illustrated at A, Fig. 19, are level and parallel with the line of the root, and as deep as the collar is to be placed (Fig. 20). For this work small corundum-points, trimmers, and files can be used.

FIG. 19.

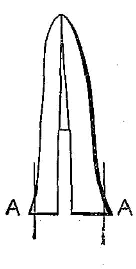
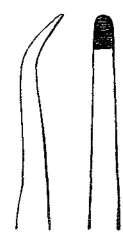


FIG. 20.

FIG. 21.

FIG. 22.

FIG. 23.



Trimmers of the shapes and sizes illustrated in Fig. 21, preferably made with cross-cut serrations, in the ordinary hand-piece or in the right-angle attachment, will easily and quickly accomplish this. Fig. 22 illustrates another style, in the form of a triangular pyramid, which can be used as a scraper in a hand-socket, bracing the hand by resting the thumb on the adjoining teeth. The points should be tempered very hard. Files and serrated scrapers shaped as shown in Fig. 23 are useful in rounding angular portions. A smooth surface should be given the cervix. On approximal sides and the curves to the other sides, medium coarse corundum tape and paper disks can be used for this purpose.

In pulpless teeth, the use of excising forceps should be avoided unless the parts admit of it without serious shock to the root. The best method of amputation is to make a succession of holes with a spear-shaped drill across the portion to be removed, and then cut between the holes with a fissure-bur or corundum-disk, which will permit of easy removal of the part (Fig. 24).

In preparing incisors and cuspids for gold collar crowns with porcelain fronts, where the pulp is to be preserved, the labial surface and incisal edge should be ground down as much as

FIG. 24.

FIG. 25.

FIG. 26.

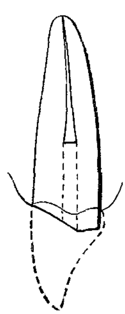


FIG. 27.

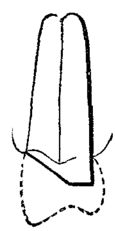


FIG. 28.

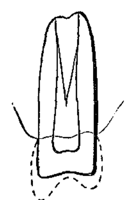
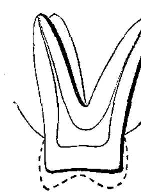


FIG. 29.



possible without exposing the pulp or subjecting it to irritation; the palatal portion at an angle from the cervical border to the incisal edge, enough to level its prominences of contour and form a slight space between it and the antagonizing teeth (Fig. 25). Pulpless incisors and cuspids should be prepared by grinding the labial face to the gum-margin, with the palatal portion slightly projecting and squared off to the inner line of the root-canal. (See Fig. 26.) Bicuspids which are to have porcelain fronts are given the same general form (Fig. 27). In preparing the roots of incisors, cuspids, or bicuspids, it is advisable to let the labial section of the end of the root project slightly beyond the gum-margin until the collar has been fitted, when it can be reduced.

Bicuspids and molars with or without pulps, for all-gold crowns, should have as much of the natural crown left as possible (Figs. 28 and 29). To give a thimble-shaped form is unnecessary and undesirable. While the approximal sides might very slightly taper toward the occluding surface, the other sides should be as nearly parallel as possible. This form is preferable in constructing the crown and is more favorable for its attachment.

The proportion of teeth with living pulps to which gold crowns should be applied is small. Such cases are those in which extensive decay has involved considerable of the coronal section of the tooth and caused more or less calcification of the pulp. The preparation of these cases, of which Fig. 30, a bicuspid, and Fig. 31, a molar, are typical, consists in the trimming of the decomposed enamel at the approximal sides, a moderate reduction of the occluding surface, and the removal of enough from the contour of the labial and palatal surfaces to allow the edge of the collar to

FIG. 30.

FIG. 31.

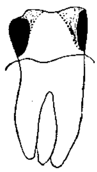


FIG. 32.

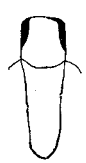
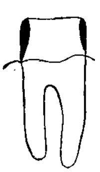


FIG. 33.



spring over and be closely adjusted at the cervical section just under the free margin of the gum. Trimming of the enamel for the purpose of deeply imbedding the edge of the collar under the gum-margin, so that it shall closely approach the pericementum, is unnecessary, either for the purpose of retention of the crown or for the preservation of a tooth with a living pulp. Irritation of the pericementum by impingement of the collar would eventually result in recession of the membrane and exposure of the edge of the collar. Fig. 31 and Fig. 33 show the typical bicuspid and molar prepared for the construction of the metallic crowns, the natural teeth having been trimmed and the cavities sterilized and filled with amalgam.

Extremely short teeth and teeth slightly imbedded in the tissues, as many third molars are, do not require as much shaping as long bicuspids and first molars.

It should be borne in mind, however, that unnecessarily cutting away the enamel and dentin of teeth with living pulps leaves them in an extremely sensitive condition, and is likely to result subsequently in some serious lesion of the pulp. Slight sensitiveness, such as may be caused by excessive shaping, is relieved by drying the exposed dentin with hot air and applying carbolic acid two or three times as required. When this treatment is not sufficiently effective, a temporary cap of pure gold, about No. 34 gage, can be quickly constructed and cemented on with gutta-percha. A small quantity of a compound of oil of cloves, carbolic acid, and chalk (described on page 9) placed in the center of the cap acts as a sedative and remedial agent.

For Ready-Made Porcelain Crowns, roots are usually ground level with the margin of the gum. The palatal portion of the end of the root in some cases may be allowed to project a trifle beyond the margin, but the labial aspect should be trimmed a little below, especially on the front teeth, if it is desirable to conceal the joint. The root-canal is shaped to the form of the post or dowel to fit it tightly. (See Part II, Chapter III, "Porcelain Ready-Made Crown System.")

The occluding edges or surfaces of antagonizing teeth should be removed sufficiently to allow ample space for the artificial crowns or to favor them in occlusion. This is especially necessary where the occluding tooth, in the absence of an antagonist, projects beyond the proper line of occlusion. When the approximal teeth crowd against and overhang the end of a root, so that the space for the artificial crown at the occluding surface is narrower than at the cervical section,—measured from mesial to distal side,—the sides of the root should be trimmed so as to give a free space between it and the sides of the approximal teeth. The approximal teeth may also be pressed away by packing on each side of the root with gutta-percha, or a small portion of their interfering surfaces removed, as shown in typical cases in Figs. 34 and 35.

Corundum or Vulcarbo wheels or points should be kept wet and cool during use in all such operations in the mouth. A piece of sponge, held against the wheel with clamping pliers, or a porte-polisher, such as is used for carrying a small piece of wood in cleaning or polishing the teeth, answers the purpose admirably, and also protects the tongue and cheek from injury.

Special Preparation of Badly Decayed Teeth or Roots.—The temporary exposure of the end of a root or of the cervical portion of a crown for the purpose of facilitating or simplifying a crowning operation, especially in the adaptation of a collar, is effected by inserting in the pulp-chamber or the root-canal a piece of gutta-percha large enough to admit of a portion being brought over against the investing membranes, to compress them for a day or more. In some cases to secure attachment for the gutta-percha, a plug of wood may be inserted temporarily in the root, and the gutta-percha packed around it. Roots can thus be exposed to the border of the alveolar process if desired. In bicuspids and molars, when decay extends up on the cervix farther than will the edge of the artificial crown or the collar, the gums should be pressed up as described, the decay removed, retaining-pits made, and the cavity filled with amalgam shaped to the contour required (Fig.

FIG. 34.

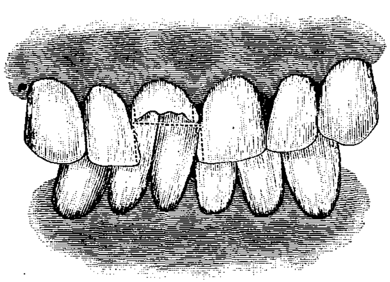
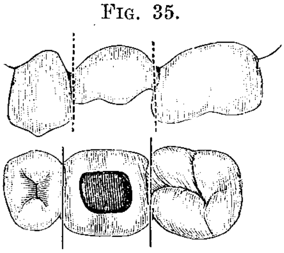


FIG. 35.



36). In such cases the amalgam will generally be in close proximity to the pulp and the cavity frequently of a form not favorable to the retention of the filling. To avoid irritation from thermal changes and better retain the filling a moderately thin mixture of oxyphosphate may be first placed in the cavity, the amalgam then pressed into it and the oxyphosphate forced out, especially at the margins where the amalgam must be brought into direct contact with the tooth-structure. In incisors and cuspids, when decay has deeply destroyed a portion of the side of the root, a tight-fitting tube of a metal to which amalgam will readily adhere, and of such size as to admit the pin of the crown, may be inserted in the root-canal, cemented with oxyphosphate, and the decayed portion restored with the amalgam on the side of the root. The post of the crown should be tapered at the end, and inserted in the canal as deeply as possible beyond the end of the tube, to gain additional strength by distributing the leverage along the whole line of the root.

In some such cases a better method is to fit and cement a pointed post as far up the canal as it can be safely introduced, leaving the end protruding beyond the gum. Then shape the side and end of the root with amalgam and cap with a platinum and porcelain jacket-crown (Part IV, Chapter VIII). Fig. 37 shows a typical central and bicuspid of this character.

When an incisor or cuspid crown post is to be inserted and the root-canal is enlarged from decay or excessive reaming, the defect in relation to the post of the crown can be remedied in the follow-

FIG. 36.

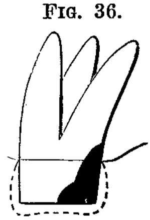


FIG. 37.

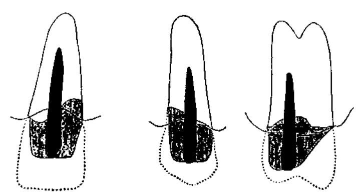


FIG. 38.

FIG. 38*a*.

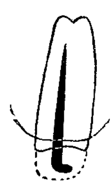


FIG. 39.

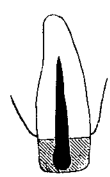
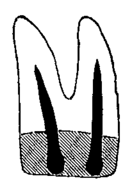


FIG. 40.



ing manner: Fit a tapering post of medium size with the point reaching the extremity of the canal. Close the foramen with a very small point of gutta-percha so that it will not interfere with the insertion of the post. Fill the canal with a thin mixture of Ash & Sons' "Rock Cement" (a zinc oxychlorid which sets in three minutes), insert the post, and in exactly thirty seconds remove it. Instantly wipe off the post and reinsert it. The temporary removal of the post prevents the adhesion of the cement to it, so that when the cement has set the post can be removed, and you have a close-fitting socket for it.

In setting a gold cap-crown on a badly broken-down tooth or root, a post of platinum or iridio-platinum wire should be fitted to the root-canals (Figs. 37, 38, 38*a*, 39, and 40). The end can be bent or a piece of gold or a globule of gold melted to it. The post should then be barbed, the point fastened in the root with a little oxyphosphate or zinc oxychlorid, and the crown built down about two-thirds its length with a quick-setting amalgam, to be shaped when hard and then slightly notched to furnish a better attachment for the cement with which the cap is set. Rolling the wire used to form the posts under the flat side of a file before using will uniformly roughen the entire surface in a manner most favorable to the adhesion of the cement. Screws may be used as posts to support the amalgam, but cemented posts are preferable. To safely retain the amalgam in position during the setting, a previously made and properly fitted collar of thin German silver or copper plate, not over No. 35 gage, may be used. When the amalgam has set, at a subsequent sitting, the metal can be readily stripped from its surface, which should be dressed down with the revolving trimmers evenly to that of the surface of the root or crown. In such cases it is presumed that the gold cap will entirely cover the exposed portion of the amalgam.

PART II.

ARTIFICIAL CROWN-WORK.

PART II.

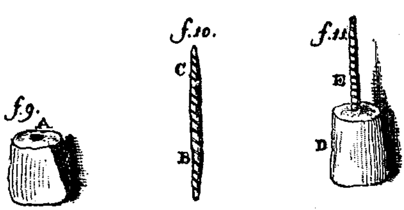
CHAPTER I.

Artificial Crown-Work.

FIRST AUTHENTIC ACCOUNT OF ARTIFICIAL CROWN OR PIVOT TEETH—THE FIRST PORCELAIN PIVOT TEETH—GOLD PIVOT TEETH—FIRST PORCELAIN AND GOLD PIVOT TOOTH OR CROWN—RICHMOND PORCELAIN AND GOLD COLLAR CROWN—THE EARLIER OPERATIONS—MORRISON AND BEER'S CROWNS—THE FOSTER AND LAWRENCE CROWNS—THE MACK AND HOWLAND-PERRY CROWNS—THE GATES-BONWILL CROWN—THE HOW CROWN—THE WESTON CROWN—THE NEW RICHMOND PORCELAIN CROWN—ADVANTAGES CONFERRED BY IMPROVEMENTS IN CEMENTS—CLASSIFICATION OF CROWN-WORK.

First Authentic Account of Artificial Crowns or Pivot Teeth.—The first authentic account we have of the use of artificial crowns or pivot teeth is given by Fauchard, in his work entitled "Le Chirurgien Dentiste ou Traités des Dents," in 1728. Fig. 41 illustrates the crown he describes. The root was ground level with the surface of the gum, the root-canal enlarged, cleaned, and filled with lead. A hole was drilled in the lead and the rough-surfaced post was forced into the soft metal to secure it. The other end of the post was fastened in the crown, which was either a natural crown or one made of ivory.

Fig. 41.



Fauchard's "Dent a Tenon."

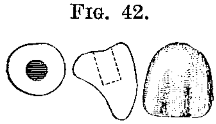
De Chemant described the use of porcelain for the construction of pivot teeth in the early part of the last century. From that time on porcelain has been used and has gradually, for the most part, superseded other materials for the construction of crowns.

The First Porcelain Pivot Teeth.—The porcelain pivot tooth or crown (Fig. 42) was the form used for many years, until recently. When first introduced it was attached to the root by means of a hickory-wood pin or pivot, one end of which fitted the hole in the center of the crown and the other that of the root-canal. The moisture, by swelling the wood, securely fastened the pivot in both tooth and root.

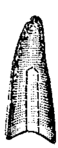
It was found that the wooden pivot in time caused decay of the root, and was liable to fracture it by expansion; it also affected the breath. These objections led to the introduction and use of a gold pivot instead.

Gold Pivot Teeth.—These gold pivots were variously secured to root and crown. In the crown the pivot was fastened by incasing it with wood or by skilfully flowing a little gold solder around the part of the pivot which set in the porcelain, and to the root by fitting in the canal a piece of hickory and inserting the pivot into the wood, or, by twisting fibers of cotton or silk around the post and pressing the crown to position.

FIG. 42.



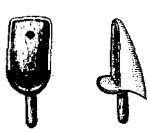
PIVOT TOOTH.



ROOT PREPARED FOR PIVOT.

First Porcelain and Gold Pivot Tooth or Crown.—The porcelain pivot tooth mounted by these methods was superseded by the use of a plain plate porcelain tooth, backed with gold and soldered to a piece of plate stamped out to accurately fit the end of the root and soldered to the pivot or pin, as shown in Fig. 43. A later improvement in the attachment of the crown consisted in the use of a gold tube, which was screwed into the root and into which the pivot was tightly fitted. This later method was devised to avoid the objectionable features connected with the use of wood. The transition from this last-mentioned method to those of modern crown-work, though most important in their results, is not so marked as regards constructive details.

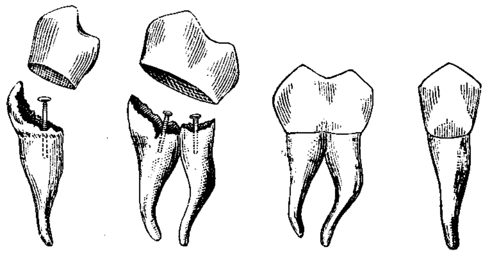
FIG. 43.



Richmond Porcelain and Gold Collar Crown.—The gold collar crown with porcelain front of present use is practically the gold-backed pivot tooth of former years, with the addition of a collar to inclose the end of the root. This addition of a collar, though apparently simple to conceive, was slow of development. It was not until such a form was presented and its advantages demonstrated by Dr. C. M. Richmond, about 1878, that its true value and possibilities were appreciated, more especially respecting the support it was capable of affording in bridge-work operations.

The Earlier Operations.—The earlier operations in porcelain crown-work were almost entirely confined to the incisor and cuspid teeth, the object being restoration for appearance rather than utility. We find, though, on investigating the history of the art, that some effort was also made by a few of the earlier practitioners to maintain and restore the usefulness of affected back teeth with crown-work. Prominent among these was J. Paterson Clark, a dental practitioner in London, England, who, as early as 1836, published a description of his method of restoring decayed and abraded molars to usefulness by covering them with gold caps stamped up on a metal die of the tooth.

FIG. 44.



The Morrison and Beers Gold Crowns.—Similar operations were described and practiced later on in this country by Dr. W. N. Morrison, in 1869, and were brought into more prominence by Dr. J. B. Beers, who, in 1873, secured a patent for his method of capping teeth with gold, as illustrated in Fig. 44.

During the progressive modifications in crown-work which evolved from the gold-pivot tooth or crown to the gold-collar porcelain crown of the present time, many improvements on the original porcelain pivot tooth as a ready-made crown were developed and introduced into practice. One of the first of this character to attain prominence was the Foster crown.

The Foster and Lawrence Crowns.—The Foster crown, introduced by Dr. E. W. Foster, in 1855, and so named, although similar to one patented by Dr. H. Lawrence, in 1849, differed from the commonly used pivot tooth in having a perforation in the center of the palatal side on a line with the root-canal. The orifice was shaped to accommodate the head of a screw (Figs. 45 and 46) by which the crown was attached to the root. The object of this form was to dispense with the use of wood as a pivot or post.

The Mack and Howland-Perry Crowns.—The first form of porcelain crown introduced which protected the end of the root by the use of cement for its attachment was devised by Dr. C. H.

FIG. 45.

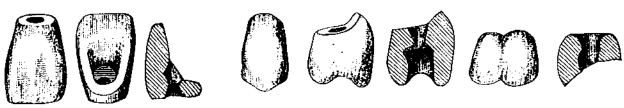
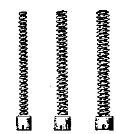


FIG. 46.



Mack, in 1872. It consisted of a hollow porcelain crown, with a cavity in the base of a shape and size to admit the extremities of pins screwed into the root or cemented in the canal. The crown was cemented on the root over these pins with gutta-percha, amalgam, or zinc oxychlorid. The Mack crown proved unreliable in practical use because of the insecurity of the attachment. The Howland and Perry crowns, which were so nearly identical that they became known as the Howland-Perry crown (Figs. 47, 48),

FIG. 47.

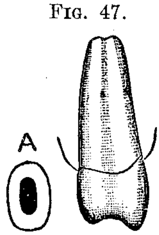
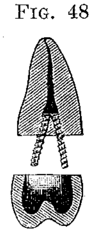


FIG. 48.



improved on the Mack by imparting to the cavity in the base a better form for the retention of the screws in the cement and a more suitable curve to the base.

The Gates-Bonwill Crowns.—The next noticeable improvement in all-porcelain crowns appeared in the Gates and Bonwill crowns, the former being the invention of Dr. W. H. Gates, about 1875, and the latter of Dr. W. G. A. Bonwill, in 1881. These also were so nearly alike that they were called "Gates-Bonwill" (Figs. 49 and 50). One of the advantages this crown possessed over the Foster was, that amalgam was used for its attachment, protecting the end of the root from decay. The base of the crown

FIG. 49.

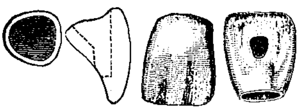
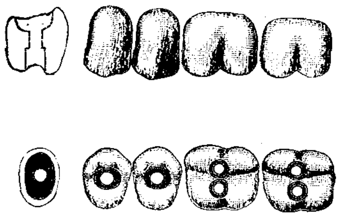


FIG. 50.



was concave and the aperture for the post of a triangular form. The crown was secured to the root with a screw-post, or a flat pin with tapering ends, anchored with the amalgam that attached the crown. This crown was extensively used for several years.

The How Crown.—The How crown (Figs. 51, 52) was invented by Dr. W. S. How, in 1883. Its novel feature was the formation of a sufficient concavity in the palatal side of the in-

FIG. 51.

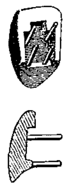
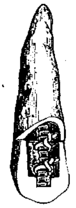


FIG. 52.

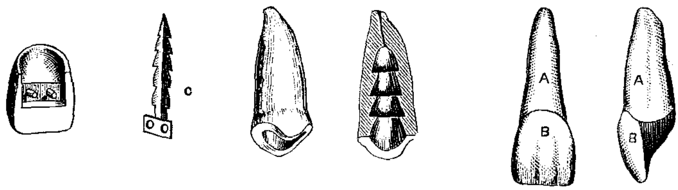


cisors and cuspids to afford space for four pins in the porcelain with room between them for the adjustment of the screw-post. The crown when fitted was attached by bending the pins around the post and packing around them and filling the cavity of the crown with amalgam.

The Weston Crown.—The Weston crown, introduced by Dr. Henry Weston about the same time, was similar in principle and structure, with this difference: The Weston post was flat and riveted to the crown before insertion. The post was first cemented in position with a small quantity of zinc oxyphosphate, and the remainder of the space then filled with either gold or amalgam. Fig. 53 shows the various steps in the operation.

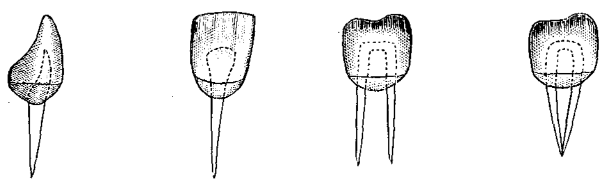
Another form of modern introduction, but limited use, was the

FIG. 53.



Brown crown, illustrated in Fig. 54. It was made with a conical base and with a long pin baked in the porcelain. In mounting it, the end of the root was concaved to receive the convex porcelain base. The object of this form of construction was to permit the

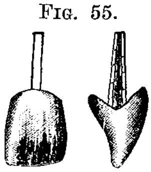
FIG. 54.



porcelain to be removed in a close bite without materially weakening the crown.

The New Richmond Porcelain Crown.—In the New Richmond porcelain crown, illustrated in Fig. 55, which was also of the all-porcelain variety, a cavity was provided at the base to exert some degree of lateral pressure on the root and thus help to guard against its fracture.

FIG. 55.



The development of what were classed as ready-made porcelain crowns as here traced, brings us to the forms which are now in use and which will be described in the succeeding chapter.

Advantages Conferred by Improvements in Cements.—Doubtless much of the present perfection of methods by which the effective results now achieved in this branch of dental prosthesis are made possible, is due to the use of cements with which the ends of roots and crowns are hermetically inclosed. Of these the first was zinc oxychlorid, introduced about 1860, though not used in this work till some years later. More important was zinc phosphate, first made known about 1877, while a better understanding of the properties of gutta-percha as applied to this purpose has contributed not a little to the result.

Classification of Modern Crown-Work.—Modern artificial crown-work affords extensive facilities for restoring the crowns of natural teeth, and furnishes means of support for bridge-work.

The consideration of modern artificial crown-work as presented in succeeding chapters is divided into two general systems,—the porcelain and the gold. Under the porcelain system are included ready-made porcelain crowns, applied with or without collars; and under the gold system, all-gold crowns, gold crowns with porcelain fronts, and special operations.

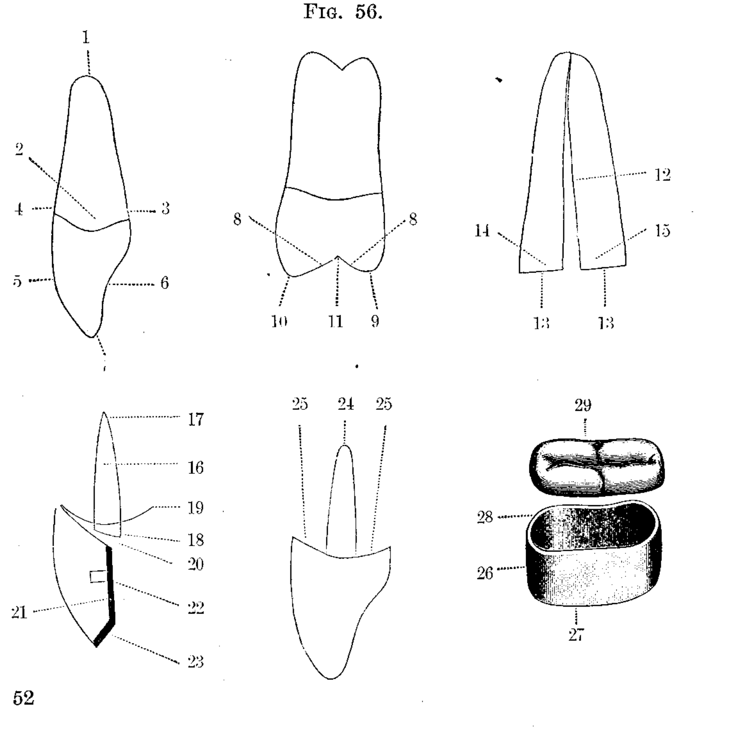
CHAPTER II.

Principles Involved in Crown-Work.

NOMENCLATURE OF CROWN-WORK—THE OBJECT OF CROWNING OPERATIONS—THE SUBJECT OF OCCLUSION—MALFORMED OCCLUSAL SURFACES—THE POST IN RELATION TO THE CANALS AND ROOTS—THE POST IN RELATION TO POST OR DOWEL CROWNS—SHORT AND LONG CROWNS—PRINCIPLES GOVERNING THE CONSTRUCTION OF ROOT-CAPS WITHOUT COLLARS—POSTS IN RELATION TO COLLAR CROWNS—SELECTION OF PORCELAIN TEETH—DEPENDENCE OF CROWN-WORK OPERATIONS ON ASEPSIS.

To systematize and explain the nomenclature used in the descriptive details of crown-work, the following definitions of terms used are given:

Fig. 56.



1. Apex.
2. Cervix.
3. Cervico-palatal surface.
4. Cervico-labial surface.
5. Labial surface.
6. Palatal surface.
7. Incisal end.
8. Occluding, occlusal, or grinding surface.
9. Palatal cusp.
10. Labial or buccal cusp.
11. Sulcus.
12. Root-canal.
13. Surface of end of root.
14. Labial or buccal section of end.
15. Palatal section of end.
16. Post, dowel, pin, or pivot.
17. Point of post.
18. End of post.
19. Cap or plate. (This part when used in connection with a collar is more generally termed the top or plate.)
20. Slot between cap and base of porcelain front.
21. Back of porcelain front.
22. Metallic backing.
23. Metallic backing on incisal surface.
24. Post, dowel, pin, or pivot.
25. Base of crown.
26. Collar.
27. Cervical edge of collar or crown.
28. Occluding edge of collar.
29. Cap or occluding or grinding surface.

Principles Involved in Crown-Work.—The practice of modern crown-work consists in the artificial replacement of the coronal portions of natural teeth affected by or lost from caries, for the purpose of securing a better appearance or greater utility or both. In bridge-work operations it includes also the capping of natural teeth with gold and the artificial restoration of excised natural crowns to be used as supports.

No matter what the forms in which teeth and roots are presented for crown-work, invariable mechanical principles govern the application, though the style or method of construction admits of selection. The general condition of the roots or teeth to be operated on, and the character, direction, and force of the occlusion are subjects that govern the *application.* The location in the mouth and the object of the operation indicate the preferable style or method of construction. Operations on the six front teeth will generally be influenced by appearance, and those on the back teeth principally by utility.

The Object of Crowning Operations.—In the crowning of roots and pulpless teeth having the coronal section practically destroyed by decay, protection against its recurrence and the fracture of the root are the subjects to be specially considered. In cases where sound teeth, or teeth with or without living pulps, only slightly decayed, are to be capped with gold as supports for bridges, the work is to be conducted principally with the view of preservation of the coronal section.

Modifying the Occlusion.—In a normal state of the occlusion of the teeth the force of mastication is received in an upward outward direction on the palatal and incisal surfaces of the six upper front teeth and inwardly in an opposite direction on the incisal and labial surfaces of the corresponding lower teeth. When bicuspids and molars are evenly occluded the force is direct. In a side or lateral motion of the jaw the force is delivered in corresponding directions against the occluding surfaces of the cusps. This lateral force upon the cusps in mastication is proportionately greater when the cusps are long as in Fig. 57, and it can be modified by giving them the entirely practical but shorter form with shallow sulci, illustrated in Fig. 58. This result can usually be accomplished

FIG. 57.

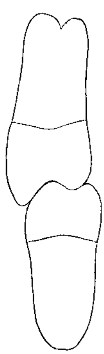


FIG. 58.

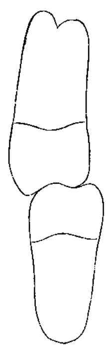


FIG. 59.

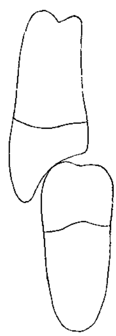
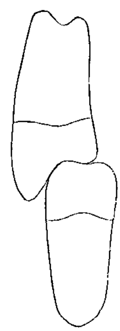


FIG. 60.



without injuriously affecting the appearance, and the work can be materially simplified by a proportionate reduction of the cusps of the natural antagonizing teeth.

As the cusps of the bicuspids and molars retain them in proper alignment with their antagonizing teeth, they should always be formed to accord with an outline of the original shape of the natural teeth.

Malformed Occluding Surfaces.—Fig. 59 shows an upper bicuspid crown with a malformed occluding surface of a shape often improperly given in a case of close occlusion.

The resultant conditions in time are that the crown and root, because of the gliding pressure exerted on the surface of the crown, are pressed outward so that its stability and usefulness are gradually impaired and finally destroyed. In a case where the symmetry and appearance imperatively demand such an extension of the labial cusps, the displacement just referred to will be prevented by giving sufficient length to the palatal cusp to lock the crown in the act of occlusion, as shown in Fig. 60. This principle may be advantageously applied in construction of crowns for the six front teeth, especially the cuspids, when, owing to the loss of the back teeth, they have to bear the force of occlusion. A slight shoulder or partial cusp will materially lessen the effect of the outward gliding pressure. (See Fig. 70.)

FIG. 61.

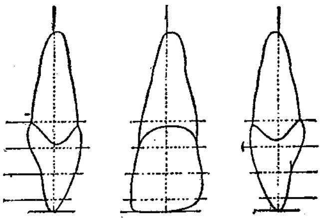
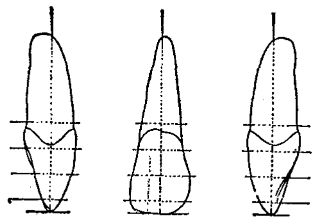


FIG. 62.



Adjustment of Incisors and Cuspids.—In the adjustment of incisor and cuspid artificial crowns or teeth the operator should be guided by the fact that the center of the line of the incisal surfaces is always located in the median line of the combined natural crown and root, as is shown in Figs. 61, 62, and 63.

Posts in Relation to the Canals and Roots.—The original forms of the canals and roots of the teeth should be studied and kept well in mind in reaming the canals for the reception of posts.

FIG. 63.

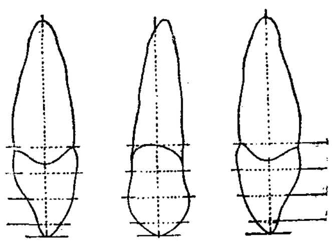
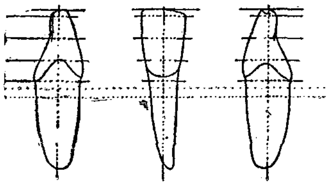


FIG. 64.



The pulp-canal is located in the central section of each root, in the incisors and cuspids very nearly on a straight line between the end of the root and the center of the incisal edge or cusp. (See Figs. 61, 62, 63, 64, 65.) This fact will materially aid in determining the direction or angle at which a drill, bur, or reamer should be introduced into these teeth. The same principle may be considered in the conduct of operations on upper bicuspids, lower first bicuspids, the buccal roots of upper first and second molars, and the mesial roots of lower molars, making due allowance for such curve of the root as may exist, should the instrument be introduced deeply into the canal (Figs. 66, 67, 68, and 69). When the natural crown of a root in normal alignment with the other

FIG. 65.

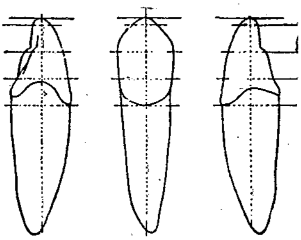
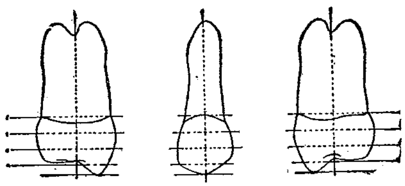


FIG. 66.

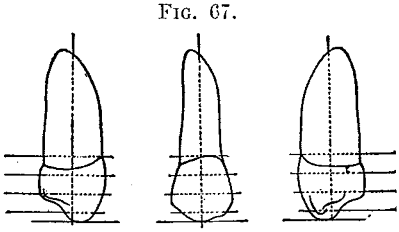


teeth has been nearly or entirely lost, the angle to give the instrument may be calculated by the adjoining teeth.

The reaming should be so conducted that while the necessary enlargement is effected, the root is weakened the least possible.

Strength is most required on the approximal sides of the upper and lower six front roots, as the pressure imparted by the post in the canal is almost entirely received in either an inward or out-

FIG. 67.



ward direction. Proper reaming of the canal in accordance with its original shape and that of the cervical section of the root, and the forming of the post to correspond, will provide the greatest proportionate amount of strength for both root and post.

As the most strength in a post is developed in the line of its greater diameter, a properly adjusted post that inclines to an oval form will afford greater strength than a round one composed of the same amount of the metal. (Fig. 71 outlines a cuspid root and oval-shaped post.)

Tapering the post allows it to be introduced deeper into the canal without excessive reaming than if made of a uniform diameter or only rounded at the point. The point of the post, what-

FIG. 68.

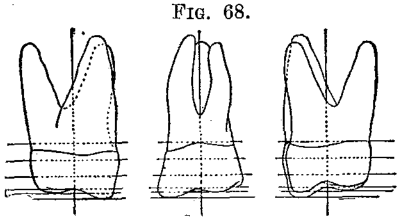


FIG. 69.

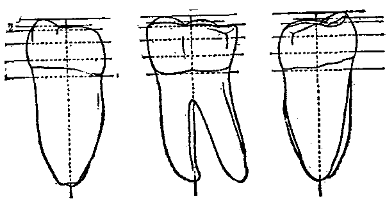


FIG. 70.

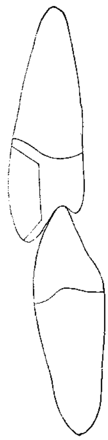
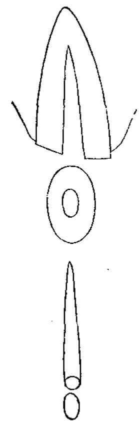


FIG. 71.



ever the shape, should be immovably fitted or anchored in the canal, especially when the remaining portion fits loosely, as seen in Fig. 72.

FIG. 72.

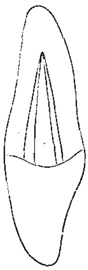


FIG. 73.

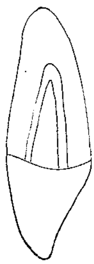


FIG. 74.

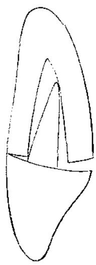
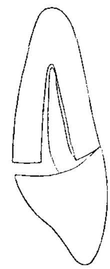


FIG. 75.



Anchoring the point defines its position and lessens the liability of fracturing the root under pressure.

When the point of a post is not anchored, as shown in Fig. 73, and cemented with gutta-percha, crown and post are likely to tilt under continued application of pressure, as seen in Fig. 74. A weak or thin post is liable to bend, as illustrated in Fig. 75. Each of these conditions causes fracture of roots carrying post or dowel crowns, or of crowns with very small or improperly applied posts and partial collars.

The Post in Relation to Post or Dowel Crowns.—A post or dowel crown without a collar is dependent entirely on the post or dowel for attachment and support. In this function the post exerts and resists in its incasement and foundation—the root—all the lateral and direct pressure incident to mastication. The length, shape, and size of a post should therefore be regulated accordingly. A post in a root distributes applied pressure its entire length along the walls of the canal; consequently, in the

FIG. 76.

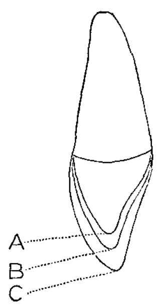


FIG. 77.

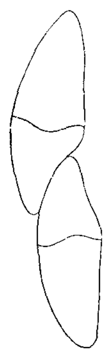
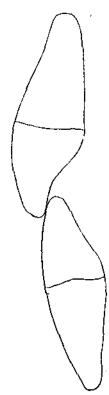


FIG. 78.



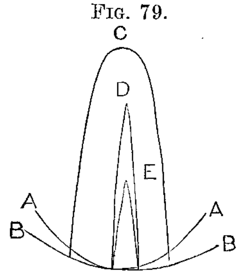
use of a long post, a proportionately greater area is involved than with a short one.

Short and Long Crowns.—The greater the distance from the end of the root the force is exerted, the greater the proportion of lateral strain the walls are subjected to. Therefore the shorter the crown, the less is the leverage or pressure. This principle is made clear by Fig. 76. The incisal edge of the crown, which ends at A, will not exert through the post so great a proportion of pressure on the root in mastication as one with an incisal edge at B, which again would exert less pressure than one extended to C. The latter would especially suggest the use of a long post.

When the occlusion of the six front teeth is deep and close, as shown in Fig. 77,—a condition termed "close bite,"—the crown and teeth or crowns as they occlude exert an increasing gliding pressure. An occlusion of this character always demands the longest possible close-fitting canal post. In occlusions occurring nearer the incisal surface, termed "open bite," as seen in Fig. 78, the pressure is more direct and proportionately less lateral in character.

Principle Governing the Construction of Root-Caps without Collars.—A cap or plate without a collar, fitted to a flat or slightly curved end of a root, does not afford a positive resistance to lateral pressure in supporting a crown. This resistance, however, can be quite effectually accomplished by giving a deep curve to the surface of the end of the root at the labial or palatal side, or both sides combined,—as resistance requirements suggest,—which will be proportioned to the length of the post. The edge of the curve at the gum-margin must come within the line of the segment of a larger circle which passes over the center of the surface of the end of the root, described by the point of the post as its center; or, in other words, the radius or distance from the point of the post to the extreme edge of the curved surface of the side of the end of the root must be shorter than from the point of the post to the center of the line of the orifice of the canal. The shorter the post, the deeper the labial and lingual edges of the curve should extend. The principle is demonstrated in Fig. 79. C is the center of the root-end, D a long post, and E a short one. AA is a segment of a circle described from the point of post E, and BB a similar segment described from D. The beveling or curving of the root should be extended beyond AA for a post like E, and beyond BB for post D.

FIG. 79.



Posts in Relation to Collar Crowns.—In collar crowns, as the root is encompassed by the collar, the principal use of the post is to retain the crown. The actual length and size of post required for a collar crown is dependent on the conditions presented. Deep, substantially fitted collars require the aid of only a moderate post. Narrow or partial collars when applied to the six front teeth require proportionately larger posts for the crowns, approximating in size to those used for the ordinary post or dowel crown.

The force of occlusion being distributed over the entire occluding surface of bicuspids and molars, when a collar is applied it should entirely encircle the root. Crowns on these roots are therefore not so dependent for security on posts as those placed on the six front teeth. A substantial properly fitted and cemented post in any root-canal, whether or not attached to the artificial crown, always materially strengthens the root.

Selection of Artificial Teeth.—Crown-work is a branch of dental prosthesis which requires judgment and skill in the selection of porcelain teeth for the work in hand, as one of the great objects in dental art should be to conceal art. In a large proportion of operations on the front teeth, the result has to be studied more with reference to appearance than utility. In size, form, and shade, porcelain teeth selected for one side of the mouth should match the corresponding tooth or teeth on the other side. The shade should be fully as dark, never lighter. Uniformity in shade of the different teeth should be avoided. Central incisors usually require to be the lightest in shade, laterals slightly darker, the cuspids darker than the laterals, and the bicuspids about the shade of the laterals. The shades of the lower teeth vary in the same order, but are a little darker. Observation of this rule in selection will avoid that extreme sameness of shade so frequently characteristic of artificial teeth, and cause them to more closely approach natural teeth in appearance.

The proper and successful performance of crown-work operations depends largely upon the due observance of the principles here presented.

Dependence of Crown-Work Operations on Asepsis.—Crown-work in the restoration of badly decayed pulpless teeth or roots is intimately associated with their treatment, more especially as regards the establishment and future maintenance of a state of asepsis. The usefulness of operations depends on the successful assurance of this condition. Recent investigations show conclusively that ordinarily infection of pulpless teeth and roots occurs from the oral cavity. It is therefore clear that root-canal filling and such restoration of any portion of the natural crown present as may be required preparatory to capping should be so conducted as to offer the greatest possible obstruction to infection.

CHAPTER III.

THE PORCELAIN READY-MADE CROWN SYSTEM.

METHOD OF PREPARATION OF THE ROOT—SCREW-POSTS—USE OF PLASTER MODEL FOR FITTING CROWNS—THE LOGAN CROWN—THE FELLOWSHIP CROWN AND THE BREWSTER CROWN—THE DAVIS CROWN—ASH'S TUBE-TEETH AND CROWNS.

THE porcelain ready-made crowns in use at the present time are the results of progressive development of this branch of the art from what was originally styled the porcelain "pivot-tooth."

Porcelain ready-made crowns are used by many dentists almost exclusively, excepting only the occasional insertion of a gold cap-crown on a posterior tooth. The reasons for this are the greater intricacy of the construction of gold crowns and personal objections to crowns with bands or collars.

The advocates of the porcelain ready-made crown claim for it natural appearance, restoration of contour, strength, and cleanliness, together with simplicity of construction and easy adaptation and attachment to the root, to which the crown is hermetically sealed. Porcelain ready-made crowns at present in use are made in two general styles. In one the end of the pivot, post, pin, or dowel, as it is variously termed, is baked in the porcelain when the crown is made, and the other end cemented into the root when the crown is adjusted. The Logan, Fellowship, and Brewster crowns are of this class. In the other style the crown is attached to the root by a pivot, post, or screw, one end of which is cemented in the root and the other in the crown, such as the Davis and Ash.

Special advantages are claimed for each of these several forms of crowns. A general knowledge of the different styles is therefore essential to determine the adaptation of each to the requirements of a case.

Crowns in which the post is to be cemented admit of alignment with the other teeth, in some cases more easily than those which are made with the post in position. The attachment of the crown to the post, however, is not nearly as reliable when cemented as when baked in the porcelain, especially in close "bites."

Preparation of the Root-End.—The preparation of the end of the root and canals to receive and retain posts is about the same for all of the different styles of ready-made porcelain crowns. The end of the root is trimmed to the gum-margin in the front teeth, slightly below it at the labial side, to hide the intended union of porcelain with root. This may require the removal of the enamel at the cervico-labial section, but not around the entire periphery of the root. The length of the root-canal is measured with a root-canal plugger and its flexible gage. A disk of rubber-dam can be placed on the plugger and used for the same purpose. By this means the proper length for the post is determined. The dimensions of the root determine the diameter. Fill that part of the end of the canal which will not be occupied by the post. Enlarge the canal with Gates-Glidden drill as deep as required to accommodate the post for the crown which is to be inserted. Next, with a gage-plate, determine the size of the post, and with small-sized fissure-burs gradually ream the canal to a dimension which the post will fit tightly. A post to be inserted in a root to attach, for instance, a Davis or tube crown, is preferably made of iridio-platinum wire.

Screw-Posts.—A size is selected which will accurately fit the hole in the porcelain crown. The surface of the wire should be roughened either by cutting a fine screw-thread with a screw-plate or by rolling the wire under a flat file. The canal should be reamed to accommodate the post. The point of the post beyond the reamed section may be tapered and introduced deep into the canal for security and to strengthen the root in such cases as suggest it. The post is cemented in the root with zinc oxychlorid or oxyphosphate. Of the two the oxyphosphate is the more easily manipulated and more reliable for the retention of the post, but otherwise the antiseptic properties of the oxychlorid strongly recommend it.

A screw-post screwed into the root is by some given preference to one which is only cemented, and in very short roots can often be used to advantage. The How screw-posts and appliances, illustrated in Figs. 80 to 85, are generally used for the purpose in the following manner:

"1. Set gage on a Gates drill (Fig. 80) to one-half the gaged depth of the canal, or further, if the circumstances require it and conditions will safely permit, and drill to that depth.

FIG. 80.

"2. Set the twist-drill in its chuck (Fig. 81) to project the same length as the Gates drill, and drill the root to exactly that depth.

FIG. 81.

FIG. 82.

FIG. 83.

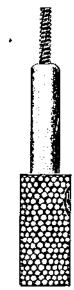


FIG. 84.

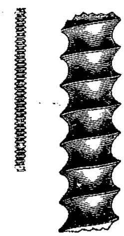
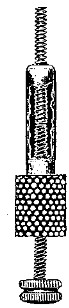


FIG. 85.



"3. Enlarge the mouth of the canal one-sixteenth of an inch deep all around to near the margin of the root, as shown in Fig. 82, using square-end fissure-bur No. 59, and then with oval bur No. 94, undercut a groove lingually and at the sides.

FIG. 86.

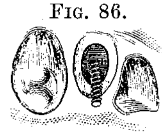
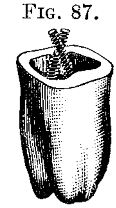


FIG. 87.



"4. Set the tap in its chuck (Fig. 83) a trifle less in length than the drill, oil it, and carefully tap the root to the gaged depth.

"5. Insert the post (Fig. 84) in its chuck (Fig. 85) to the exact gage of the tap, and turn the thumb-screw down hard on the end of the post, then screw the post into the root by hand, release the thumb-screw, unscrew the chuck a half-turn, bend the post until the chuck stands in center line with the adjoining teeth, and unscrew the chuck from the post."

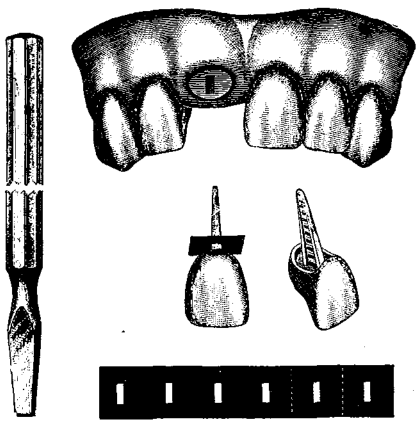
The appearance of posts in relation to roots is illustrated in Figs. 86 and 87.

In these operations, as likewise in others, posts of platinum or iridio-platinum are to be preferred to those made of alloys that contain a large percentage of the baser metals, as the ultimate corrosion of the latter tends to impair the dentin.

Just before a screw-post is screwed into the canal, it is advisable to apply a little of a thin mixture of cement on its surface.

Plaster Model to Fit Crown.—A plaster model and "bite" of the case will aid in the selection of a suitable crown and in the preliminary fitting to the root. A post of wood or metal placed in and left extending from the root-canal, and then withdrawn in the impression, will give the line of the canal in the plaster model. Exposing the end of the root, by pressing the gum away from it with gutta-percha preliminary to the operation, will greatly assist the operator, by enabling him to avoid accidental laceration of the adjoining membranes, and the annoyance attending their bleeding, besides permitting him to carefully study the adjustment and cementation of the crown. The obtaining of a close joint is much facilitated in all forms of porcelain crowns by passing a disk of black marking- or impression-paper over the post or pin which is to retain the crown, and placing the crown in position on the root. (See Fig. 88.) Cut the paper in a strip, and, to admit the post, form holes with a punch, as shown on margin of Fig. 88. The points which prevent perfect adjustment are marked on both root and crown, either of which can be dressed off accordingly as seems most desirable.

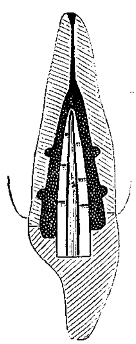
FIG. 88.



Crowns in which the post is baked in the porcelain will first be described.

The Logan Crown.—The Logan crown, now so extensively used, was invented by Dr. M. L. Logan. Its distinctive features are the cupping out of the base surrounding the strong platinum post, the form of the post, and the baking of the post in the porcelain. As originally made the post was round, but shortly after the tapered I-beam post was introduced. At first the I-beam post was plain (Fig. 89), and it was nicked or serrated across the flanges by the dentist when mounting the crown. The present form, with a continuous double flange and transverse ribs, is shown in Figs. 90, 91, 92, 93, and 94. The larger end is baked in the porcelain, the flanges and ribs affording a very strong hold. The cupped-out base permits the use of a larger body of cement in setting, and the ribs give the cement a hold similar to that of the porcelain, the whole forming an ideally secure mounting.

FIG. 89.



Original form of the Logan Crown.

FIG. 90.

FIG. 91.

FIG. 92.

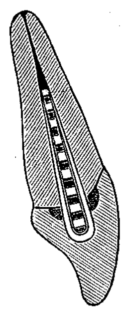


FIG. 93.

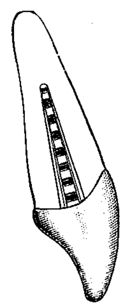


FIG. 95.

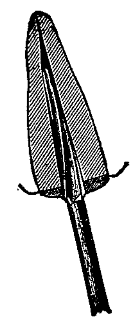


FIG. 96.

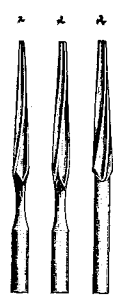
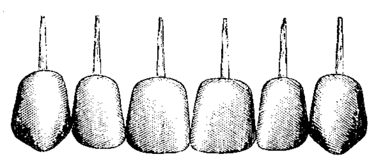
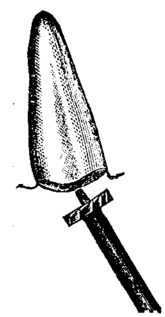


FIG. 94.



Set of six front upper crowns, natural size.

FIG. 97.



The cupping out of the base also gives a great advantage in fitting the crown, as the comparatively narrow rim is ground away with but little labor and no risk of marring or destroying the post in the process.

Mounting.—In the preparation of a root for a Logan crown the root-canal is enlarged and so shaped that the post if possible, at least at its point, shall fit tightly. This is best done by first using the Gates-Glidden drill and then enlarging the canal to the proper form and size with a root-canal reamer (Figs. 95 and 96).

The root surface at its labial side is preferably trimmed with suitably shaped corundum-points or wheels, or with a root-facer

Fig. 98.

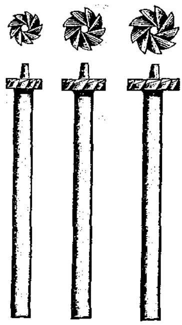


Fig. 99.

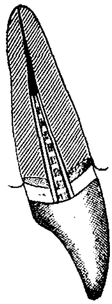
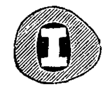


Fig. 100.



Enlarged sectional view of a left central incisor root with anchor-post in position.

(Figs. 97 and 98), so as to give it a labial slope, which will permit the lapping of the labial face of the crown at the cervical border over the face of the root and effect an artistic as well as a desirable

Fig. 101.

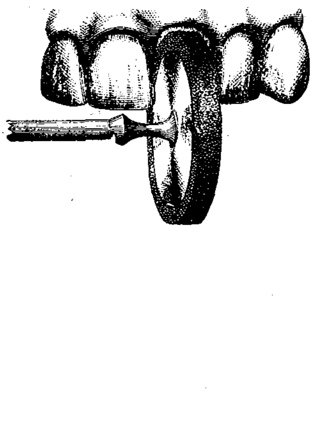


Fig. 102.

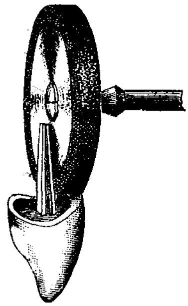
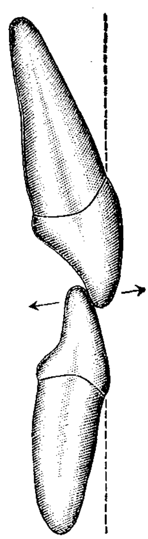


Fig. 103.



form of joint under the gum-margin. As the root-canal is being reamed the post of the crown is to be frequently inserted (Fig. 99) to determine the fit (Fig. 100) and proper alignment of the crown. When the base of the crown touches the end of the root, points of contact that interfere with an accurate adaptation should be removed. This can be effected by trimming either the surface of the root or the base of the porcelain crown.

When the root or porcelain requires to be extensively removed, it is generally best done with a safe-side wheel, such as is shown in Figs. 101 and 102, to avoid injury to adjoining teeth or the post. At this stage of the fitting the use of a disk of articulating paper (Fig. 88), as already explained, will simplify and facilitate the operation. Fig. 103 illustrates a properly fitted Logan crown.

For short or small roots the post of a Logan crown should be proportionately reduced in length or size. For bifurcated bicuspid roots the post can be bent as shown in Fig. 104. Fig. 105

FIG. 104.

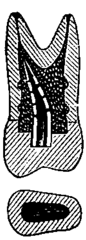


FIG. 105.

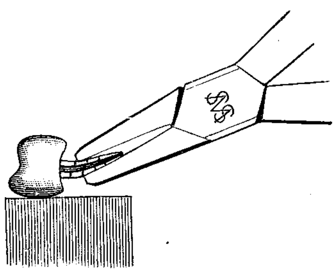


FIG. 106.

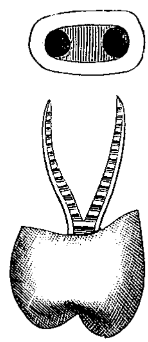
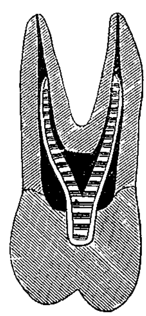


FIG. 107.



illustrates the best manner of bending the post. A preferable method to practice in some cases, that of splitting the post, is exhibited in Figs. 106 and 107.

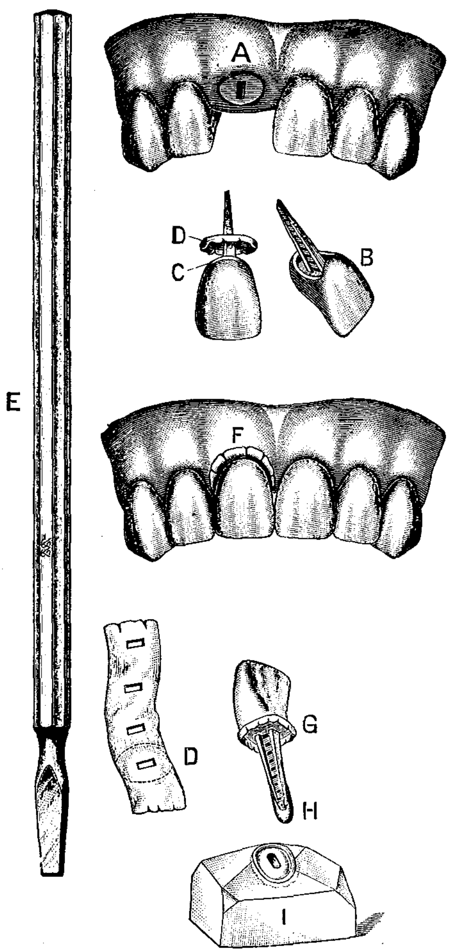
Zinc oxyphosphate or gutta-percha, or the two combined, are used to cement the Logan and similar styles of ready-made porcelain crowns.

Method of Fitting Logan Crown by Model of Natural Tooth.

First prepare the face of the root to be crowned as desired (A, Fig. 108), and having selected a suitable crown, B, bend the pin, if necessary, so as to make a proper alignment.

Next place a piece of sheet wax around the pin next to the porcelain, C, then take No. 60 tin foil and trim a disk a little larger than the abutment, D, pierce the center of the disk with the crown pin or instrument shown in the margin, E, pushing the disk down until it touches the wax; place the crown on the root and force it to place, F, the wax driving the tin-foil disk to a perfect apposition with the abutment of the root.

FIG. 108.



Remove the crown with the wax, holding the tin-foil disk in position, and with a pair of sharp-pointed scissors snip the edges of the disk slightly all around. Place a small pellet of wax on the point of the pin, H, then insert the pin up to the porcelain in quick-setting plaster, I; after the plaster hardens warm the crown and remove it, the snipped edges of the disk serving to hold it in position; clean off the wax and replace the crown on the model, and you have a perfect metallic-surfaced model of the abutment of the root to which to grind with a perfect view of every surface of the root, the wax which was on the end of the pin allowing it to penetrate the plaster as the porcelain is ground away. By this method a Logan crown can easily be made to fit perfectly.

The Fellowship Crown and the Brewster Crown.

The Fellowship crown (Fig. 109) and the Brewster crown (Fig. 110) are crowns with fixed posts. The posts are made of a German silver alloy, which, after the crowns have been baked, are attached by another baking with a low-fusing porcelain. The post

FIG. 109.

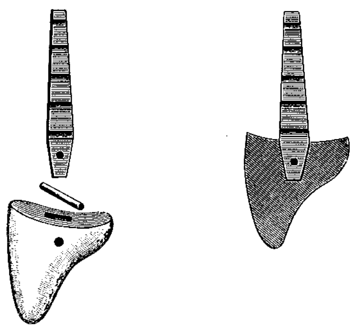
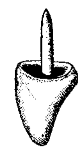
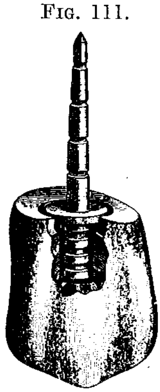


FIG. 110.



of the Fellowship is additionally secured by a piece of wire, which passes laterally through a perforation in the post and base of the crown. The application of these crowns is very similar to that of the Logan crown.

FIG. 111.



The Davis Crown.

This form of crown (Fig. 111) has a cavity extending into the base of the crown, the orifice of which is reamed. The dowel-pin, which is made of German silver, has a shoulder or rim near the end. The end of the pin fits in the cavity of the crown and the rim in the reamed section. When the crown and dowel-pin have been properly fitted to the root, if oxyphosphate is the cement to be used, post and crown may be cemented in position simultaneously. If gutta-percha is preferred for the root-canal, the dowel-pin is first cemented in the crown with oxyphosphate, and after it has set the pin is fixed in the root with the gutta-percha.

Ash's Tube Teeth and Crowns.

These teeth have a perforation through the center, with a thin platinum tube baked in the porcelain. They are supported on the root by the fluted post, shown in Fig. 113. When the crown is properly ground, the base is to be countersunk sufficiently to receive the shoulder of the pin. The pin is then bent so as to allow the crown to assume its proper position on the root. The socket-handle instrument, shown in Fig. 120, is the most suitable for this purpose. The attachment of the crown is made by first securing the pin in the crown with sulfur or soft solder and then cementing the fluted post in the root-canal with either gutta-percha or oxyphosphate.

FIG. 112.

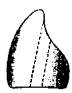


FIG. 113.

FIG. 114.

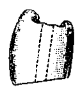


FIG. 115.

Figs. 116, 117, 118, 119, 120, and 121 illustrate Ash's dowel crowns.

They are applied in a manner similar to the Davis crown. The dowels or posts are made of what is termed "Dental Alloy," and are strongest at the part to bear the greatest strain, the portion where the crown joins the root.

FIG. 116.

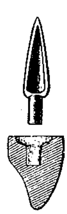


FIG. 117.

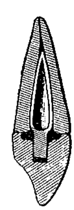


FIG. 118.

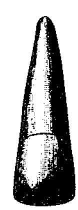


FIG. 119.

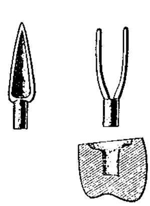


FIG. 120.

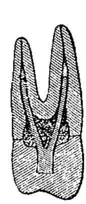


FIG. 121.

Remarks on the Use of Porcelain Ready-Made Crowns and Crowns without Collars.

Porcelain ready-made crowns have some decided advantages. They are especially useful in many cases where an inexpensive or easily adjusted crown is required, or where some pathological condition limits the probable durability or permanence of any operation. In the insertion of porcelain crowns, the removal of the whole or a part of the natural crown, which could be utilized to some extent as a foundation by other systems, has given rise to various objections. If the natural crown is entirely cut away the pin, or post, upon which almost the entire support of the artificial crown is thrown, exerts great leverage in the root-canal when no band or brace is present on the exterior of the root to relieve the strain. With the whole force of mastication bearing directly upon these pulpless roots, whose disintegration is slowly but constantly progressing, the inevitable result can well be conjectured. Sooner or later they are fractured, and their usefulness as a foundation ended. These facts, and the lack of strength incident to some forms of construction, are the principal objections urged against porcelain crowns as ordinarily inserted.

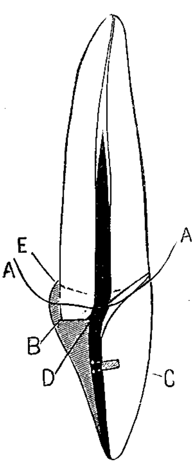
Crowns in which the post is cemented in the porcelain are less suitable for close bites than those styles in which it is baked in.

CHAPTER IV.

Porcelain Crowns with Vulcanite Attachment—A Temporary Crown.

Fig. 122 illustrates a porcelain crown with vulcanite attachment. The prepared root extends at the palatal side a little below the gum line (A) at the point B. A plate tooth (C) is ground and fitted to the root. An iridio-platinum post is then fitted to the root, flattened slightly and bent at D, and riveted to the tooth. The proper alignments of the tooth and post to the root are then obtained, and they are invested and the post soldered and strengthened at the point D. The backing is then grooved and notched slightly, wax applied, the crown adjusted to the root, and the wax shaped so as to form a foundation and overlapping edge at the palatal portion (E), and also extend around the post up the canal. The crown is next removed, invested in a flask, packed with rubber, and vulcanized. In trimming and finishing, the rubber may be allowed to form a partial band or collar around the palatal portion of the root, where it will not show. It is then cemented on to the root with oxyphosphate.

Fig. 122.



A Temporary Crown.—Fit in the root-canal a post of metal, preferably made of German silver wire. Let the post extend out of the canal about one-eighth of an inch and roughen the sides. Perforate a disk of the heaviest pattern tin or 1/1000 platinum foil with the post, and fit to the end of the root. Fit a suitable two-pin vulcanite porcelain tooth to the disk. Groove out the porcelain, if necessary, to fit over the post. Wax the porcelain tooth to the disk and post, remove, and invest in plain plaster of Paris. Remove the wax with boiling water, and apply a little muriate of tin to the end of the post. In the place of the wax, flow fusible metal, which melts at not less than 200 degrees, or tin solder, if gutta-percha is to be used to cement the crown, and instantly press down firmly into the investment with a napkin over the finger; cool, remove, trim, and cement on the root with gutta-percha that softens at a low heat.

CHAPTER V.

Gold Collar Crowns.

CONSTRUCTION AND ADAPTATION OF COLLARS—METHODS OF MEASUREMENT—FITTING OF COLLARS TO ROOT OR CROWN—APPLICATION OF A LOCAL ANESTHETIC—COLLAR CROWNS HYGIENICALLY CONSIDERED.

This style of gold crown includes those methods which consist in banding, capping, and hermetically inclosing with gold the end or the neck of a root, with or without any portion of a natural crown, for the purpose of securing stability to the artificial crown, preventing fracture of the root and decay of the parts. This method possesses much practical value as a preserver of tooth-structure and restorer of usefulness to the teeth, and affords excellent supports for bridge-work.

Collar crowns, the use of which has become quite general, have been described by many writers in the past. Dr. William H. Dwinelle relates the application of the method to a crown with a porcelain front,[1] and Drs. W. N. Morrison[2] and J. B. Beers[3] tell of it in the construction of all-gold cap-crowns, showing its use fifty or more years ago.[4]

Collar crowns of which the part that essentially constitutes the cap is constructed in sections, will be first described.

The Construction and Adaptation of Collars.

Careful study of the different forms of crowns and roots, and of the anatomical structure and relationship of the contiguous parts, is most essential for the perfection of construction and adaptation required in collars, bands, or ferrules, as they are variously designated.

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[1] *American Journal of Dental Science*, April, 1855.
[2] *Missouri Dental Journal*, May, 1869.
[3] Circular to dental profession, 1873.
[4] J. Patterson Clark, 1836.

Many devices and methods in use facilitate this operation, but its skilful performance can only be attained by study and practice, as is proved by the easy and perfect manner in which it is done by experts in crown- and bridge-work, who use no appliances but pliers and shears guided by an intuitive perception of the requirements of each case.

FIG. 123.

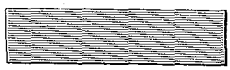


FIG. 124.

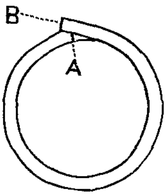
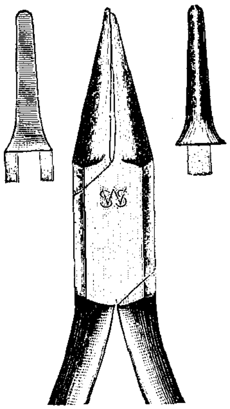


FIG. 125.



The collar is preferably made of 22- to 23-carat gold plate; the tendency now is to use a softer alloy of plate than formerly. Pure gold plate lined with platinum is also used, and platinum[1] plate in special cases.

Gold plate of No. 28 to No. 30, or gold and platinum about No. 30, U. S. standard gage,[2] affords the requisite strength, together with easy adaptation to the form of the crown or root. The size of the cervix of the root or dimension of the natural crown to be capped, and whether it is to effect only restoration of the crown or to also give support to bridge-work, should govern the choice of the gage of plate to be used. Cuspids and molars require a heavier plate than small laterals or lower incisors, and in all forms of gold caps the gage should be increased when they are to support bridge-work.

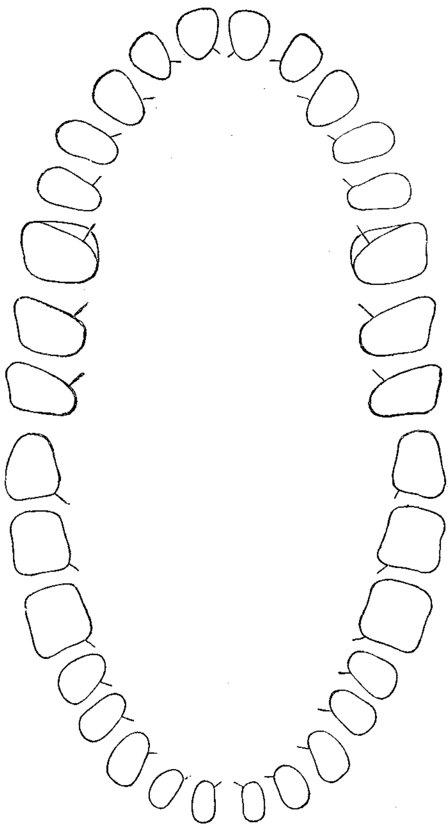
The natural crown or root having previously been properly prepared (see page 34), a strip of the metal is cut of the length required, and generally from one-fourth to one-half of an inch in width (Fig. 123). The end to underlap at joint is beveled with a file (A, Fig. 124). The strip is then bent

[1] The use of platinum plate, No. 32 to 34 gage, is specially recommended to students, as collars formed of this metal are not apt to be melted in any of the soldering processes. If very thin platinum is used, pure gold can be flowed over the outer surface after it is adapted to the cervix, to stiffen it. A little dampened fine marble-dust or whiting should be placed on the inner surface of the collar during the operation to prevent intrusion of the gold on that part. This method is excellent when a small, narrow collar is required for an incisor crown which is difficult to adjust to the form of the root.

[2] U. S. standard gage is the gage always referred to in this book.

with suitable pliers (Fig. 125) to the average form (Fig. 126), any special deviation from such average being noted (Fig. 127), and to the size of the cervical periphery of the root of the tooth to be crowned. The edge toward the gum may also be trimmed, so that it will in a measure approximate in shape the curve of the margin of the gum. It is then placed on the root and adapted as closely as possible to its form, with the upper edge of the metal pressing gently under the free edge of any portion of the gum it may meet. It is then removed and cut so as to allow the ends to lap over slightly. The adaptation to the root is then continued, during which process the metal should be clamped at the joint, heated, and chilled in water after each trial, in order to maintain the shape given to it. At the last adjustment to the root, the lap-over is marked on the metal with a sharp-pointed instrument, the collar is removed, and the edges brought tightly together flush or a little over the mark. The joint is made by placing in the seam the least possible quantity of solder, or, better still, of fluxed solder filings, and holding the collar with a clamp in a blue (Bunsen) gas flame while the solder is fused. Another method frequently adopted is to grasp the seam at the cervical side of the collar with the points of a clamp such as is shown

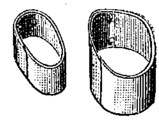
FIG. 126.



The palatal side of the superior molars, in many cases, is of the large oval form indicated by the outer line to the form of the first molar. The small spurs indicate the points generally found the most suitable to make the joint.

in Fig. 193, or, better, with soldering-pliers (Fig. 128), or, ordinary solder-tweezers held in a vise (Fig. 129), and unite the seam only at the extreme outer end with an atom of solder fused with a blowpipe. The points of the clamp or tweezers prevent the solder from flowing along the joint. The cervical side of the collar is left open by this method of procedure, which permits the collar to be slightly contracted, if desired, then the solder can be flowed across the collar. The collar is next slipped over the point of a small anvil, and the joint tapped and trimmed level.

FIG. 127.



Methods of Measurement.—The root is encircled with a strip of thin sheet copper, about No. 34 gage, previously annealed, one-sixteenth of an inch or less in width, and the copper fitted to the cervix.

FIG. 128.

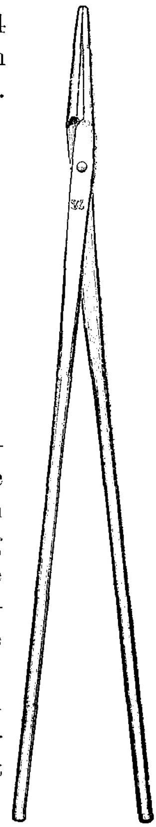
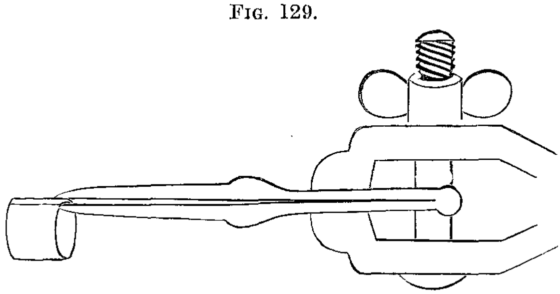


FIG. 129.



It is removed, and cut so there will be a slight lap-over of the ends on the root, then again fitted to the root, and the position of the lap-over end marked on the copper. This little strip of copper, which, being soft and flexible, can be most accurately fitted to the root without inconvenience to the patient, when removed shows the exact length and shape to cut the gold or platinum for the collar.

The copper pattern is laid upon a strip of the metal from which the collar is to be formed, from one-quarter to one-half inch in width, and the exact length required is marked, and the metal is then cut a trifle longer than the mark indicates (less than one-sixteenth of an inch), to allow for an overlap joint. It is then bent and the ends brought together, the outer end placed even or flush with the mark, and soldered as above described. The collar is next bent to the shape of the root, when it is ready to be ad-

FIG. 130.

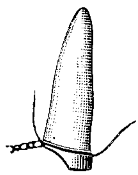


FIG. 131.

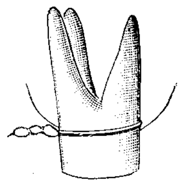
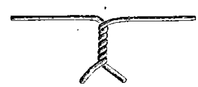


FIG. 132.



justed. This method is simple and practical, and also economical, as it accurately defines the amount of plate required.

To measure with a wire: Form a loop of copper wire, about 30 gage, by twisting the ends together with pliers. Slip the loop over the tooth or root, press the wire down under the gum-margin,

FIG. 133.

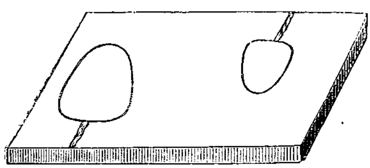


FIG. 134.

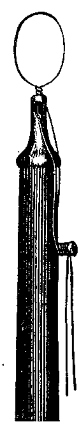
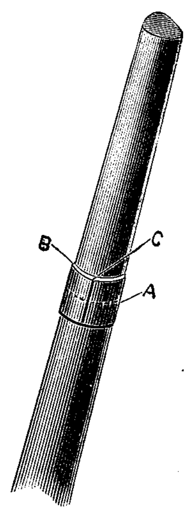


FIG. 135.



and twist the ends with the pliers until the loop fits tightly at every point (Figs. 130 and 131). Slip off the loop, cut it in the center, and extend the ends lengthwise in opposite directions, as shown in Fig. 132. Then lay it on the surface of the plate of which the collar is to be constructed, and mark the length. Cut the metal beyond this mark sufficiently to allow for an overlap; bevel and lap the ends to the mark and solder them.

A dentimeter, such as is exhibited in Fig. 135, greatly facilitates measurements with wire. The ends of the wire are passed into the hole in the face of the head, and out through the openings which are cut into it from two sides. The loop thus formed is adjusted around the tooth or root, the end of the dentimeter is pressed against the root at the gum-margin, the loop pulled tight, and the ends of the wires wound around the boss on the handle. A few turns of the dentimeter twist the loop tight, when the wires can be unwound from the boss, the dentimeter laid aside, and the loop removed.

When a mandrel is used in forming a collar, the size or shape is first taken with a wire. The wire ring is then carefully removed, laid on a piece of air-chamber tin, a piece of flat iron put over it, and with a blow from a hammer on the iron the wire is driven into the tin (Fig. 133). It is next extricated from the tin, slipped on a mandrel that represents the form of the root to be crowned, and pressed down gently as far as it will go without stretching the wire (A, Fig. 134). The distance from the end of the mandrel to the wire is then measured and marked on a strip of paper, and

FIG. 136.

FIG. 137.

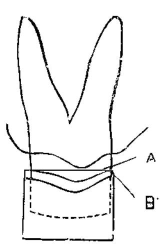
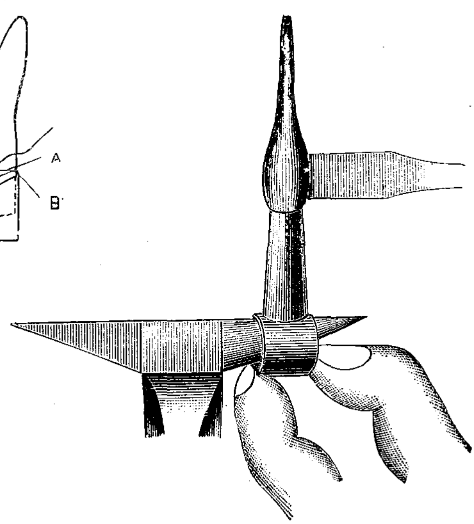


FIG. 138.



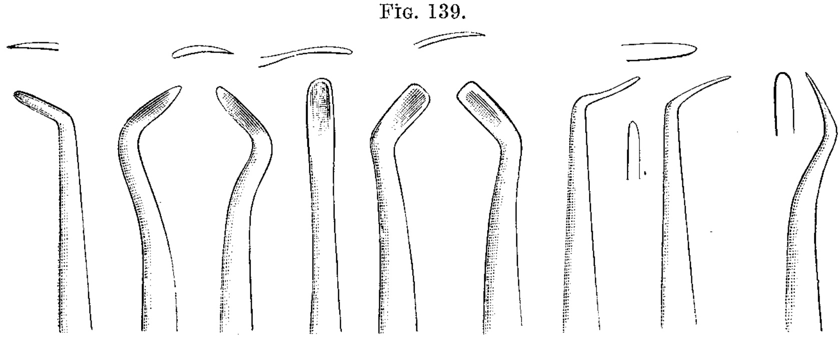
the wire removed. The gold to form the collar is then bent and shaped on the mandrel, with the edge which is to form the cervical portion (B) placed a little below the line of the wire (A), as shown by the measurement previously taken. The ends of the gold are beveled, slightly lapped, and the edge of the lap-over marked (C) and soldered. The collar is then shaped to the form given by the wire in the tin, after which it is ready for adjustment in the mouth.

Fitting of Collar to Root or Crown.—When the collar has been formed, it is adjusted on the root and pressed or, with the aid of a piece of wood placed across its outer edges, gently tapped up to the margin of the gum. A line parallel with the margin is marked with a sharp-pointed instrument on the collar (A, Figs. 136 and 137), which is then removed, trimmed to this mark, readjusted, and again marked (B), and the process continued until the collar fits proportionately under the margin of the gum.

If this part of the operation is skilfully performed, and the collar is not forced into the investing membrane of the root, very little pain will be caused the patient.

If, on adjusting, a collar is found a trifle too small, it is easily enlarged by tapping with a riveting hammer on an anvil (Fig. 138) at the edge-end of the collar marked B, Fig. 124. By this means the surplus gold at this point can be thrown into the collar and its circumference proportionately enlarged without altering its gage. If, on the contrary, the collar should prove to be too large

FIG. 139.



in circumference, the difficulty can be remedied by slitting the gold nearly but not entirely across the side opposite the joint, beveling and lapping the edges slightly, soldering, and trimming. The edge is then burnished to the periphery of the root. For the purpose of fitting collars a set of burnishers should be used especially formed to suit the different positions and avoid irritation of the margin of the gum. (See Fig. 139.) Finely serrated foot-shaped gold-foil condensers can be advantageously used to flatten an edge or a stiff or angular point of a collar.

Application of a Local Anesthetic.—The application of a local anesthetic, such as cocain, will lessen pain attending the adaptation of a collar under the gum-margin. Cocain is very effective in the form of a saturated solution in glycerin. The parts should be surrounded with a napkin, or with bibulous paper, and dried.

Then a drop of the solution is placed on a slab, and a little at a time is carried on the edge of a thin burnisher and applied well up under and around the free margin of the gum of the tooth operated on. When this has been done, some of the excess of the solution, which will usually be found at the cervix, may be rubbed on the labial and palatal sides of the gum. The patient should be directed not to swallow the saliva during and for some time after the application of the cocain. The anesthetic effect produced by this method will usually be found sufficient to partly or entirely divest the operation of pain, and of such duration as to seldom require repetition except at subsequent stages of the operation.

Electrolysis (cataphoresis) will effect rapid diffusion of the cocain, the solution of cocain being placed on cotton against the sides and margins of the gums. A weak current of electricity should be used, the positive pole being applied to the cotton and the negative pole to the cheek or held in the hand of the patient. The time the method requires is the objection to its use.

Collar Crowns Hygienically Considered.

The principal argument against collared or ferruled crowns is that they are productive of irritation to the peridental membrane, ultimately causing its absorption and the exposure of the collar. This would be theoretically and practically true of a rough or porous substance encircling the root, or of an imperfectly and unskilfully adjusted or cemented ferrule or collar, which would by its presence hold a position analogous to a calcareous deposit; but it could not be fairly predicated concerning a perfectly fitted collar, forming at its edge a smooth and imperceptible union with the sides of the root, and presenting a uniform and benign surface to the investing membrane. In the case of perfectly adapted collars, when any irritation of the membrane exists, it will be found to result from such causes as usually produce it when the natural crowns are present, namely, dental concretions. A tarnished and unclean condition of the surface of the gold of the collar will produce irritation of the membranes, which is a matter independent of the collar itself, and easily remedied by cleansing and polishing the surface. Where an acid condition of the secretions of the mouth exists, a collar of platinum is suggested in preference to gold, as this metal will not be affected, but will constantly present an untarnished surface.

When evidences of a tendency to pyorrhea alveolaris exist, a collar adjusted to support bridge-work should not be extended under the gum-margin; instead the edge is best placed considerably above the gum-margin, so as to better permit treatment of the disease.

CHAPTER VI.

Gold Collar Crowns with Porcelain Fronts.

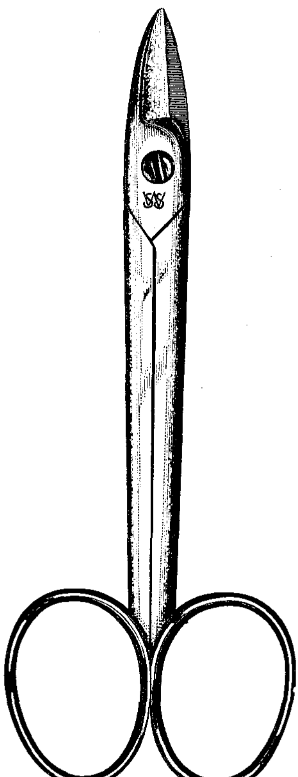
INCISORS AND CUSPIDS: CONSTRUCTION AND ADAPTATION OF THE CAP—THE POST—METHOD OF FORMING POSTS TO ACCURATELY FIT CANALS—POST AND CAP—SELECTION AND ADAPTATION OF PORCELAIN FRONT—PROTECTING THE INCISAL EDGE—BACKING THE PORCELAIN FRONT—PREPARATION FOR INVESTMENT—SOLDERING AND FINISHING BICUSPIDS AND MOLARS—DR. STOWELL'S METHOD OF APPLYING A COUNTERSUNK TOOTH OR A LOGAN CROWN—CROWNING IN CASES OF ABRASION—GOLD CROWNS WITH PORCELAIN FRONTS FOR TEETH WITH LIVING PULPS.

This style of crown for incisors and cuspids, as originally made by Dr. C. M. Richmond, and with which his name has become associated, consisted of a cap for the root, formed of a band of gold capped with platinum, on which was soldered a tooth with a slot in the center between the pins. Through this slot and the center of the cap a screw passed, which entered into a cylinder previously screwed and cemented into the root-canal.

The form of gold collar crown in general use is, in principle, the same as what was formerly known in dentistry as a gold pivot-tooth, with the addition of a gold collar for the root, and having the advantage of oxyphosphate for its cementation. These improvements enhance its value as a crown, and materially change the process of its construction.

Adjustment of the Collar.—In making an incisor or cuspid crown of this style, the root-canal is treated, the root shaped, and a collar made and fitted as described in the preceding chapter. The collar is held in position on the root, a sharp-pointed instrument introduced inside of the collar, and the line of the surface of the root scratched on the metal around the circumference. The collar is removed and trimmed a trifle flush to this mark with small-pointed shears (Fig. 140). It is adjusted on the root, and the edge of collar and root ground even, removing some of the surface of the root if necessary for this purpose. In the operation of grinding, the collar should be first firmly held in position on the root at the labial side while the palatal section is ground, then at the palatal while the labial is being reduced. At the labial section, the collar and surface of the root should be removed, so as to be invisible if the patient exposes the gum-margin in speaking or laughing. In cases where there is no such exposure, a proportionate amount more of the collar and root may remain; this is often desirable, as it affords additional strength. The work will then present an appearance respecting the collar such as is shown in Fig. 141 and at A, Fig. 145.

FIG. 140.



As the sides of the collar are parallel with the line of the cervical section of the root, the edge of the collar at the palatal side forms a right angle with the surface of the end of the root (A, Fig. 141). In close occlusions this is liable to give a shape to the finished crown at that part quite perceptible and objectionable to the patient. This can be avoided by slightly rounding off the palatal edge of the root to the form illustrated at B, Fig. 142. The collar is then slit two-thirds across, as outlined at S, Fig. 142, the edges beveled slightly, lapped, fitted on the root, pressed and burnished to the part, and soldered. In the finished crown the collar will then present a form nearer that of the natural tooth, as illustrated in Fig. 143.

The top of the collar that completes the cap is made of very thin platinum plate, about No. 37 gage or 1/1000 foil. The foil is preferable when it is desirable to have the least possible space occupied by the platinum at the labial section of the cap. Thin platinum forming the top to the cap does not materially affect the strength of the finished crown, as that part is reinforced by the solder subsequently applied.

To Form the Cap to the Collar.—A piece of the platinum is cut, square or round, considerably larger than the circumference of the collar. The outer edge of the collar is placed against the platinum and adapted to its surface by slight pressure between the fingers. With the collar so placed the edge of the platinum is seized with a clamp. A piece of solder, with flux, is placed on the platinum outside of the collar and against or touching it. The whole is then held in the flame of a Bunsen burner, the solder fused, and collar and top united (Fig. 144). The quantity of solder applied must be very small, barely sufficient to unite the parts. So limited, it will not flow over the inside of the cap to interfere with its fit on the root. All parts of the edge of the collar and platinum should touch

FIG. 141.

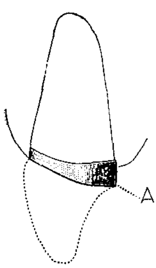


FIG. 142.

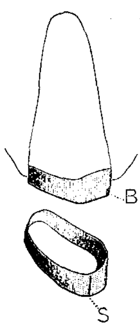


FIG. 143.

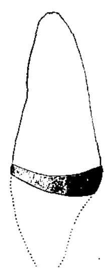
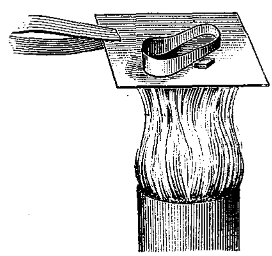


FIG. 144.



before they are soldered, otherwise in subsequent soldering the seam is liable to open up. Perfection in this part of the work is most easily attained by first attaching the platinum to the edge of the collar at one point with a mere particle of solder, to retain and position it, and then readapting the rest of the edge and completing the soldering. When the collar and top are united, the platinum is trimmed to the outline of the collar with small shears, and finished smooth with a corundum-point.

The cap is next adjusted on the root. Should any part of the cap not seem to go to its position accurately, a little pressure with a foot-shaped foil condenser along the edge of the collar at the part soldered to the top will correct it, if the soldering has been properly conducted. Pressure is next exerted with the finger on the palatal side of the cap to retain it in position while the labial section is burnished to the flat surface of the root. This adaptation of the platinum steadies and positions the cap on the root. The cap is then ready to receive the post.

Preparation of Canal to Receive Post.—In a collar crown of the style described, the collar is largely relied upon for retention on the root, and the post is therefore not usually as important a part as in a crown where a partial collar or no collar is used. To receive the post, the root-canal is first reamed with a Gates-Glidden drill and then with suitable sized fissure or round burs (B, Fig. 145). The orifice to the canal should be slightly enlarged with a large, round bur, to give it a slightly cup-shape form. Into this depression the platinum of the cap to the collar is to be burnished. The object of the depression is to provide a space to flow the solder in around the post to reliably attach it to the cap, especially should conditions require that the end of the post be ground off close to its surface. (See Fig. 146 in section.)

FIG. 145.

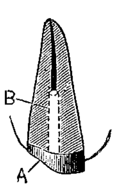
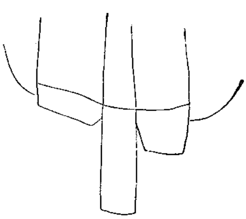


FIG. 146.



Posts.—Platinum or iridio-platinum wire, preferably round, Nos. 16 to 18 gage—a little smaller for laterals or other roots which require its reduction—is used for posts. A hollow post, the open space in the center of which is small, affords the advantage that it can be drilled out of the canal in a comparatively easy manner if for any reason it becomes necessary to remove the crown, as the drill will follow the fine opening in the center of the wire.[1] The use of posts made of alloys of the base metals is to be condemned for this style of work. The wire may be first rolled under a flat file, to roughen its surface. It should be slightly tapered and introduced one-quarter of an inch, more or less, up the canal, as indicated by the conditions of the case (Figs. 145 and 147) respecting length of root, size of artificial crown to be mounted, and character of the occlusion. A long, large crown or a close occlusion suggests a longer and heavier post than a small crown or a more favorable occlusion. If the canal is for any reason much enlarged, the point of the post should be tapered and extended to its extremity in order to strengthen the root as well as anchor the crown. (See Part I, Chapter II.) When

[1] Hollow posts are now manufactured and sold.

gutta-percha is the cement to be used to attach the crown, a longer post is required than for oxyphosphate. The post should fit the canal in such a manner as to need the presence of only a small quantity of the gutta-percha to secure it (Fig. 147).

Method of Forming Posts to Accurately Fit Canals.—To form a post which will accurately fit a canal, especially canals which for some reason are considerably enlarged, slightly taper the point of a piece of platinum wire about No. 20 to 21 gage and a half-inch long. Fit it to the extremity of the canal and bend the end of the wire toward the labial side at a right angle, to indicate its position when inserted (Fig. 148); tip the point of the wire with pure gold by fusing on it a pellet of gold foil. Cut a strip of platinum foil 1/1000 gage about one-eighth of an inch wide and

FIG. 147.

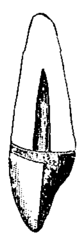


FIG. 148.

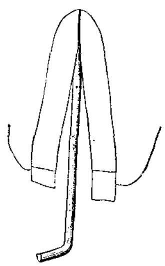
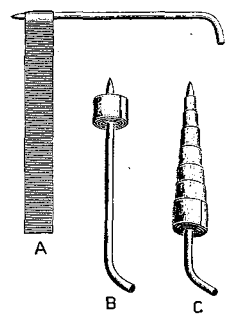


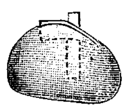
FIG. 149.



an inch in length, bend the end of the strip of foil over the end of the wire close to the point, and solder the wire and foil in a Bunsen flame. The tip of gold at the point of the wire on fusing will attach the strip (A, Fig. 149). Next wind the strip around the wire, as shown at B, Fig. 149, and insert in the canal. The folds of foil will press down on the wire in conformity to the size and shape of the canal, as illustrated at C, Fig. 149. Seize the exposed portion of the foil and wire firmly with small-pointed pliers, remove in position, and solder in a Bunsen flame with pellets of gold foil. Apply only enough gold to unite the layers of platinum, for if an excess be used the shape of the post will be altered and it will not fit the canal. The corrugations on the post formed by the layers of platinum foil afford an attachment for the cement.

Post and Cap.—The post having been formed, the cap is adjusted on the root, the platinum over the canal is burnished into the orifice and punctured. The end of the post is seized between the points of wire pliers and the post inserted and forced to position in the canal and the correctness of its relations with the cap observed and decided. Cap and post are next removed, both dried, slightly heated, and the surface of the cap and extreme end of the post veneered with adhesive wax. The cap and post are again adjusted to position on the root, a small pellet of the wax is placed over the end of the post and pressed against the surface of the cap and around the post. The wax is chilled with water and the cap and post carefully removed and invested. The investment material should be carefully flowed into the interior of the cap, so as to fill every crevice. When set, the investment is trimmed and reduced to as small a size as permissible (Fig. 150). It is next heated and solder flowed into the depression about the post flush with the surface of the cap. Should any extensive aperture exist in the platinum around the post at the orifice of the canal before soldering, a pellet of gold foil may be gently pressed in the place to aid the solder to cover the part. After removal from the investment and boiling in acid, the cap and post are adjusted in position on the root.

FIG. 150.

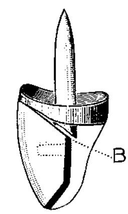


Selection and Adaptation of the Porcelain Front.—The adaptation of the porcelain front to the cap is next made, either directly in the mouth, or by the aid of a model of the case. When a model is to be used, a bite in wax with the cap in position is first taken and afterward an impression with impression-compound, or preferably plaster, which will remove the cap in position and include the adjacent teeth, especially the opposite corresponding tooth to that being crowned, if present. To permit easy removal of the cap from the model, if the crown is to be fitted in the mouth during its construction, a little wax should be placed with a heated spatula around on the inner surface of the collar and the sides of the post also be slightly veneered with it. A plaster model is made, and the wax bite having been adjusted on it, an articulating model is also made.

The projecting end of the post is next cut off a little above the surface of the cap with a thin disk or cutting pliers. The end of the post is then reduced with a corundum-wheel close to the surface at the labial side, but left slightly projecting above it at the palatal for additional strength should such a form offer no obstruction to the setting of the porcelain front (Fig. 151).

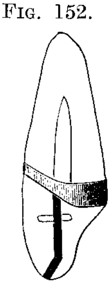
The porcelain front is formed of a cross-pin tooth. The shade selected should be at least as dark as that of the opposite corresponding natural tooth, if present, or, if absent, that of the adjoining teeth. The general form, while suitable in appearance, should be such as will permit of proper adaptation without excessive reduction by grinding. The curve of the sides toward the base should be such that when the front is ground, the base shall not greatly exceed in width the surface of the cap, and the pins be located so that their strength shall not become impaired in the required removal of the porcelain for the proper adjustment of the front.

FIG. 151.



There are two methods of setting the porcelain front to the cap. In the first method the front is ground to position with the base of the porcelain closely fitted to the surface of the cap (Fig. 152). The palatal surface and incisal edge of the front are then backed with metal, invested, and soldered to the cap.

FIG. 152.

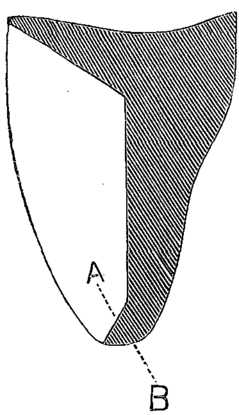


In the second method, which is preferable, the front is fitted at the cervico-labial section to rest on the cap, while the remainder of the base is ground so as to form a slightly increasing space toward the palatal side just over the post (B, Fig. 151). The cervico labial edge of the porcelain front should be placed even or full with the edge of the collar. As the porcelain rests on the cap at only one point, it simplifies the work of correctly positioning the front with the other teeth. This space between porcelain and cap can subsequently be uniformly filled with the solder and greater continuity of structure obtained than by the first method. If a model is used, although it facilitates the operation of fitting, the exact alignment of the front had best be determined by adjustment in the mouth.

To Protect the Incisal Edge of the Porcelain Front.—To protect the incisal edge of the porcelain front against fracture in such way that the gold shall be invisible, the porcelain should be ground and beveled off to the incisal edge at a proper distance from the pins, as shown in Figs. 151 and 152; also at A, Fig. 153. In the final finishing the gold is brought on a straight line, or nearly so, with the edge of the porcelain, as shown at B, Fig. 153. By this plan the porcelain is protected and the gold is rendered invisible when viewed from the front.

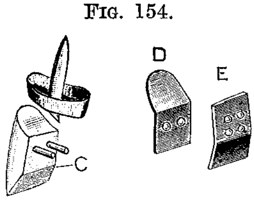
Backing the Porcelain Front.—The backing of the porcelain front should fit the porcelain closely and furnish the greatest possible strength to the finished crown. It is made of platinum or gold. Platinum imparts a slightly blue, and gold a yellow shade to the porcelain. The best platinum for the purpose is in the form of foil 1/1000 gage, as such a thickness permits the metal to be closely adjusted to the surface of the porcelain.

FIG. 153.



The front is first divested of every particle of wax,—best done by immersing it in boiling water. The platinum is applied to extend in one piece over the back of the front down on the base as far as possible between the porcelain and the top of the cap without interfering with the positioning of the front. The ends of the pins are first pressed against the platinum and its surface indented. Holes are punched through the indentations and the platinum closely adapted to the surface of back and base (B, Fig. 151) to carry the solder and fill the space between the porcelain and cap. The platinum is next trimmed off even with the edge of the porcelain, except at the incisal section, where it is cut even with the back of the front at the line C, Fig. 154 giving the backing when off the front the form shown at D. The incisal section and only the back of the front is then additionally backed with a piece of 22-carat gold plate, or of platinum and gold, about No. 30 gage. Holes for the pins are punched and countersunk in the plate, which is cut and fitted the width of the front and only long enough to extend past the pins, and to cover and extend slightly beyond the edge of the incisal surface. The gold will then present a form such as is shown at E, Fig. 154. Two or three holes are punched from the inner side of the backing outward above the pins, as shown at E, Fig. 154, to enable the solder to easily enter and

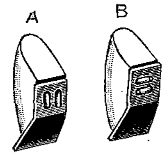
FIG. 154.



flow between the backings. The platinum foil backing having been closely adjusted to the surface of the porcelain, the gold backing is placed over it and the pins bent down on the surface in either of the positions shown at A and B, Fig. 155. When bent as at A, they assist in retaining the solder in position in soldering and thickening the backing at that point, if that is desirable.

When the first or inside backing is preferably formed of pure gold instead of platinum foil, it is applied in the same manner as the platinum, but must be of about No. 37 gage. Platinum-lined gold nearly as thin as platinum can be used instead of pure gold, with which, by placing the gold side toward the porcelain, the same effect on the shade can be obtained as with pure gold.

FIG. 155.



Other methods of backing are in use. Of these, one which may be advantageously practiced, especially when the back of the porcelain front is ground quite short, is: First back the front and reinforce the incisal section with pure gold plate in one piece of about No. 30 to 32 gage. Next cover the base with platinum foil of at least 1/2000 gage by heating the porcelain, varnishing the base with adhesive wax, and pressing the foil on the surface. By again heating the front and foil and by exerting uniform pressure over the entire surface with a napkin or a pellet of cotton, the foil will be closely cemented against the surface of the porcelain and the intervening varnish of wax imperceptible. The surplus foil is trimmed off close to the edge of the base of the front.

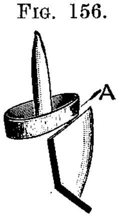
Another method is to first back with either platinum or gold plate of No. 30 to 32 gage only the palatal side of the front, apply the thin platinum foil to the base, and as the crown is ready for investment, place and cement in position with wax a piece of 22-carat gold plate over the incisal section, leaving the ends of the plate extending out sufficiently beyond the edge of the porcelain to retain it in position in the investment.

The metal used in backing a front should be annealed during the process, and the portion which comes in contact with the porcelain closely adapted by pressure and burnishing. Close contact affords better support to the porcelain and greater continuity of structure to the crown. When plate is used for the backing a die may be used, to assist in adapting it closely to the porcelain. An intaglio die sufficient for the purpose can be quickly formed by pressing the back of the front against the surface of a piece of impression-compound, Dental Lac, or sealing-wax, chilling the material, and removing the front. The plate can be swaged against the surface of the porcelain in this die. Another method is to place the porcelain tooth with the backing on it in position wrapped in tissue paper in a swager. The pressure should be gradually increased from light to heavier blows from the hammer on the plunger. In backing porcelain fronts the metal used should be neatly trimmed to the sides. It must not be bent over the edges closely, especially at less than a right angle, as expansion and contraction of both porcelain and solder are very liable to cause fractures.

Preparation for Investment.—The porcelain front when backed is adjusted on the cap. Should the metal backing the base of the front interfere with its proper adjustment on the cap, as is liable to occur at the cervico-labial section, it should be thinned with a small corundum cone, or entirely removed at the obstructing point, and that portion of the porcelain allowed to rest directly on the cap. The front is first attached to the cap with only a small quantity of adhesive wax, until its alignment is quite accurately determined, when hard wax is added to more securely retain it. The whole is then chilled in cold water and a final adjustment made to positively assure its correctness. Before investing, additional wax is added to the metallic parts of the crown sufficient to impart to them the desired form when soldered and also to allow additionally a slight excess for finishing. A little wax is generally placed on the sides of the collar at the cervical section of the porcelain front, especially where any portion of it projects over the line of the collar, for the purpose of providing space in the investment for the solder to flow and contour the part.

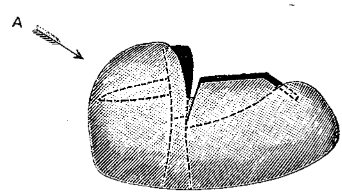
When the porcelain projects beyond the edge of the collar at the cervico-labial section, as frequently occurs in cases of cuspids, a space is left, such as is shown at A, Fig. 156. This space should be evenly filled with gold solder when the front is being attached to the cap. To accomplish it the platinum foil applied to the base of the porcelain should be extended over the whole surface and slightly beyond the edge of the porcelain at

FIG. 156.



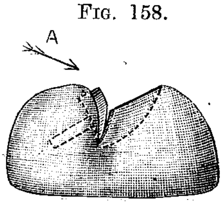
the cervico-labial section. The open space is filled and shaped evenly with wax a little flush at the edge of the collar. To assist in drawing the solder to the part, a narrow strip of No. 30 rolled gold foil may be neatly adapted over the surface of the wax. Should the foil extend slightly beyond the edge of the wax and rest on the surface of the porcelain, it will not cause fracture if closely adapted to the surface. In such cases the flowing of solder to the part is further facilitated by forming an aperture either on the bottom or on each side of the investment, which will expose it and if necessary permit solder to be applied directly. This can be most easily done by attaching a small cone of wax, as indicated by the dotted lines in Fig. 157, before investment, thus forming a channel, the orifice of which can afterward be shaped or enlarged.

FIG. 157.



Investment. — Calcined marble-dust and plaster is the generally preferred material for investment. It is used in the proportions of two parts of marble-dust to one of plaster. Potassium sulfate may be added to the water to hasten the setting, in the proportion of one small teaspoonful to a pint of water. The crown is first wet by dipping in water and then a little of the investment material is placed in the inside of the cap. Another portion is next placed on a piece of paper in the form of a small mound, and the crown is gently pressed into it until all the parts are covered except the wax on the palatal side of the backing. When the investment has set, it is trimmed and reduced in size as much as it properly can be and the investment material removed, so that the metallic parts of the crown are slightly exposed at the side, as shown in Figs. 157 and 158. The wax is removed by pouring boiling water on the investment. Instruments should not be used to remove wax, as they are liable to disturb delicately adjusted parts. Borax ground fine, mixed with water, or liquid flux, is applied with a brush to the metallic parts and in the seams before heating. When Parr's fluxed wax is used for the benefit of the flux it contains, the wax

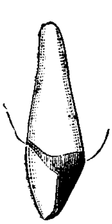
FIG. 158.



is allowed to burn out as the investment is heated. The objection to burning wax out is that the resulting *débris* is liable to pit the solder slightly.

Soldering and Finishing.—The investment should be first dried and heated to a dull red over a Bunsen flame (see Part V, Chapter IV) and then removed to a soldering-block. Gold solder, cut into small pieces, in quantity only sufficient to fill interstices and unite front to cap, is placed in and over the aperture between the front and cap. The solder should have been previously immersed in borax finely ground in water and then dried; or, after it is placed in position, it should have a small quantity of calcined borax or Parr's flux sprinkled over it. By heating the investment uniformly, especially underneath, and in the direction A, Figs. 157 and 158, with the large flame of a gas blowpipe, the solder is melted and gradually flowed downward and between the front and cap and in the interstices between the pieces of metal forming the backing. More solder is added by degrees and fused in this manner until the spaces between the porcelain and cap and at the sides are filled in and continuity of structure assured. After letting the body of the investment cool slightly, so as not to *draw back* the solder that has been already fused in the deep portion of the investment, additional solder is placed on the backing and cap, and with a small-pointed flame flowed over these parts. Only sufficient gold should be applied to properly contour the parts. When soldered the investment should be allowed to cool slowly, the crown removed and boiled in acid to thoroughly remove the borax, and then trimmed and polished. In finishing, the motion of the wheels in trimming and polishing should be so directed that the edge of the metal adjusted to the porcelain is brought against the surface. Fig. 159 represents the completed crown.

FIG. 159.



A more expeditious method of constructing this style of crown, which is practiced to some extent, is to unite the post and porcelain front to the cap in one soldering, as follows: After having fitted the post to the root-canal and cap, lay the post aside. The porcelain front is next ground and adapted to the cap, properly backed with metal, attached in position on the cap with wax cement, adjusted in the mouth, and removed. The pin is next warmed and placed in position by passing the end through the hole at the inside of the cap into the wax attaching the porcelain front. The whole is next adjusted in the mouth to get the exact line of the pin, carefully removed, invested, and soldered.

Bicuspids and Molars.—Bicuspids crowned by this method will have greater strength if a portion of the palatal section of the natural crown is preserved (Fig. 27), because of the support it affords to the collar which will cover it.

The end of the root is capped after the manner of the typical central already described, one or two pins being used in the canals as required. Where only one pin is used, it is best inserted in the palatal canal. A porcelain cuspid tooth, or a bicuspid front, is then ground, backed, and adjusted on the cap to represent the labial aspect, and secured with wax. It is carefully adjusted in the mouth, and the occluding edge of the porcelain is ground to clear the antagonizing teeth (A, Fig. 160). With a die of

FIG. 160.

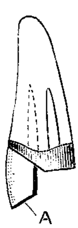


FIG. 161.

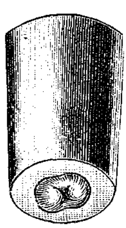


FIG. 162.

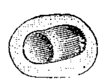


FIG. 163.

FIG. 164.

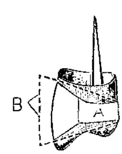
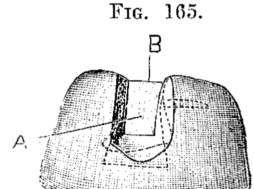


FIG. 165.



suitable size representing the occluding surface of a bicuspid, as illustrated in Fig. 161, a piece of pure gold plate (about No. 30 gage) is swaged (Fig. 162) and the cusps filled in with 18-carat solder or gold plate.[1] The cap is then trimmed (Fig. 163), ground, and fitted to the occluding edge of the porcelain front (Fig. 164) in proper position as regards occlusion, and the wax attaching it is shaped to the contour of the crown (A). A piece of very thin gold plate or of No. 60 foil (B) is then adjusted on each approximal side of the crown, which is invested (Fig. 165). The long ends of the side-pieces of gold plate are designed to retain

[1] A hard-flowing solder is best for use in filling cusps to protect porcelain fronts to crown- or bridge-work. It is made of two parts 18-carat gold plate and one part 18-carat solder. The plate and solder should be melted together and rolled out quite thin and kept ready for use (Part V, Chapter I).

them in position, as the investing material may be removed from the portion inclosing the sides of the crown (A). Mica—isinglass—may also be used as suitable for this purpose instead of gold. In the process of soldering, the solder is placed in the aperture at B, and the flame of the blowpipe being directed on the exposed sides of the gold at A, the solder is flowed into every part, forming perfect continuity of structure of the metallic portion of the crown. If this aperture at A is left open without the gold or mica, and the solder is first flowed in the interstices as described in soldering an incisor crown, the remaining solder necessary to contour the part can be added, if the pointed flame is used and not applied to the other portions of the crown and investment. In finishing, the surplus gold is trimmed to the contour of a bicuspid tooth. Fig. 166 represents the finished crown.

In difficult cases and occlusions the work is simplified by first soldering the porcelain front to the cap. The crown is then adjusted in the mouth and the porcelain ground to properly clear the occluding teeth and allow space for the gold cap. The gold cap is next adjusted in position, the parts shaped with wax inserted, and the soldering completed. To form the occluding and palatal section of the crown in exact accordance with the occluding teeth, where the occlusion is abnormal, the parts are to be first neatly modeled in hard wax and a die cast of the occluding surface. From this a cap can be stamped that may be easily fitted to properly occlude.

The method described produces a perfect and artistically formed crown, but simpler and quicker methods are practiced. One of these is to build up the palatal cusp with several pieces of gold plate, which have been previously melted into the form of small balls and flattened out on an anvil. These, laid in position and united with solder, are shaped in finishing to represent the palatal cusp (Fig. 167). The porcelain front should be backed so that the solder can be flowed over its occluding edge.

Another method is to extend the palatal part of the collar down, as shown in Fig. 168, and then fill in the space with solder. In finishing, the gold is trimmed to the form of the crown. As much as possible of the natural crown should be left at the palatal side of the collar, the exposed edge of which may be slit and brought in against the side and soldered to give contour. With this form of collar one pin, in the palatal root-canal, is sufficient.

It should be allowed to extend out of the cap enough to just touch the lower teeth when they are occluded. The exposed end of the pin will be an exact guide as to the amount of solder required to form the grinding-surface. In this and in the method

FIG. 166.

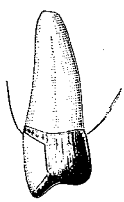


FIG. 167.

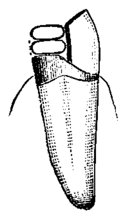


FIG. 168.

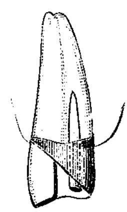
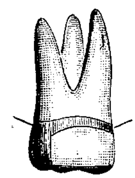


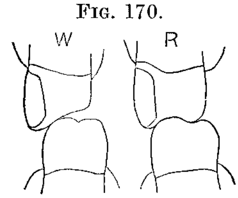
FIG. 169.



previously described, the porcelain front may be soldered and the palatal cusp formed in the one investment.

A faulty method of forming bicuspid crowns, especially in a close occlusion, and one to avoid, is the shaping of the palatal side, as shown at W, in Fig. 170. The occluding surface should be shaped so that the cusp of the occluding tooth shall be interlocked in occlusion, as illustrated at R, Fig. 170, instead of glancing off. In the latter event, the root is liable in time to be forced outward and loosened.

FIG. 170.



For a description of the Hollingsworth method of attaching a

FIG. 171.

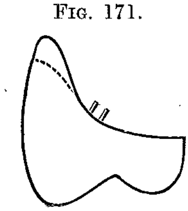


FIG. 172.

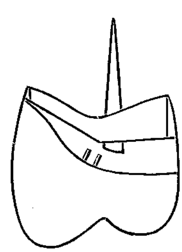
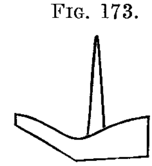


FIG. 173.



porcelain facing to a gold cap the reader is referred to Part III, Chapter XIV.

The method of construction of molar crowns with porcelain fronts is similar to that for bicuspids (Fig. 169).

Saddle-back Tooth.—The saddle-back tooth is a porcelain tooth in which the base curves in an unbroken line from the buccal surface at the neck to the heel at the palatal side, without any shoulder, the pins being inserted as shown in Fig. 171. The base of the porcelain tooth selected should be at least as large as the surface of the cap (Fig. 172). When the tooth is ground and fitted, it is backed flush to the edge of the base with pure gold No. 34 gage, or platinized gold (pure gold alloyed with 2 to 3 per cent. of platinum), still thinner, waxed in position on the cap (Figs. 172 and 173), and invested so that the seam of wax shall be fully exposed. In soldering, the flame must be directed under the investment, to draw the solder into the seam.

Dr. Stowell's Method of Applying a Countersunk Tooth or a Logan Crown.—A countersunk tooth or a porcelain crown can be soldered on the cap, according to Dr. S. S. Stowell's method, as follows:[1] "The tooth used may be a Logan crown or an ordi-

FIG. 174.

FIG. 175.

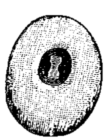


FIG. 176.

FIG. 177.

FIG. 178.

nary countersunk tooth, but in most cases the Logan crown, having a strong pin, is preferable. The pin is first cut off, then the tooth is ground to fit on the cap, the porcelain and the stump of the pin being reduced alike evenly and smoothly; after which the stump of the pin is ground with a small wheel below the surface of the porcelain (Fig. 174). The tooth is then invested (Fig. 175) and pure gold fused on to the platinum pin, and while in a fluid state it is 'spatted' down flat with a wax spatula (Fig. 176). The gold is then filed or ground down even with the porcelain, and at the palatal border the tooth is ground to bevel back until the gold is reached (Fig. 177). The tooth is then secured in place on the cap with wax cement (Fig. 178), the case invested, and heated until the wax has melted and burned out. A small clipping of thin platinum plate is crowded into the opening (Fig. 179) caused by the grinding of the bevel on the crown. The

[1] *Dental Cosmos*, vol. xxix, page 641.

clipping of platinum serves as a lead for the solder, which follows it down into the countersunk cap, around the ends of the dowels, and finally attaches itself to the pure gold already attached to the stump of the platinum pin. Fig. 180 represents the completed crown. A sectional view of a like crown (Fig. 181) also shows the organization in detail. A porcelain crown can be used to represent any of the teeth in the same manner. (See Figs. 182 and 183.)"

FIG. 179.

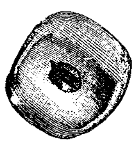


FIG. 180.

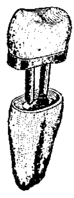


FIG. 181.

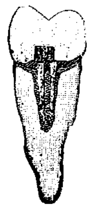


FIG. 182.

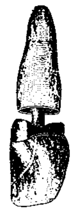
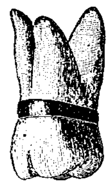


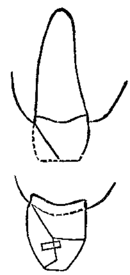
FIG. 183.



For the construction of crowns of the last two styles described, considerable space between the surface of the end of the root and the occluding teeth is required, as a shallow intervening body of porcelain, unprotected by metal, is liable to fracture.

Crowning in Cases of Abrasion.—In a case of extensive abrasion of the incisal edges of the anterior teeth, with pulp living though considerably calcified in the coronal section, crown-work to restore the length and form of the teeth is best performed by removing a portion of the labial aspect of the natural crown and then forming the artificial crown similar to a gold collar crown with a porcelain front without the pin. Fig. 184 gives an outline of the construction of such a crown. If a case should suggest the necessity of a pin, a short one can be inserted between the line of the pulp-chamber and the palatal wall.

FIG. 184.



In case the tooth is pulpless, the canal can be opened up and the post extended into the root of the tooth.

The incisal edge of the porcelain should be well protected by the use of clasp gold and solder instead of the ordinary gold plate. When an incisal surface of considerable thickness is suggested, it is best built to the desired depth after the first protecting piece has been soldered, by applying successive layers of plate rolled thin, of the size of the incisal edge, each being perforated with two or three holes with punch forceps, so that the solder shall more easily flow between and unite them. (See article on "Gold Tips," Chapter XV.)

Gold Crowns with Porcelain Fronts for Teeth with Living Pulps.

In the anterior teeth, in case of atrophy or erosion, or where decay has destroyed the approximal sides of a tooth in such a manner that crowning is considered the most desirable operation to perform, the pulp is frequently found unexposed and in a normal condition. The importance of its preservation in such a case is unquestionable.

The crowning of such cases with gold jacket-crowns, carrying a porcelain front attached with solder, is generally a questionable procedure. The room required for the gold and the small space left for the porcelain, together with the difficulty of securely attaching the latter, render such a construction rarely practicable. Jacket-crowns for such cases are now best made of platinum and porcelain, to which the reader is referred (Part IV, Chapter VI). The construction of gold crowns with porcelain inlays for bicuspids is also described in the same chapter, and in the account of the Hollingsworth System (Part III, Chapter XIV).

CHAPTER VII.

ALL-GOLD COLLAR CROWNS FOR BICUSPIDS AND MOLARS CONSTRUCTED IN SECTIONS.

METHODS OF KNUCKLING THE COLLAR AND GIVING CONTOUR—FORMING THE OCCLUDING SURFACE, METHODS NOS. 1, 2, 3, 4, 5, 6, AND 7—ALL-GOLD-CROWNS FOR INCISORS AND CUSPIDS—CASES OF ABRASION.

THE root and crown having been properly prepared, the collar is formed and adjusted as described at page 75, and the edge toward the antagonizing teeth trimmed, to fully clear them in occlusion. The collar is then slightly expanded toward the occluding surface for better contour.

FIG. 185 A.

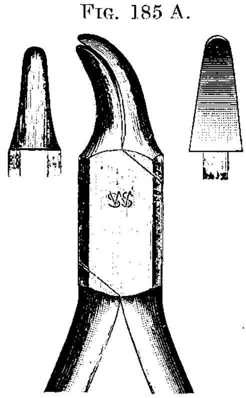
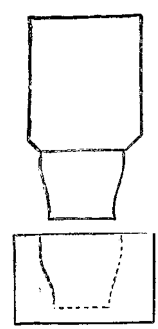


FIG. 185 B.

FIG. 186.



Methods of Knuckling the Collar and Giving Contour.—If the collar is long enough, a contour, approximately that of a natural tooth, can be imparted to the side with the aid of suitable pliers, such as are illustrated in Fig. 125, one beak of which is rounded at the point and shorter than the other. The Johnson and Reynolds forms, Figs. 185 A and 185 B, are also useful for shaping the plate and removing inequalities caused by the use of the first form. Contour may also be given by a mandrel die, or mold (Fig. 186). A close knuckling can be insured by pressing the collar against the approximal tooth in the manner shown in Fig. 187.

Methods of Forming the Occluding Surface or Cap to the Collar. *Method No. 1.*—The collar, having been fitted (Fig. 188 A represents a typical case), is removed, filled with plaster, and adjusted in position.

The antagonizing teeth, having been covered with a piece of tin foil, are then occluded until the plaster sets. (See Fig. 188 B.) The collar is then removed. The surface of the plaster inside the collar will give the impression of the natural root or crown,

FIG. 187.

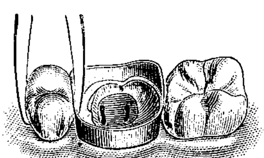


FIG. 188 A.

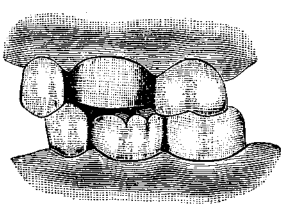
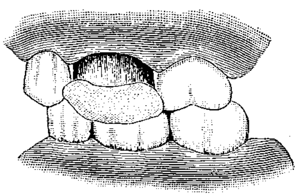


FIG. 188 B.



and the outside that of the antagonizing teeth. The latter furnishes an outline to form the grinding-surface of the crown.

The plaster at the occluding section is then trimmed and shaped to represent the cusps and fissures of the natural tooth, enough of the surface being removed to allow for the thickness of the plate that forms the cap. In shaping, the typical forms of grinding-surfaces, illustrated in Fig. 199, can be used as a guide.

A small tube of copper, a trifle larger in circumference than the crown under construction, is filled with Melotte's "Moldine," and the surface rubbed with soapstone. An impression of the lower portion of the form of the crown A to the line B, Fig. 189, is then made in the moldine, and a strip of paper wound around the tube, extending about an inch above the edge. Fusible alloy is then melted and poured into the mold, thus forming a die. An indentation is made with a punch in a block of lead, into which the die, when cold, is hammered slightly beyond the impression of the edge of the collar. By this method a die and a counter-die (Fig. 190) can, with practice, be completed in five minutes. With this die the cap is then struck up on the lead from a flat piece of plate and fitted to the collar.[1] A little of the surface of the plaster in the collar may have to be removed from under the cap, if, on trial in the mouth, the model or the cap is found a little flush. The crown, with the plaster still inside the collar, is fixed in a soldering-clamp of one of the forms shown in Figs. 191, 192, 193, and 196, which holds the parts together and permits the flame to reach all points. One of the points of the forms illustrated in Fig. 193 may be shaped to that shown in Fig. 196 to hold the cap in position on the collar, while the other point is used to support the collar. With the clamp (Fig. 191), the blow-pipe flame is the best. The other forms suggest the Bunsen flame. The parts of the crown can also be held together for soldering with iron wire in the form of a loop passed over the grinding-

FIG. 189.

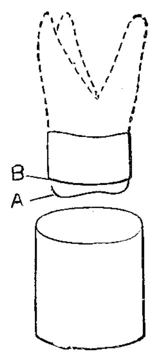
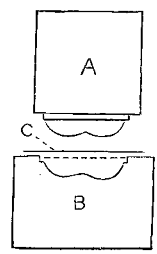


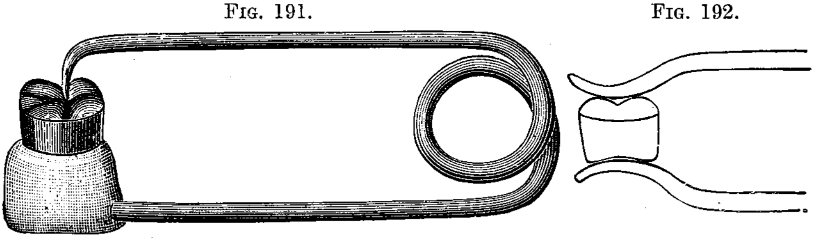
FIG. 190.



A, Fusible-metal die.
B, Counter-die.
C, Plate to form the cap.

FIG. 191.

FIG. 192.

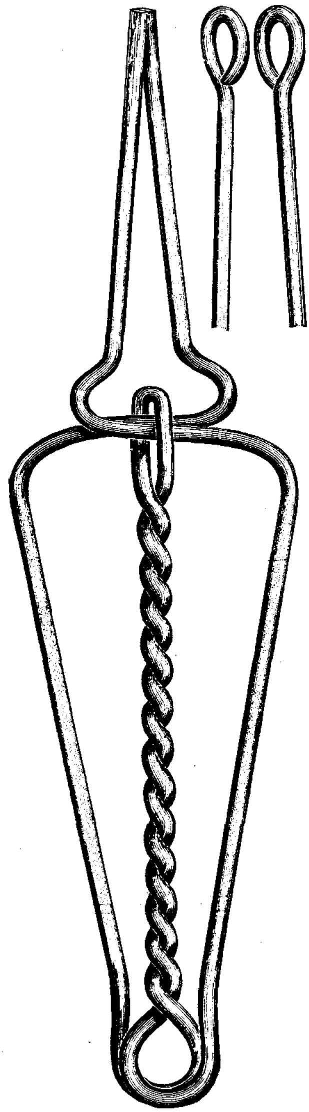


surface, against the sides of the collar, with the ends twisted together over the aperture of the neck of the crown. No more solder should be used than is necessary to unite the parts or give any required contour, as an excess necessitates additional labor in finishing.

[1] For a description of the use of Dental Lac to form molds for the purpose of swaging caps, etc., see Part V, Chapter III.

Method No. 2.—If the crown is not to be contoured with the aid of the solder, when the cap is struck up, melt solder into the cusps, and then adjust the cap in position on the collar, for which purpose some of the plaster underneath the cap must be removed. A jet of flame from the blowpipe is then thrown upon it in such a manner as will cause the solder to flow down on the edge of the collar and fill the seam from the inside. The objection to this method is that, when a large portion of the natural crown is inclosed by the gold, the solder will occasionally alter the inside form of the fitted cap, thereby interfering with its adjustment, which is a defect troublesome to correct.

FIG. 193.



Method No. 3.—This method is specially suitable in cases where all or nearly all of the grinding-surface of the natural crown is present or where the bite is close. Adjust the collar in the mouth, and, with a small piece of wax or impression-compound pressed upon it, take an impression and "bite," in which the collar shall be imbedded and removed. With this a model and articulation are made and the form of the cap shaped in wax. An impression of the cap is then made, either in moldine in a soft state in a tube, or in plaster, and a die cast. The cap is stamped on this die, then adapted to the collar by the model, and the crown finished. This method[1] can be adopted when it is preferable to construct the crown between the visits of the patient, after having first made and fitted the collar.

Method No. 4.—In utilizing a tooth as an abutment in bridge-

[1] Dr. N. W. Kingsley's method.

work when all or nearly all of the occluding surface of the natural crown is present and for any reason very little of it can be removed, a practical method of construction is to mark the outline of the occluding surface on the inner surface of the collar; then remove the collar and trim so as to leave a border of about one-sixteenth of an inch outside the mark. This border is then thinned with a corundum-wheel, and slit as seen in Fig. 194. The collar is next adjusted on the natural crown, and the slit border bent over to the form of the occluding surface, to which it is burnished. A piece of pure gold plate, about No. 30 gage, is then placed on the occluding surface of the tooth and adapted to it and to the collar. The gold may be first struck in the form

Fig. 194.

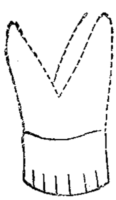


Fig. 195.

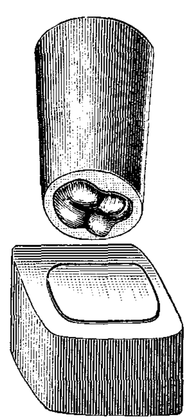
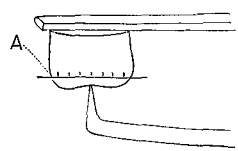


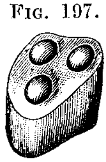
Fig. 196.



of a cap on a block of lead, hammering into it a die of the surface of the tooth to be crowned (Fig. 195), or one corresponding closely, made with a cusp button as described in the Hollingsworth System, Part III, Chapter XIV. The antagonizing teeth are then occluded on the gold, which is thereby pressed to form to articulate with the occluding surfaces. Enough of the occluding surface of the tooth crowned or of the cusps of the occluding tooth ought to be removed to allow for the thickness of the gold covering its surface. The collar and cap are next removed and soldered. This is done by resting the collar on the cap, which is held by a pair of tweezers, or by clamping the cap and collar together and placing the solder in small pieces around the collar outside the cap, at A, Fig. 196, and soldering by holding in a blue gas flame. Only sufficient solder should be used to join and fill the seams, so that it will not interfere with adjustment on the natural crown. A closer and neater joint will be obtained by at first attaching only one corner of the cap to the collar, with the smallest possible quantity of solder, then readjusting collar and cap on the tooth, adapting their edges together with a foot-shaped foil condenser, and then completing the soldering.

Method No. 5.—When intervening space will permit the formation of a solid gold occluding surface to a collar crown, the following is a very practical method: Fit the collar and trim the edge toward the occluding surface so as to leave between it and the cusps of the occluding teeth a space of at least one-sixteenth of an inch. Remove the collar, and solder over the occluding surface a flat piece of gold plate about No. 30 gage for bicuspids, or platinum about No. 34 for molars, preferably using a small quantity of hard-flowing solder. Trim off the surplus plate flush with the collar. To form the cusps: Melt scraps of gold plate on the surface of a soldering-block in small globules, one for each cusp, and slightly flatten each globule on an anvil with a hammer. Place the globules on the surface of the cap in proper position to form the cusps and attach each with a small piece of hard-flowing solder (Fig. 197). When all the cusps are attached, then melt on sufficient ordinary solder to properly fill in and give form to the surface of the cap. Adjust the cap in the mouth and trim the gold of the occluding surface to a form which will permit the occlusion of the other teeth, then polish the crown. This is a very practical and quick method of forming a gold crown.

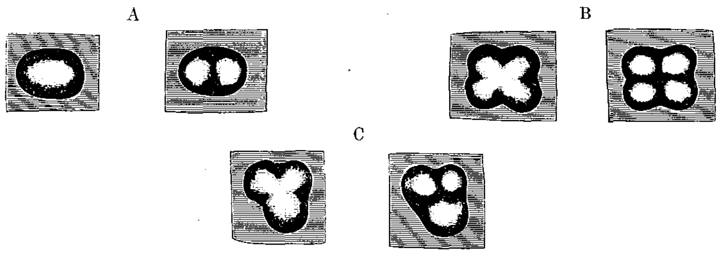
FIG. 197.



Method No. 6.—The methods described insure a perfect occlusion of the crown with the antagonizing teeth. In the absence of antagonizing teeth, or when the general form of the grinding-surface permits it, the cap can be struck up with a die similar to the one shown in Fig. 195 that approximates in size and form what is required. The cusps are then filled in with 18-carat gold plate, hard-flowing solder, or ordinary solder, and the edges of the inner surface of the cap ground level on the side of a corundum-wheel. The entire circumference of the edge of the collar is also leveled, and the cap adjusted, clamped, and united. If the cusps of the cap are filled in with solder, it will flow down and join the collar on the inside; if with gold plate or hard-flowing solder, the cap and collar must be joined with solder either on the inside or outside.

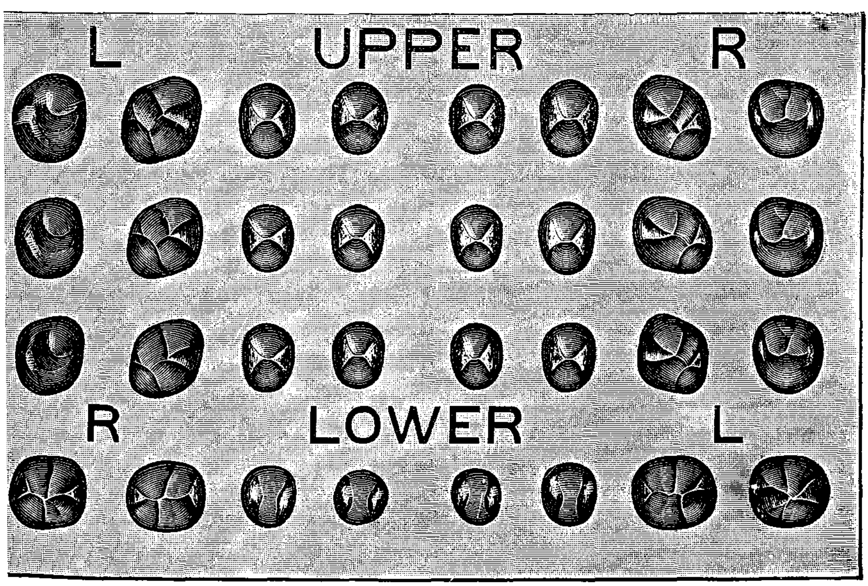
Method No. 7.—When the mere form of the grinding-surface for the crown is all that is required, an impromptu one may be made by indenting a piece of pure or soft gold plate with the round end of an instrument-handle on a piece of lead to form the cusps,

FIG. 198.



then reversing the cap, resting it on a flat surface, and creasing between the cusps with a burnisher. One large indentation, such as is shown in Fig. 198, A, when indented and creased across the

FIG. 199.



center with the edge of a flat, thin burnisher, will represent a bicuspid. Four indentations closely made, as shown in Fig. 198, B, when creased between, can be used to represent an upper or lower molar, and three similar indentations, properly creased, a second or third upper molar, as seen in Fig. 198, C.

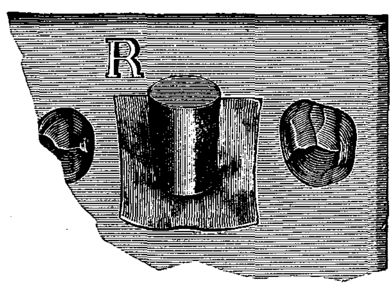
Method No. 8.—Metallic caps, or forms of the occluding surfaces of teeth for use in constructing crowns, are quickly made with a die-plate, such as is shown in Fig. 199,[1] "in which are four groups of intaglio dies representing the peculiar cusps of the bicuspids and molars. The hubs A, B (Fig. 200) are of the sizes shown, and are made of an alloy composed of tin one part, lead

FIG. 200.

C A B

four parts, melted together. The mold C should be warmed, the metal alloy poured in every hole, and the overflow wiped off just before the metal stiffens; this will make the butts of the hubs smooth and flat. After a minute or two the mold may be reversed, the hubs shaken out, and the casting process continued until a considerable number of hubs shall have been made. In Fig. 201 a molar hub is shown in place on a piece of No. 32 gold plate, which lies over the upper right first molar die. A succession of blows on the hub with a four-pound smooth-faced hammer will drive the

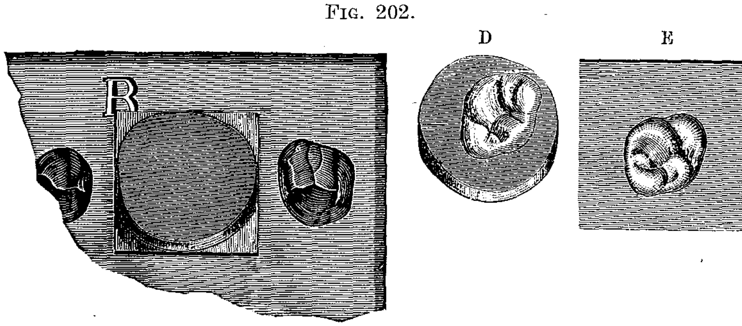
FIG. 201.



[1] *Dental Cosmos*, vol. xxix, page 482.

plate into the die, and at the same time spread the hub metal from the die center to its circumference, in such a manner that the plate will be perfectly struck up with the least possible risk of being cracked. The flattened hub is seen in Fig. 202, which also shows at D the obverse of the struck-up hub, and at E the cameo of the struck-up plate, having every cusp and depression sharply defined. The counter-die plate (Fig. 199) is made of a very hard cast metal, which will admit of the striking-up of many crown plates by the means described, if the crown plates be not too thick and stiff. Of course, they should be annealed before they are placed over the die. If a cusp or fissure should

FIG. 202.



chance to crack in hubbing, a small piece of plate may be struck up over the fissure, and then soldered to the original cap."

The methods which have been described for the construction of all-gold bicuspid and molar crowns are those generally adopted in practice. Of others, Dr. J. J. R. Patrick's method[1] consists of first forming a very narrow collar and telescoping it with a seamless cap of the form of the crown, and soldering along the line of the cap to the collar. When the upper edge of the collar is lapped over on the grinding-surface, as shown in Fig. 203, the soldering can be done through the aperture A.[2]

FIG. 203.

All-Gold Crowns for the Incisors and Cuspids.—When the teeth are abraded and short, with flat incisal edges (Fig. 204), and the all-gold crown required is to correspond in form or be only a little longer, the gold collar, after being fitted to the tooth, is slit

[1] Dr. Patrick, the *Dental Cosmos* for October, 1888, page 706.

[2] Dr. R. H. Adair's method.

on the palatal or lingual side, and bent and burnished to it. The collar is then removed and the seams soldered together. This is best done by holding the collar in a Bunsen gas flame, with the solder placed in position in very small pieces, and only sufficient in quantity to join the seams. The collar is next adjusted to the tooth, and the gold at the incisal edge trimmed even. A flat,

FIG. 204.

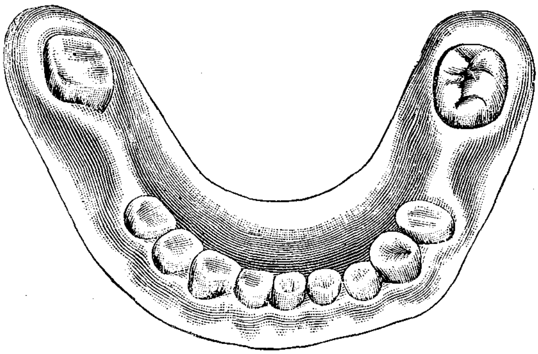
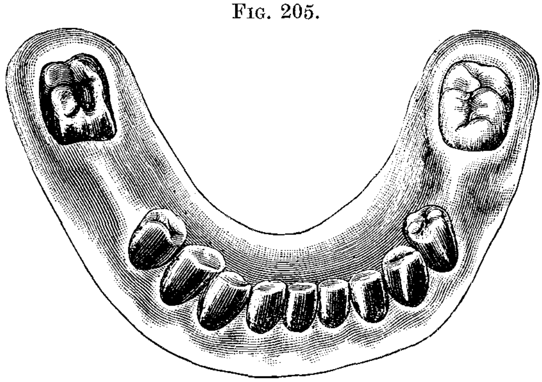


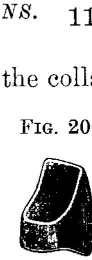
FIG. 205.



thick piece of gold plate or clasp-material is soldered across the incisal edge to form and inclose that portion of the crown.

Fig. 204 represents a case of abrasion of the lower teeth, to which all-gold crowns have been applied to open the bite, as shown in Fig. 205. In such cases, owing to the attrition of the occluding teeth, the cap forming the occluding surface should be constructed of heavy gold clasp-plate and solder. An artificial plate replaces the upper teeth.

FIG. 206.



When the gold crown required is of the normal form, the collar when properly fitted should be cut away at the palatal section, as shown in Fig. 206. The edge of the gold is then chamfered, and bent and burnished over the incisal edge and sides, close to the natural tooth. To this open section is next adapted a flat piece of gold plate, the collar is removed, and the parts are soldered together, using very little solder. Small pieces of solder or solder filings can be melted in the interior of the incisal edge to increase its thickness, if necessary.

Another method is to select a porcelain tooth of the desired form and of the size of the gold crown, and use it as a model to cast an intaglio die. The die is made by placing moldine in a pill box, smoothing off the surface, and imbedding half of the porcelain tooth with the palatal or pin side down. Next wind paper around the box, slightly warm the porcelain tooth, and pour in fusible metal. On separating and removing the porcelain tooth from the fusible metal, you have an intaglio die of the face of it. The use of Dental Lac for this purpose is described in Part V. On this intaglio die shape a piece of soft gold plate, No. 30 to 32 gage, to the form of the labial surface of the crown. Remove, bend, and burnish the metal round to the form of the sides and palatal section of the tooth, trim the meeting edges, and solder (Fig. 207).[1]

FIG. 207.

A fusible-metal die of the prepared form of the natural tooth is a material aid in the construction of any of these styles of crown.

In pulpless teeth with only a little or none of the natural crown remaining, the root can be shaped and capped as for a collar crown with a porcelain front (see page 83) with a post in the root-canal, and a gold front applied instead of one of porcelain. This is done by shaping or stamping the form of the labial face of the tooth required in gold plate, mounting it in position on the cap as in the case of a porcelain front, and attaching with solder. The concave portion at the palatal side of the gold front is filled in and shaped with solder at the same time.[2]

The construction of an all-gold crown for an incisor or cuspid is most easily accomplished by the seamless method described in Chapter VIII.

[1] Dr. J. T. Usher, *Dental Cosmos*, vol. xl.

[2] Dies and molds to shape plate for these purposes can now be found in the Hollingsworth and other crown outfits.

CHAPTER VIII.

THE GOLD SEAMLESS CAP-CROWN SYSTEM.

SEAMLESS ROOT-CAPS FOR CROWNS WITH PORCELAIN FRONTS—INCISORS, CUSPIDS, AND BICUSPIDS—IMPRESSIONS AND DIES—METHOD OF STAMPING SEAMLESS METAL CAPS—ALL-GOLD SEAMLESS BICUSPIDS AND MOLARS—MODELS, DIES, AND METHOD OF SWAGING—ALL-GOLD SEAMLESS INCISORS AND CUSPIDS.

THIS method consists in the use of a gold seamless cap for the construction of the required root-cap or crown.

Seamless Root-Caps for Incisor, Cuspid, and Bicuspid Crowns with Porcelain Fronts.—Incisor, cuspid, and bicuspid crowns with porcelain fronts are constructed by this method as follows: The natural crown is ground down to within about one-eighth of an inch of the gum at the palatal wall, or enough to clear the antagonizing teeth when occluded, and slanting from the posterior edge of the pulp-chamber to the cervico-labial edge of the gum and slightly under its margin if it is desirable to conceal the joining of the crown with the root. The sides are shaped the same as for a collar crown (Fig. 208).

Impressions and Dies.—A die of the end of the root is next made. For this purpose an impression of the part is taken with gutta-percha on the end of a piece of wood trimmed to the proper size, or, better still, by placing a thin mixture of plaster of Paris to which a little potassium sulfate has been added, or some moldine, in a tube formed of a strip of copper about one and one-half inches in length and three-eighths of an inch in diameter, cut out on the sides to the depth of half an inch, with the flange for the palatal side shortened[1] (Fig. 209). The impression thus taken will be confined almost entirely to the end of the root to be capped. When gutta-percha is used, it is cooled and dried perfectly. A strip of paper is

FIG. 208.

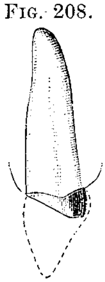
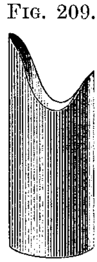


FIG. 209.



[1] See Part V, Chapter III, which describes how to make a tube without soldering.

tied around the wood or tube, and a die cast with the fusible metal. The cooling is hastened by immersion in a glass of water. When cool, the die is removed from the mold, and the metal is trimmed, with file and chisel, a little deeper than the gum has permitted the impression of the root to be taken, and without altering the form of the end of the root (Fig. 210). A counter-die is then made by driving a punch of suitable size into the surface of a block of pure lead, into which with a few blows of a hammer the die is forced.

Methods of Stamping Seamless Crowns.—A cap of pure gold, or preferably of platinum, with which to cover the root is first

FIG. 210.

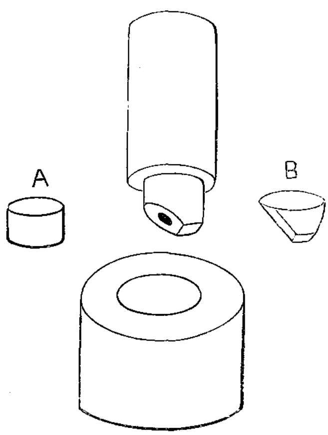


FIG. 211.

FIG. 213.

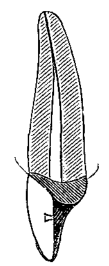
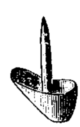


FIG. 212.

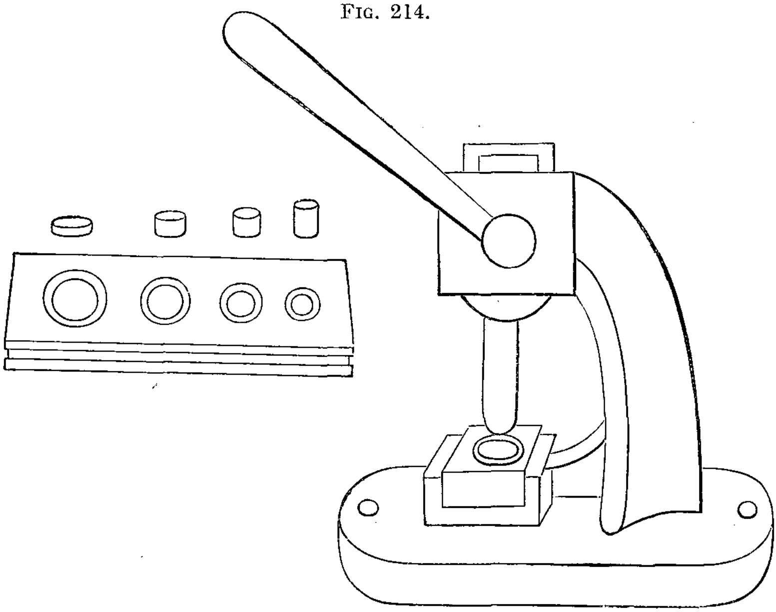


made. This can be formed by placing a piece of the plate, No. 30 gage, of suitable size upon a block of lead, and with an oval-shaped punch one-fourth of an inch in diameter gradually driving it into the lead until the gold has assumed the shape of a cap about an eighth of an inch in depth (A, Fig. 210). The gold should be protected from the lead by the intervention of a piece of thin kid and should be withdrawn from under the punch and annealed from time to time during the process, otherwise, as in all such operations, it is liable to be cracked.

Caps of metal can be made in different sizes and kept on hand for use in this and other styles of crown-work by means of a stamping machine, which in principle is such as is used by jewelers for forming cap-shaped pieces of gold, and in factories for making copper cartridges. The gold plate, cut into circular pieces, is pressed through a steel die-plate, with punches gaged to the holes; at each punch a small portion of the gold is turned over, thus preventing its lapping or creasing. Repeated annealing of the metal is very necessary in this process. A properly constructed press should be used for the purpose, such as is illustrated in Fig. 214, instead of hammering the punches through the plates, because when treated in that manner the metal is liable to be torn or creased.

The cap is then annealed and swaged on the die to the form

FIG. 214.



The form of stamping machine introduced by the late Dr. J. J. R. Patrick.

of the end of the root (B, Fig. 210). The palatal portion of the cap should be allowed to go well up under the free edge of the gum, and at the cervico-labial edge it can be, if preferred, cut out to the edge of the root. In the process of adjustment, the edges which fit under the gum should be marked and trimmed as directed in describing the construction of a collar crown, and then burnished close to the sides of the root and into the orifice of the root-canal, forming a perfect-fitting seamless cap (Fig. 211). A platinum pin is then fitted in the root-canal and soldered to the cap (Fig. 212), as in the construction of the gold collar crown with porcelain front (page 86), with which operation the remainder of the process of construction is identical. Fig. 213 represents the completed crown.

The advantages of this style of crown are, simplicity, as the formation of a collar is avoided, and strength, as a large portion of the natural crown can be left at the palatal side. This affords a stronger and more reliable foundation than can be obtained at any other point, as the direction of the force in mastication is forward at an angle with the line of the root, and although the metal of the cap, where it encircles the root at the cervico-labial edge, is entirely removed, the crown is still held securely.

All-Gold Seamless Bicuspids and Molars.—All-gold seamless crowns for bicuspids and molars that will accurately fit the natural crown and root, and occlude properly with the antagonizing teeth, are easily and quickly formed, if sufficient of the natural crown remains to admit of temporary restoration of its contour with gutta-percha or any other suitable plastic material. The sides of the natural tooth and the occluding surface should be removed at least the thickness of the plate to be used.

Models, Dies, and Method of Swaging.—An impression of the restored tooth is next taken in plaster or moldine in a thin copper tube which will fit under the free margin of the gum and closely encircle the tooth, as explained on page 112, and in Part V, Chapter III, which also explains the construction of the copper tube. A die is then formed of fusible alloy; or a plaster model can be made from an impression of the tooth taken in wax, and a mold obtained from the model with moldine. Additional preparation and shaping of the natural crown to receive the artificial crown can then be proceeded with.

Where the natural crown is very badly decayed or broken down and the method just described is not practicable, the portion of the natural crown or root remaining should be shaped and prepared to receive an artificial crown. Then the form of the cervix is ascertained with a wire, as described on page 78, an impression of the parts taken in wax or impression-compound, and the wire form, the twisted ends having been shortened, is carefully adjusted on the wax at the cervical line. The plaster model, when made, will show the wire slightly imbedded in the plaster. The plaster should be trimmed to the inner edge of the wire, as that represents the exact form of the root (Fig. 215), and the wire cut and removed.

Another method is to fit a copper collar accurately to the root with projecting points on the sides of the collar, which will remove in the impression. In such a case plaster must be used for the impression. When the model is made the collar, on being cut and removed, will represent the exact form of the neck.

From a "bite" taken in wax and fitted on the model a plaster articulation is then made. A hole is drilled in the center of the form of the root on the model to be crowned. In this hole, and over the end of the root, a ball of soft plaster, slightly colored with carmine, is placed, and the teeth of the articulation, covered with tin foil, closed on it. This, on separation, gives the outline of the form of the grinding-surface for the crown. The sides of the

Fig. 215.

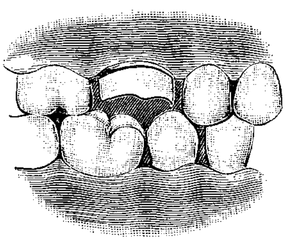
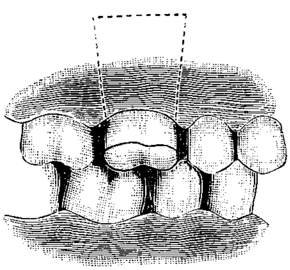


Fig. 216.



plaster are then trimmed to the form of the crown, and the whole carved in detail (Fig. 216). As the crown will always stamp larger in circumference than the die, in proportion to the thickness of the gold used, it should be remembered allowance must be made by trimming off a proportionate amount of the grinding-surface, either before the impression of the natural tooth is taken, or, from the plaster model of the tooth when it is shaped. The former is the preferable method to practice, as the latter will afterward require the removal of at least the same proportionate amount from the natural tooth when the crown is fitted, which is not always easily done.

When the plaster model for the crown is made, it is separated from the rest of the model at the dotted line seen in Fig. 216, and trimmed in the form shown by the cast A, Fig. 217. From this model the die is made in a tube with moldine and fusible metal, as already described, and in Part V, Chapter III. The cast should always be lengthened at the neck, so that the crown when constructed shall have a surplus in depth of gold to allow for any trimming or shaping of the collar that may be required. The counter-die (B, Fig. 217) is made by punching a hole in a block of lead and hammering the die into it. The crown, which is usually formed of gold only slightly alloyed, or gold lined with very thin platinum from No. 29 to No. 32 gage, is then made by first stamping a piece of plate (see page 114) in the form of a cap of

FIG. 217.

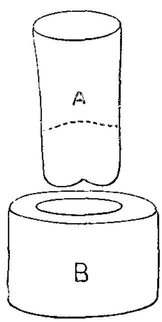


FIG. 218.

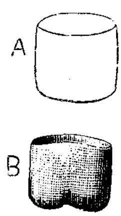
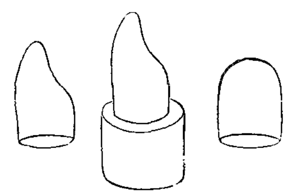


FIG. 219.



gold (A, Fig. 218), which is then placed on the cast, tapped with a horn hammer to the general shape, and with the aid of the counter-die (B, Fig. 217) swaged to the form of the crown B, Fig. 218. A piece of kid-leather or rubber-dam should be used to cover and protect the gold from the lead, and to facilitate its removal from the counter-die. An allowance for the thickness of the gold must be first made, by driving the die with two thicknesses of kid, without the gold on the cast, into the counter-die to enlarge it. If this is not done, the gold is liable to be torn in the swaging.

All-Gold Incisors and Cuspids.—Incisor and cuspid crowns from which a portion of the gold on the labial aspect is to be removed (see article on "Shell Anchorage," page 210), or which are to be used entire as supports for bridge-work, can usually be advantageously formed with seamless caps (Fig. 219). The necks of these crowns will usually have to be contracted in fitting in a contracting plate, or slit, lapped, and soldered.

CHAPTER IX.

Imparting Contour to Seamless Gold Crowns.

CROWNS SWAGED ON DIES—METHOD OF SLITTING AND CONTRACTING THE NECK—USE OF CONTOURING PLIERS—EXTERNAL APPLICATION OF METAL—TO CONTOUR ON THE DIE WITH A SWAGER—SECTIONAL MOLD METHOD—FORMATION—MOLDS—SHAPING THE CAP—READY-MADE GOLD CROWNS.

Crowns Swaged on Dies.

Method of Slitting and Contracting the Neck.—Crowns for cases in which decay has extensively involved the approximal sides, owing to encroachment of the adjoining teeth, generally require very little if any contour. Some form can be imparted to a straight-sided seamless crown by slitting the collar directly in the center of the palatal side, contracting the neck, tapering the underlapping portion, adjusting on the tooth, burnishing the gold, removing, and soldering. This contraction also imparts a very close fit to the collar. When considerable contour is required, the crown should be formed with the desired size and shape of grinding-surface. The collar is then to be slit and contracted at one or each of the approximal sides as is found necessary, fitted, and soldered.

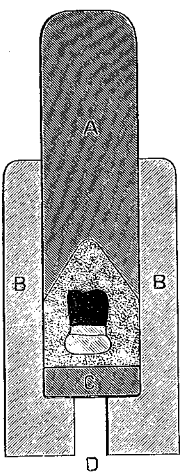
Use of Contouring Pliers.—"Contouring" pliers are used by some to give form to a seamless crown, sufficient to knuckle it against the adjoining teeth; but the bulge that is imparted by this means is generally located well toward the neck of the crown, instead of being close to the grinding-surface where it is required.

External Application of Contour.—A close knuckling of the grinding-surface of a seamless crown to that of an adjoining tooth can always be easily made by scratching the surface of the gold at the point the knuckling is desired, packing on Moss Fibre Gold or foil, and flowing a little solder over it, then fitting and trimming to the desired size and shape.

To Contour on the Die with a Swager.—A seamless crown may be given contour on the swaging die in the following manner:

Form the die for the intended crown of a fusible metal which melts at 180° F. Reduce the neck of the die to the shape and size required for the crown, which can be accurately determined by measurement with a strip of copper, or, cast a die of the exact shape from a sectional plaster mold of the tooth, formed longitudinally in halves. Place over the die a tight-fitting seamless gold cap. Mallet and burnish the gold as closely as possible to the die. If it is a bicuspid or molar, swage the grinding-surface. Place the crown in a small shot swage, as illustrated in Fig. 220, surrounded with the shot, and insert and hammer the plunger, which will cause the shot to uniformly swage the gold by degrees closely to the die. When the swaging is completed, remove the die from the crown by placing it in boling water to melt out the fusible metal. Should any of the metal adhere to the gold, immerse the crown in nitric acid, which will quickly dissolve it.

FIG. 220.



Sectional Mold Method.—The artistic requirement of all gold crown-work is, that it shall reproduce the anatomical contour of the natural teeth. Such a form can be given bicuspids and molars by the sectional mold method more easily than by any other. For this reason it is the method adopted for the manufacture of ready-made gold seamless contour crowns. The sectional mold method, though a practical one for the manufacturer, will be generally found tedious for the

FIG. 221.

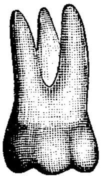


FIG. 222.

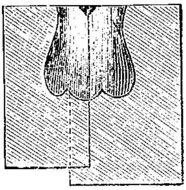
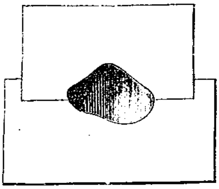


FIG. 223.

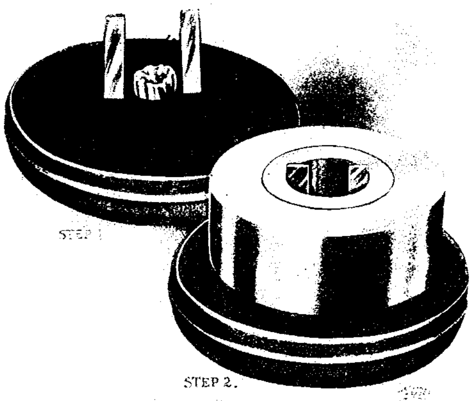


formation of a single crown for an individual case in the hands of the ordinary practitioner.

Formation.—To describe and illustrate the process we will take a superior molar (Fig. 221). A natural tooth, or one made of plaster, is used as a model. From this a sectional mold is made in Babbitt's metal, zinc, or fusible alloy, as illustrated in Figs. 222 and 223.

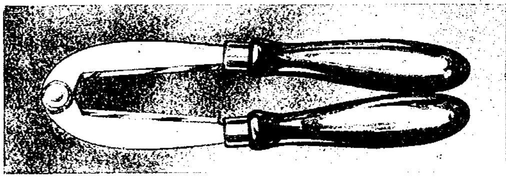
Molds.—Flasks are now manufactured and sold to facilitate the formation of a metallic sectional mold. Fig. 224 illustrates

FIG. 224.



a flask of this kind, "the Turner." The form of the tooth to be molded is placed in the center, occluding surface up. The molding ring is set around the tooth form (small diameter up) and

FIG. 225.



the two metal strips placed inside the molding ring on each side of the tooth form, but not touching it, on a straight line from mesial to distal side. The melted fusible metal is next poured, covering the tooth form and forming the entire mold. The larger molding ring is placed around the smaller one to cool the metal. While the metal is yet slightly warm the metallic mold is taken out of the ring, the strips on the sides removed, and the mold split in two through the slots formed by the metal strips with the dividers shown in Fig. 225. The tooth form is next removed, the parts put together the same as before being split and set back in the small ring, and the mold is then complete.

Shaping the Cap.—Into the mold a cap of gold (Fig. 226) 23 to 24 carats fine, No. 28 to 30 gage, is adjusted, fitting tightly the orifice of the closed mold. The mold is placed in a vise, the cap expanded to the general form of the mold by hammering into it a mass of cotton or some other suitable material, and with a wood

FIG. 226.

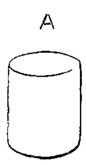


FIG. 227.

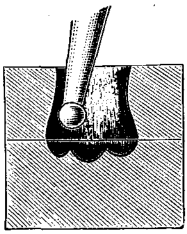


FIG. 228.

point or a burnisher revolved by the dental engine burnished into every part of the mold (Fig. 227). To facilitate the process, the mold should be frequently opened, and the gold annealed. Fig. 228 represents the completed crown.

Ready-Made Gold Crowns.—Ready-made seamless gold crowns, such as the "Evans," are made in the manner above described. They are arranged in sets of different sizes, representing the average forms generally required, with some of the usual deviations.

CHAPTER X.

Adjustment of Seamless Gold Crowns.

EXPANSION OF THE COLLAR AND CROWN—ALTERATION OF A SIDE OR PART OF A CROWN—ALTERATION OF THE OCCLUDING SURFACE—CONTRACTION OF THE NECK—TO DEEPEN THE CUSPS—TO POINT, LENGTHEN, OR NARROW IN APPEARANCE THE LABIAL CUSP—TO REMOVE THE INDENTATION BETWEEN CUSPS—STRENGTHENING AND REINFORCEMENT OF SEAMLESS GOLD CROWNS—METHOD OF FORMING A SOLID GRINDING-SURFACE—EXTERNAL REINFORCEMENT OF SEAMLESS GOLD IN "CLOSE BITES"—COMPARATIVE MERITS OF THE SECTIONAL AND SEAMLESS METHODS OF CONSTRUCTING GOLD CROWNS.

A superior molar—one of the most difficult teeth to operate on —will serve as a typical case to illustrate the process of adjustment. The crown or root is first shaped, and, if necessary, built down with amalgam, straight, or tapering slightly on its sides toward the occluding surface, as described at page 40. A crown of the proper size is specially made or selected from a ready-made stock. If the latter, its selection will be facilitated by having a plaster model of the case and a wire measurement of the neck. The crown is an-

Fig. 229.

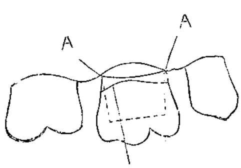


Fig. 230.

Fig. 231.

nealed, slipped over the end of the root or tooth, and gently worked upward—the gold of the collar will adapt itself to the form of the root in the operation—until the edge meets the margin of the gum (A A, Fig. 229).

1. Mark a line (B) on the gold parallel with the margin of the gum.

2. Remove and trim to this line (A, Fig. 230). If necessary, repeat the marking and trimming until the edge meets the gum evenly.

3. Bevel the edge of the gold, readjust the crown and press

it up until the edge of the collar passes under the margin of the gum, and, if the occlusion is correct, burnish the gold to the cervix (Fig. 231).

Expansion of the Collar and Crown.—If the collar of the crown needs enlargement, it is easily and most properly accomplished with crown expanders (shown in miniature form in Fig. 232), the points of which should be introduced at first just within the edge of the neck, and the gold spread sufficiently to allow it to fit over the end of the natural crown or root, the process of expansion being gradually continued as the crown is brought into position. By proceeding in this manner too great expansion is avoided.

FIG. 232.

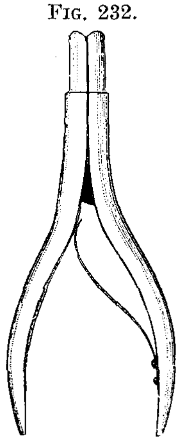
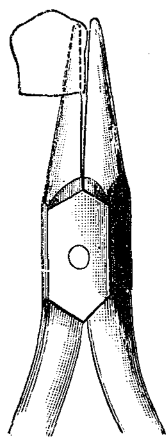


FIG. 233.



Alteration of a Side or Part of a Crown.—The contour of one or both sides can be depressed and the crown thus narrowed by introducing the points of a crown expander or some tool that will fit loosely inside the crown, then steadying the crown with the fingers as shown in Fig. 234, and tapping the sides to be reduced with the flat end of a riveting hammer. Pliers will also accomplish it, one beak being placed inside of the crown, and the other against the bulge on the outside (Fig. 233). This is necessary when the side of a crown presses on an adjoining tooth, and the crown is thus prevented from coming into proper position.

To Alter the Shape of a Portion of the Collar or Side of a Crown, slip the crown over the point of an anvil, or the end of a pair of expanders, or a small round-handled instrument held in a vise, and then tap the part to be altered with the flat end of a riveting hammer to the form desired.

Alteration of the Occluding Surface.—Before the crown is pressed up to its apparently proper position, the occlusion should be examined, and calculations carefully made to obviate any defects of articulation, which can be readily corrected at this stage by proper manipulation of the crown.

FIG. 234.

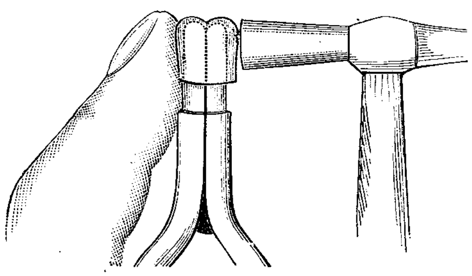
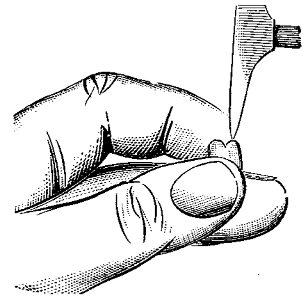


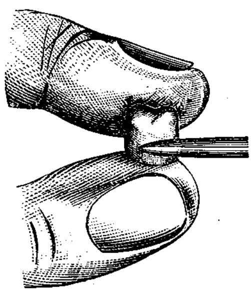
FIG. 235.



Alteration of the Grinding-Surface.—Place crown in position on the tooth and flatten the part with a large gold-foil condenser tapped with the mallet, or hold the crown and tap the part as shown in Fig. 235. The closing of the antagonizing teeth upon the crown by the patient with force will aid or complete the operation of articulating.

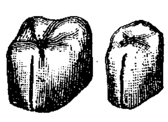
Contraction of the Neck.—To slightly contract the neck bend in the edge of the gold at the neck with narrow-beaked pliers, and holding the crown evenly and firmly between the fingers, as shown in Fig. 236, burnish the sides and neck section inward around the entire circumference of the crown.

FIG. 236.



To Considerably Contract a Crown.—Slit the gold longitudinally at the palatal or lingual side its full length to the grinding-surface, as shown in Fig. 237, bevel off the edge to lap under, contract the crown, readjust to the tooth, remove, place the smallest quantity of solder or dampened flux solder filings in position on the seam, and then solder by holding

FIG. 237.



in an alcohol flame, or by carefully heating in the upper section of a Bunsen flame. Next proceed with the further adjustment of the crown.

The line of the seam can be stoned off and polished after the crown has been fitted, and additionally soldered to strengthen the sides or grinding-surface.

To Deepen the Cusps.—Trim a piece of wood to the form shown in Fig. 238, rest the neck on a folded napkin, and press the wood between the cusps.

To Point, Lengthen, or Narrow in Appearance the Labial Cusp of an upper bicuspid crown, gently tap the gold on each side of the labial cusp toward the point at the angle shown in Fig. 239.

To Remove the Indentation between the Cusps and thus flatten the entire grinding-surface, introduce inside the crown a

FIG. 238.

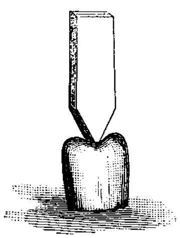


FIG. 239.

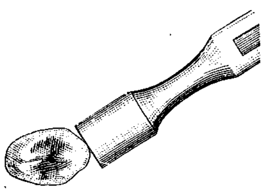
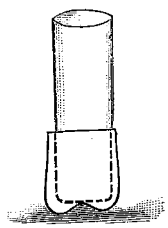


FIG. 240.



flat-ended piece of wood the size of the crown and press downward as shown in Fig. 240.

Strengthening and Reinforcement of Seamless Gold Contour Crowns.—Additional strength and stiffness can be given to seamless gold crowns, when desired, in several ways, by soldering in an open flame. The liability of melting the gold which forms the side of the crown in the operation has, with some, been one of the objections to their use. Great care must be exercised to avoid this, to which end the crown should be held in the upper section of the flame, watched, and instantly removed as soon as the solder fuses and flows. The heat should be very gradually and uniformly applied by twisting and moving the crown well up and down in the flame, so that the gold of the crown shall at no time become hotter than the solder. If this precaution is not observed the solder is apt to penetrate the gold of the crown. The crown should be held in such a position that a full view of the interior is presented and the melting of the solder rendered visible; this will occur at a *red heat.*

To stiffen the whole interior of the crown, after it has been properly adjusted, dampen the inner surface with wet cotton on the point of an instrument; place in the interior a quantity of fluxed solder filings (solder filings mixed with Parr's flux or pulverized vitrified borax); place the finger over the neck end of the crown, invert, and shake well. A portion of the solder filings will adhere evenly all over the wet surface. The finger is then removed and the surplus dropped back into the bottle. Catch the edge of the neck with tweezers, and heat the crown in a large alcohol or gas flame until the solder fuses, when it will flow evenly over the surface of the gold without materially altering the general form.

A crown may be stiffened externally by flowing a film of 22-carat coin solder over all or part of its surface.

The grinding-surface of seamless crowns can be thickened by filling the interior of the cusps with solder. If considerable of the natural crown is present, the solder should be confined to the cusps, avoiding all excess, which would be liable to obstruct the readjustment of the crowns, a difficulty which often occurs and which is troublesome to correct.

Method of Forming a Solid Gold Grinding-Surface with Moss Fibre Gold and Solder.—A grinding-surface of solid gold, which will be uniform in shape to that of the natural crown it is to cap and not liable to interfere with the readjustment, may be formed as follows: Dry the gold crown and place in the interior of the grinding-surface a layer of Moss Fibre Gold. Insert the crown, press to position and occlude the teeth, and remove the crown. The Moss Fibre Gold will exhibit an impression of the tooth. Add more Moss Fibre Gold until a nearly condensed lining of it fills the grinding-surface. Next saturate this lining of the Moss Fibre Gold with solder. This is done by applying and fusing the solder cut in very small pieces, or fluxed solder filings, on the surface of the gold, a very little at a time and in quantity only so much as the Moss Fibre will absorb. If more solder than this is applied the adjustment of the crown is liable to be obstructed. If the operation is properly performed it will result in an interior of gold that will correspond in form with that of the natural tooth.

External Reinforcement with Platinum and Gold in "Close Bites."—In a very close bite when removal of only very little of the occluding surface of the tooth crowned, or of the occluding teeth, is for any reason permissible, a film of solder or 18-carat plate may be flowed over the outer surface, or a piece of perforated platinum foil of a size only sufficient to cover the occluding surface can be pressed or swaged to its form and closely soldered, using only a very small quantity of solder. By this latter method the grinding-surface will ocupy the least possible space and present a metallic face which will very effectually resist attrition. The platinum will absorb enough of the solder, if sufficient heat is applied, to give the grinding-surface of the crown a color resembling that of clasp-gold.

Gold seamless crowns, especially those made of platinized gold, can be filled solid, by investing the outside surface in plaster and marble-dust, heating up the investment, placing solder, small pieces at a time, inside the crown and fusing it, by applying the full flame of the blowpipe around or underneath the investment.

Seamless crowns can be inserted in an easy and inexpensive manner by filling in the lower section of the crown with amalgam from which the mercury has been well pressed out instead of gold, and then cementing on the crown with oxyphosphate in the usual manner. In a case so inserted, with no antagonizing teeth, the result is the same as though the inside of the occluding surface of the crown was filled with gold; but if antagonizing teeth are present, the gold of the crown is liable to wear through in places and expose the amalgam.

Altering a Gold Crown to the Exact Form of Any Corresponding Natural Tooth.—Ready-made gold seamless contour crowns frequently afford the means of easily and quickly performing a crowning operation. In a case having nearly all the natural teeth present, in which the occluding surface and sides differ in shape from the form of the gold crown, to such an extent as to interfere with its adjustment, a die of the natural crown should be made of fusible metal (Melotte's Fusible Alloy, see Part V, Chapter III), and with it the interior of the gold crown should be altered in shape sufficiently to receive the natural crown, by resting the occluding surface of the gold crown on a folded napkin and gently tapping the die into it. By this means a ready-made gold crown is quickly altered to the exact shape of any tooth.

Comparative Merits of the Seamless and Sectional Methods of Constructing Gold Crowns.—The seamless and sectional crown methods each possess their respective advantages for the accomplishment of the work in hand. By expertness the same effectiveness in result can generally be accomplished by either method. The constructive details of each adapt it specially to certain classes of work, wherein for this reason it is superior to the other in that it affords facilities for the accomplishment of the result with less labor. Thus, crowns for very short teeth of abnormal occlusion, also cases of abrasion requiring special forms of incisal and occlusal surfaces of solid metal, are generally best constructed in sections. Bicuspids and molars as well as incisors and cuspids, when all or nearly all of the natural tooth is present and the occlusion is normal, are generally constructed to advantage by the seamless methods.

CHAPTER XI.

Various Forms of Gold Crowns with Porcelain Fronts.

PORCELAIN AND GOLD CROWN WITHOUT A COLLAR—ROOTS BELOW GUM-MARGIN: SPECIAL FORMS—CUP-SHAPED CAP: DR. VAN WOERT'S METHOD—DR. CHUPEIN'S METHOD—READY-MADE POST AND DISK—DR. SANGER'S METHOD—DOUBLE CAP-CROWN.

Porcelain and Gold Crown without a Collar.—The root of a cuspid will be taken as a typical case to illustrate the construction of this style of crown.

The end of the root is prepared the same as for a porcelain crown (Fig. 241). The root-canal is enlarged with a drill which will closely fit the opening and the orifice slightly reamed. Into the canal, gaging its full diameter, is fitted a piece of iridio-

Fig. 241.

Fig. 242.

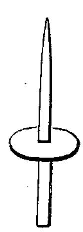
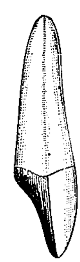


Fig. 243.

Fig. 244.



platinum wire, tapered off to a point, so that by introducing it far up the canal greater strength can be obtained, and the root rendered less liable to longitudinal fracture from pressure in a forward direction. A piece of platinum plate, a trifle larger than the end of the root, of about No. 34 gage, with a hole punched in its center, is then slipped on the post, which it must fit tightly (Fig. 242).

When the post is adjusted firmly in the canal, the platinum plate is pressed down on the root, and burnished into the orifice of the canal around the post. When the post is withdrawn from the root, the platinum will adhere to it, if fitted closely, without the use of wax. A particle of pure gold with borax is put in the joint, and melted in a Bunsen gas flame. Barely enough of the gold should be used to unite the parts. When soldered, the post and cap are again adjusted in the mouth and the cap malleted and burnished to the form of the end of the root, so that its edge will leave a mark on the platinum. The cap, on being removed, should be trimmed to this mark, and again burnished on the root (Fig. 243). Sometimes the platinum may be slightly burnished over the edge around the palatal portion of the root. The post is then cut off just above the platinum, and a plate tooth fitted, backed, and cemented with wax in position on the cap, as described on page 88. The whole is then removed, invested, and soldered with gold, which should be melted in at the base of the post, as at this point, when in use, the strain is very great. The post is then barbed, and the crown is cemented to the root with gutta-percha, oxyphosphate cement, or both combined (Fig. 244).

Roots Below Gum-Margin.—The crown just described is a suitable form for application in cases where the cervical end of the root through either decay or fracture is considerably below the surface of the gum and does not admit of the use of a collar. In such cases the end of the root should be first fully exposed by pellets of gutta-percha fastened in the orifice of the root-canal and extending over the surface of the end of the root, pressing away the gum, the application being repeated as often as necessary. The above method of shaping the cap is preferable to stamping it, as suggested by some writers.

Special Forms.—Several methods of capping are practiced in which, by giving the end and sides of the root specified forms, the use of a collar is avoided and protection against decay or fracture is promised.

Cup-Shaped Cap.[1]—The root is removed to, or very nearly to the line of the gum, and the edge of the end rounded off under the gum-margin, leaving the end tapering to the orifice of the canal, as illustrated in Fig. 245. The cap is made of a disk of gold, about No. 31 or 32, or of platinum, about No. 34 gage. This is first perforated and adapted to the orifice of the root-canal, which requires to be slightly enlarged. The disk is then slit at the center

[1] Dr. J. Rollo Knapp's method.

of the palatal side and slightly lapped (A, Fig. 246), and then again fitted to the end of the root and closely adapted to its surface and margin, which the lapping over of the slit easily permits. The edges are then united with the least possible quantity of solder. The edges of the cap, guided by several adjustments, are trimmed even with the sides of the root and the post soldered in position. B, Fig. 246, shows the cup-shaped cap with post ready for the adjustment of the porcelain front, which is attached in the usual manner.

Dr. F. T. Van Woert, in constructing crowns without collars, shapes the end of the root, and adapts the cap, as shown in Fig. 247. The slant given to the palatal side aids the root to resist force in a forward direction.

Partial Collar Crowns.—The advantages of a collar can in a

FIG. 245.

FIG. 246.

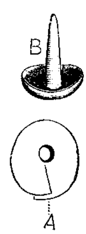


FIG. 247.

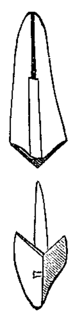
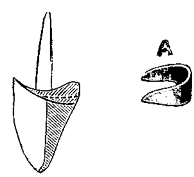


FIG. 248.



great measure be given these forms of post or dowel crowns by the addition of a metal flange encircling the palatal section of the root, as shown in Fig. 248. A piece of gold or platinum, similar in shape to that shown at A, is formed and fitted to the crown, fixed in position on the crown with wax, and adjusted in the mouth against the surface of the neck of the root, removed, invested, and soldered. After finishing, the metal flange is burnished against the root before the crown is cemented.

Dr. T. F. Chupein's method to form a partial collar-cap for a root is: Cut a strip of platinum of about No. 32, or gold plate of No. 30 gage, to the shape shown in Fig. 249, for instance, for an incisor. Bend the metal to the form illustrated in Fig. 250. Place the collar on the root with the broad portion at the labial side. Grasp the ends with pliers and draw the metal tightly together against the sides. Remove and solder the ends together (Fig. 251). Trim the edge of the collar to the surface of the root. Solder on a thin piece of platinum plate to form the cap (Fig. 252), and remove the surplus plate and projecting ends and the labial section of the collar (Fig. 253). The cap is then ready to have the post fitted and soldered to it in position (Fig. 254). As the labial section of the collar assists in determining the exact relation of the cap to the root, it is best in some cases not to remove that portion until after the post is soldered.

FIG. 249.

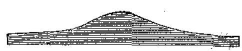


FIG. 250.

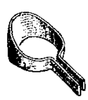


FIG. 251.

FIG. 252.

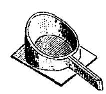
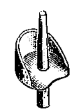


FIG 253.

FIG. 254.



Post and Disk Method.—Ready-made posts corresponding in size to the Ottolengui reamers, Fig. 96, with prepared disks of platinum, can be used to facilitate the construction of crowns of this style.

The posts are illustrated in Fig. 257. A disk of platinum with

FIG. 255.

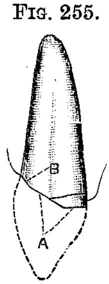
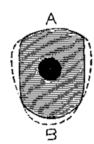


FIG. 256.



a perforated depression in which a little pure gold has been melted is shown in Figs. 258 and 259.

The method is as follows:

Shape the surface of the end of the root as shown in Fig. 255.

Trim the approximal and palatal sides of the end of the root as illustrated in Fig. 256, but leave the labial side A, intact.

Enlarge and ream the root-canal with Ottolengui root-canal reamers, shown in Fig. 96, to the proper depth, first using the smallest size, and if necessary the larger sizes afterward.

Select a post (Fig. 257) corresponding in number to that of the reamer used. Seize the large end of the post with the points of the pliers and fit the post to the canal. Move the post up and down—but do not twist—a few times in the canal, and any slight discrepancy that may exist respecting size will be instantly removed.

Grasp the post when fitted in the canal with the pliers, having the points close to the surface of the end of the root. Remove the post without changing the relation of the pliers. Screw the post into the hole in the depression of the platinum disk, shown in Fig. 258, and in section in Fig. 259, up to the points of the pliers, thus giving the post its position in the disk.

Bend the sides of the disk downward, as shown in Fig. 260, and adjust the post in the canal to determine their relative positions. By twisting the post, changes of its position in the disk may be effected, also by pressing the post further through the platinum while the disk is in position on the root.

FIG 257.

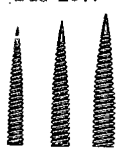


FIG. 258.

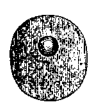


FIG. 259.

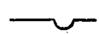
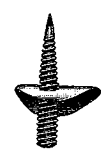


FIG. 260.

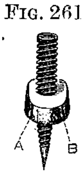


The orifice of the root-canal should be slightly enlarged with a round bur to allow the depression of the disk to fit within it. Press the post firmly upward in the root-canal to assure that its original position is not interfered with by the disk.

Remove the post and disk, the disk retaining its position on the post. Unite post and disk by holding them in a Bunsen gas flame until the pure gold in the depression is fused. No flux is necessary, as sufficient remains from the fusion of the gold in the depression.

Place the post and disk on the root, and press and mallet the platinum to it with a large flat plugger, which, owing to the rigidity of the post in the canal, will accurately retain the platinum in position on the end of the root. Remove and slit the platinum at two or three points between the palatal and approximal sides to the outline of the end of the root, as shown in Fig. 261, at A and B, and bend the platinum over with the pliers to embrace the approximal sides of the root.

FIG. 261.



Again place the post and cap on the root, and closely fit the side flaps, with the aid of foot-shaped condensers and burnishers. Next bring the palatal flap down to position. Frequent removals and annealings are necessary during the process, which should include the final trimming of the edge of the platinum, smoothing with a corundum-point, and then an annealing and all-round burnishing of the cap to the root. Cut off the end of the post above the cap with a corundum-disk and level with a wheel. The

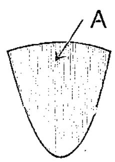


FIG. 262.

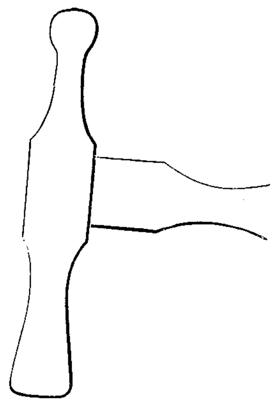


FIG. 263.

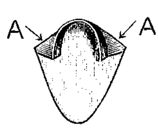


FIG. 264.

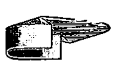


FIG. 265.

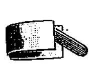


FIG. 266.

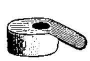
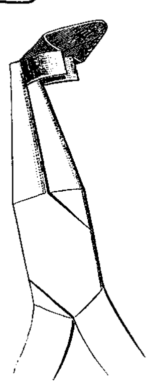


FIG. 267.



cap can now be invested and the seams soldered, or this can be done in the soldering on of the porcelain front.

At the cervico-labial section the porcelain can rest on the platinum, or the platinum can be trimmed, so that the front edge of the porcelain may be fitted directly against the root, and cover it.

The remainder of the construction is similar to that of a full collar crown, described at page 88.

The Sanger Method.—This method, presented by Dr. R. M. Sanger to simplify the construction of the half-collar cap for crowns, is as follows: A piece of pure gold plate, gage No. 30, is cut to about the shape of Fig. 262. Being annealed, it is grasped at the straightest edge (Fig. 262, A) with a pair of clasp-benders, and hammered down to the flat end of the benders with a small riveting hammer (Fig. 263) until it assumes the shape shown in Figs. 264 and 265. With a pair of curved shears it is cut along the collar on the outside at A A, Fig. 264, and trimmed down so that the metal tongue will pass between the two free edges of the collar, as in Fig. 266. It is then placed on the root in the mouth and burnished and trimmed to fit, carefully removed and soldered along the free edges on the outside and the points cut off, result-

FIG. 268.

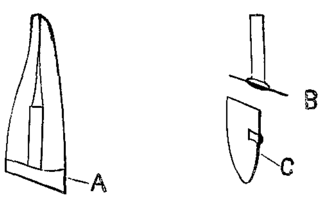
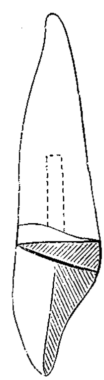


FIG. 269.

FIG. 270.



ing in a half-collar cap, as shown in Fig. 267. The remainder of the work is the same as in the construction of any backed and soldered crown.

The Double Cap-Crown: Dr. Parr's Method.—The advantage of this form of crown is that the root is securely and permanently capped independently of the crown, which can be removed without disturbing the cap on the root. For use in crown- and bridge-work the outer cap may be made without a collar, as shown in Fig. 269, or with a partial collar, which half encircles the inner cap over the palatal portion, and tapers off from the palatal to the labial section, as illustrated in Fig. 270. The cap on the root is cemented with oxyphosphate, and the post and outer cap with gutta-percha.

The root is prepared, banded, and capped without a pin, the same as for a gold collar crown (A, Fig. 268). A hole is made in the cap, and a post fitted in the canal. A piece of pure gold plate or platinum is cut fully the size of the surface of the root cap. The plate is perforated in the center and the post inserted into the hole, which it should fit tightly. The post is next inserted in the canal and the plate is adapted to the surface of the root cap and around the post. Post and cap are removed and soldered together, forming an outer cap, which is trimmed evenly with the edge of the root cap (B, Fig. 268). The porcelain tooth, C, to form the crown, is fitted and soldered to the outer cap. When finished, the crown is cemented in position with gutta-percha, as shown in Fig. 269.

A double cap-crown with detachable or removable crown post, for use in connection with detachable or removable bridges, is described in Part III, Chapter XI.

CHAPTER XII.

Setting All-Porcelain Crowns on Capped Roots.

THE LOGAN: DR. WHITE'S METHOD—COLLAR-CAP—A SIMPLE METHOD —THE DAVIS CROWN ON A CAPPED ROOT.

The Logan Crown.[1]—Prepare the end of the root and the canal in the usual manner and adjust in proper position a Logan crown. Grind the palatal side of the base of the crown so as to give it the slant shown in A and B, Fig. 271. Take a disk of platinum foil 1/1000 to 1/500 in thickness, push the pin of the crown through it, adjust the foil closely to the base of the crown, and secure it with wax cement, as seen in Fig. 272.

Fig. 271.

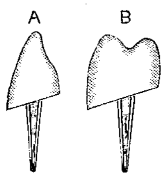


Fig. 272.

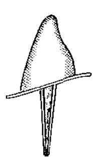


Fig. 273.

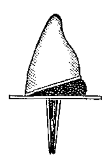


Fig. 274.

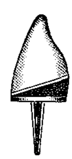


Fig. 275.

Trim the platinum disk to the edge of the base of the crown so there will be no overlapping. Next place a small ball of wax on the platinum around the pin and over this wax another disk of platinum foil (Fig. 273). Heat the foil, to cause adhesion of the wax, by rubbing a hot instrument over its surface, and chill in water. Insert the post of the crown in the root and press the crown to position and occlude the teeth to positively assure its correctness. The pressure of the wax against the foil shapes it to the exact form of the surface of the end of the root. Remove and trim the second platinum disk to the outline of the root (Fig. 274). If the palatal side of the root is trimmed so that it stands a little

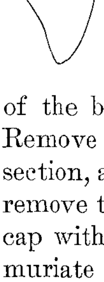
[1] Dr. Gordon White's method.

above the gum line, the surplus platinum at that part may be slit, lapped, and burnished around this exposed portion to form a partial band.

The wax is next dried with bibulous paper, the sides properly shaped, and then covered with two triangular pieces of platinum (Fig. 275). Attach the platinum to the wax by rubbing a hot instrument over its surface, and invest the crown. When the investment is set, wash the wax out with boiling water. Heat the investment and flow solder in between the two pieces of platinum and finish in the usual manner. Porcelain may be substituted for gold in the construction by this method. In such a case, the disk of platinum next to the crown is not used, the wax being placed on the base of the crown. The crown should be invested and the platinum fastened to the post with a particle of pure gold to retain it in position while the triangular space is filled with porcelain body and baked (Part IV, Chapter VI).

Collar-Cap.—The end of the root is prepared, a gold collar fitted, and the collar capped with platinum foil 1/1000. The cap is adapted to the surface of the end of the root, punctured, and burnished to the orifice of the canal. A platinum disk is next perforated and fitted to the base of the Logan crown, the same as in the method previously described, with which the remainder of the operation is identical (Fig. 276).

FIG. 276.



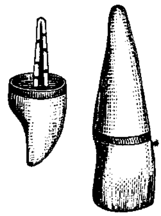
A Simple Method.[1]—Shape the end of the root for a collar-cap, and bevel it off at the cervico-labial section if exposure of the collar is to be avoided. Construct a collar-cap (Fig. 277). Place the cap on the root, perforate the cap, and adapt it to the orifice of the canal. Fit a Logan crown in correct position, so that the edge of the base of the crown accurately fits the surface of the cap. Remove the crown, place zinc oxyphosphate in the countersunk section, and adjust in the mouth. When the oxyphosphate has set, remove the crown and cap and solder the pin on the inside of the cap with a very small quantity of solder,—tin and lead,—using muriate of zinc as a flux, a few blasts of the blowpipe only being required. Place the cement in the root-canal and cap and cement crown in position. Fig. 278 shows the finished crown.

[1] C. S. W. Baldwin, *Dental Cosmos*, January, 1887.

The Davis Crown on a Capped Root.—Grind the root evenly to the gum-margin, removing all the enamel except a little that may

FIG. 277.

FIG. 278.



be allowed to remain at the palatal side, and give the labial section of the root a slight bevel. This bevel is for the purpose of permitting the covering of the band at this point with the porcelain, as shown in Figs. 279 and 280.

FIG. 279.

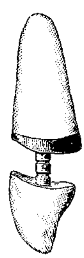
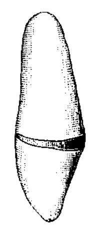


FIG. 280.



Band and cap the root, giving the labial side of the collar a slanting form, and fit and solder in the Davis pin, as shown in Fig. 279. Take an impression, make a model and articulating model, grind the crown to fit the cap accurately all around the edge of its base, and to fit over and cover the band of metal at the labial section. In doing this use small corundum-points and a paste made of a mixture of rouge and oil, with which paint the surface of the cap for the purpose of marking on the porcelain the points of contact. When the crown is accurately ground to fit the cap by the model, it is advisable to positively assure the correctness of its alignment. The crown is next cemented on the cap and the cement allowed to set with the crown removed from the mouth. Fig. 280 shows the finished crown attached to the root, which may be done with gutta-percha or oxyphosphate. Bicuspids can be made in a similar manner.

The use of porcelain in its application to this crown by the above method is explained in Part IV, Chapter VI.

CHAPTER XIII.

Treatment by Crown-Work of Fractured Teeth and Roots and Cases of Irregularity.

FRACTURED CROWNS AND ROOTS—LONGITUDINAL FRACTURE—SLANTING FRACTURE OF THE ROOT—RESTORATION BY BANDING AND CAPPING—INLAY METHOD—AMALGAM—POST AND AMALGAM—PERFORATION OF A SIDE-WALL OF A ROOT-CANAL OR OF THE DENTIN AT THE BIFURCATION OF THE ROOTS—DR. FARRAR'S CANTILEVER CROWN—FORMATION OF THE SPUR—METHODS OF CROWNING IN CASES OF IRREGULARITY.

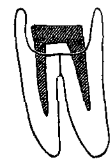
The crowning of fractured teeth and roots is a process that requires skill and delicate treatment. Its practicability depends on the nature of the fracture, the present health of the parts, and the length of time that has elapsed since the occurrence of the injury.

Longitudinal Fracture.—By this is meant a fracture extending lengthwise through the crown or what remains of it, and along the root or roots. Foreign substances having been removed from within and around the parts, the crevice of the fracture is syringed thoroughly with tepid water and then with hydrogen peroxid. The fractured parts of the root are then drawn together with waxed floss silk, passed at least twice around the tooth, and tied, the ends being passed through twice in forming the knot. The pulp-chamber is then prepared, and dovetail slots are drilled across the parts (Fig. 281).

Fig. 281.

If it is suspected that in the preparation any particles of dentin have invaded the crevice of the fracture, the ligature must be removed, the parts again syringed, and the ligature readjusted. The upper parts of the root-canals are then filled with gutta-percha, or, preferably, with zinc chlorid, and the main body of the cavity and the slots with a hard, quick-setting amalgam. Another method is to drill the line of one of the root-canals as deeply as possible parallel to that of the other, fit a post in each, and connect the two together with a piece of plate, as shown in Fig. 282, and cement the posts in the roots.

FIG. 282.



At the next visit of the patient the ligature is removed and the parts carefully prepared for crowning. The circumference of the root is first measured with a wire, a tight-fitting collar constructed, and the crown then completed in the usual manner. The crown may be favored by leaving a slight space between its occluding surface and the antagonizing tooth.

The great drawback in these cases is that the patient generally fails to present himself immediately for treatment, and foreign substances work into the fracture, causing inflammation, which is difficult to control. Often subsequent to treatment a septic condition of the fracture supervenes, the irritation caused thereby and the exudations from the fracture becoming so annoying that extraction is the only alternative.

Teeth fractured as above described are rarely found with living pulps.

Slanting Fracture of the Root.—Fractures of this kind are frequently found in incisors or cuspids and in bicuspids.

In the incisors or cuspids the fracture is generally caused by the leverage or strain that has been exerted by the post of a collarless crown. The crown, if still in position, will be found loose, the fractured piece of root adhering loosely to the membranes and the remaining portion of the root firm.

The crown and loosened portion of the root are removed and the latter preserved for use as a pattern. The hemorrhage is checked with styptics and the parts anesthetized with cocain. The space between the root and gum is packed with gutta-percha to force back the gum and to expose and give free access to the margins of the fracture, after which the patient is dismissed. In two or three days the gum will have healed, so that on the removal of the dressing little or no hemorrhage will occur to interfere with the work.

Restoration of the Fractured Part by Banding and Capping.—In a case of this kind (Fig. 283) the restoration of the fractured part by banding and capping for crowning purposes is as follows: A piece of soft platinum plate, gage No. 32, is cut to about the shape of Fig. 284, the fractured piece being used to determine the shape and size of the apron portion (Fig. 284, A), while the wings (B B, Fig. 284) are made sufficiently long to reach around the entire root in the form of a collar. With an ordinary pair of clasp-benders the platinum is shaped to fit the fractured piece of root (Fig. 285), and it is then placed in the mouth and the wings are brought around the root to complete the collar form. It is then removed and soldered, and forms a collar with an apron as represented in Fig. 286. A piece of flat platinum plate, gage No. 30, is then placed across the end of the collar mesio-distally and soldered to the edge (Fig. 287, A A). It is then placed back on the root and perforated for the reception of the tube and pin. A seamless platinum tube is procured by fracturing an Ash tube-

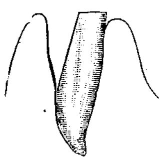


FIG. 283.

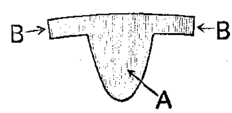


FIG. 284.

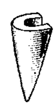


FIG. 285.

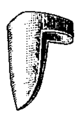


FIG. 286.

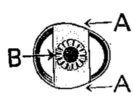


FIG. 287.

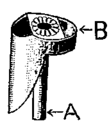


FIG. 288.

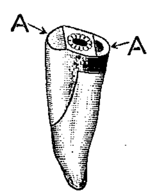


FIG. 289.

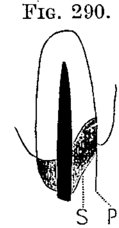
tooth. A piece of round platino-iridium wire which perfectly fits the tube is passed through the tooth and held in position while the tooth is broken away from the tube, thus preventing the marring of the tube, providing a strong platinum tube with a pin which fits it exactly. A suitable tube may be formed out of platinum foil or very thin plate.

With the collar apron in position on the root, the tube and pin are pushed through the perforation and up into the canal as far as possible, and then with a sharp instrument the tube is split and folded down on the flat piece, as illustrated at B, Fig. 287. It is then removed and soldered, giving the construction represented by Fig. 288, which is ready for final placing on the root.

The method of setting is as follows: The pin is placed in the tube to prevent the oxyphosphate from passing into the tube and to serve as a handle to hold the piece firmly while packing the amalgam. A small amount of cement is placed in the canal and around the point of the tube (Fig. 288, A), also around the inside of the band, where it engages the root (Fig. 288, B). The piece is then placed on the root and held firmly until the cement hardens, when the remainder of the space around the pin, and between the apron and the root where the fracture occurred, is packed with a quick-setting amalgam through the openings at A A, Fig. 289. The last illustration (Fig. 289) shows the work completed and ready for the reception of the crown.[1]

Inlay Method.—The inlay method of restoration of an extensive fracture of a root for the purpose of capping with a porcelain and platinum jacket-crown or an all-gold cap-crown, is as follows: Fit a substantial post, the point of which will extend deeply in the canal (Fig. 290). Cut a piece of platinum foil of about 1/500 of an inch gage and of a size which will a little more than cover the end of the root and the fractured section. Place the platinum foil over the parts, and press it in the orifice of the canal. Puncture and adapt it to the part and insert the post in position. Cement post to platinum with wax, withdraw, invest, and solder together with an atom of pure gold. Next adjust the post and platinum to the root, and by repeated fitting and trimming, using a very small burnisher, adapt the platinum to the edges of the fractured portion and the surface of the end of the root. The platinum should only cover the surface of the fracture to the margins and not extend beyond them. Accuracy in this respect is accomplished by first burnishing the platinum to and just over the edge of the fracture so that the shape and form of the part is impressed on the metal, which, when removed, can be trimmed, guided by this mark, to accurately meet the fracture, but not extend over.

FIG. 290.



Wax is next shaped upon the platinum to represent the lost portion of the root. The surface of the wax representing the side of the lost part is covered with platinum foil from 1/2000 to 1/1000 of an inch in thickness, trimmed to just meet the margin of the platinum at the line of the fracture. The free or open end

[1] Dr. R. M. Sanger's method.

of the platinum should extend outside of the gum-margin, as shown at P, Fig. 290. The work is next invested upright with the open end exposed, the wax washed out with boiling water, and gold plate or solder is melted in its place, as indicated at S, Fig. 290, and around the post. When soldered, the margins of the inlay are smoothed and it is cemented with oxyphosphate. After the cement has set the surplus at the margins should be carefully removed. This method when well done gives an almost imperceptible line of union between the metal and the root. The root is then ready to be mounted with a platinum and porcelain jacket-crown (see Part IV, Chapter VI) or a metallic crown.

Amalgam.—Both of these methods present a non-oxidizable surface of metal against which the tissues will heal benignly, which is not the case when amalgam is used and its surface is left exposed, even though polished. The use of amalgam is therefore

FIG. 291.

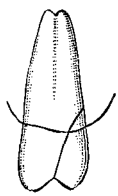


FIG. 292.

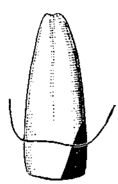
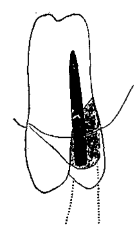


FIG. 293.



best confined to comparatively small fractures and to decay extending under the gum.

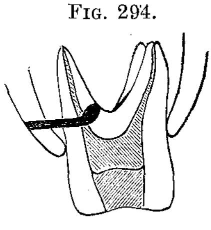
Fractures of the crown and side of the root occur in bicuspids, where large fillings are inserted extending from the anterior to the posterior approximal walls, leaving the separated buccal and palatal cusps to bear the brunt of mastication. The fracture seldom extends beyond the edge of the alveolar process. The fractured part having been carefully removed, a dovetail slot is made in the crown or root, in which gutta-percha is inserted for a day and the gum pressed back, so as to fully expose the surface and margins of the fracture. The form of the neck is then in a measure restored with amalgam, which, when hard, is polished (Figs. 291 and 292). The tooth or root is then crowned, the mode of operation being the same as in any other case.

Post and Amalgam.—A post in the root-canal gives greater security in connection with amalgam in cases that suggest it, as illustrated in Fig. 293. The post should be made of platinum with a globule of gold solder melted on the part which rests in contact with the amalgam. The use of posts made of alloys of the base metals is not permissible in these operations. When amalgam is used to restore a fractured root, the collar of the crown to be inserted is supposed to nearly or entirely cover it.

Perforation of a Side-Wall of a Root-Canal or of the Dentin at the Bifurcation of the Roots.—Extensive perforation by decay of the root of a tooth below the line of the edge of the alveolar process seldom admits of successful treatment. When the decay is of limited extent, and a very slight perforation has been produced by its thorough removal or by the improper or careless use of a bur, cicatricial tissue may be induced to form over the part by creating and maintaining a sterilized condition, and then sealing the cavity.

The method of procedure is as follows: First effect sterilization of the dentin and canals. Bathe the perforated part with hydrogen dioxid. Dry the canal thoroughly. Fit closely over the perforation a small, flat piece of gutta-percha, warmed and applied with a gentle pressure, sufficient only to produce adhesion without forcing the gutta-percha through. The filling of the canal can then be carefully completed. Zinc oxychlorid is the most suitable in these cases, as no pressure is required, and a dense antiseptic filling in the roots and over the cap on the perforation is the result. If this method proves unsuccessful and inflammation ensues, the position of the perforation should be carefully calculated, and an artificial fistula should be formed on a direct line with it through the gum and alveolar process. (See Fig. 294.) Carbolic acid may be used to obtund the tissue as described at page 30. The necessary perforation through the alveolar process should be small in diameter, and be made with a drill. Frequently the position for the intended fistula is best located by introducing a sharp-pointed probe through the canal and perforation externally through the tissues. Injections then can be made outward through the fistula, and the perforation sealed with gutta-percha similarly to the closing of a foramen in cases of alveolar abscess, after having previously filled the canal or canals above the perforation.

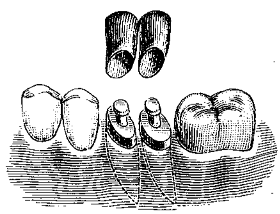
FIG. 294.



Crowning Molar Roots Decayed Apart at the Bifurcation.—The roots of a molar decayed apart at the bifurcation can often be crowned serviceably by making a cap for each root separately, and then soldering the sides of the caps together (Fig. 295). Where one root is missing, the other can be crowned singly.

Dr. Farrar's Cantilever Crown.—Figs. 296 and 297 represent cantilever crowns. Fig. 296 illustrates a sectional view of three

FIG. 295.



teeth, and an amputated first bicuspid root which was subsequently extracted, showing the application of the cantilever crown T P, set upon the decayed second bicuspid and made to project over to bridge the space formed by the loss of the first bicuspid, and resting in contact with the cuspid so as to connect the broken line of

FIG. 296.

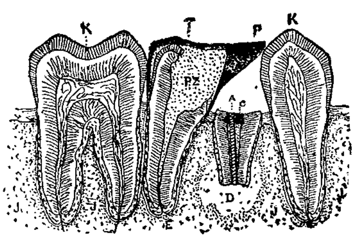
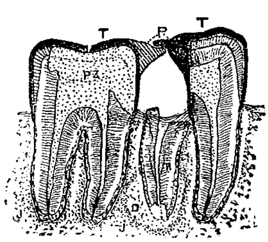


FIG. 297.

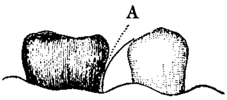


masticating surfaces and prevent tilting forward of the second bicuspid.[1] Fig. 297 illustrates the appearance of two molars, the posterior half of one of which was destroyed, showing also the application of two cap-crowns, which are constructed so as to form a cantilever bridge over the chasm by locking midway in such a manner as to prevent tilting or sliding of surfaces, and at the same time be easily cleansed by a quill or thread.

[1] Dr. J. N. Farrar, *Dental Cosmos*, vol. xxvi, No. 3.

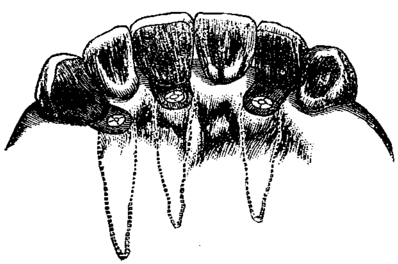
Formation of a Spur.—A spur to bridge a space in cases such as have been described is conveniently formed by first attaching the edge of a piece of heavy platinum foil to the side of the gold crown with wax or solder, as shown in Fig. 298. The crown is then fitted in the mouth and the platinum bent and burnished over against the adjoining tooth or crown, removed, invested, and solder flowed in the aperture at A. The surplus metal is to be trimmed away on re-adjustment in the mouth.

FIG. 298.



Methods of Crowning in Cases of Irregularity.—Fig. 299 represents a case of irregularity treated by Dr. Bonwill. On

FIG. 299.



account of the poor character of the teeth, their position in the palatal arch, and the age of the patient, it was beyond correction. The pulps were destroyed, the crowns removed, posts fitted to the canals, and the ends of the roots capped. An impression was taken which removed the caps, and a model and articulating model made, which showed the caps in position. Porcelain fronts were backed and fitted in correct alignment with the other teeth and connected to the caps with a strip of platinum reinforced with solder. The model under the strips was scraped sufficiently to cause them to press against the gum.

FIG. 300.

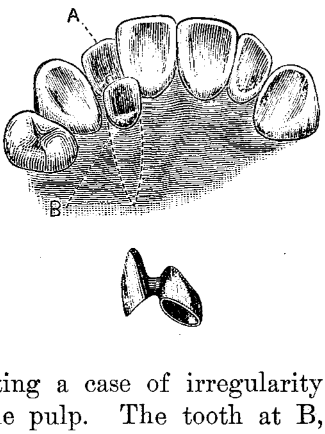


Fig. 300 shows a method of treating a case of irregularity without destroying the vitality of the pulp. The tooth at B, which stood inside the line of the lower teeth when the mouth was closed, was trimmed, shaped, and capped without destroying the pulp. To this cap was attached the tooth A, with an oval-shaped piece of gold for cleanliness that cleared the lower teeth in occlusion. The cap, which was then cemented to the natural crown, *was entirely hidden from view by the artificial tooth or porcelain front.*

CHAPTER XIV.

Partial Crown-Work.

GOLD-PLATE PARTIAL CROWNS—GOLD HOLLOW OR BOX INLAYS—SOLID GOLD INLAYS WITH EXTENSIVE RESTORATION OF CONTOUR—SOLID GOLD TIPS FOR ABRADED PULPLESS FRONT TEETH—GOLD TIPS IN CASES OF LIVING PULPS—EXTENSIVE RESTORATION—PORCELAIN AND GOLD.

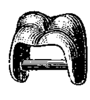
Gold-Plate Partial Crowns.—This is one of the forms of partial crown-work which may be adopted with advantage when, for any reason, the insertion of a solid metallic filling or inlay is not desirable. The cavity having been properly excavated, its orifice is trimmed as uniformly straight or circular as its position and character will allow, and the edge of the enamel beveled off, tapering toward the center. Deep or extensive undercuts may be filled with oxyphosphate. In the preparation of cavities in the grinding-surface, trimming and cutting away the enamel should be confined to that surface. In approximal cavities which reach the grinding-surface, it is advisable to extend them into that surface and bring the gold over and anchor it there, so as to afford greater security against its displacement in mastication. The bicuspid shown in Fig. 301 will serve as a typical case to illustrate the constructive details.

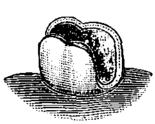
Fig. 301.

The cavity having been properly prepared, a die of the tooth in its original form is then secured. For this purpose the mold is made by taking an impression of the tooth with wax or impression-compound, making a plaster model, and then restoring the contour and forming from it the mold in moldine; or the shape of the natural tooth may be restored with wax or gutta-percha and the mold made directly from it with plaster in a tube. The die and counter-die having been formed (see Part V, Chapter III), a piece of pure gold, No. 28 to 30 standard gage, the exact thickness being governed by the size and nature of the cavity, is struck up to the form and size of the part to be capped. The gold is then adjusted to the cavity, to the margin of which the edges are trimmed and burnished to fit close and flush. In the case of large cavities, including a part or the whole of the approximal surface, a plaster model of the tooth and of the empty cavity from an impression taken in wax or impression-compound will facilitate and guide the preliminary trimming and shaping of the gold. Two headed pins fixed on the inside of the cap (Fig. 302) are usually sufficient to secure it, but others can be added if the conditions of the case seem to require it. In compound cavities, including one side and the grinding-surface, one pin at least should be fixed in the latter portion. Where the grinding and both approximal surfaces are included, a wire should be extended from one side to the other (Fig. 303), but the brace should not touch the bottom of the cavity.

FIG. 302.

FIG. 303.

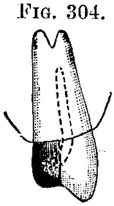




In pulpless teeth the pin from the upper part of the cap should extend up the canal, which gives great stability in such cases (Fig. 304).

In soldering the pins or loops to the gold plate, a little solder can be flowed over the adjacent parts if deemed necessary to stiffen and strengthen them.

FIG. 304.



Oxyphosphate, as a rule, is preferably used for the cementation of these caps, as it forms a solid and unyielding foundation, and, when properly protected from the fluids of the mouth by a carefully adjusted cap, is very durable.

The cement should be first inserted in the cavity, and then a small quantity placed around the pins of the cap, which should be immediately adjusted accurately in position. When gutta-percha is used, it is heated and applied in the same manner to cavity and cap. The cap is then heated, pressed into position, and held there until the gutta-percha hardens. This can be hastened by the application of cold water from a syringe. The surplus of gutta-percha is then removed, and the edges of the gold burnished.

These caps applied to teeth with living pulps show durability of a commendable character. The advantage they possess over pieces of porcelain is found in the close joint that can be made with the edge of the enamel by burnishing the gold against it.

Gold Hollow or Box Inlays.[1]—These consist of a hollow inlay made by first forming a gold matrix of the cavity and then capping the matrix with another piece of plate contoured to represent the lost section of the tooth. The process is as follows: The margins of the cavity should be made either square or slightly beveled and smooth. When the edge of the enamel wall is weak it should be beveled to protect it by the overlapping edge of the gold inlay. All undercuts should be removed, or filled in with cement as the conditions suggest. The object is to give as much as possible a spoon-shaped form to the cavity. An impression is taken with impression-compound. A small pointed piece of the compound is first warmed over an alcohol flame and passed into the cavity of the tooth, and the rest of the compound instantly pressed to position and cooled with water before removal. The impression and "bite" can be taken together; or, if not, the bite can be afterward taken in wax. The patient is then dismissed until the next appointment. The part representing the tooth and cavity in the impression is filled with either copper amalgam or oxyphosphate, and the remainder of the impression with plaster. In packing the amalgam or oxyphosphate a small portion should be built up to engage the cement and to hold it firmly in position in the plaster. An articulating model is next made.

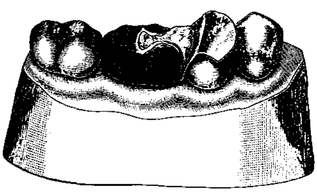
Pure gold, about No. 36 gage, is used to make the inlay shell. A piece of this thin gold plate, of a size considerably larger than the cavity, is pressed and burnished to the shape of the cavity on the model with burnishers and pellets of cotton. The gold should be trimmed so as to everywhere barely overlap the margins of the cavity and burnished so as to distinctly mark the line of the margins on the gold. In the central or axial section of the gold matrix a hole of the proportion illustrated in the matrix, Fig. 305, is then punched. The cap or outer shell of the matrix for an approximal or buccal cavity, where the restoration required is not extensive, is made as follows: A piece of pure gold of the same thickness as the matrix is cut large enough to extend over the entire surface to be restored. One edge is trimmed and fitted to come just within the cervical margin of the gold matrix and is then united with a tiny piece of 22-carat gold plate.

FIG. 305.

[1] Dr. H. B. Tileston.

The matrix is put back on the model, where the piece of plate soldered to it will stand straight up above the occluding surface of the tooth. Wet cotton is then packed into the cavity between the two pieces and the gold forced out so as to give the desired form to the part or knuckle it against the adjoining tooth (Fig. 306). The gold is next bent over the cotton and down upon the occluding surface, and the articulating model closed tightly together and the thin gold forced into proper articulating form. Holding the models firmly closed, the gold is bent down all around to the edges of the matrix, using foot-shaped condensers and burnishers, the cotton being tucked in when in the way.

FIG. 306.



The edge of the cap or outer piece of gold is next trimmed so as to come within the excess of gold provided in the matrix piece, and so the margin will lie as nearly as possible along the true line of the margin of the cavity. This arrangement allows the soldering to be easily and properly performed and provides an overlap of thin gold for the final burnishing and finishing. The cotton is next removed either by raising the cap or pulling it out through the hole in the back of the matrix.

At the next visit of the patient the inlay is adjusted in the tooth, corrected, and perfected both as to accuracy of fit and occlusion. The edges are soldered together with very small pieces of 22-carat plate, which are placed along the seam on the little ledge formed there by the surplus of the gold which forms the matrix.

The interior is next partly filled with 18-carat solder by dropping small pieces through the hole in the back and fusing by holding the inlay in a spirit or Bunsen flame.

The surplus gold at the edges of the matrix should be trimmed and polished, the inlay again inserted in the cavity, and the edges again burnished (Fig. 307).

FIG. 307.

The inlay is then removed, the cavity in the back filled with cement, and the inlay cemented in position. While the cement is soft, the edges of the inlay should be burnished all around the cavity so as to bring the gold against the enamel at every point and leave no cement exposed.

When the cement has set, the edges may be additionally trimmed and burnished.

In a case demanding extensive restoration of contour, where the method above described is not applicable, the desired contour may be built out and carved with wax or plaster, from which a die and counter-die are made and the outer piece of plate struck up. Or a quicker way, and one giving about as good results, is to carve up the contour in plaster placed in the matrix, press this model into warmed sealing-wax or Dental Lac, and burnish a piece of gold plate into the intaglio die thus obtained. Adjust and correct the plate on the model with burnishers and pliers.

Solid Gold Inlays.

This form of gold inlay is used in the front teeth as well as the back ones. It is especially suitable in operations where strength and resistance to the force of occlusion and attrition are required to a degree not afforded by a filling of pure gold.

For Small or Medium-Sized Cavities in the Front or Back Teeth, the sides of the cavity are shaped straight or slanting slightly toward the center. The matrix is made of pure gold No. 38 gage or platinized gold composed of pure gold alloyed with 2 per cent. of platinum, 1/500 of an inch in thickness. Platinized gold of such a gage is much to be preferred to the heavier gage of pure gold. It is more conveniently manipulated, especially in small cavities and narrow spaces, and because of the presence of the platinum is not so liable to be accidentally melted in the construction of the inlay.

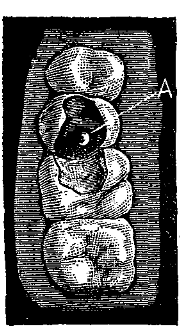
The piece of the metal selected to form the matrix should be cut large enough to line the cavity and extend about $\frac{1}{8}$ of an inch beyond the margins. It is placed over the orifice, pressed into the cavity, and, with small round-headed burnishers, burnished to the walls. The surplus around the orifice is next brought down and burnished to the edge of the cavity and the surrounding surface of the enamel.

The matrix is removed, and a very small quantity of solder is placed and fused in the bottom by holding in a spirit or gas flame. Only enough solder should be applied to barely cover the bottom, so as to leave the sides intact. Fluxed solder filings are the most suitable for the purpose. The matrix is next adjusted in the cavity, very accurately adapted to the margins, and a piece of Moss Fibre gold is packed in the bottom of the matrix, and attached by again holding the matrix in the flame and heating sufficiently to slightly fuse the solder already applied. To the Moss Fibre gold so attached enough more is added to fill the matrix and shape it to any required form. Solder is next placed, a little at a time, on the surface of the Moss Fibre gold, and fused. Only enough solder to fill the porous structure of the Moss Fibre gold and form a solid inlay should be used, as an excess necessitates the labor of its removal. After soldering and adjusting in the mouth, should the contour require an addition of gold at any point, place a small piece of the Moss Fibre gold over the part, and heat the inlay sufficiently to slightly fuse the solder and attach it. More Moss Fibre gold can then be added and solder applied to properly shape the part.

The inlay thus formed is next trimmed and polished. For accuracy the trimming of the extreme edge is best done with the inlay in position in the cavity. A little of the gold may be removed from the bottom or sides of the inlay with a small stone or a fine finishing bur operated with the dental engine, to provide a space for the cement. When inserted and cemented, the inlay resembles a gold filling.

Extensive Restoration of Contour.—The best method to practice for approximal cavities in molars and bicuspids is as follows: After preparing the cavity as has already been described, an impression is taken in impression-compound and a plaster model made. A piece of No. 36 gage pure gold is shaped first to the cavity on the model and then to the tooth in the mouth. The gold is depressed into any anchorage cavity that has been secured at the occluding surface. In a case such as is illustrated in Fig. 308, a little of the solder is first melted in the most depressed part of the matrix cavity of the occluding surface, by holding the matrix in a spirit or gas flame. The matrix is again fitted to the cavity and the operation of filling the cavity with Moss Fibre gold and solder as above described continued until the required contour is ob-

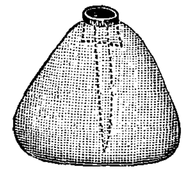
FIG. 308.



tained. To facilitate the contouring it is well to tack at the proper point a small globule of high-grade gold solder, as shown at A. To and around this globule pack Moss Fibre or crystal gold or foil to the line or bulge of the required contour, and flow solder in the interstices, shaping the rest of the inlay at the same time. If considered necessary, the matrix may be invested for this final soldering. Solid gold inlays made after the manner just described can occasionally be utilized advantageously to anchor and support bridge-work.

Solid Gold Tips for Abraded Pulpless Front Teeth in preference to fillings are constructed in the following manner: An opening is made through the occluding surface of the crown into the root-canal. A flat post, wide enough to fit closely in the pulp-chamber across its greatest diameter, thus tending to prevent any rotary motion of the gold tip, is then formed. A thin piece of pure gold plate, about No. 30 gage, is adapted and burnished, with hand-burnishers and Herbst's revolving agate points, into all the irregularities of the abraded surface, and into the orifice of the pulp-chamber. The gold is then trimmed flush and even to the edges, and burnished just over them. An opening is next made in this gold cap, and through it the post is inserted in position, fastened with wax, removed, and soldered to the cap. The post and cap are inserted in position and the end of the post cut off to about the length the gold tip will need to be and the gold again burnished to the edges of the tooth and trimmed closely.

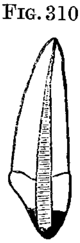
FIG. 309.



Wax cement is then placed on the gold and shaped to the exact form of the required gold tip. This is next encircled with a strip of No. 60 gold foil fitted against the surface of the wax, except at the incisal edge, and extending slightly over on the surface of the enamel of the tooth. This foil is to form a matrix. All is now removed and invested in finely calcined marble-dust and plaster. (See Fig. 309.)

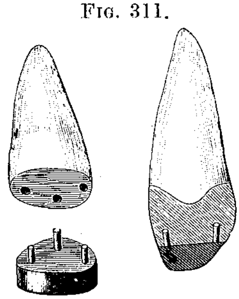
The investment is next heated, and 20-carat gold solder melted into the matrix formed by the foil encircling the cap. The surplus gold is then trimmed to the edge of the abraded surface of the tooth and to the desired form for the tip, and polished. The trimming or polishing of that portion of the tip at or adjacent to the edge which fits against the tooth should always be done with the tip in position on the tooth. When finished, the gold tip is cemented in position with a thin mixture of oxy-phosphate. Fig. 310 gives a sectional view of a central incisor tipped in this manner.

FIG. 310.



Gold Tips in Cases of Living Pulps.—In these cases two or three small platinum pins, as the case may suggest, are used in holes drilled about the pulp-chamber, in the manner shown in Fig. 311. Three pins are generally placed in upper incisors and two in lower incisors. The three pins should always be used except in very small lower incisors where the space will not permit more than two. The pins should be inserted and soldered in the gold plate one at a time, the plate each time being adjusted to the surface of the tooth. The first pin, if fitted tightly in the hole through the gold, can be soldered without investing, but an investment should be made for the soldering of each subsequent pin, as otherwise the previously soldered pin or pins are apt to move from position. The least possible quantity of solder should be used on the first two pins. After all the pins have been soldered in position to the gold cap, it is adjusted on the tooth and the gold very carefully burnished to its surface, trimmed, and shaped up with wax as previously described. A final investment is then made and the required form of the incisal edge of the tooth added with solder.

FIG. 311.



In a case with a vital pulp, or in a pulpless tooth if the gold tip required is short, the ends of the pins extending above the cap will hold and maintain enough solder in position to give material for proper contouring, without enveloping the wax with a matrix of gold foil.

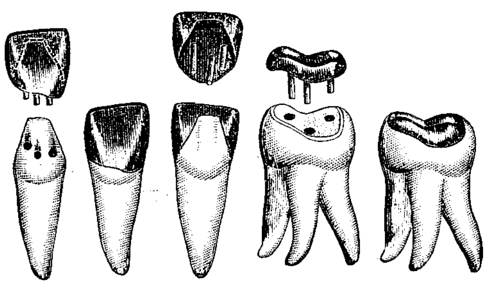
Another method[1] of building the invested and fitted cap to the required length is: Roll down a piece of solder very thin, about No. 34 or 35 gage, cut it to the size of the tip, and punch holes in it for the pins to protrude through. Next cut a piece of 20- or 22-carat gold plate to at least the size of the cap and punch holes in

[1] Dr. F. Milton Smith's method.

it for the pins in the same manner as for the solder. Place the solder on the cap and the plate over the solder, and apply the broad flame of the blowpipe. When the solder melts, the piece of plate will settle into position. If one piece of plate does not give sufficient length to the tip, attach another layer of both solder and plate. When extreme hardness is required, use clasp-gold instead of plate. If three pins are used, it is very seldom necessary for stability to extend the plate beyond the incisal surface, over the palatal side of the tooth.

Cases of Extensive Restoration.—Restoration in gold of a crown having a vital pulp by the methods explained, is shown in detail by Fig. 312,[1] [2] which illustrates the partial restoration of

FIG. 312.



a central incisor and molar, both still vital. The gold for the incisor, it will be seen, is adapted to the palatal surface and supported by three pins.

Fig. 313 shows the details of a restoration cast filling for a molar. The contour of the part to be restored was shaped in wax on the cap and pins. The wax was covered with No. 60 gold foil except at one end, and invested in the form of a matrix as shown at A, and in section at B. The wax was removed from the matrix through the open end with boiling water, and the matrix was heated and properly filled with gold solder through the same opening.

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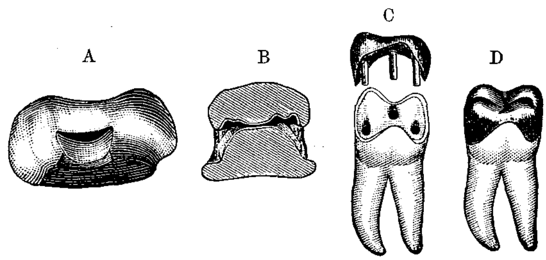
[1] An experience of several years in the use of gold tips as described shows that they are much to be preferred to tips formed of gold foil, even by the very best operators, the alloyed gold being superior to pure gold in resisting attrition.—G. E.

[2] Dr. C. L. Alexander.

Another method is, after the cap or matrix has been made and fitted to the surface of the tooth, to shape up the grinding-surface with wax, from which make a die and strike up a cap of pure gold, about No. 34 gage. Fit the cap over the wax and adjust in the mouth to determine occlusion, remove, and invest. Leave an opening at one end, and in large cases at both ends, into which to melt solder.

FIG. 313.



Porcelain and Gold.—The restoration of an extensive fracture of an incisor crown with porcelain and gold, such as is shown in Fig. 314, may be accomplished as here described: The edges of the crown to form the joining with the porcelain are trimmed straight and level, and then polished. A shallow groove is generally formed to advantage at A, Fig. 315. A very thin piece of platinum is then adapted to the crown, as shown at B, Fig. 316.

FIG. 314.

FIG. 315.

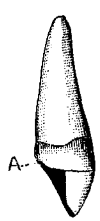


FIG. 316.

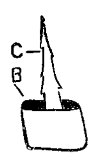


FIG. 317.

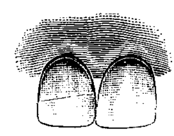


FIG. 318.

The pin C is fitted to the root-canal, passing through the platinum. The post and cap of platinum are then attached with wax, removed, invested, and soldered with pure gold. A little of the gold at the same time is flowed over the cap. The cap and post are then adjusted to the crown, and the cap is trimmed level and burnished closely against the surface of the portion to be restored and into the groove at A, Fig. 315. At this stage of the work, to facilitate the subsequent operations, an impression can be taken which will remove in it the cap, and from this a model can be made. A cross-pin porcelain tooth is then ground down to a size and shape that will properly restore the part and form an accurate joint with the labial edge of the natural crown, at which point the platinum should be removed and the edge beveled off so that the porcelain shall rest directly against the tooth-structure. The porcelain is then backed, cemented to the cap, removed, and soldered with 20-carat solder. The partial crown when properly finished is cemented in position with oxyphosphate.

Fig. 317 illustrates a fractured central incisor in which the pulp was not exposed, restored with a short piece of a porcelain tooth soldered to the cap. The cap to the fractured part was fastened by three small pins, as shown in Fig. 318, which illustrates the details of the construction. Operations for the restoration of teeth, such as is here described, are generally now preferably performed entirely in porcelain.

CHAPTER XV.

Processes Connected with Crown- and Bridge-Work.

CORRECTION OF EXCESS OF SOLDER—TO SECURELY ATTACH A CROWN—IMPORTANCE OF REMOVAL OF FLUX FROM INTERIOR OF CROWNS—FINISHING AND POLISHING.

Correction of Excess of Solder.—To correct the accidental presence of solder on the inside of a crown which interferes with its adjustment, make a thin paste of rouge and oil. To determine exactly at what point the gold strikes, twist a wisp of cotton tightly on the point of an instrument and with it paint the natural tooth with the paste and place the crown upon it. The interfering spot will be exactly marked on the gold. This should be trimmed with a small corundum-point, and the crown again inserted to determine whether enough has been removed. If preferred, the paste can be placed on the inside of the gold crown. In this way the interfering point will be marked on the natural tooth, which can then be trimmed instead of the gold to permit proper adjustment.

To Securely Attach a Crown.—If the tooth is short, and the occlusion of a character requiring the reduction of the collar to such a degree as to suggest insecurity when the crown is cemented, a barbed or headed pin, which will anchor in the natural crown or root, should be soldered in the center of the gold crown, as shown in Fig. 319. This is done by passing the pin through a hole drilled in the occluding surface of the crown, which is then adjusted in the mouth, removed, invested, and the pin soldered from the outside.

Fig. 319.

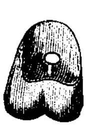
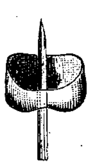


Fig. 320.



In the case of a seamless crown, if the pin is tapered and fitted tightly to the hole (Fig. 320), the soldering can be accomplished without investing, by holding the crown and pin with solder in position in an alcohol flame.

Importance of Removal of Flux from Interior of Crowns.—Always boil a crown in acid to remove the flux. The removal of flux from the inner surface of the crown is absolutely necessary if it is intended to use it in bridge-work, as solder will have to be melted on the outside.

Finishing and Polishing Crown-Work.—Before the finishing the gold should first be properly shaped, which includes trimming the collar off to a feather edge where it fits under the gum, so that the seam of the union with the root will be imperceptible. The gold that has been placed on the incisal edge of the incisor and cuspid crowns should be trimmed away, so that although it will protect the porcelain, very little if any gold will be seen when the crown is in position in the mouth.

The preparatory or preliminary dressing off of the gold should be done with small corundum or Gem wheels and points, first coarse, then fine, on the dental engine, which, for this part of the work, are preferable to files or the lathe. Gem wheels may be used dry when desired. This is an advantage in trimming certain parts of the metal, as corundum must be kept wet. The cutting property of carborundum for the purpose is not superior to that of good corundum. Besides carborundum, as it is disintegrated in the grinding, leaves a black sediment that obscures the work and invades the interstices. In the final finishing use fine pumice with leather polishing-wheels on the engine, or felt wheels on the lathe; and, in the polishing, a brush wheel, with whiting and rouge on the lathe. The end of a short stick of soft wood loosely fitting the interior of a gold crown may be used to assist in holding it while polishing with the lathe.

Insertion and Cementation.—In the insertion and cementation of all crown- and bridge-work, the object to be effected is the same in principle; that is, to form with an insoluble material a solid, substantial, and impervious union between the natural tooth or root and the artificial crown.

CHAPTER XVI.

Cementation of Crown- and Bridge-Work.

ZINC OXYPHOSPHATE—METHOD OF MIXING—APPLICATION—OXYPHOSPHATE WITH PARTIAL APPLICATION OF GUTTA-PERCHA—CEMENTATION WITH GUTTA-PERCHA—DOWEL CROWNS—COLLAR CROWNS—GUTTA-PERCHA CEMENT—ADVANTAGES—METHOD OF USING—METHOD OF MEASURING THE CEMENT—TO PROVIDE FOR SURPLUS CEMENT—REQUIREMENTS FOR SUCCESS—OXYPHOSPHATE IN COMBINATION WITH GUTTA-PERCHA CEMENT—AMALGAM.

Zinc Oxyphosphate.

As a cement for effecting the proper union between the natural tooth or root and the artificial crown, the zinc oxyphosphate is generally preferred, and is in many respects one of the most suitable that has as yet been found. If at all exposed, even the best preparations are slowly soluble in the mouth, and the porosity of the compound permits it to absorb gases and fluids and gradually become septic. Exact scientific proportions of the chemical substances of which the cement is composed are essential in its preparation. The zinc oxid should be calcined at a high heat, and then ground to an impalpable powder. It should possess the property of being uniformly dense and hard clear through the center, when set, after being mixed thin and formed in a mass. The density of one preparation of zinc oxyphosphate in comparison with another can be tested by placing samples of each of the same size, mixed under similar conditions, in red ink. After immersion for one or more weeks the samples can be removed, washed, then cut through the center, and their comparative density determined approximately by the depth of the stain.

The setting of the best preparations of pure zinc oxyphosphate is materially affected by temperature. Thus, a cement which is slow-setting at 40° F. is apt to be quite quick-setting at 80° F. In some of the preparations of cement, an effort is made to remedy this variation by adulterating with various substances, but this tends to increase the solubility of the compound. A standard preparation of cement, answering the requirements previously outlined, should be used in crown- and bridge-work.

Method of Mixing.—For all styles of crowns with collars, and for bridge-work depending on crowns of similar construction, the cement should be mixed to the consistence of a very thick cream; but for crowns without a collar or ferrule it can be moderately thick. For mixing the cement, a piece of plate-glass about 5 inches long and 3 inches wide as a slab, and a small spatula, are suitable. The surface of the slab must be perfectly clean. The acid and powder should first be separately placed on the glass, the amount of powder being fully equal to the requirements of the acid. A portion of the powder should be drawn over and mixed with the acid, and then more of the powder added, a little at a time, until a suitable consistence is reached, when the surplus powder should be instantly thrown off the slab, and the mixing, which must be rapid and thorough, continued. It is not a good plan to mix cement excessively thin, and then wait until it becomes thickened by the process of setting to a consistence suitable for use. The resulting compound is unnecessarily acid, the overplus of acidity being proportioned to the excess of acid used over the quantity required, and its character as a cement impaired. On the other hand, if mixed too thick, force is required to bring the crown or cap to position, and the thin edges of collars are liable to be sprung from the sides of the roots; neither will the cement adhere with such tenacity to the parts as when mixed at a proper consistence. If the slab is placed on a towel which has been saturated with ice-water, the cold will retard the setting, which is quite an advantage in many cases, especially in the use of some preparations of oxyphosphate. In this respect the side of a square bottle filled with ice-water and well corked has its advantages as a mixing slab in hot weather.

Application.—The parts to be crowned should be previously syringed with water and hydrogen dioxid if the gum-margins are slightly lacerated, then protected by a napkin, bathed with alcohol applied on cotton with tweezers, and dried with absorbent cotton or bibulous paper. In cases where the prepared teeth or roots have been exposed to the action of the secretions of the mouth for one or more days during the construction of the work, before its final insertion, the surface of the tooth-structure also should be thoroughly cleaned and sterilized. This is effectively done with fine pumice moistened with compound tincture of iodin, applied with a stick over the entire surface of the tooth-structure and under the gum-margin. The iodin not only aids in cleansing and sterilizing the parts, but also acts as an astringent on the membrane of the gum.

A rope of twisted absorbent cotton may be wound around each natural crown and pressed close against the gum, with the ends twisted together at the labial side so that the cotton can be easily seized and instantly removed at the moment the cement is ready. Crown-posts may be slightly barbed or roughened. Collar crowns should be inserted and given a final burnishing. Each cap or crown, having been thoroughly cleaned and dried, is first filled with enough cement to insure a slight surplus. A small portion is then put in each root-canal or hollow part of a natural crown present, and the artificial crown or bridge immediately adjusted in position. In most cases it is best to quickly remove the napkin and close the mouth to insure the occlusion of the teeth, and then open the mouth and replace the napkin. The crown or bridge should be held under a slight pressure until the cement has set. For this purpose a piece of wood notched on the end can be used. In setting bicuspid or molar crowns and in bridge-work, however, it is better in the great majority of cases to occlude the teeth, and keep them in position under a steady pressure until the cement sets. Under these circumstances the saliva can reach only the surplus portion of the cement, and cannot interfere with that under the cap or crown. One or two thicknesses of tin foil, placed over the crown as the teeth are occluded, will slightly favor the length.

When the cement has set perfectly hard, and not before, the surplus around the edges should be removed. In collar or shell crowns the extreme edges of the gold of the collar or shell should be given a final burnishing. Excessive burnishing and force, though, should be avoided, as tending to injure the cement under the collar. Wet floss silk or dental fiber, charged with pumice, should be passed between and around the teeth to remove every particle of the superfluous cement, and finally the parts should be syringed with tepid water.

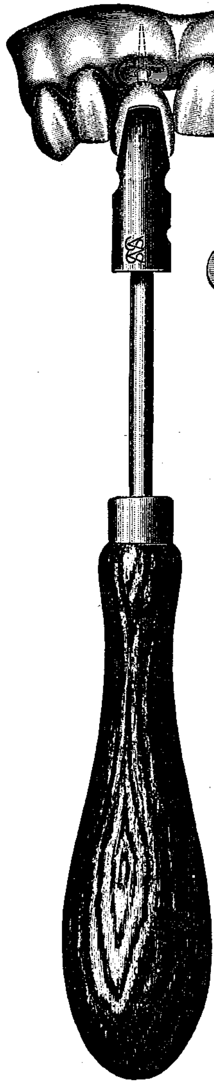
The patient should be requested to call in a few days, so that an examination may be made to see if any particles of the cement were overlooked. Cleansing gently at this time facilitates the healing of the gum around the collar or neck. Care in these little details tends to prevent that inflamed appearance and recession of the gum often seen around crowns, and also insures a satisfactory result to the patient and commendation to the dentist.

Oxyphosphate with Partial Application of Gutta-Percha.—Previous to insertion the posts of crowns should be slightly barbed. By incasing the post with a film of gutta-percha it is made easily removable, which is a desirable feature in crown- or bridge-work. This is done by warming the whole crown enough to heat the post, and then painting the post with a thin coat of chloro-gutta-percha. The heat instantly evaporates the chloroform, leaving a thin film of warm gutta-percha adhering to the post. The crown is then instantly placed on the root and removed. This defines the relations of the gutta-percha on the post to the walls of the canal, and indicates any slight surplus if present. Cementation with the zinc oxyphosphate completes the operation. At any time, by warming the crown, the thin sheath of gutta-percha is softened and the attachment of the post may be easily broken. This method of setting the post makes bridge-work, so supported, more easily detachable. A film of gutta-percha placed in the grinding-surface or on the sides of a gold cap will also provide a similar advantage in case of a gold crown. The gold cap should be first heated, the gutta-percha inserted, and the cap adjusted and removed and the amount and position of gutta-percha exactly determined. The cementation is then conducted as without the gutta-percha. In all-gold cap-crowns a vent for the escape of air and surplus cement is made by some in the form of a small hole, usually in the deepest fissure of the grinding-surface, but it is a practice that is now being generally discarded. When the cement has hardened, the hole must in all cases be closed with a gold or amalgam filling.

Cementation with Gutta-Percha.—The merits of gutta-percha for the cementation of crown- and bridge-work are: Gutta-percha is insoluble in the fluids of the mouth, and at any time the work can be removed by the application of sufficient heat to soften it. To be able to remove work thus easily is an advantage that is apparent without comment. In comparison with oxyphosphate, gutta-percha, although possessing the advantages of elasticity, lacks rigidity, so that its sphere of application is limited. Of the ordinary preparations of gutta-percha, the pink base-plate is the most suitable for cementation purposes, and can be manipulated about as easily as any of them.

Post Crowns.—First thoroughly clean, dry, and heat the crown. Paint the post and the base of the crown, and any recesses in the latter, with a very thin solution of chloro-gutta-percha. The heat instantly evaporates the chloroform, leaving a mere film of gutta-percha tenaciously adhering to the parts. Fill the recess and cover the base of the crown with a perforated disk of gutta-percha, and press the crown to position on the root without drying it of the saliva. Let the gutta-percha cool a little, remove crown, and trim surplus from edges; wipe out canal with chloroform, dry with cotton and hot-air syringe. Next place on the post or in the canal enough gutta-percha to insure a very slight surplus, heat the crown, and press to place.

Fig. 321.



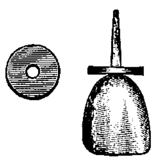
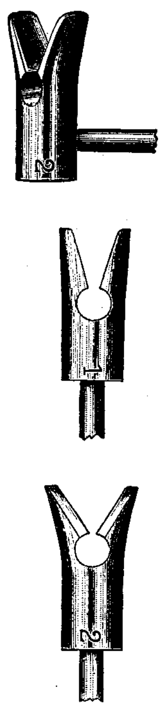


Fig. 322.

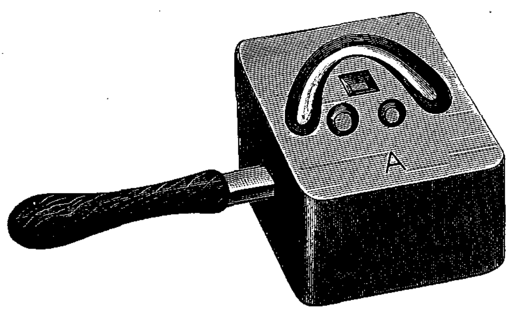


A crown-setter, illustrated in Figs. 321 and 322, heats the crown and aids in setting with gutta-percha. Heat the copper end sufficiently to soften the gutta-percha, and place the grooved end over the crown with the heated copper in contact with the porcelain. Hold the setter against the crown until the gutta-percha becomes soft, when pressure will force the crown with its pin to its proper position. The cooling of the gutta-percha can be hastened by dipping the crown-setter in a tumbler of ice-water and holding it against the tooth until it is cold. When the gutta-percha is cold, the surplus is removed with a warmed sharp instrument, and the edges smoothed by drawing back and forth against them some twisted fibers of cotton or floss silk saturated with chloroform.

Collar Crowns.—When the crown to be cemented has a collar or cap, it is best to first apply the gutta-percha only to the cap and adjust the heated crown on the root or tooth while wet with the saliva of the mouth, which will prevent adhesion, for the purpose of measuring the amount of gutta-percha required. Next wash, dry, and reheat the gutta-percha and place a little on the post. Dry the tooth or root and cement the crown to place. This is the best method to pursue in the cementation of any form of supporting caps for a bridge.

As to the amount of heat that can be tolerated by a patient in the use of gutta-percha, a good gage will be the fact that any heated crown or bridge that can be held in the fingers of the

FIG. 323.



operator can generally be inserted without great discomfort to the patient.

Gutta-Percha Cement.

The cementation of crowns and bridges with ordinary gutta-percha is a troublesome operation, and their removal is difficult, as much more heat will be required to soften the gutta-percha when it is old than when it was first applied. For this reason a preparation of gutta-percha which will soften at a much lower temperature and which can be manipulated more like a cement is preferable. Gutta-percha cement is of this character.

Method of Using Gutta-Percha Cement.—The following is a description of the method of using gutta-percha cement and the instruments and appurtenances connected with it for cementation of crowns or bridges:

FIG. 324.

FIG. 325.

FIG. 326.

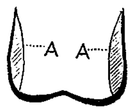
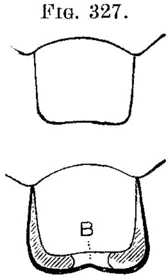


FIG. 327.



1st. Clean perfectly each post and the inside of each cap.

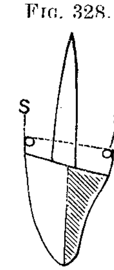
2d. Place the cement heater (Fig. 323) on a support over a Bunsen flame, remove the handle, and heat until a drop of water placed on the surface will instantly boil and be evaporated. Insert the handle, remove and place it on a small asbestos pad, or a couple of instruments laid crosswise on a table, and again remove the handle.

3d. Place the crown or bridge in a slot in the cement heater, heat the spatula, and place the requisite amount of cement on the surface of the cement heater, opposite the slots marked A, Fig. 323. Manipulate the cement *thoroughly* with a hot spatula (Fig. 324, in miniature), and it will immediately assume a plastic consistence. To apply the cement, hold the crown or bridge with tweezers in the slot of the cement heater, or remove and hold in a napkin with the fingers. Reheat when necessary and return it to the slot when the cement has been applied.

This cement should be applied with the hot spatula a little at a time and in quantity only in very slight excess of what is required, as the surplus will not press out so easily as oxyphosphate. In the case of collar crowns the proper and simplest method to pursue is to first measure the amount of cement required.

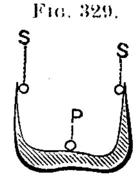
Method of Measuring the Cement.—This is easily done by, first, placing only a little of the cement on the sides of the interior of the collar of a cap or that of a gold crown, as shown in section at A A, Fig. 326, adjusting the work in exact position in the mouth on the wet natural teeth by pressure and occlusion of the antagonizing teeth, and then instantly removing. The saliva on the teeth will prevent adhesion of the cement. The surplus cement on the sides will be pushed to the bottom of the cap, and when the cap is removed will show the impression of the natural tooth as illustrated in Fig. 327. Any vacancy at the point B, in the bottom of the cap, will very accurately indicate the deficiency. Next wash the saliva out of the cap with a syringeful of water, rinse with alcohol by pouring in a few drops, and place the work on the cement heater and wait until the alcohol has evaporated, then apply the required additional cement. A small, straight, blunt-pointed instrument, such as a broken excavator, is useful to carry small pieces or pellets to the bottom or corner of a cap. By one or two insertions in the manner described the exact amount of cement can be determined.

FIG. 328.



To Provide for Surplus Cement.—For the final insertion a slight surplus may be added. It should consist of a very small quantity placed continuously around the cervical edge of the cap or crown, as shown at S S, Figs. 328 and 329, which illustrate a Richmond and an all-gold crown in section. In the case of the all-gold crown, a pellet of cement, not larger than a pin-head or a fraction thereof, may be additionally placed in the center of the grinding-surface, as shown at P, Fig. 329. When the cervical edge of a collar is to be burnished over a projecting point, a little of the cement may be previously placed at that part on the surface of the tooth toward the cervix, as the cement in the collar is liable to be pressed from position in the adjustment.

FIG. 329.



In any form of crown with a closely-fitting post, such as a porcelain or Richmond crown, first measure the amount of cement required at the base or cap by placing the cement at that part, inserting the crown in the mouth, and removing before applying to the post. In the case of a Richmond crown, first place the cement in the interior of the cap on the sides of the collar.

As only a very small quantity of cement will intervene between a close-fitting post or metallic cap and the tooth-structure, the adjustment is more easily effected in the mouth when the cement is evenly placed over the surface.

When the cement has been applied, the crown or bridge is left on the cement heater until ready to be adjusted in the mouth.

To Apply Gutta-Percha Cement in the Form of a Film Over a Surface, place a little of the cement in the convexity formed in the bottom of the jar not containing the colored cement you are using, add chloroform, mix with a camel's-hair brush, and apply the solution evenly over each post and on the inner surface of each metallic cap. Next place the crown or bridge in the slot of the cement heater to evaporate the chloroform and soften the cement. This method slightly impairs the strength of the cement. Its application is best confined to long, close-fitting gold crowns or posts, or to the temporary cementation of work.

4th. Syringe with water the tooth or teeth to be crowned, protect from saliva, bathe with alcohol applied with a pellet of cotton, dry, and evaporate all moisture with a hot-air syringe.

Now remove the crown or bridge from the cement heater, and when it has cooled to a point that will barely permit it to be held between the fingers, instantly place and press it to position in the mouth, and in the case of a gold crown or bridge have the patient forcibly occlude the teeth. This cement is very adhesive, but a chloroform varnish for the purpose, termed "adhesive fluid," may be applied to the tooth before the insertion of the work to further increase this property.

Should a hollow place be present in a tooth, it should be first filled with a pellet of the cement. If the cavity is shallow, varnish it with the adhesive fluid before inserting the cement.

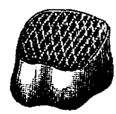
Should a crown or bridge not go to position because of an excessive amount of cement, the cement will have to be again heated. This is done without removing the work, by protecting the membranes and applying a crown heater, as shown in Fig. 325 (in miniature), which is applicable to all the teeth, or in Fig. 321, for incisors and cuspids exclusively. Pressure is then again exerted. This process is to be repeated until the crown or bridge is brought to proper position and the surplus cement pressed out.

The cement is next to be chilled with cold water from a syringe. Metallic collars are to be burnished at the neck. Surplus cement present is to be removed with the point of an exploring instrument.

Gutta-percha cement is, to a certain extent, hardened by the application of cold, but does not acquire its greatest density before the next day, when the surplus can be more easily removed.

The best possible adhesion of the cement to metal is se-

FIG. 330.

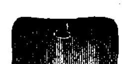


cured by lightly scratching intersecting lines on the posts and inner surfaces of metallic crowns, in the form shown in Fig. 330, with a fine, sharp-pointed instrument, previous to the process of cementation. In open-face or shell crowns, this process applied to the inner surface of a strip of the metal traversing the cervical portion of the labial face very materially aids in the retention of the cement.

Requirements for Success.—For the successful use of gutta-percha cement, bridge-work must be properly constructed. Porcelain or Richmond crowns should have long, substantial posts, either round or of the Logan pattern, properly fitted to the canal. (See Fig. 331.) If the canal is enlarged from some cause, or of an irregular form, after closing the foramen with gutta-percha, taper the end of the post and fit the point deeply in the canal. Fill the canal with a thin mixture of Ash & Sons' "Rock Cement" (a zinc oxychlorid, which sets in two minutes), using a wisp of cotton wound tightly on a serrated broach to pump it in place, insert the post and in thirty seconds withdraw it, wipe off the film of cement adhering to the surface of the post, and reinsert it in the canal. Slightly withdraw and reinsert the post at intervals during the remainder of the two minutes required for the setting of the cement. Or, varnish the post with a thin film of gutta-percha cement dissolved in chloroform and evaporate the chloroform. Fill the canal with oxyphosphate and insert the post. When the oxyphosphate has set, heat the post or crown, withdraw it, and wipe out the canal with a wisp of cotton saturated with chloroform to remove any of the gutta-percha cement adhering in the canal. Either method gives a tight-fitting socket of cement in which the post will fit closely. For all-gold crowns, badly decayed teeth should have their sides restored with amalgam. Roots should have posts or screws cemented in them and then be built up with amalgam, as shown in Figs. 39 and 40. Short gold crowns, supporting bridge-work, frequently require one or two pins that will fit in small holes drilled in the deep fissures of the occluding surfaces, as shown in Fig. 332, or in a slot or cavity in the side extending nearly to the cervical margin of the gold crown, as illustrated in section, in Fig. 333. A pin, no matter how short,

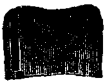
FIG. 331.

FIG. 332.



inserted in the center of the occluding surface of an all-gold crown, always steadies the crown, and in that way assists in its retention. A gold crown, the labial face of which has been entirely removed, should have pins of platinum inserted in cavities or slots, on one or both of the approximal sides, as shown in Fig. 405. Rolling the wire under the flat side of a file before using in the construction will roughen it and offer a better surface for the adhesion of the cement. Partial caps on bicuspids, centrals, or cuspids are well secured in this manner, or by the use of the Carmichael and the "Staple Crown" described on page 213.

FIG. 333.



Gold crowns inserted with gutta-percha cement can be burnished in at the neck without injury to the cement, which is not the case in the use of oxyphosphate. This property in gutta-percha cement will be found of great advantage, where the contour of a tooth, for instance, used as an abutment for bridge-work, has not been reduced to the circumference of the neck. All-gold crowns in such cases should be made of soft gold plate, or platinized gold. The collar can be stiffened, where considered necessary for rigidity, with solder around the sides, toward the occluding surface, and the metal then tapered off gradually toward the edge. A gold crown, by being burnished inward around the neck of a natural tooth, is additionally secured, and no matter how short a crown, very seldom requires the aid of a post or pins for the purpose of retention.

Favored by proper construction, over 90 per cent. of cases of bridge-work can be reliably cemented with gutta-percha cement. Among the exceptions are very short caps or open-face crowns, in which pins or posts cannot well be inserted, and which, in supporting bridge-work, are subjected to a great strain.

Oxyphosphate in Combination with Gutta-Percha Cement.—Gutta-percha cement may be used in combination with oxyphosphate by applying the gutta-percha cement somewhat scantily, and, in the final insertion of the work, coating the natural crowns or roots with a thin mixture of oxyphosphate instead of using the adhesive fluid. This method will result in the presence of a film of oxyphosphate and a very large proportion of gutta-percha cement. It will increase the security of attachment while the proportion of oxphosphate present will not be enough to interfere with removal. The inherent weakness of gutta-percha as a cement lies in its lack of adhesion to tooth-structure. This combination overcomes this objection.

For the removal of crowns and bridges cemented with gutta-percha, see Part III, Chapter IX.

Amalgam.—Amalgam is but seldom used to support and retain porcelain crowns. Where it is desirable to use amalgam, Dr. Kirk gives copper amalgam the preference as an attachment for the Logan crown to weak or badly-decayed roots. The following is Dr. Kirk's method for the adjustment of Logan and similar classes of crowns, which he has found satisfactory in those extreme cases where there has been much loss of root-structure through the action of caries in the root-canal, resulting in a large funnel-shaped opening with more or less weakened root-walls.

The canal is prepared by removing the softened structure, filling the apex, and making suitable undercuts or roughnesses along its walls, and then filled flush with its orifice with a good grade of copper amalgam softened to a plastic, buttery condition. The apical end of the crown-pin is sharpened to a point or hatchet edge as may be most expedient, and placed against the amalgam surface in the root-opening, and the crown at once driven to place in close contact with the root by holding against its morsal (occlusal) surface a suitable point mounted in the engine-mallet. For this purpose, the blow of the mallet should be considerably increased in intensity beyond that ordinarily used for filling-operations. The point used in the mallet for driving the crown home is best improvised from a porte-polisher armed with a hickory point, the use of which avoids chipping the porcelain. All excess of copper amalgam is by this means driven out between the contact surfaces of the crown and root in precisely the same manner as occurs in the use of oxyphosphate. An excess should be used in order to be sure of filling all interstices. This method, involving the use of copper amalgam, is advocated only in the class of cases described, for which it possesses the advantage of giving complete support to the root, because of the great strength and insolubility of the material employed. Other amalgams experimented with for this purpose have not been so satisfactory, because of their lack of plasticity, and of the flowing quality which characterizes the copper amalgam when subjected to the rapid vibratory percussive force of the engine-mallet blow.

PART III.

BRIDGE-WORK.

PART III.

BRIDGE-WORK.

ANTIQUITY OF—PRIMITIVE METHODS—MODERN LITERATURE—MODERN METHODS—ADVANTAGES—OBJECTIONABLE FEATURES—IMPARTIAL CONSIDERATION.

Antiquity of.—The artificial replacement of the loss of a portion of the teeth by bridging the vacant spaces with substitutes, supported in position by means of their attachment to adjoining or intervening natural teeth, is, as we have seen in the introduction, of ancient origin, having been practiced long before plates came into use.

FIG. 334.

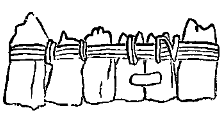
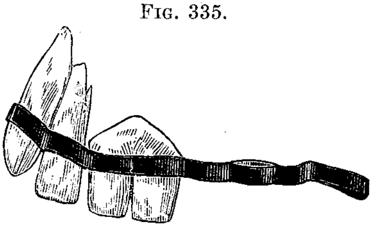
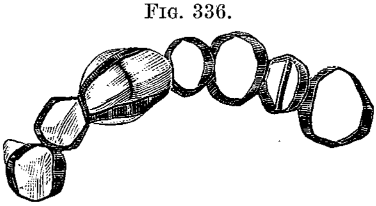


FIG. 335.



Primitive Methods.—Originally, the application and mechanical construction of such dentures was of a most primitive character; and as the attachments were simply ligatures or clasps of gold, the teeth were more ornamental than useful. Figs. 334, 335, and 336 illustrate the antique methods.[1] Fig. 334 is an illustration of a specimen of ancient Phœnician dentistry. Fig. 335 is that of one in the Etruscan age, dating about five hundred years B.C. Fig. 336 gives a view of the same denture inverted.

FIG. 336.



[1] See *Independent Practitioner*, vols. vi and vii, "Evidences of Prehistoric Dentistry," by J. G. Van Marter, D.D.S., Rome, Italy. Figs. 334, 335, 336 are copies of the illustrations of the specimens, the first of which is represented as being in the museum of the Louvre, Paris, France, and the second in the Corneto Museum, Corneto, Italy.

Dentures constructed on the bridging plan by various methods have been occasionally employed from the earliest days of modern dentistry, though until recent years the system has not obtained general recognition nor been extensively practiced.

Modern Literature.—Dental literature presents bridging operations as described by Dubois d'Chemant in 1802, J. B. Gariot in 1805, C. F. Delabarre in 1820, Dr. S. S. Fitch in 1829, William Imrie in 1834, J. Patterson Clark in 1836, and Dr. W. H. Dwinelle in 1856. Figs. 337 and 338 are copies of illustrations in Dr. Fitch's work, published in New York in 1829, and Fig. 339 one from a translation of F. Maury's work in 1843. In 1871 the bridging

FIG. 337.

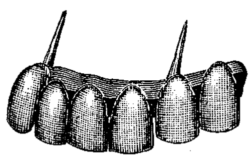


FIG. 339.

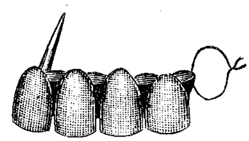


FIG. 338.

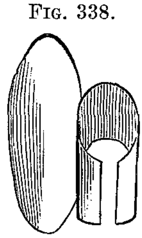
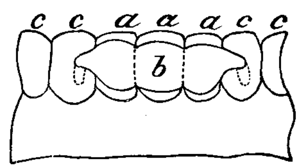


FIG. 340.



process or bridge principle was again brought to notice by a patent applied for in England by Dr. B. J. Bing, of Paris, for an improved means of supporting and securing a bridge by anchoring with cement or fillings, clasps or bars, extending from it into holes formed in the adjoining teeth (Fig. 340). The system was also practiced in operations by the late Dr. M. H. Webb, and is described in his "Notes on Operative Dentistry."

Modern Methods.—The facilities afforded by the artificial crown-work now in vogue for supporting and securing bridge dentures have caused a revival of the system in an improved form, now termed "Bridge-Work," in which artificial crowns cemented to natural teeth or roots are employed as abutments to support artificial teeth which span or bridge the spaces between them. These bridges are so devised, in the best methods, that while supplying the patient with the means of masticating his food, the cleanliness of the denture is also provided for.

Advantages.—Ordinarily, bridge-work is immovably cemented in position. The claims set up in its favor are as follows:

First. The perfect replacement of lost teeth by artificial ones, and without the use of a plate.

Second. The absence of any mechanical contrivance to interfere with the tongue in articulation.

Third. The natural teeth are not abraded by the presence of clasps, the functions of the sense of taste are more perfectly performed, and a healthy condition of the tissues preserved, because the gums and palate are not covered over with a plate.

Fourth. The solidity and immovability of the denture at all times, both in speech and mastication.

Fifth. The weight of the denture and the strain of mastication are proportionately distributed on the natural teeth, which are better suited to sustain them than the contiguous alveolar surfaces.

Sixth. Its special adaptation to the replacement of single teeth, or of a small number, where bridge-work is usually superior to any other device.

Seventh. While all operations performed for the restoration of lost teeth, like other remedial operations, are temporary rather than permanent in their results, bridge-work as regards permanency takes equal rank with any other operative procedure.

Objectionable Features.—The following, on the other hand, are the objections raised against bridge-work:

First. It fails to restore the contour of the soft tissues above the bridge, as artificial gums cannot properly, in most cases, be used in this style of work.

Second. The slots beveled under the artificial teeth, called self-cleansing spaces, fill with particles of food.

Third. The speech and comfort of the wearer are often affected by these self-cleansing slots under the front teeth.

Fourth. The teeth employed as abutments are usually irreparably destroyed by the process of crowning.

Fifth. If an extensive bridge is made of gold, being immovable, it is impossible to keep it perfectly clean, as the metal will gradually tarnish in parts out of reach of the brush, and will gather offensive matter on its surface and in its interstices.

Sixth. In cases where it becomes necessary to temporarily remove the bridge for the purpose of repair, or because of disease in the teeth which support it, the operation is difficult and the bridge is usually injured so as to unfit it for reinsertion.

Seventh. The teeth which support the bridge are required to bear more force and pressure than nature intended,—where the piece is large, many times more,—and, the bridge being permanently attached, at no time can any rest be given the abutments or the contiguous parts by its temporary removal. Thus in a piece of bridge-work of fourteeen teeth supported by caps or crowns on four natural ones, each one of the natural teeth may have to bear more than three times the strain in supporting the weight of the denture and the force of mastication, that was intended. The ultimate result is evident to anyone who is experienced in dental practice; and unless the anatomical conditions are most favorable, the usefulness and durability of such work is liable to be limited in character, considering the time, trouble, and great expense attending it.

Such are the objections which have been put forth against bridge-work; and yet, whatever may be urged against it, its advantages have won from a majority of the profession, including many accepted authorities, an enthusiastic, almost a sensational, indorsement; some practitioners even going so far as to proclaim it the only true method for the insertion of artificial teeth.

Impartial Consideration.—Judged impartially, bridge-work has many advantages when practiced by experts who properly construct and apply it. Without doubt it has been, and is still, abused. Bridges have been inserted where the support was insufficient, or the construction was wrong in principle or faulty from lack of skill. More than this: bridge-work has been passing through the experimental period, when failures are apt to appear more prominently than successes. The chronicles of dental literature, however, in this respect offer only a repetition of the historical difficulties that attend all new departures in the arts.

CHAPTER I.

Construction of Bridge-Work.

MECHANICAL PRINCIPLES—PREPARATION OF THE SUPPORTING TEETH OR PIERS—CONSTRUCTION—IMPRESSIONS AND MODELS—SELECTION AND ADJUSTMENT OF THE ARTIFICIAL TEETH—BACKINGS—SELF-CLEANSING SPACES—INVESTMENT, SOLDERING, AND FINISHING—WARPING, HOW TO AVOID—CONSTRUCTION IN SECTIONS—ADJUSTMENT AND ATTACHMENT—CONSTRUCTION OF SMALL PIECES OF BRIDGE-WORK.

To the skilled mechanical dentist, well versed in metal- and crown-work, bridge-work does not present extreme difficulty. The foundations or abutments—that is, the teeth or roots on which the bridge will rest—are first to be considered, due respect being paid to the mechanical principles controlling the leverage and the force of occlusion in mastication.

Mechanical Principles.—The amount of strain that can be borne by the different teeth, individually and collectively, according to their position and condition of health, should be carefully calculated. As a rule, the force exerted upon the incisors in occlusion will be directed outward on the upper, and inward on the lower teeth, and its tendency when they support a bridge will be to gradually push them out of line in each direction. When the incisors are replaced by a bridge, the tendency of the force of occlusion is toward a similar result. On the bicuspids and molars the force is direct. The rules which govern the number and position of the teeth or roots required as foundations for bridges in practice, are as follows:

One central root will support two centrals, and if spurs or bars from the sides of the bridge rest upon or are anchored in the adjoining teeth, a lateral in addition.

Two central roots will support the four incisors, spurs or bars resting on or anchored in the cuspids to be used additionally, if the case requires them.

The cuspid roots, alone, or with the aid of a central root, will support the six anterior teeth.

One molar or bicuspid on one side, and a bicuspid or molar on the other, with one or two roots in an intermediate position, will support a bridge between them.

One right and one left molar, with the assistance of the two cuspids, will support a bridge comprising the arch between them.

A bridge on one side of the mouth can be supported by two or three teeth or roots on that side. The cuspids always afford the most reliable support.

In general, the application of these principles will cover the subject of foundations, the operator being governed by the exact condition of individual cases. In a bridge of the six anterior teeth on the two cuspids, when the articulation of the antagonizing teeth is close and deep, the strain should be relieved by an additional attachment of the bridge to the teeth posterior to the cuspids. This may be accomplished in this case, as well as in other differently located pieces of bridge-work, in a variety of ways, the character or form of device to be determined by conditions and requirements of each case. The adjoining tooth or teeth may be capped with open-faced gold crowns or by crowns which entirely envelop the natural crown; or, a bar may be extended into and anchored partly across the occlusal surface of the additional supporting tooth. If this is pulpless, the bar can be extended into the pulp-chamber. An inlay anchorage may also be utilized for the purpose of support. This, like the bar, does not necessitate extensive mutilation of the form of the natural crown.

Selection of the most suitable teeth as abutments or piers in bridge-work operations so as to most effectively distribute the force of occlusion will assure the best practical results, especially as regards the maintenance of stability of the abutments, on which depends the durability of the work.

Preparation of the Supporting Teeth, Piers, or Abutments.—The preparation of teeth or roots to support a bridge is the same as for ordinary crowns, except that the trimming of the sides and the drilling of the root-canals of the various anchorages should be, as far as possible, in parallel lines, so that the collars and posts of the crowns shall move readily to their places in the adjustment of the finished bridge. Teeth or roots which are to be supplied with porcelain-faced or all-gold cap-crowns are crowned by some one of the methods already described. The roots which are to carry porcelain-faced crowns can be so crowned or only capped, the posts being soldered and allowed to project a short distance beyond the caps.

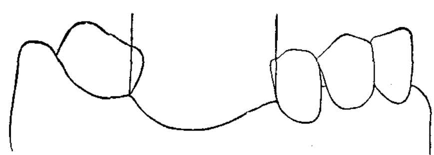
The lines of the crowns of teeth or root-canals to be used as abutments or supports for bridge-work are seldom exactly parallel. This condition should be borne in mind and receive proper consideration in their preparation. When one of the bridge supporting teeth tips, or when two of them lean toward each other, the tipping side or sides may require extensive trimming, while the other side or sides will generally need proportionately less. Frequently a leveling or straightening of the contour at its projecting point only will be necessary. This is explained in Fig. 341, which is supposed to represent a molar and cuspid with living pulps. The cuspid in tipping forward has straightened the line of the posterior or distal side, so that it requires very little trimming. The proportion requiring removal at the point A will be regulated to some extent by the shape given the molar. By considerable reduction of the posterior side of the molar at the point B,—to a line parallel with the anterior or mesial side of the cuspid,—a form is given to both teeth which, with a moderate reduction of the anterior or mesial side of the molar, will permit proper removal and insertion of the caps in the construction and adjustment at the cervical section when permanently inserted.

Fig. 341.

It is not essential that the parallel lines of the sides of prepared teeth shall form a right angle to the surface of the gum or the space between them.

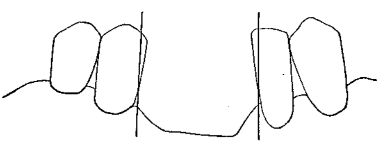
The application of this principle to the preparation of a lower molar and bicuspid for an intervening bridge is shown in Fig. 342, which is typical of cases frequently presented. Here straightening of the posterior or distal side of the bicuspid and removal of a considerable portion of the anterior or mesial side of the molar, as illustrated by the lines, will secure a form that will permit of the adjustment of the caps.

Fig. 342.



This principle is further exemplified in Fig. 343, should these lower cuspids or the lateral incisor be used to support a bridge.

FIG. 343.



The presence of decay on that side of a tooth requiring the most shaping facilitates the operation, as chisels and cross-cut burs can be used to remove the main portion of the bulging enamel. The cavity should be excavated and filled with cement, or, preferably, amalgam, previous to the final shaping.

Plain, thin corundum-disks will remove the approximal surface toward an adjoining tooth more rapidly than those of vulcarbo, but they must be used with greater precision to avoid fracture. Commence with a disk of moderate circumference and follow with larger sizes. Removal, or mutilation of the contour of an adjoining tooth, should be carefully avoided. Frequently the formation of a space can be advantageously commenced with a thin safe-sided separating file, then increased with paper corundum-disks. These may be then followed with the regular disk. Small, moderately thick corundum-wheels or disks, whose circumference has been considerably reduced by use, may be advantageously used on the sides of the teeth approximal to the space to be bridged. The reduction of the labial and palatal or lingual sides need only be such as will give a form that will permit the edge of the collar of the crowns to slide over the coronal section and assume the proper position at the gum-margin. The occluding surfaces of teeth require to be removed sufficiently to permit the presence of an intervening surface of metal capable of resisting attrition. The proper thickness of the metal for this purpose is regulated by the character of the occlusion. The hardness of the metal to be used for forming the occluding surfaces, whether it is an alloy of copper and platinum or largely copper, in contrast to gold plate such as is used to form the sides of the crown, may also be considered in calculating its resisting power.

The reduction of sound teeth to be used as abutments in bridge-work to a thimble-shaped form is unnecessary. Such a reduction demands in many cases the devitalization of pulps whose vitality can be preserved, as a rule, by the adoption of less extreme measures. The removal of contour so as to permit the collar of a gold cap to pass just under the free margin of the gum is sufficient.

To pass deeper than this point will generally demand considerably more reduction of the coronal section above it. Figs. 344, 345, 346, and 347 illustrate upper and lower bicuspids and molars of normal form. The lines indicate as much as usually requires removal in such cases.

The proportion of "bulging" constituting the contour of teeth varies considerably. Short bicuspids and molars commonly de-

FIG. 344.

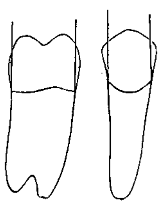
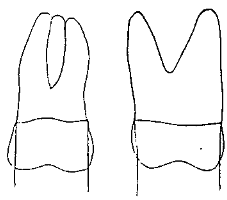


FIG. 345.



mand less shaping to prepare them for the reception of caps than longer teeth. Second and third molars, when the gum-margin covers the coronal section extensively, seldom require much shaping.

In the case of a sound molar with the crown fully exposed and slight recession of the gum, a reduction of the contour sufficient to permit a proper adjustment of the collar of the metallic cap at

FIG. 346.

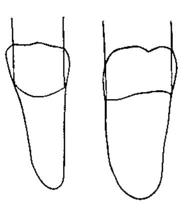
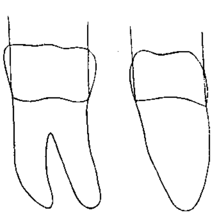


FIG. 347.



the neck will seldom be found practicable without extirpation of the pulp.

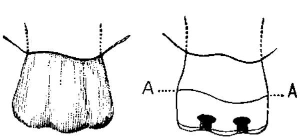
A secure anchorage to such molars and bicuspids, especially those in the lower jaw, is easily obtained by merely reducing the contour sufficient to allow the formation of a cap which will partly cover the coronal section and fit at the margin as shown in Fig. 348. One or two short pins may be inserted in the cap for additional security if considered necessary.

In a case where a molar tips in the manner shown in Fig. 349, the most advisable plan usually is to cap the molar regardless of its position, and place on the anterior side of the crown a socket attachment for the posterior or distal end of the bridge.

The presence of decay with extensive calcification of the pulp in a tooth will admit of the removal of more enamel and dentin than if it were perfectly sound.

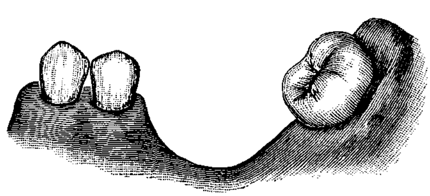
When teeth are pulpless, shaping can be more freely practiced. In such cases the collar should be carried well under the gum-margin as a protection to the devitalized dentin against decay, and the occluding surface may be more extensively removed. Extreme reduction of the coronal section of a tooth does not always facilitate the work of construction, frequently rather the reverse, as the presence of a reasonable portion of the crown will steady the collar or cap during its formation. It will also assist in its reten-

FIG. 348.



A A is the line to which the natural crown may be removed and the gold cap extended.

FIG. 349.



tion in correct position in the mouth for the construction of the bridge-work.

In the preparation of the front teeth for post crowns with porcelain fronts, when necessary, the canal may be reamed a little to one side at the orifice and the post of the crown correspondingly tapered on that side to favor its insertion in and removal from the canal.

As to whether an incisor or cuspid should be entirely capped with gold, or a method adopted by which the metal shall be only slightly exposed or entirely invisible, in preference to excising the crown and inserting on the root a cap with a porcelain front, is a subject to be determined by the conditions and circumstances of the case. The position and occlusion of a tooth, its shape and general appearance, whether it is sound,—free from decay,—or partially or extensively decayed, whether the pulp is living or almost entirely calcified or has been already devitalized, are conditions, and the age and sex of the patient are circumstances, which should influence the operator in the adoption of the form of construction. The illustrations in succeeding chapters on bridge-work show, by a large selection of cases, numerous methods which may be practiced.

A normal or uniform line of occlusion of the teeth favors the construction and use of bridge-work. When such a condition does not exist, the defect should be remedied as much as possible by trimming the incisal edges and occluding surfaces of such teeth as are out of line.

FIG. 350.

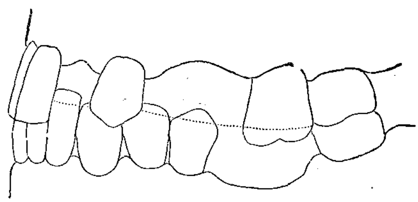
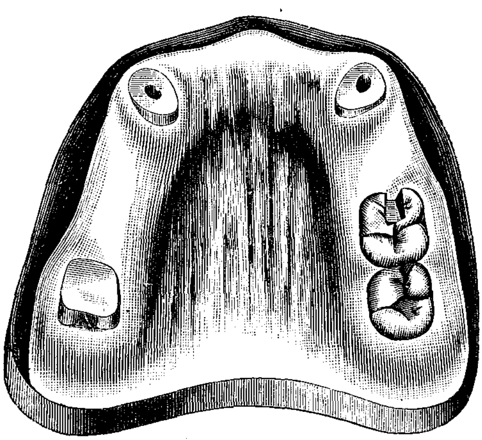


Fig. 350 illustrates a case in which the occlusion is not uniform. The dotted line indicates how much of the various teeth requires to be removed to remedy the defect and render the occlusion favorable to the insertion of bridge-

FIG. 351.



work. Sometimes the removal of a pulp is necessary in order to effectively shorten a tooth which has become excessively elongated.

Construction.—The case represented in Fig. 351 will be used to illustrate the construction of a piece of bridge-work in all its details. The abutments, or supports, consist of the right second molar capped with an all-gold crown, constructed in sections by first forming the collar and then soldering on the cap (see page 101), the two cuspid roots capped for collar crowns with porcelain fronts (see page 83), and the left first molar, which will afford anchorage to a bar on that side of the bridge as shown in Fig. 352. A slot, dovetail in form, is usually cut well into the body of the last-named crown, but not to an extent that will endanger the pulp (Fig. 353). If the tooth is not decayed, the slot may be first cut with a corundum or vulcarbo disk. The shaping is best completed with fissure-burs.

FIG. 352.

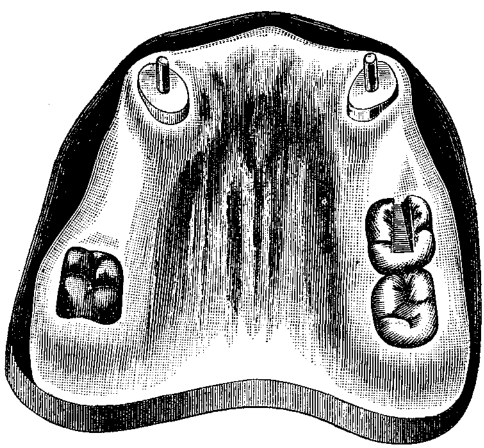
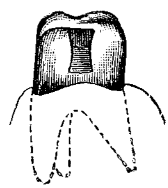


FIG. 353.

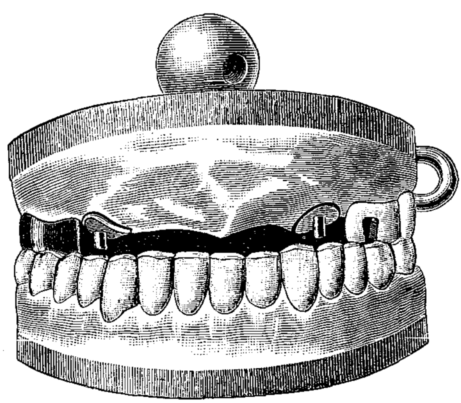


Impressions and Models.[1]—With the crowns and caps in position, an impression of the case and the articulating or occluding teeth is then taken at the same time with plaster slightly colored with carmine, to which is added a little potassium sulfate,—less than the proportion of salt generally used,—which causes it to set quickly. The plaster is mixed moderately thick, and either rolled in a mass in the fingers, which should be wet to prevent adhesion

[1] Impression-compound is used to some extent for this purpose instead of plaster, but in the author's opinion cannot be recommended as suitable. Dental Lac may be used in some cases for small impressions (see Part V, Chapter III).

of the plaster, or with the aid of a spoon is placed around in the mouth on the crowns, caps, and parts to be included in the bridge, and the antagonizing teeth occluded tightly and so held until the plaster sets. The mouth is then opened and the plaster carefully removed, the pieces being adjusted together should it break. The crowns and caps (the latter held more firmly by the protruding ends of the pins) are generally removed in the impression; if not, they should be transferred from the mouth to it. The plaster is then varnished and oiled, and on the side containing the crowns a model is run, composed of one-third calcined marble-dust and two-thirds plaster, to which a little potassium sulfate may be added. When this model has become properly set, it is mounted with plaster on an articulator, and the other side of the colored plaster impression giving the articulation is run with plaster and the opposite section of the articulator adjusted. When the impression plaster is removed (an operation which is greatly facilitated by its having been colored with carmine), a correct model

FIG. 354.



and articulation of the case will be found, with the crowns and caps in exact position as in the mouth (Fig. 354). The surface of the model, which is softer than one of pure plaster, is much hardened by the application of several coats of thin sandarac varnish.

Another method is: first take the "bite" or impression of the occluding teeth in wax with the caps and crowns in position in the mouth, and after that the impression of the case in an impression-tray with plaster. When the model has been made, the wax "bite" is then placed on it and an articulating model run in the usual manner.

Dr. Melotte's method is to place a piece of impression-compound in the space between the crowns to be occupied by a bridge, and occlude the teeth. The compound is then chilled, removed, trimmed, and readjusted until it accurately fits the space, when it is placed in position and an impression is taken with plaster. When the impression is removed, iron pins to act as dowels are placed in the portions representing the natural teeth, and then several pieces of fusible metal, by a few puffs of flame from the blowpipe, are melted in around the pins. The rest of the impression is then run with plaster and marble-dust in the usual manner. This forms a plaster model on which the natural teeth are represented in metal. These metal teeth are to be removed before investing in soldering the bridge. An impression of the occluding teeth is taken in plaster, and the entire impression run with fusible metal. When the plaster impression is removed from the model of the bridge, the piece of impression-compound between the crowns is to be left in position, and the metallic model of the occluding teeth fitted in place, guided by the indentations of the occluding teeth in the compound, and the case mounted on an articulator. The principal object of this method is to avoid fracture of forms of natural teeth, both in removal from impressions and in the construction of the bridge-work.

Fracture of the form of the occluding teeth of the articulating model or "bite," when made entirely of plaster, can be almost entirely avoided and their removal from the plaster impression simplified by giving them the shapes illustrated in Figs. 355 and 356. This is done by trimming and shaping the mold of the teeth in the plaster impression at the lingual side to form C or C, after the removal of the impression from the mouth, and thoroughly

FIG. 355.

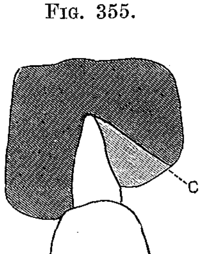
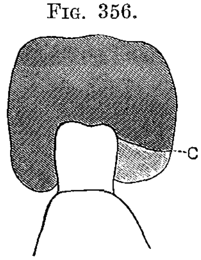


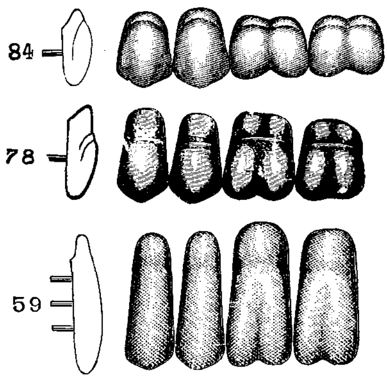
FIG. 356.



varnishing and oiling before running the plaster. The shape given in no respect impairs their form for the articulating work.

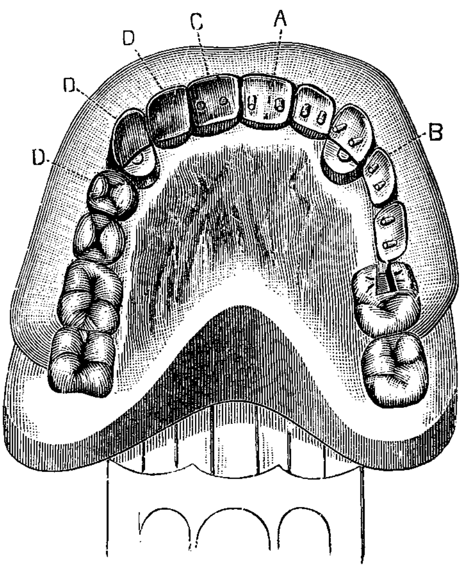
Selection of Artificial Teeth and Formation of Dummies.—The pins protruding from the caps on the model are next cut off short. Teeth are selected,—ordinary cross-pin plate teeth for the incisors and cuspids, and partial teeth, representing the front section of the tooth and styled porcelain facings, which were specially designed for crown- and bridge-work, for the bicuspids and molars (Fig. 357). Cuspids are sometimes used to form the fronts for bicuspids. The teeth are ground and fitted to the model and articulation, so that the labial upper edge of the teeth shall press lightly on the gum. Those which are intended to form the fronts of the caps on the cuspid roots should be adjusted in the ordinary manner for single crowns. To determine the proper positions of the teeth for producing the best appearance, they can be adjusted in the mouth on wax, without the gold crowns or caps of the supports. The correct position of the teeth on the model having been obtained, investing material, composed of one part plaster to two of calcined marble-dust, is placed on the outside of the model on the labial aspect of the teeth, merely sufficient in quantity to hold them in position, thus forming a matrix, or, the matrix can be formed of plaster and entirely removed before investing for soldering (Fig. 358). The wax is then removed, exposing the palatal portion, and permitting the forms and position of the teeth to be studied. The porcelain teeth or fronts, with the exception of fronts for the roots capped, are then removed from their investment, and the base ground from a line on the palatal side below the pins, straight to the labio-cervical edge (A and B, Fig. 358). This is to form the self-cleansing spaces.

FIG. 357.



Backings.—The incisors and cuspids are backed and the incisal edges shaped and backed so that they will be protected when soldered and finished the same as in the case of a single crown as described on pages 89 and 90. The backings, if preferred, may be extended down on the curve of the self-cleansing space. A more desirable result is secured if the backing extends only to the edge of the self-cleansing space, and the porcelain is polished, as its surface is superior in cleanliness to that of gold. If the platinum backing used is so exceedingly thin as to be of the nature of foil, it is advisable to rivet a small piece of gold plate over it on the back of the tooth, to insure against melting the platinum off the porcelain with the gold in the soldering, which is apt to occur if

Fig. 358.



Shows "dummies" in various stages of construction. A, central incisor, and B, bicuspid, ready for metallic backing. C is a central backed. D D D, porcelain fronts as they appear on insertion after the process of backing, capping, and soldering.

a pointed flame is directed against it. The cuspids are backed in the manner described for collar crowns.

The bicuspid and molar porcelain fronts, their tips being ground off (A, Fig. 359), are lined in a similar manner. A cap of pure gold or gold lined with platinum, representing the grinding-surface of each tooth, is struck up as described and illustrated in the construction of gold crowns (see page 95), and the concave portion filled by melting in scraps of 18-carat gold plate or hard-flowing solder. When 22-carat gold is used to form the cap it should be filled with ordinary or hard-flowing solder. The surface is then ground smooth (B), and closely fitted to the tip of the porcelain front to form the occluding surface in accordance with the articulation of the lower teeth, and the triangular space between the backing and cap filled in and shaped with wax to the form shown in Figs. 361 and 364. The metallic occluding surface is to protect the porcelain. Triangular pieces of very thin gold plate, platinum, No. 60 gold foil, or mica (C, Fig. 359), cut and fitted

FIG. 359.

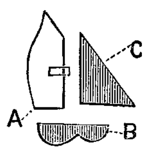
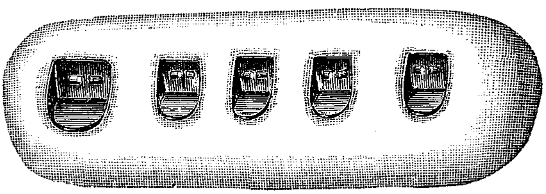


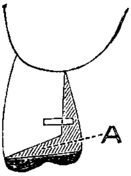
FIG. 360.



to the sides, over which they should extend slightly, will retain the gold in position when melted, but are seldom necessary. The tooth is next invested with the others, leaving the back open, presenting the form of a pocket (Fig. 360).[1]

Another method of constructing bicuspid and molar dummies is to fit the cap to the buccal edge of the porcelain front, back the porcelain with thin platinum, extending the backing over and between the porcelain and cap, and then filling in the space with gold in soldering, as shown at A, in Fig. 361.

FIG. 361.

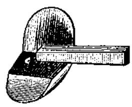


The bar intended to be anchored in the slot cut in the molar on the left side is made of platinum wire, about No. 15 U. S. standard gage, with the end shaped as shown in Figs. 362, 367, and 368. It may be fastened with wax to the artificial tooth and adjusted in the mouth to determine accuracy of position before investing.

[1] See the Hollingsworth System for description of method of swaging grinding-surfaces of several crowns and dummies on one piece of plate.

Self-Cleansing Spaces.—The advisability of constructing bridge-work with what are termed self-cleansing spaces is not favorably accepted of late by many practitioners. Instead, the following method is adopted: Porcelain fronts thicker in the line from the labial to palatal side than those most commonly used are selected. The base or cervical section of the porcelain is ground and fitted to the alveolar ridge very exactly. The fronts are then waxed in position, and with a fine-pointed lead-pencil a line is drawn accurately around the base of each porcelain front on the model. The fronts are then removed, and with a suitable scraper the plaster under, and only under, the base of each is removed uniformly the thickness of cardboard. The porcelains are then fitted back in position with the bases in the indentations. The work is then proceeded with in the usual manner. When the bridge is finished and inserted, the base of each porcelain will uniformly indent the gum to the depth the plaster was removed. This conformation will exclude particles of food and present a much more agreeable shape to the tongue and a better appearance for the patient. The shape a bicuspid dummy would assume, constructed as described, is shown in Fig. 361.[1]

FIG. 362.



The teeth forming the bridge between the crowns are called "dummies." In the construction of dummies it is well to favor the occluding surface by shaping it a *trifle narrower* from *labial* to *palatal side* than the *corresponding natural tooth was*, and for the purpose of forming less of a slant between the occluding surface and the gum.

FIG. 363.

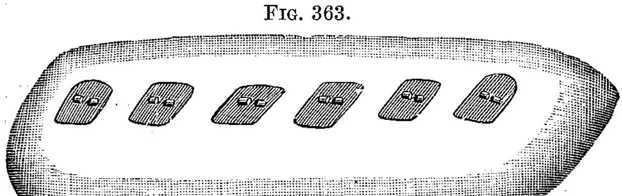
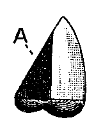


FIG. 364.



Investment and Soldering.—All the porcelain teeth or fronts can be invested at the same time, including the incisors and porce-

[1] The author, at present, in his own practice constructs most of his work in this manner.

lain fronts to the cuspid crowns, in the manner shown in Fig. 363. In the soldering, if the backing is done with platinum, and the occluding surfaces of the bicuspids and molars made with 24-carat gold or gold lined with platinum, 18 or 20-carat gold plate or hard-flowing solder (Part V, Chapter I) may be melted into the pockets formed by the cap and side-pieces to fill out to the line at A, Fig. 364, and flowed over the backings of the incisors and cuspid fronts in sufficient quantity to shape them as shown at B, Fig. 365. When the backing and occluding surfaces are made of 18 or 20-carat gold plate, 18 or 20-carat solder and small pieces of gold plate should be used. After the soldering and removal of the borax with acid, the metal of each tooth is very carefully trimmed and shaped,—it is easily done at this time,—with corundum-wheels and points, but not polished.

The teeth are next placed in their relative positions on the

FIG. 365.

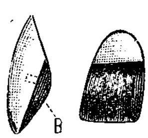
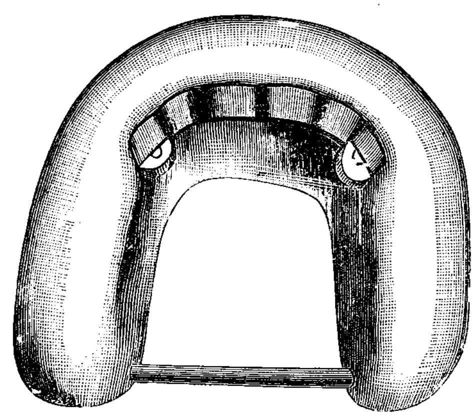
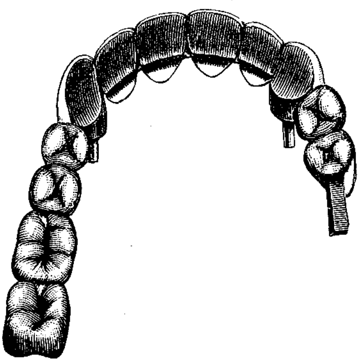


FIG. 366.



model as shown at D D D, Fig. 358, and attached to one another with wax in proper relation and only where they are to be united with the gold solder. The model is then detached from the articulator, trimmed down as much as possible in size, and additional investing material, composed of two parts marble-dust and one of plaster, or one part plaster, one marble-dust, and one common white sand, applied until all of the bridge is covered except the space along the backings and crowns where they are to be united in the soldering. To prevent fracture during the soldering process, which might readily occur from contraction in so large an investment, an iron wire or a narrow horseshoe-shaped strip of sheet iron should be placed in the investment so as to encircle the teeth and crowns about one-eighth of an inch from their exterior surface (Fig. 366). In any spaces between the backings pieces of gold or platinum plate or wire, about one-eighth of an inch long, are placed lengthwise, very small places being packed with gold foil, and the joints well soldered. When the backings have been soldered with gold plate or hard-flowing solder, 20-carat solder may be used. If the backings were done with 20-carat solder, an easy-flowing 18-carat solder should be used. The soldering is best done with a gas blowpipe on a piece of charcoal with a concave depression. (See "Soldering," Part V, Chapter IV.) When the bridge is removed for finishing, the joints of the backings and crowns are finished with corundum-wheels and points and leather polishing-wheels on the engine, and the entire bridge finely polished with whiting or rouge carried by a brush-wheel on the lathe. Any little pits that may exist can be filled in with gold foil. The bridge is then ready for insertion (Fig. 367). If the constructive details have been properly performed as described, a finished piece of bridge-work is the result.

FIG. 367.

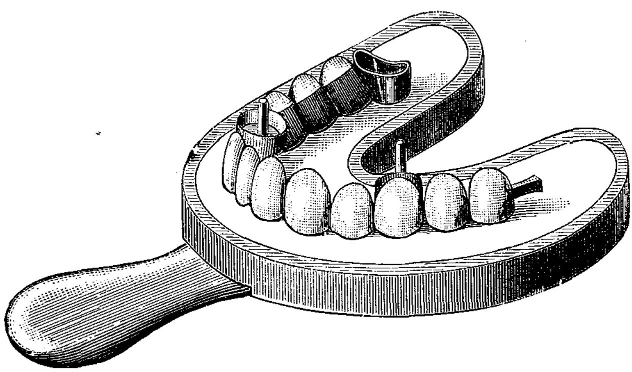


In constructing bridge-work most prefer, after the porcelain fronts are backed and the caps forming the occluding surfaces of the bicuspids and molars are properly adjusted on the model, to invest and do the entire soldering at once. When this plan is followed, pieces of gold wire or plate should be laid lengthwise in the slots under the gold caps of the porcelain fronts, all interstices packed with gold foil, and the parts filled in and all the sections of the bridge joined together in the soldering. By this method there is less liability of fracturing the porcelain fronts, but warping is more apt to occur, the soldering is more difficult to perform, especially for a novice, and the finishing of the bridge is not so easily done.

How to Avoid Warping.—In large pieces of work warping may be avoided, whichever method of soldering is adopted, by first removing the "dummies" from the model, in proper position, partially incased in plaster, investing and soldering those of each span together. The spans are then replaced in the matrix and soldered to the abutments.

Construction in Sections.—Another method much practiced and which gives good results is to construct the bridge in sections, adjust the sections in the mouth, and remove them in an impression-tray, using only sufficient investing material to cover the points of the teeth and crowns, as shown in Fig. 368. The bridge and the investing material are then removed from the impression-tray, and more investing material is added to complete the investment. The sections of the bridge to be united are then

FIG. 368.

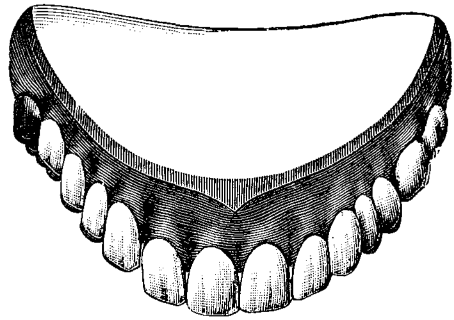


exposed and soldered together. To permit the investing material to be easily removed from the impression-tray, it is well to melt a film of wax on the interior surface, then cool and serrate the surface of the wax. The plaster will firmly adhere to the wax, but will loosen when the tray is heated. In the case just described, the right and left cuspids and molar sections could be made first, adjusted in position, the incisors then formed between them, and all soldered together; or, the front section, consisting of the cuspids and incisors, could be first made, and then the rear extensions to the molars added. The crowns or caps that constitute the piers should never be temporarily removed from the model for any purpose and again replaced to finish the construction, as not the slightest variation in their position is allowable.

Adjustment and Attachment.—The bridge when finished is adjusted in the mouth, every point carefully examined, and any alterations required are then made. Should the edges of the collars of any of the crowns catch, so as to prevent their being placed in position, a small quantity of articulating paste (a thin paste of rouge and oil) should be applied inside the cap or caps interfering, and the point found and trimmed off. If extensive warping has occurred in the soldering, the bridge must be sawed apart in one or two places, adjusted in the mouth, and removed in an impression-tray as shown in Fig. 368, then invested and united with solder in corrected position in the same manner as already described in "Construction in Sections."

When the adjustment of the bridge is accomplished, it can at first be temporarily inserted for a day or two, if desired, which permits it to settle accurately in position, and define surely any slight points in the occlusion which may seem to require alteration. Should there be evidence, after temporary use, of the need of changes, the removal of a little of the occluding surface of the cap at the required point, and of the antagonizing teeth, will generally be sufficient to correct it. If the bridge is warmed and paraffin, to which a little aristol has been added, is placed in the caps before inserting, the secretions will be better excluded and a septic odor prevented. Burnishing the collars will usually secure the bridge; if not, it can be cemented with a little gutta-percha placed in each cap, instead of the paraffin. For its permanent attachment the pins or posts of the crowns are barbed, and the teeth and roots to which crowns have been fitted are then treated the same as single crowns, and the bridge cemented on with oxyphosphate or gutta-percha cement. The end of the bar is anchored in the slot by either a gold or an amalgam filling. (See chapter on "Bar Bridges.") Fig. 369 represents the bridge in position.

FIG. 369.



The Construction of Small Pieces of Bridge-Work is much simplified by the following method: Crowns are first made for the teeth or roots that form the abutments and temporarily placed in position. The teeth—"dummies"—which form the span, having been ground and backed, with or without the aid of a model, are adjusted and attached with wax cement in proper position between the crowns. The crowns and dummies are then removed together, in an impression-tray filled with investing material. The inside of the tray should be previously oiled or coated with a film of wax and the surface serrated. The

FIG. 370.

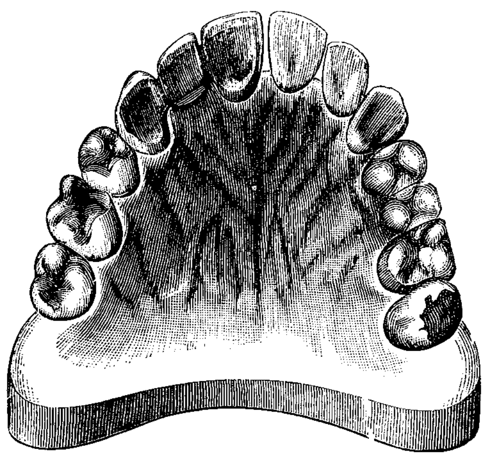
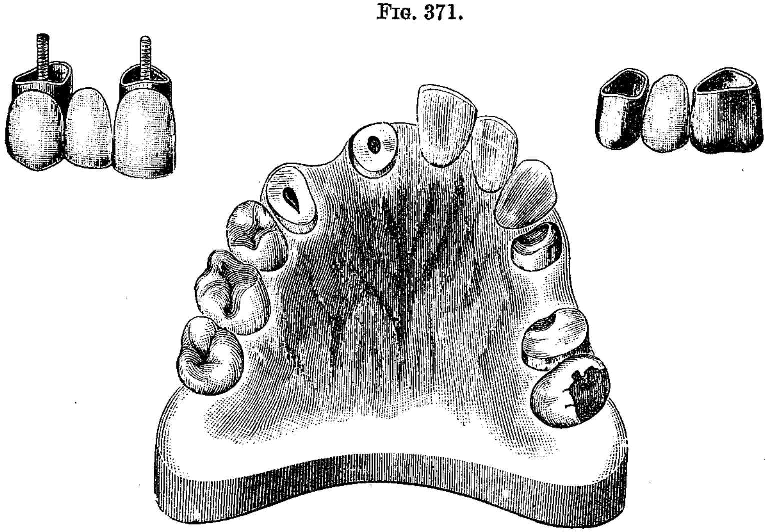


FIG. 371.



impression-tray is then heated, and the investment with the crowns and dummies removed; more investing material is then mixed, and the exposed parts of the crowns and teeth covered. The investment, when set, is then cut away sufficiently to expose the parts that are to be filled in and united together in the soldering process. Figs. 370 and 371 represent cases of bridge-work constructed in this manner. Part or parts of a large bridge being constructed in sections may be similarly formed and then united.

In an extension bridge of two teeth, often a preferable method is to properly adjust crown and dummy tooth cemented with wax in the mouth, carefully remove them in position, then invest and solder together.

CHAPTER II.

Special Processes and Appliances in Bridge-Work.

SHOULDERS ON THE ANTERIOR CROWNS OR ARTIFICIAL TEETH—SOLID PORCELAIN DUMMIES WITH GOLD BASE—DIATORIC TOOTH DUMMIES —SOLID GOLD DUMMIES—A BAR ANCHORAGE SLOT IN A SOLID GOLD CROWN—ALL-GOLD HOLLOW DUMMIES—CONNECTING BANDS OR BARS FOR BRIDGES—INTERVENING ROOTS—SHELL CROWN OR ANCHORAGE—SEAMLESS SHELL CROWN—CEMENTATION OF SHELL CROWNS—SPECIAL FORMS OF SHELL PIN CROWNS—THE CARMICHAEL CROWN—THE STAPLE CROWN.

Shoulders on Anterior Crowns or Artificial Teeth are sometimes desirable, especially on the superior cuspids at the point of occlusion with the lower teeth. A shoulder can be made by melting gold plate into the form of a small ball or globule, then flattening it out and soldering it against the backing.

Another method in the case of a crown is, in the formation of the collar, to extend it toward the occluding teeth, as shown in Fig. 372, and then protect the incisal or occluding porcelain with a strip of metal applied, as illustrated in the case of a "dummy" tooth in Fig. 373, which is to be reinforced and additionally filled in with solder to the dotted line A, by specially investing or in the soldering of the bridge. The strip of gold should be extended a little beyond both sides of the backing or over the incisal edge of the porcelain to retain it in position in the investment.

FIG. 372.

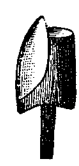


FIG. 373.

Solid Porcelain Dummies with Gold Base.—In some cases of bridge-work on the lower jaw, protection of the incisal edges and occluding surfaces of dummies with gold renders them noticeable to an extent which is very objectionable to many patients. This can be remedied in bicuspids by forming the occluding surface and the exposed portion of the labial face of porcelain in the following manner: Select a suitable sized ordinary bicuspid designed for vulcanite, and level out the headed portion of the pins by squeezing with pliers. Cut a strip of pure gold about No. 34 gage, of a size to encircle the tooth, and give an excess in length and width of about one-eighth of an inch. Trim the strip to the shape seen at Fig. 374, and punch a hole, A, in one of the corners. Slip this over the left-hand pin A, Fig. 375, wrap the gold tightly around the porcelain, and bring it over, as shown by the dotted line, on to the right-hand pin marked B. Mark the location of the pin and punch a hole, put the pin through the hole, and bring the gold down on the porcelain. Outline

FIG. 374.

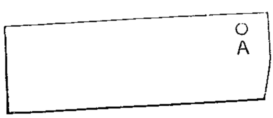
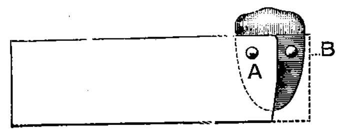


FIG. 375.



on the gold enough to expose the porcelain as shown in Fig. 376. Remove the gold and cut out the portion marked. Replace the gold on the tooth, pinch in around the base of the porcelain, and cut off the excess of length, also the excess at the overlap on a diagonal line so as to make an even joint. Bend the pins, invest, and flow solder over pins and seam. When completed you will have a dummy of the form exhibited in Fig. 376, which can be placed in position and attached with solder. Saddle-back teeth instead of plain teeth for vulcanite work may be used in this method.

FIG. 376.

Diatoric Tooth Dummies.—Dr. R. M. Sanger has devised a method of using diatoric bicuspids and molars set in a gold base or socket, which form a dummy of considerable merit, both as to appearance and practicability.

To explain the construction of a diatoric tooth dummy a bicuspid will be used as a typical case.

FIG. 377.

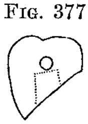


Fig. 377 outlines the plan of the structure of a diatoric porcelain tooth.

The tooth is selected to fit the case with as little grinding as possible. (The form in which they are made permits the cervico-buccal edge to rest on the gum with little or no grinding.)

A piece of pure gold plate of about No. 32 gage is cut of a size sufficient to cover the base of the tooth and project over the edge about one-sixteenth of an inch. This is laid on the base of the tooth and pressed and burnished to fit as nearly as possible. A metal ring (Fig. 378, A), small enough to fit in a crown swager, is filled with modeling compound and the occluding surface of the diatoric tooth is pressed into the compound, as shown in Fig. 378, B. The compound is chilled, the partly fitted piece of gold plate is placed in position on the tooth, and the whole is placed in a swager (page 119) and covered with corn meal. The plunger is then inserted and the gold swaged to fit the base of the tooth accurately. On removal, the margins of the gold are trimmed to extend slightly beyond the edge of the base, as shown in Figs. 379 and 380. The gold is then burnished around the edge close to the porcelain and well down into the hole in the center. It will probably be perforated when being burnished into the central hole; the burnishing should be continued, however, until the metal closely fits the edges, and then the depression is partly filled with gold foil. Next remove the gold socket from the tooth and fill up the remainder of the central depression with 20-carat solder until it is flush. This gives a gold socket and pin which firmly hold the diatoric tooth and take the place of an ordinary gold backing.

FIG. 378.

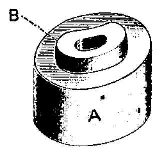


FIG. 379.

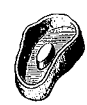


FIG. 380.

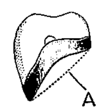
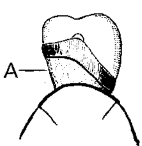


Fig. 379 shows the socket and Fig. 380 the socket in position on the diatoric tooth. When the teeth and sockets are set up in position on the model in the construction of the bridge, the sockets are waxed to each other on the lingual side and to the piers. The whole can then be removed from the model, correctly adjusted in the mouth, and the teeth occluded to correct any error in the occlusion of the diatoric teeth. The diatoric teeth are then removed from the sockets, and afterward the piers and sockets from the mouth in an impression of investing material. With the addition of more investing material to protect and cover the piers, the work is put in form for soldering. The approximal surfaces of the sockets are joined, and for additional strength a piece of No. 26 gage gold plate is laid across the lingual aspect from pier to pier, and the whole uniformly overflowed with solder to the dotted line A, Fig. 380, so as to give form to the part. When the construction of the bridge is to be conducted on the model, the diatoric teeth are removed from the sockets, the sockets and piers covered with investing material, the lingual side of the work exposed, and the parts soldered.

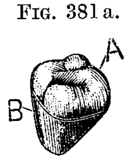
If the base of the bridge is to be made to rest firmly on the gum with a saddle, the shape and size of the saddle are marked on the plaster model, the model is slightly scraped to insure a tight fit, and thin platinum is burnished or swaged to fit the model. This saddle should not extend beyond the line where the cervico-labial edge of the tooth will rest, but on the lingual side it should extend sufficiently far to be retained in position by the investing material. After removing the wax cement, the triangular-shaped space between the dummies and the platinum is packed with foil and solder, and with the blowpipe flowed to a homogeneous mass filling the entire space flush to the lingual surface, as in Fig. 381, A. To prevent possible injury to the fine edges of the sockets, the polishing should be done with the porcelain teeth in position, but to avoid soiling the joints the teeth should not be permanently cemented in the sockets until the polishing is completed. The teeth may be permanently fastened in the sockets with oxyphosphate, sulfur, or gutta-percha cement. They are replaceable in case of fracture without removing the bridge.

FIG. 381.



Solid Gold Dummies.—In a close occlusion, when the patient prefers strength to appearance, the bicuspids and molars may be made of solid gold. They are constructed by stamping up the cap (A, Fig. 381 a) representing the grinding-surface (see page 107), adjusting and cementing to this with wax a piece of plate cut and shaped to form the front and sides (B), the whole being then invested and filled in with gold solder and scraps of gold plate, or, if pure gold and platinum have been used in the sections of the crown, with 18- or 20-carat plate.

FIG. 381 a.



Seamless contour crowns can be used for the purpose as follows: The proper crown having been selected, the gold is trimmed and the crown adjusted in position on the model. A matrix of plaster is then placed on the labial side, to hold it in position and permit exposure of the palatal portion. The crown is then removed, and cut away to the form required on the palatal or lingual side. It is next invested and filled in with scraps of gold plate and solder.

A bar bridge can be made with these seamless crowns by passing a platinum wire through the crowns before filling in (Fig. 382).

A Bar-Anchorage Slot in a Solid Gold Crown, to support the end of a bar as shown in Fig. 383, is constructed as follows: The natural crown is ground down, and the neck shaped, banded, capped, and pivoted as in Fig. 384. The gold or platinum forming the top of the cap on the root is made perfectly flat and left

FIG. 382.

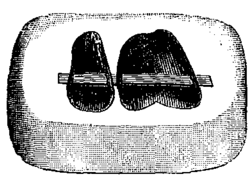
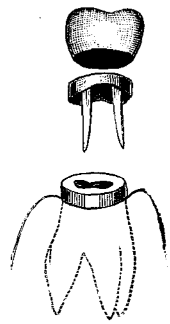


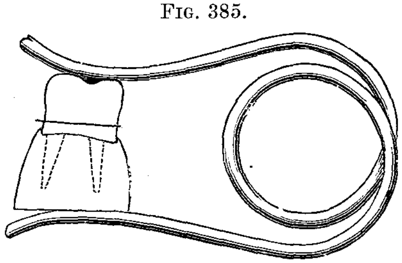
FIG. 383.

FIG. 384.



projecting a little at the sides. A contoured crown of pure gold, or gold lined with platinum as a precaution against melting, is shortened sufficiently to represent the absent coronal section of the tooth. In the side of the gold crown a slot is cut large enough to form the anchorage cavity the bar is to rest in. A shell of thin platinum of the size and shape of the anchorage cavity is then inserted

FIG. 385.

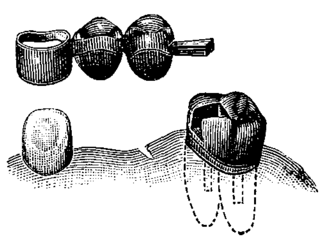


in the slot and cemented with wax on the inside of the crown. The crown is then invested and filled in with scrap plate and 18-carat gold solder, which should be cut into small pieces, and be placed successively in the crown and melted by maintaining a uniform heat with the large flame of a blowpipe. The base of the crown is next ground level and accurately fitted to the cap so that the occluding surface shall properly articulate with the antagonizing teeth. It is then clamped to the cap in position, the posts having first been protected with investing material (Fig. 385), and soldered, making a perfect joint. This is an easy method of constructing an otherwise difficult form of crown.

Fig. 386 illustrates from the palatal side a bridge of two solid gold bicuspid dummies supported by a bar-anchorage in a solid gold crown on the roots of a molar, and a shell crown on a cuspid.

All-Gold Hollow Dummies are recommended in a large proportion of cases in preference to solid ones, especially for the upper jaw. They are formed as follows: Take a gold seam-

FIG. 386.



less contour crown of suitable size, with a thick grinding-surface, or one which has been reinforced with solder or gold plate and from which the flux is removed. Cut away the gold forming the palatal section of the collar to the form termed self-cleansing; or shape the neck of the crown to the exact contour of the portion of the gum the dummy is to rest on. Melt a small quantity of solder with flux to a ball form. Fit a piece of platinum plate, about No. 32 gage, over the open end, and place the ball of solder on the platinum within the gold cap. (See Fig. 387.) Hold cap and platinum in a Bunsen flame, and heat slowly until the solder melts and appears under the edge of the cap; then instantly remove from the flame, trim the platinum, and stone the edges. This gives a hermetically inclosed dummy tooth of gold, from the interior of which the air has been exhausted by the heat. The dummy can then be placed in its position on the bridge and soldered in the usual manner. If the base of the dummy is to rest on the gum, a little of the plaster should be scraped away, sufficient to make some allowance for the thickness of the platinum forming the base, and cause pressure and insure closeness of fit. Fig. 388 gives the palatal aspect of a bridge, the dummies of which were constructed in the manner described. The bicuspid dummy is given a self-cleansing form, and the molar is shaped to rest on the gum.

FIG. 387.

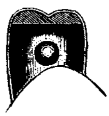
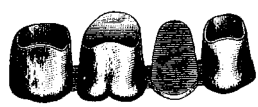


FIG. 388.



The use of hollow gold dummies is a saving of time and expense to the operator; being of light weight, in many cases they are preferable to solid ones. For the lower jaw they can be shaped advantageously to the form shown in Fig. 389, thus overcoming the annoyance of the so-termed self-cleansing spaces. The collar section of the crown is slit on the sides A, shaped and bent inward toward the neck at the buccal as well as lingual sides, and the neck trimmed at the edges to fit the shape of the alveolar ridge and the slits soldered. The opening is then closed with platinum, as shown in Fig. 387.

FIG. 389.

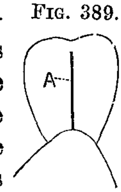
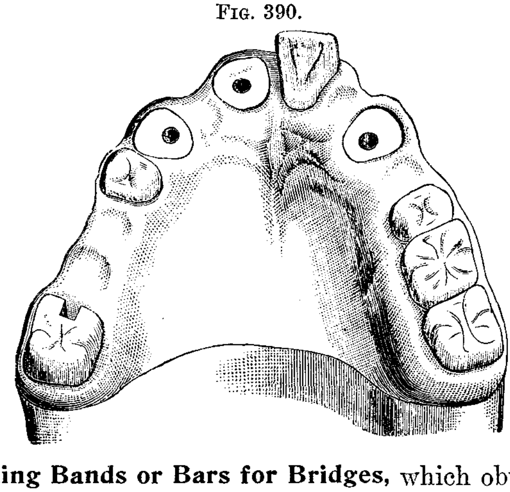


FIG. 390.



Connecting Bands or Bars for Bridges, which obviate the removal of crowns of intervening natural teeth between the sections of a projected bridge, are formed by passing a heavy band of round or oval-shaped gold or iridio-platinum wire around the intervening teeth, close to but not touching them, and pressing slightly into

FIG. 391.

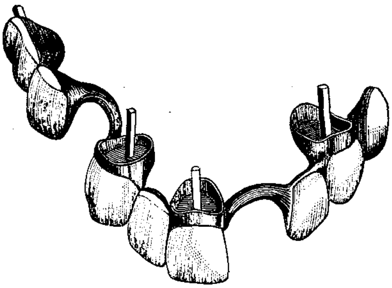
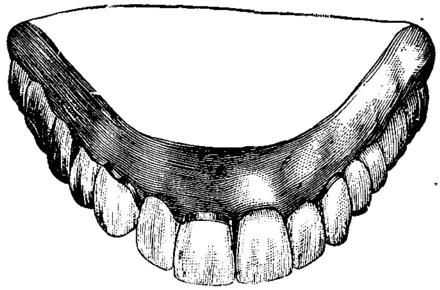
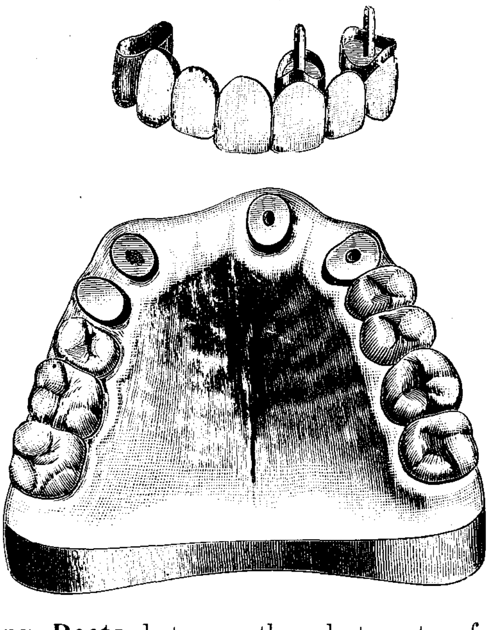


FIG. 392.



the gum so as not to present too pronounced an interference to the tongue. This is accomplished by slightly indenting the bar in the surface of the model before soldering. (See Figs. 390, 391, and 392.)

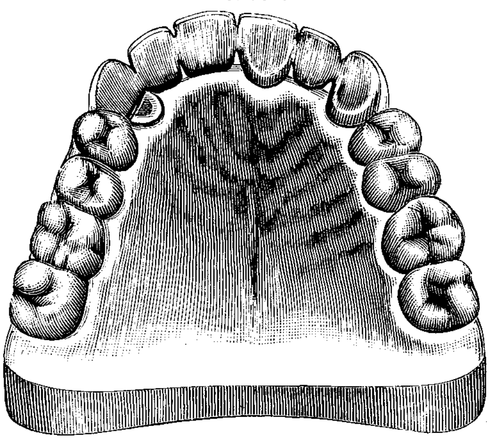
FIG. 393.



Intervening Roots between the abutments of a projected bridge should not be extracted, but whenever practicable they should be treated, filled, and trimmed level with the gum, as they can usually be made to afford some support for the bridge, which may rest upon them. Figs. 393 and 394 represent a case in which the root of the cuspid on the right side has been so treated and utilized.

Shell Crown.—A shell crown or anchorage for a cuspid to support bridge-work, if the conditions will permit, is preferably used instead of a gold collar crown with porcelain front, where the insertion of such a form of crown involves the excision of a natural crown with a living pulp. A convenient method of construction is the following: Shape the natural crown parallel on

FIG. 394.



the sides, and, if necessary, remove a little of the bulge at the labio-cervical section. Construct and adapt to the cervix, and slightly under the gum-margin of the natural crown, a gold collar wide enough to extend a little beyond the incisal edge. Remove a portion of the gold from the incisal labial section, and slit the palatal surface on both sides of its center, as represented in Figs. 395 and 396. The part at A is bent back, and the parts at B B beveled, bent in on the crown, and burnished close to its surface. The piece A is next brought down in position, and adapted to the crown and over the parts B B.

FIG. 395.

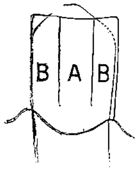
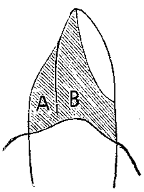


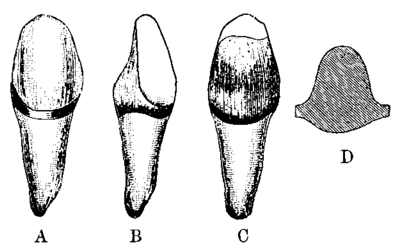
FIG. 396.



The collar has now assumed the form of a gold crown having an open face and seams. The seams are next united by flowing solder into each of them, a little at a time, by holding the crown with tweezers in a Bunsen gas flame. The seams will hold and retain solder sufficient to join and fill them without its flowing over the adjacent parts, unless there is an excess of heat or solder. When the soldering is completed, the crown is adjusted, a line showing the exact portion of the labial aspect to be exposed marked on the gold, the crown removed, its edges trimmed to the mark, and the soldered parts smoothed with corundum-wheels and points on the engine.

Another method for the construction of a shell crown preferably practiced by some is: Fit a gold collar around the natural crown, and remove the gold at the labial aspect, as shown at A, Fig. 397. In the vacancy between the collar and tooth at the

FIG. 397.



palatal side, fit and burnish a piece of pure gold, or, in the case of a very close bite, thin platinum plate, which will cover the exposed surface of the tooth at that part, and fill in the space between the collar and piece of plate with wax cement. D, Fig. 397, shows the form generally of the piece of plate before it is fitted in the collar. Remove the collar, invest, and flow solder into the space between the piece of plate and collar, and remove the surplus gold of the collar extending above the crown; B and C show the finished shell crown.

A Seamless Shell Crown is formed as follows: From an impression of a natural crown taken in plaster, or moldine, a die of fusible metal is formed, and from it a counter-die in lead is made. (See chapter on "Gold Seamless Cap-Crown.") On the die a crown is shaped, burnished, and then stamped from a seamless cap of gold (Fig. 398). This crown is then fitted on the natural tooth, the labial aspect of which is exposed by the removal of the section of gold covering it in either of the forms shown in Fig. 399. A shell crown for a cuspid may be made for some cases from a gold collar by shaping the collar on a die of the tooth, the same as a gold cap. The shell formed in whatever manner is then filled with investing material, and strengthened by flowing 20-carat solder over the surface.

FIG. 398.

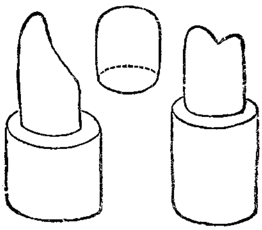
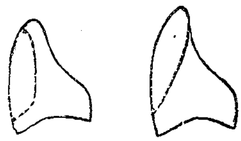


FIG. 399.



For cuspids this process has decided advantages in the easy formation of a perfect-fitting crown or shell for bridge-work.

Fig. 400 shows the forms usually given shell crowns for bicuspids. When the gold is removed at the labio-cervical part, the

FIG. 400.

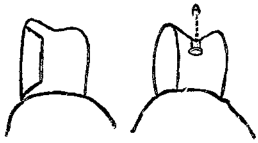
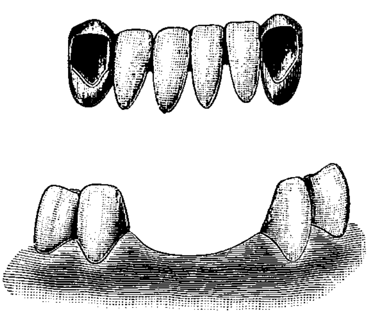


FIG. 401.



crown should be additionally secured by a pin introduced and soldered at the point A.

Fig. 401 illustrates a bridge in which the lower incisors are supported by shell crowns on the cuspids.

In cases where this form of crown is expected to sustain a great strain, the gold at the cervico-labial section should be reinforced by the addition of a strip soldered across it and extending around on the sides, as shown in Fig. 402. The edge of the strip should be beveled off even with the surface of the rest of the gold.

Fig. 403 represents the restoration of the inferior bicuspids and

FIG. 402.

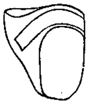
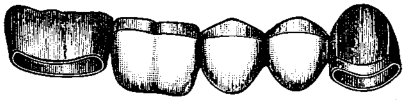


FIG. 403.



molar on the right side, by a bridge with a shell crown on the cuspid and an all-gold crown on the second molar as abutments.

The Cementation of Shell Crowns.—To secure a better adhesion of the cement in the cementation of such caps, the surface of the enamel should be cleaned with pulverized pumice wet with aromatic sulfuric acid. The tooth is then washed and dried perfectly. The cement should be thoroughly mixed to the consistence of a thick cream, the inside of the band covered with it, and then the surface of the tooth and the bridge brought to position. When the strip of gold which traverses the cervico-labial section

FIG. 404.

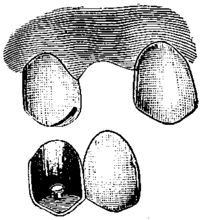
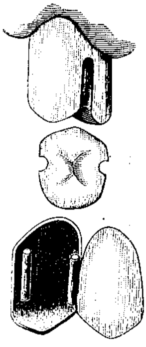


FIG. 405.

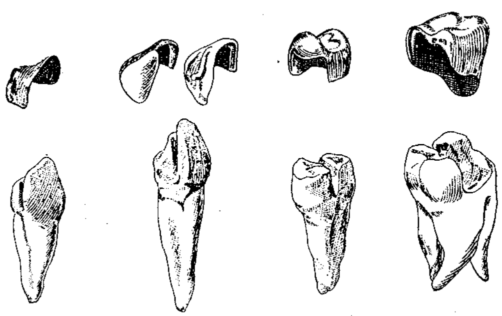


is made narrow, the washing out, in time, of the cement at that part, especially when oxyphosphate is used, is one of the difficulties connected with the use of this form of crown.

Fig. 404 shows a pin shell crown that covers all but the labial face of the tooth, which can be made to support a porcelain front representing a cuspid or bicuspid. By forming two grooves, respectively in the mesial and distal sides of the natural tooth, for the reception of platinum pins passing through the grinding-surface of the cap and fastened with a little solder on the outside, much more security of attachment is obtained with a partial cap, and without the least exposure of gold. (See Fig. 405.) In a favorable case a central or cuspid cap may be formed on this plan to support a lateral. A third pin placed at the palatal side toward the cervix will tend to additionally secure the cap.

In most cases where shell crowns are used on the upper jaw, the gold forming the distal side of the cap can be brought around slightly on the labial surface of the tooth without being observable when viewed from the front; but it must be cut short at the mesial side and not be allowed to extend beyond the line of the porcelain front placed alongside of it. On the lower jaw the band of gold which extends across the labial aspect need only be removed

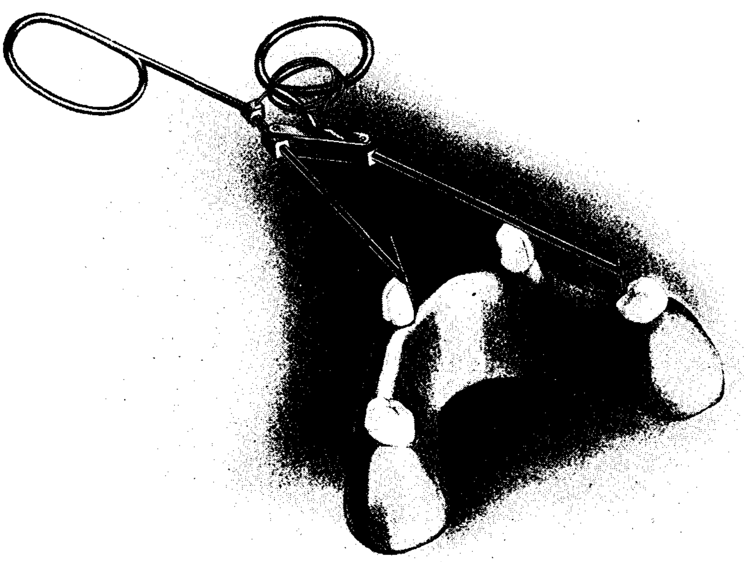
FIG. 406.



enough to avoid exposure in speaking. On the lower jaw much more gold can be left at the cervico-labial section than on the upper, as only enough need be removed at the incisal edge to avoid exposure of the metal.

The Carmichael Crown consists of a gold cap which covers a little more than half of the natural crown standing toward the palatal or lingual side, and is retained by a groove which runs across the incisal or occlusal surface and along the sides. The tooth is prepared as follows: Trim parallel from the palatal to the center of the mesial and distal sides the surfaces of each tooth to be capped. Sufficient of the tooth should be cut away to give a form to the section to be covered which will accommodate the thickness of the metal and permit the caps to be drawn on and off without spreading at the margins. Enough of the occlusal surfaces is also to be removed to allow for the thickness of the gold which will cover that part. With a thin disk cut a groove directly across the incisal or occlusal surface. In the case of an incisor or cuspid the cut is made near the front plate of enamel, but not so close as to weaken it; in a bicuspid, across between the cusps a little toward the outer cusp; in molars, across the center. With a short enamel fissure-bur, cut two side grooves on the lateral surfaces, connecting with the groove across the crown, and extending to the line of the gum-margin. (See Fig. 406.)

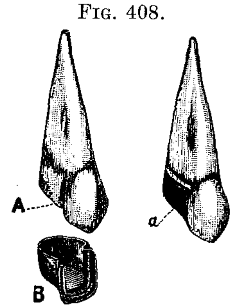
FIG. 407.



The grooves form the mechanical retention. They should be moderately deep, in shape the full half of a circle, be uniform in size, and parallel to each other. Fig. 407 represents Dr. Carmichael's device for gaging the lines of the grooves and sides of the teeth that are capped.

To form the cap, take an impression of the prepared tooth and make a fusible-metal die. On this die shape a cap of pure gold, No. 37 gage, by adapting, folding the meeting edges, and burnishing down the metal. For bicuspids and molars lay the strip across the occlusal surface, bend the ends down on the mesial and distal sides, and then crimp the gold together closely at the palatal side. Next give the flaps two flat folds to hold them together and leave the fold projecting from the tooth. In soldering, this projecting fold is utilized to hold the cap. In incisors and cuspids bring the end of the strip over the incisal edge and crimp the gold at the mesial and distal corners of the incisal edge. Bind the cap upon the die, and also when fitted on the natural tooth, with floss silk to prevent it from springing away while burnishing. Burnish the gold in the grooves first on the die, then on the tooth, and flow in solder by degrees. After each soldering fit the cap on the tooth in the mouth to assure accuracy. Should any breaks occur in burnishing the gold in the grooves, pack in gold foil. When the grooves are soldered, stiffen the whole surface of the cap with small, thin pieces of clasp-gold, No. 34 gage, laid on in succession a few at a time, and attached with solder. The soldering is best done on a charcoal block. A little dampened marble-dust or investing material may be placed inside the cap to prevent invasion of solder. Trim and finish the surface of the cap. Fig. 406 shows teeth prepared ready to receive the caps. Fig. 408, a cap off and in position. Figs. 409 and 410, a case of bridge-work constructed with these caps.

FIG. 408.



A, Groove in tooth.
B, Cap.
a, Cap in position.

The Staple Crown.[1]—The staple crown is similar in principle to the Carmichael, differing only in the use of a platinum wire to fit the groove in the tooth for the retention of the crown instead of a projection of the plate, as shown in Fig. 414. The preparation of the natural crown is much the same for either. For the staple crown the groove requires to be made very uniform in size, so that the wire shall fit it evenly. The gold cap is adjusted over the wire and burnished on each side of it so as to set the wire in a slight depression of the plate and permit it to be removed in position with the cap. The wire is next attached to the cap with minute pieces of solder, which are placed along the wire on the inside of the cap, one piece at a time. The soldering can be done

[1] Dr. F. L. Marshall, Boston.

in a Bunsen flame. Only barely enough solder should be used to attach the wire so as to avoid obstruction to the adjustment of the crown.

Another method for the construction of this style of crown is to attach the staple to the piece of plate before adapting the plate to the tooth, as follows: Cut the ends of the staple of the proper

FIG. 409.

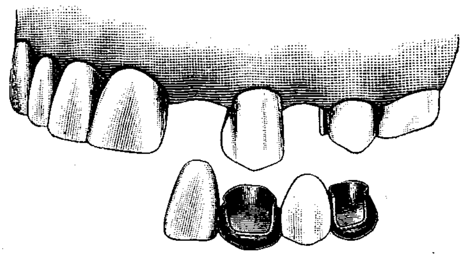
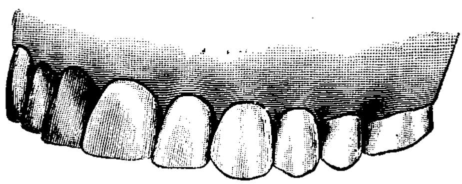


FIG. 410.



length to fit the grooves, having the cross-bar flush with the palatal portion of the tooth. (See Fig. 411.) Take a thin piece of pure gold from No. 30 to 35 gage, and large enough to fully cover the back of the tooth. Grasp the staple in a pair of pliers, hold in contact with the piece of pure gold at about the angle illustrated in Fig. 412, and solder with 22-carat solder at the point of contact. Bend the gold loosely around the sides of the staple and trim the cervical portion. Place the staple in the groove and at first adapt it either on the mesial or distal side of the tooth, and burnish the gold against the surface and the staple. (See Fig. 413.) Remove and solder. Replace the crown, burnish the gold closely to the palatal and other side of tooth and staple, and remove and solder. Again replace and burnish all around the free edges and trim off the surplus. Remove, invest, and stiffen up the whole surface of the crown with small pieces of plate and solder as before described in the Carmichael crown. Fig. 414

represents the finished crown. In the construction of bicuspid and molar crowns, the collar section is formed of a strip of gold plate as follows: Cut a band of gold the same as for a full crown, but shorter. Solder one side of the staple at about one-sixteenth of an inch from one end of this band. Place the staple on the tooth, draw the gold around the tooth to the opposite side, burnish tightly to the neck and against the staple, and remove and solder. Strike up a piece of plate to the form of the cusps, fit to the top of the band, and solder the cap at its point of contact with the

FIG. 411.

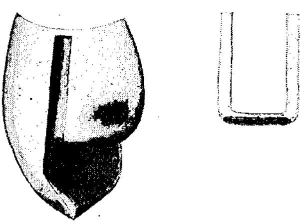


FIG. 412.

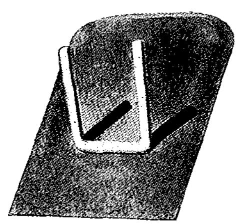


FIG. 413.

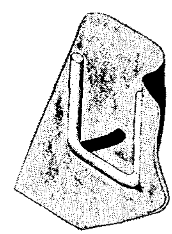


FIG. 414.

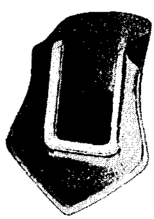


FIG. 415.

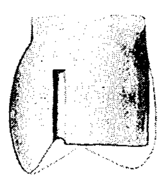
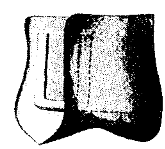


FIG. 416.



staple. Adjust on tooth, and have the patient bite firmly to adjust to occlusion. Burnish the edge of the cap to the outer cusp of the tooth and also to the band. Remove, and solder the edges of the cap to the band.

To stiffen up the crown, boil in acid, fill the inside with investing material and flow solder over the surface, or use clasp-plate and solder as directed for the Carmichael crown. Fig. 415 shows the prepared tooth, and Fig. 416 the finished bicuspid crown.

The method of forming the Carmichael crown of one piece of metal may be applied in the construction of the staple crown.

CHAPTER III.

Extension Bridges.

PRINCIPLES GOVERNING—CONSTRUCTION—SPUR SUPPORT—A SPUR ANCHOR.

This term "extension" is applied to bridges chiefly supported by one abutment. In relation to the anterior teeth, it means attaching a dummy to an artificial crown, to replace an adjoining absent tooth. A bridge of this style replacing two or three of the posterior teeth is formed by using two of the teeth anterior to it as one abutment, with a saddle for the other. A saddle is an oval-shaped piece of gold, or platinum plate, of the form of the gum and a little larger than the base of the tooth, placed under the posterior tooth of the bridge.

In extension bridge-work, the portion which constitutes the bridge exerts on the abutments, in resisting the force of occlusion, an action like that of a lever. The ratio of the force exerted is proportioned to the length of the bridge or lever from the abutment or fulcrum. This principle must receive consideration in the employment of this form of bridge. A flange or spur support, if attainable, should, as a rule, be applied. More than one tooth should not be extended from an abutment without ample alveolar support besides. When two approximal crowns support an extension bridge tooth or dummy, the force is counterbalanced by the resistance of the farthest anchorage crown from the bridge, the pressure on which is in a direct line from the socket, the approximal crown acting as a fulcrum, the force on which is upward in the line of the root. The occluding surfaces of the bridge tooth should not be extended from an abutment without ample to offer less occluding surface to the antagonizing teeth, which should barely touch.

Construction.—Figs. 417 and 418 represent an extension bridge. A crown on the cuspid, an all-gold crown on the first bicuspid, and a saddle, are the abutments. In constructing this bridge, the crowns to form the abutments were first constructed and united with solder. The crowns were then adjusted in position, and an impression and articulation taken in plaster, in which the crowns were removed. From this impression a model was made of plaster and marble-dust, and an articulation in plain plaster. With the crowns in position on the model as in the mouth, the bridge was then constructed by the methods described on page 191. The part of the model on which the saddle rested was marked, and enough of the surface of the plaster removed to cause the saddle to press tightly against the soft

FIG. 417.

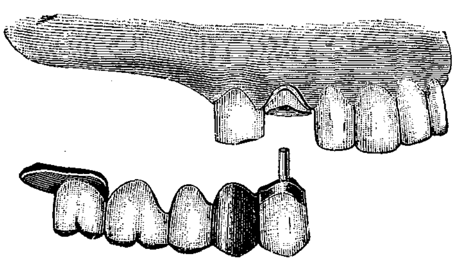


FIG. 419.

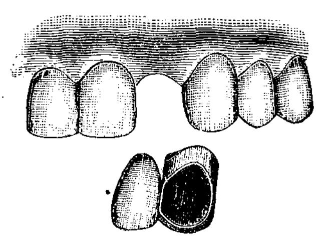


FIG. 418.

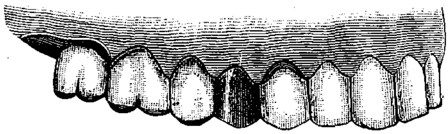
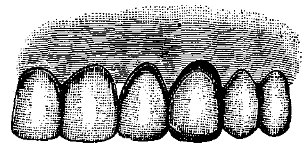


FIG. 420.



tissue when the bridge should be completed and inserted in the mouth. This can also be more accurately accomplished by marking the space the saddle is to occupy on the surface of the impression, and fitting thereto a disk of thin sheet lead of from No. 22 to 30 gage as the hardness of the membranes suggests. The space occupied by the lead will cause a proportionate depression on the model when made. As the edges of the saddle should press more forcibly against the tissues than the central portion, it is well to slightly scrape the plaster at the margins. A bridge of this character should be temporarily inserted and worn for two or three days to allow the saddle to depress the tissues and permit the bridge to settle into its proper position before permanently cementing it. In the cementation of the bridge care should be taken that no particles of oxyphosphate remain under the saddle.

All-gold crowns which are to sustain the strain of an extension bridge should be stiffened with solder so as to possess great rigidity. If this precaution is not taken, the constant springing motion of the extension bridge will, in some cases, gradually bend the gold of the side of the gold crown away from the surface of the natural tooth, and cause leakage by disintegration of the cement.

A shell crown on a cuspid can be used as an abutment in this style of bridge to support a lateral in many cases, instead of excising the natural crown and mounting an artificial crown on the root for the purpose (Figs. 419 and 420).

Figs. 421 and 422, 423 and 424, represent small extension

FIG. 421.

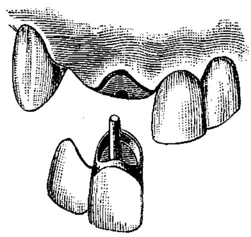


FIG. 423.

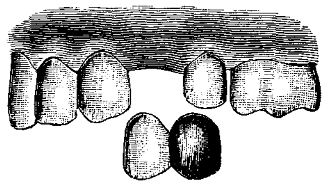


FIG. 422.

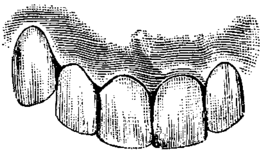
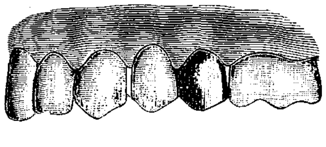


FIG. 424.



bridges of frequent construction, the former for the anterior portion of the mouth, the latter to replace posterior teeth.

Dr. T. Fillebrown's method of constructing a bicuspid or molar all-gold crown when the sides of the natural tooth have not, for some reason, been reduced in dimensions to those of the cervix, is to first form and fit a full-sized collar of thin pure gold, then adapt and solder over it a second and narrower collar of thin 22-carat gold plate, extending only from the occluding surface about half the distance to the gum-margin. The cap for the occluding surface is then added in the usual manner. When the finished crown is cemented in position, and while the cement is yet quite soft, a burnisher is passed around the neck of the crown, and the pure gold forming that part, as represented by A, Fig. 425, is brought close against the neck of the natural tooth. This method of forming a gold crown may be advantageously practiced in some of these cases of bridge-work.

Figs. 426, 427, and 428 represent an extension bridge. The anterior abutment consists of the six front teeth, which were all

FIG. 425.

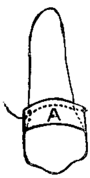


FIG. 426.

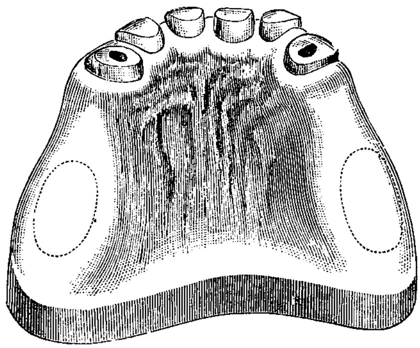


FIG. 427.

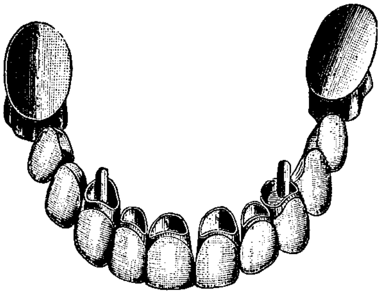
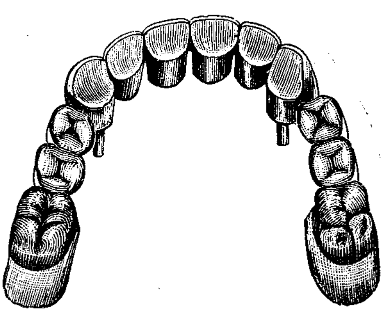


FIG. 428.



crowned and joined together, the pulps being preserved in the incisors. A saddle on each side forms the posterior abutments. In cases similar to this, when the dummies are extended to such an extreme distance posterior to the abutments, if antagonizing molars are present, a mere saddle is insufficient to equalize the strain, especially as absorption goes on to some extent under the saddle. An extension of not over two teeth, consisting of one bicuspid and a molar on each side, resting on a plate or saddle extending from the cuspids back beyond the bridge teeth or dummies, is suggested instead.

A Spur Support consists of a flange formed at the end of an extension bridge, affording support by resting against the palatal wall of an incisor or a cuspid, or in the sulcus between the cusps of a bicuspid or molar, as shown in Fig. 429. Fig. 430 illustrates

FIG. 429.

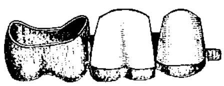


FIG. 430.

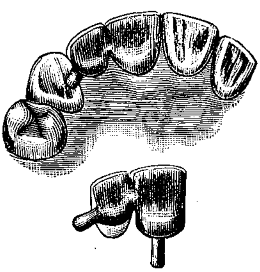


FIG. 431.

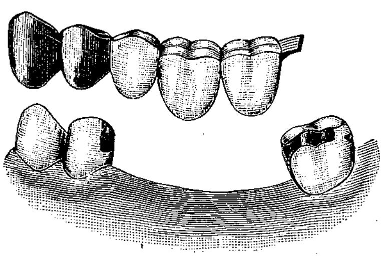
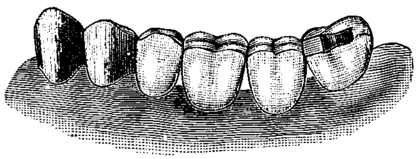


FIG. 432.

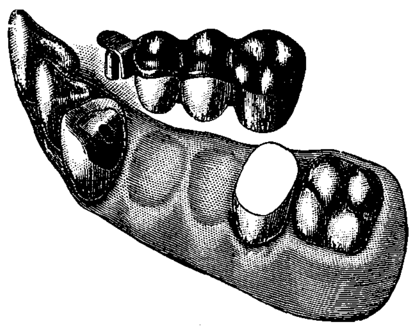


a case with a spur resting against a cuspid. In the case represented in Figs. 431 and 432 the spur rests in an indentation in an amalgam filling in the molar. This form is termed a cantilever bridge.

A spur support is best formed as follows: When the dummies are mounted on the model ready for investment, adapt on the model of the tooth where the spur is to rest a piece of very thin platinum. Place on the surface of the platinum, when adjusted, a still narrower piece of gold plate. Wax them in position and invest. The ends of the platinum and plate should be left extending farther across the tooth than will be required for the spur, to furnish a means of retaining the metal in position in the investment during soldering. The wax should cover only the portion of the spur to be soldered.

A Spur Anchor.—A spur anchor consists in the addition to a spur of a pin which anchors but is not cemented in a filling placed in the side of a supporting tooth. An amalgam or gold filling is inserted in a deep cavity formed in the side of a tooth, as illustrated in Fig. 433, which represents a typical case. A hole is drilled in the center of the filling about one-sixteenth of an inch in depth, large enough to loosely receive a platinum or gold pin of about No. 16 gage. A disk of platinum, large enough to cover the filling, is adapted to its surface and perforated over the orifice of the hole. The end of the pin is cemented in position with wax, invested, and first connected to the disk with a small quantity of solder. Disk and pin are next placed in position in the mouth and the disk burnished to the surface of the filling. The disk is removed and trimmed so that it shall be a line smaller than the surface of the filling and so that its edges shall not rest on or touch the enamel of the tooth at any point.

FIG. 433.



The bridge is then constructed in the usual manner. The crown for the posterior tooth and the disk are placed in position, an impression taken, and a model made in which the crown and disk appear in position. In the further construction the disk is reinforced with solder and becomes part of the bridge.[1]

Another method is to form a plain spur in the manner first described, then insert the bridge in the mouth, drill a hole in the spur, fit and cement in the pin, remove, invest, and solder.

[1] Dr. S. S. Stowell's method.

CHAPTER IV.

Bar Bridges.

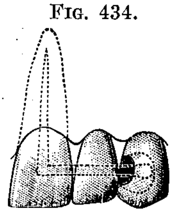
INCISORS AND CUSPIDS—ANCHORING THE BAR—BICUSPIDS AND MOLARS—AN EXTENSION BAR BRIDGE—GOLD INLAY ANCHORAGE BAR.

This style of bridge receives its name from the fact that the teeth or dummies forming it are supported by bars anchored in the natural teeth on either side by means of fillings. Failure to appreciate its limitations, and faulty construction are responsible for disappointments in its use which have militated against its more common application.

In the first place, its successful employment is confined to the insertion of one, or, at most, two teeth. An attempt to support more than two teeth by this method will most certainly result in failure.

The most glaring fault of construction is insufficient anchorage for the bars. If the anchorage tooth is alive, the bar should extend in a suitably shaped cavity two-thirds or three-fourths the width of its palatal or occluding surface, according as it is an incisor or a cuspid, or a bicuspid or molar, and be thoroughly secured by the filling-material. Thus anchored, the bar is capable of supporting the bridge and resisting the leverage exerted on it in occlusion and mastication, which it cannot reliably do when simply anchored in a shallow filling inserted in the side of a tooth,—an incorrect method too often practiced.

Fig. 434.



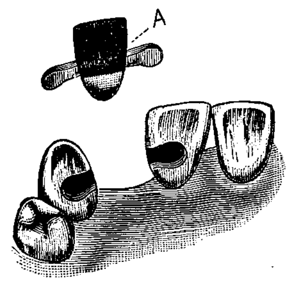
In a pulpless tooth the bar should be bent and inserted into the root-canal, as shown in Fig. 434.

Incisors and Cuspids.—In the incisors and cuspids the anchorage cavities or slots are formed in the palatal portion of the teeth, extending from the approximal surface contiguous to the space to be bridged, two-thirds to three-fourths the width of the tooth, and usually about one-third of its length from the gingival margin

(Fig. 435), direct access into the cavities being afforded through the palatal wall. The slots or cavities having been formed, a model of the case is made. Should the cavities to receive the bar be imperfectly represented on the model, they should be trimmed and shaped to correspond to those in the mouth. The exact alignment of the porcelain tooth in the mouth having been determined with the aid of wax, it should be adjusted on the model and secured in position by a matrix of plaster.

The base of the tooth should rest firmly on the gum, to accomplish which a small portion of the plaster should be removed from underneath the tooth on the model.

FIG. 435.



The bar is best constructed of platinum wire, Nos. 14 to 16 gage. Platinum is preferred to iridio-platinum, because it is easier of manipulation. The wire can be extended in one piece entirely across the bridge from one anchorage to the other by bending, or by removing a portion of its bulk back of the porcelain tooth; or the bar can be cut and made in two sections, if the position of the anchorage cavities so suggests.

The ends of the bar should be flattened with a hammer, annealed, and shaped as shown at A, Fig. 435. The remainder of the section of the bar which is to rest in the cavity is best filed on the sides, so as to give it a somewhat triangular form, the broad base of which is toward the bottom of the cavity. This form favors the ready impaction of the filling-material which is to secure the bar.

The porcelain tooth having been backed, the bar, whether in one piece or two sections, is attached to it with wax cement, then removed from the model and soldered. Enough gold should be added to properly contour the tooth and securely fasten the bar.

Anchoring the Bar.—Gold and amalgam are the only filling-materials suitable for securing bars. Amalgam is objectionable only when the position of the cavity renders it visible. Under such circumstances, however, the exposed portion can be cut away when set, and covered with gold. Fastening one end of the bar temporarily with oxyphosphate, while the other is being secured, will sometimes facilitate the operation of anchoring with amalgam.

but the best plan is to fasten the ends of the bar with gold-foil pellets secured by pits drilled alongside the bar, and then fill flush the remainder of the cavities with amalgam. The amount of gold used need only be sufficient to secure the bridge against the slightest motion until the amalgam sets.

When the anchorage tooth is pulpless, the end of the bar which extends into the canal should be cemented first. Frequently, when bicuspids and molars containing large cavities of decay are used for anchorages, it is advantageous to first insert the anchorage fillings, and then drill out sufficiently to admit the bar, which can then be secured with additional filling-material.

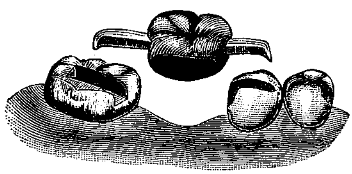
When gold is the filling-material used, the rubber-dam, which must be thin, is first adjusted on the natural teeth, and the bridge then pressed to position over it. In anchoring with gold, the best way is to first fill such portions of the cavities as are inaccessible when the bars are in position, how far to proceed being determined by occasionally trying in the piece as the gold is inserted. The bridge is then pressed to place, and held firmly while the ends of the bars are secured by condensing around them a few pellets of foil, after which the gold is carefully impacted around the bar, the filling of one of the cavities being carried to completion before going on with the other.

In the preparation of the cavities, their sides should be given an undercut form with strong edges. When only sufficient tooth-structure has been removed at the approximal portion to just admit the bar, it is a doubtful experiment to attempt to fill the narrow seam around it with gold. In such cases, this portion of the filling is better made with amalgam, which is inserted at the sides and along the floor of the cavity before the bridge is fixed in position. Then, beginning at the interior end of the cavity, gold can be inserted and gradually condensed toward the amalgam, with which it will unite when brought in contact. Any surplus of amalgam can be removed subsequently when it has set. Amalgam placed around the bar as here described is seldom visible from the labial side, and the quantity required is insufficient to materially discolor the tooth.

Bicuspids and Molars.—In bicuspids and molar bar bridges the bar should be carried well across the occluding surface, and the end bent and imbedded in the line of the sulcus toward the side opposite to that from which the bar enters, as shown in Fig. 436.

Forming the end of the bar in this way affords the greatest security, when it is properly anchored with the filling-material, by preventing any rotatory movement, or any loosening of the bar by force applied in a forward direction.

FIG. 436.

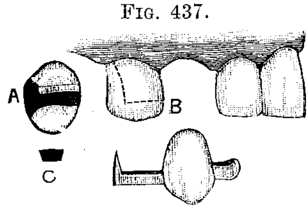


The principles involved and the method described for shaping and securing the ends of bars apply equally well to cases where one end of the bridge is supported by a bar and the other by an artificial crown, as has been previously illustrated.

An Extension Bar Bridge.—In this form of bridge the artificial (dummy) tooth is supported by a bar anchored in a natural tooth at one end only. At the other end of the bridge the bar is either made in the form of a spur to rest against the adjoining natural tooth, or it is not extended beyond the dummy.

In the case represented in Fig. 437, an upper cuspid, the patient, a lady, declined to have the bicuspid capped or crowned in any way for the purpose of supporting the cuspid. The distal side of the bicuspid at the time contained a large filling. This filling was removed, and a cavity of proper shape to receive a bar was extended forward from it between the cusps to the mesial side. A suitable bar for the cavity was formed to support the cuspid in the manner illustrated at A and B. The angular form (C) given the bar rendered it, when anchored with the filling-material, very secure, and fully capable of supporting the cuspid.

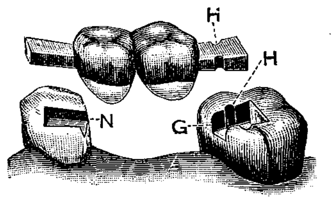
FIG. 437.



The filling-material, which was gold, occupied most of the space of the occluding surface between the cusps. The occluding tooth was trimmed off proportionately. A spur extended from the anterior side of the artificial tooth resting on the lateral incisor. The occlusion was favorable to the insertion of the bridge tooth in the form presented, and it had been comfortably and satisfactorily worn for ten years when last seen. When examined it showed no change, except that the force of occlusion on the cuspid had slightly bent the bar and caused the tooth to assume a slightly deeper position in the jaw. In some instances the bar of a bridge of this kind can be extended across the occluding surfaces of two teeth, and additional support thus obtained. (See page 235.)

Gold Inlay Anchorage-Bar.—Frequently a solid gold inlay formed of a shape approximating an anchorage-bar, that fits a correspondingly shaped cavity or slot in a natural tooth, as illustrated at N, Fig. 437 a, or in a gold crown,[1] as shown at G, can be used to advantage as a support for bridge-work. The cavity or slot is first formed slightly dovetail, with straight sides flaring a little toward the margin, and with a depth proportioned to the width. The cavity or slot should be so positioned as to permit proper adjustment of the bridge.

FIG. 437 a.



The matrix to form the bar is made by adapting 1/1000 platinum to the cavity or slot in the natural tooth or metal crown in the same manner as for a porcelain inlay, described in Part IV, Chapter V. The matrix, after having been adapted, is filled with wax, a piece of iridio-platinum wire inserted into the wax, and the matrix removed and invested. The wax having been removed with boiling water, the matrix is filled with 22-carat gold plate, applying the heat for fusing it mostly under the matrix. Zinc phosphate is required to securely anchor an inlay anchorage-bar unless the other end of the bridge is supported by a collar, when gutta-percha may be used. Drilling a hole in the seam at one or both sides of an anchorage-bar,—one-half in the crown, the other in the bar, as shown at H H, Fig. 437 a, and then filling it solidly with cohesive gold,—will additionally fasten or key it in place. When zinc phosphate is used it will also prevent displacement while the cement is setting.

The practical application of bar bridge-work is limited, although it affords advantages for artificial restoration not presented by other methods in many cases where a single tooth has been lost. Its practical success depends chiefly upon the character of its supports and the skilfulness with which it is anchored.

[1] Formation of a slot in a gold crown is described on pages 205 and 308.

CHAPTER V.

Partial Cap and Pin Bridge.

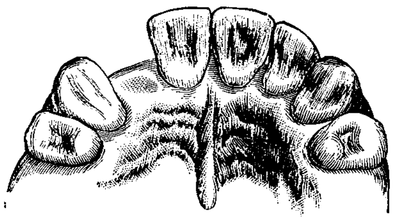
CONSTRUCTION—LIMITATIONS—ADVANTAGES OF THE METHOD IN CASES WITH PULPLESS TEETH.

This style of bridge is used only in case of loss of a single front tooth.

Fig. 438 represents a typical case, in which a lateral incisor (crown and root) had been lost, the cuspid and central incisor, fully vitalized, and without approximal carious cavities, remaining in position.

Construction.[1]—1. Take an accurate impression in plaster. From this obtain a plaster model of the parts.

Fig. 438.



2. Make from pure gold, rolled to the thinness of No. 28 gage, base-plates, to be carefully adjusted to the palato-approximal surfaces of the cuspid and incisor. These can be made by swaging on dies and counter-dies obtained from the model, but more conveniently by bending the gold into shape upon the plaster model and pressing and burnishing it into perfect adaptation upon the natural teeth.

3. Select a plain plate porcelain tooth of suitable length that will fit easily into the interspace; back with gold or platinum; adjust in position to the gold base-plates on the model, and attach

[1] Dr. W. F. Litch, *Dental Cosmos*, vol. xxviii, No. 3.

with wax cement. Remove and fit in the mouth, and chill with ice-water. Next remove from the mouth, invest, and solder tooth and plates together, as shown in Fig. 439.

4. For attaching the denture as thus far constructed, drill a small cylindrical opening through the palatal surface of the enamel of the cuspid and incisor respectively. These openings should usually be placed about as indicated in Fig. 441, at C D.

FIG. 439.

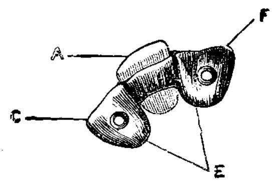


FIG. 440.

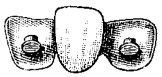


FIG. 441

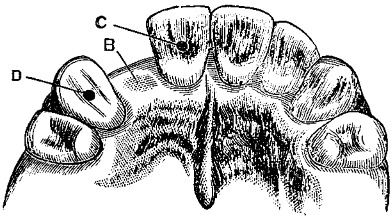
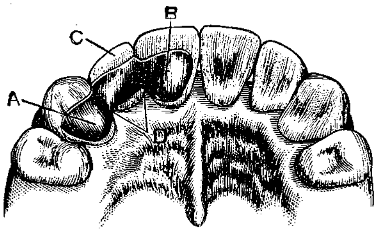


FIG. 442.



Sometimes, owing to a close occlusion or to the contour of the tooth, it is desirable that they should be located a trifle nearer the neck of the tooth. Each opening should be well undercut, but must not encroach upon the dentin far enough to endanger the pulp. In size the openings need not be larger than will admit a platinum pin-head, in diameter corresponding to No. 13 gage, with a shank of No. 18 gage. Into each of these openings must be fitted a platinum pin of the size indicated. The head of each pin must be made thin and perfectly flat both upon its upper and under surfaces.

5. In each of the base-plates make an opening corresponding in position to those in the natural teeth. Pass through these openings and cement in them the free ends of the platinum pins. While the cement is yet plastic, place the denture in position in the mouth, carefully pressing the pin-heads into the openings made for them, and burnishing the base-plates into perfect contact with the palatal surfaces of the teeth; chill the cement, remove, and invest. Next attach the pins, and also flow solder over the surface of the base-plates to stiffen them.

Fig. 439 represents the appliance without the pin. A is the porcelain tooth and backing; E, the base-plates; C and F, the openings for the pins.

Fig. 440 represents the appliance completed with the pins in position.

Fig. 441 represents the natural teeth and interspace B, with openings C D for retaining-pins.

Fig. 442 represents the appearance of the bridge when cemented in position. The occluding teeth should be trimmed sufficiently to leave a slight space between them and the caps.

The bridge is attached by cementing in position with oxyphosphate.

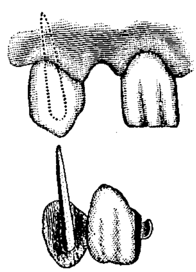
Limitations.—When the supporting teeth have vital pulps and very sensitive dentin, the difficulty of securing reliable anchorage for each of the plates seriously militates against this method. Loosening of the bridge, especially in "close bites," is apt to occur at the most inopportune moment, demanding its immediate recementation. Practical experience by the author in the use of this form of attachment shows that three pins—inserted as deeply as possible without too closely approaching the pulp—are necessary in each of the plates.

Advantages in Cases with Pulpless Teeth.—This method possesses considerable merit when the supporting teeth are pulpless and free from decay or only slightly affected. A substantial post introduced in the root-canal of either a central or a cuspid will be found sufficient to afford reliable support for an adjoining artificial lateral with the addition of a spur on the palatal surface of the contiguous tooth on the opposite side of the crown, independent of any other attachment.

To replace an absent superior lateral, for instance, when the adjoining cuspid is in normal condition, the extirpation of its pulp and the application of a support, such as is described, will frequently be found preferable to a method which demands excision of the natural crown, an operation to which many patients would strenuously object.

Fig. 443 illustrates a typical case in which a lateral is to be artificially replaced. In such cases the cuspid, being more capable of giving the required support than the central, is the proper tooth to devitalize and use as the abutment. When the pulp of a cuspid is removed by instantaneous extirpation, or by arsenic used in a judicious manner, very little discoloration of the dentin and enamel is liable to ensue (see Part I, Chapter II).

FIG. 443.



The entrance to the pulp-chamber should be made well toward the incisal edge, so as to be in a direct line with the root-canal. The orifice needs to be enlarged sufficiently to admit a substantial post and permit the metal which constitutes the cap to be depressed into the orifice and around the post, so that the projecting end can be finished off level with the surface of the cap yet have a secure attachment to it.

To construct this attachment a tapering platinum post is fitted well up the canal. A disk of pure gold plate, No. 30 to 32 gage, or of platinum, about No. 34 gage, is adapted to the entire palatal surface of the tooth. This is facilitated by first burnishing or shaping it on a fusible-metal die of the tooth. The metal is then to be burnished down into the reamed orifice of the root-canal, a hole made through the metal into the canal and a post fitted therein, waxed in position in the metallic cap, removed, invested, and soldered. In the soldering enough solder should be flowed over the surface of the cap to strengthen and stiffen it. The surplus projecting end of the post should usually be cut off even with the external surface of the cap, but if it does not interfere with the antagonizing teeth in occlusion, it may be left extending from the cavity or be only partly removed during the construction. In the case of lower incisors and cuspids, the projecting end will afford a means for easy removal when in position on the roots, especially if an impression is taken.

The cap and post are next adjusted on the tooth and a porcelain tooth ground, fitted in position, and cemented with wax to the cap, the work removed, and the parts soldered together. The addition of a spur to rest in the central is advisable, as illustrated in Fig. 443.

This method of constructing abutments is applicable to more extended operations, such as the supporting of four incisors on the two cuspids alone or in conjunction with a central tooth or root.

CHAPTER VI.

Application of Bridge-Work in Cases of Pyorrhea Alveolaris.

DR. RHEIN'S METHOD OF "SPLINTING"—THE PARTIAL CAP AND PIN-BRIDGE METHOD—USE OF CONNECTING COLLARS.

In cases of pyorrhea alveolaris when the teeth are very loose, connecting them together with bridge-work steadies them in their sockets and consequently permits more effective treatment.

Fig. 444.

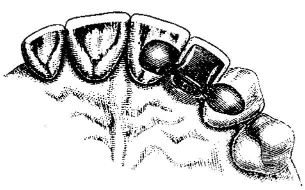


Fig. 445.

Fig. 446.

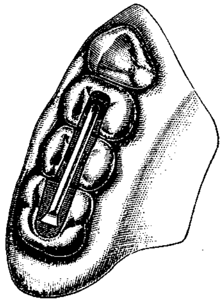
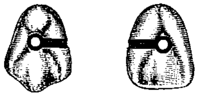


Fig. 447.



Dr. Rhein's Method of Splinting.—In these cases Dr. M. L. Rhein advocates the use of a form of bridge-work he terms "splinting." By the adoption of this method the natural appearance and shape of the teeth are preserved and their hygienic condition interfered with very little, if any. The method as applied to a superior central and cuspid to carry a lost lateral is shown in Fig. 444, to lower teeth in Fig. 445, and to two bicuspids and a molar in Fig. 446. The pulps of the teeth in these cases were removed, with the exception of the molar, and grooves or slots were cut, as shown in Figs. 446 and 447. Staples of triangular platino-iridium wire with parallel arms (Fig. 448) were fitted into the individual root-canals of the pulpless teeth with an extension added to the staple in the form of a straight bar to extend into the slot in the molar. In the case of the artificial lateral the bar was carried across the backing and attached as shown in Fig. 449.

Dr. Rhein's method of anchoring the bar and restoring the form of the teeth in these operations is to first line the circumference of the outer plane of the orifice of the pulp-canal and the bottom of the groove with a thin gold filling, leaving the entrance to the

FIG. 448.

FIG. 449.

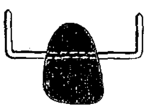


FIG. 450.

FIG. 451.

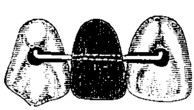


FIG. 452.

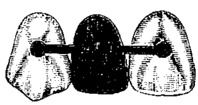
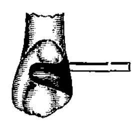


FIG. 453.

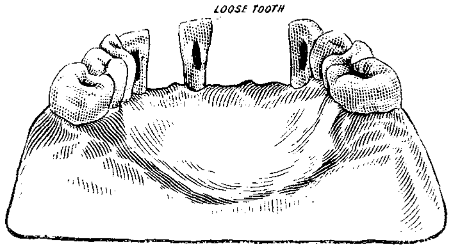


canals open for the admission of the pins of the staple. This is accomplished by filling the canals with cones of bibulous paper nearly to the orifice, then placing over the bibulous paper in the orifice a thin layer of oxyphosphate, and while the cement is soft gently patting into it pellets of gold. After waiting a few minutes gold foil is malleted over the entire inner surface of the slot and around the orifice of the pulp-chamber. With a fissure-bur entrance to the paper cone in the canal is easily made and the paper withdrawn, leaving the canal open for the admission of the pin, as shown in Fig. 450. The canals are next filled with oxyphosphate, in such amount as will avoid an excess, and the pins of the bar are cemented in proper position (Fig. 451).

After the cement has hardened sufficiently, the gold filling which line the groove in which the staple lies is continued and brought up over the sides of the wire, which is ultimately completely covered by it, as shown in Fig. 452. When the gold is properly finished with plug-finishing burs and fine cuttlefish disks, there is no edge or unevenness present, as seen in Fig. 453, which illustrates a cuspid as it appears with the protruding bar.

The Partial Cap and Pin-Bridge Method.—The partial cap and pin-bridge method, described in the preceding chapter, is

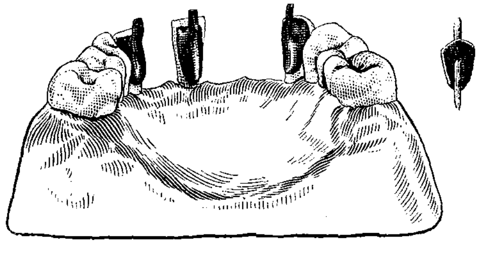
FIG. 454.



specially useful in application to cases of pyorrhea alveolaris. By this method the loosened teeth can be joined together and supported without exposure of metal.

In such cases the pulps are removed from the affected teeth and the root-canals treated. Pins and caps are fitted to each tooth,

FIG. 455.



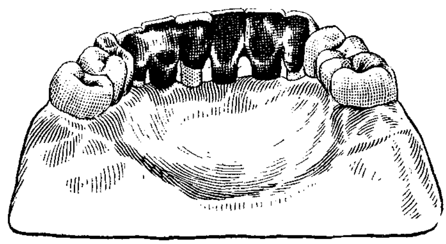
the ends of the pins being left protruding from the caps. An impression is then taken, removing the caps and pins in position. They are next invested and soldered together.

An intervening absent tooth or teeth may be supported between sections of the caps.

The method is specially applicable in cases involving the lower front teeth. Fig. 454 illustrates such a case with the teeth prepared; Fig. 455, the caps with their projecting posts in position; Fig. 456, the constructed denture, and Figs. 457 and 458, the denture in position on the teeth.[1]

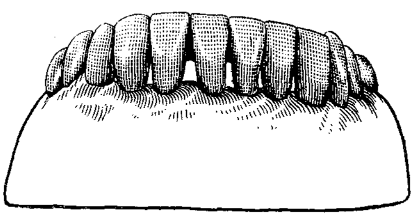
FIG. 456.

FIG. 457.



Use of Connecting Collars.—Fig. 459 explains and illustrates a method of restoring an incisor and supporting the adjoining loosened teeth with successive cemented connecting collars of gold

FIG. 458.



in cases of pyorrhea alveolaris. For the application of such collars the teeth generally need to be slightly separated. The collars may be formed of a strip of pure gold plate, about No. 32 to

FIG. 459.

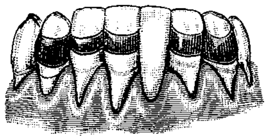
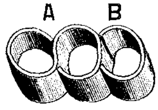


FIG. 460.



33 gage, by bending and fitting the strips to the forms of any two teeth, in the shape shown in Fig. 460, A. This leaves but one thickness of the plate between the teeth. An additional loop can

[1] Dr. D. D. Smith.

then be added as shown at B, for one adjoining tooth. All the soldering can be done quickly with the Bunsen burner without investing. Parts of the loops which demand it should be slit and lapped, to permit the gold to be brought close to the surface of the tooth.

The bands of metal should be adjusted toward the incisal section of the teeth, leaving the inter-approximal spaces between the teeth entirely free. The cementation can be done with zinc phosphate, or gutta-percha cement if removal is contemplated.

CHAPTER VII.

REMOVABLE AND REPLACEABLE PORCELAIN FRONTS.

PURPOSE OF THEIR USE—MODIFICATION OF DR. WARDWELL'S METHOD—DR. VAN WOERT'S PLIERS AND "MASON'S DETACHABLE TOOTH"—A SIMPLE FORM—DR. ALEXANDER'S METHOD—DR. BRYANT'S METHOD.

REMOVABLE porcelain fronts are used to avoid the risk of fracturing the porcelain in the operation of soldering, but principally to permit their more easy replacement in case of fracture. The replacing of a porcelain front after the work has been permanently fixed in position is frequently attended with great difficulty, and the result is often unsatisfactory or doubtful regarding its permanency. The desire to obviate such difficulties has prompted the introduction of various methods of construction in which the porcelain fronts are removed from their positions previous to the soldering processes, and afterward adjusted so as to be easily replaceable by means of duplicates in case of fracture when the work is being worn in the mouth. These methods applied to a bar bridge afford access to the cavities of anchorage.

Dr. I. F. Wardwell's Method.—A modification of Dr. I. F. Wardwell's method, which is simple in construction and application, is as follows: A thick, narrow piece of 18-carat gold plate, at least No. 18 standard gage, is soldered to the tooth, and its the tooth, is burnished against it, well into the undercut sides, the 462). A very thin piece of platinum, covering the entire back of the tooth, is burnished against it, well into the undercut sides, the platinum being annealed several times during the operation. The platinum is held in a flame while a small quantity of pure gold is flowed over the outer surface and then refitted to the back of the tooth, to which it is again burnished. This operation is repeated until the platinum and gold form a moderately light backing which fits perfectly. The platinum surface is then covered with investing material, and on the other side 18- or 20-carat gold plate flowed until a suitable thickness is obtained. When trimmed into proper shape and attached to a bar or a bridge, this forms a substantial backing or socket (Fig. 463), in which, when the bridge is finished or the bar anchored, the porcelain tooth can be fastened with a little zinc phosphate or gutta-percha cement (Fig. 464). Dr. F. T. Van Woert has introduced pliers with combination points which much simplify the construction of a socket of this form and the replacement of the porcelain front in case of fracture by the patient.[1] Owing to the manner in which this style of removable front is inserted in its socket, it does not admit of protection of the incisal edge, and is consequently much more liable to fracture than one which is properly protected.

FIG. 461.

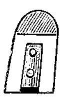


FIG. 462.

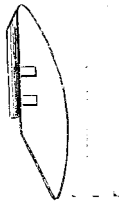


FIG. 463.

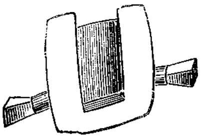
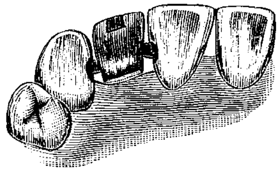


FIG. 464.



A Simple Form.—Any ordinary porcelain front to a bicuspid or molar dummy can be made on the removable or replaceable plan, by backing the porcelain in the usual manner with gold or platinum plate without bending the pins, adjusting the gold cap in position, attaching the cap, and backing with wax cement, then, removing the porcelain front (Fig. 465), investing and soldering the cap and backing together. The backing must be made thick with solder, the holes in it deepened with a drill, and the pins of the porcelain front serrated and fitted therein. After the final soldering, the porcelain fronts are cemented in position with oxyphosphate. This method, though affording sufficient attachment for a short molar, such as is illustrated in Fig. 465, is suggestive of insecurity for most of the front teeth.

FIG. 465.

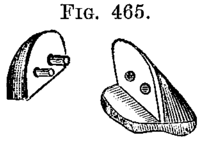
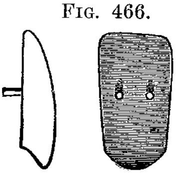


FIG. 466.



Dr. Alexander's Method.—Dr. C. L. Alexander's method is to use teeth having long pins, as in Fig. 466. The facings are fitted in proper position and cemented with hard wax.

[1] Porcelain fronts or dummies of the character described with the backing baked in the porcelain of the tooth can now be purchased ready-made under the name of "Mason's Detachable Tooth."

The wax around the pins is then heated with the point of a hot instrument, and the facings are removed without disturbing the backings. Half-inch pieces of fine iron binding-wire are bent to form staples, their ends heated and pushed through the pin-holes from the facing side in the backings, leaving a loop on that side and projecting ends on the other, which are twisted. The wax is removed from the backing and little ferrules of pure gold placed around the pin-holes (Fig. 467). Hard wax is next applied on the

FIG. 467.

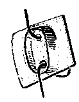
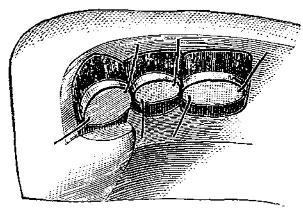
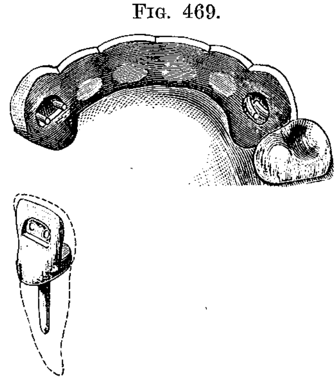


FIG. 468.



outside of the ferrules, the ends of the iron wire brought down to hold them in position, and the inside of the ferrules filled with investing material. Fig. 468 shows an invested case ready for the soldering process, which will unite the ferrules to the backings,

FIG. 469.



and at the same time join the backings to each other and properly shape them. When soldered and trimmed, the facings are put in place with a very thin oxyphosphate cement between fronts and backings, the pin ends are bent down on the backing within the ferrules, and the ferrules filled with amalgam packed moderately dry. The bridge is then put aside until the amalgam has set, when it is ready for insertion. Fig. 469 shows a central crown ready to receive the porcelain front, and a piece of bridge-work with the cuspid ferrule chambers as yet unfilled.

Dr. E. A. Bryant's Method.—This differs from that just described in that the space between the two pins of the tooth, as they project straight out from the porcelain, is first filled in with soft solder so as to unite the pins and form an oval-shaped flat-ended flange. The backing is made with a box to accommodate this flange, and into this when attached the flange is cemented.

CHAPTER VIII.

General Application of Crown- and Bridge-Work.

CENTRAL OR LATERAL INCISORS, CUSPIDS OR BICUSPIDS—CENTRALS, LATERALS, OR CUSPIDS COMBINED—CUSPIDS, BICUSPIDS, AND MOLARS COMBINED—BICUSPIDS AND MOLARS COMBINED: USE OF PARTIAL CAP—INCISORS, CUSPIDS, BICUSPIDS, AND MOLARS COMBINED.

The construction and general application of bridge-work, as explained in the foregoing chapters, are additionally explained and illustrated in applying them to the following typical cases:

Central or Lateral Incisors, Cuspids or Bicuspids.—Figs. 470 and 471 illustrate a method of replacing a superior central or

Fig. 470.

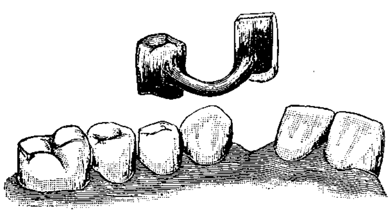
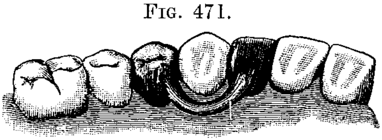


Fig. 471.



lateral. The central or lateral is formed with a base of gold or platinum resting closely on the gum. A gold cap-crown on the first bicuspid is used to support it in position by means of an iridio-platinum bar. A small spur placed on the mesial side of the bridge-tooth, and resting on the central, is suggested in such cases.

Figs. 472 and 473 show a case in which two centrals are supported in position by bars extending from gold crowns on bicuspids. The method of construction in these cases is: First cap the bicuspids; then fit and back the bridge-tooth or teeth and fasten in position in the mouth with hard wax. Next take a plaster impression. Remove and make plaster and marble-dust model, showing teeth and crowns in position. Mark and slightly groove the line of the bar on the model. Fit the bar in position in the groove, and wax the ends to cap and tooth. Fasten the center of the bar and cover the teeth and caps with investing material, and solder bar or bars and cap or caps together; spurs resting on the laterals may also be applied.

Figs. 474 and 475 illustrate a method of construction which will

FIG. 472.

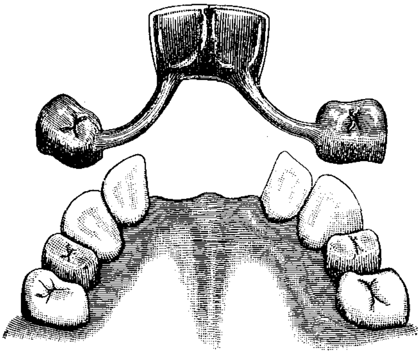
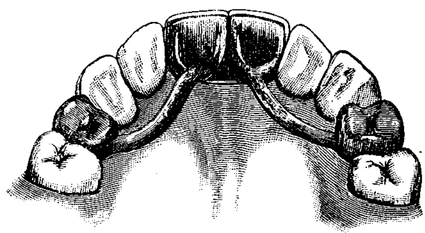


FIG. 473.



avoid the exposure of gold, and also the pressure of a bar against the membrane of the gum. A shell crown is constructed as described on page 212, Fig. 405, for the bicuspid. The crown is placed on the tooth, the lateral adjusted and cemented in position,

FIG. 474.

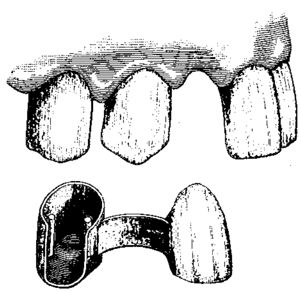
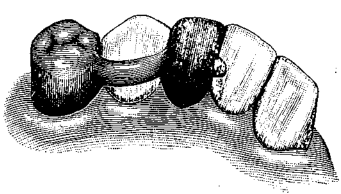


FIG. 475.



an impression taken, and a model made as described in the construction of case illustrated by Figs. 470 and 471. With the crown and lateral in position on the model, a narrow strip of thin platinum plate is fitted across the palatal side of the cuspid, touching the gold crown and backing of the lateral. Over the platinum is placed a still narrower piece of gold plate (clasp-gold preferred). These are waxed at the ends to the cap and lateral, and held in position in the center with investing material. When the ends have been attached with the solder to the crown and lateral, the investing material is removed from the center and the solder is then flowed across the bar. This forms a bar with a surface of platinum to rest against the tooth.

FIG. 476.

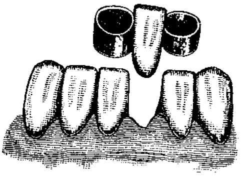


Fig. 476 shows a form of bridge-work suitable for the replacement of one or two inferior incisors. The labial section of the shell crowns which form the support for the artificial tooth should be removed only enough to avoid any considerable exposure of the gold in the movement of the lips.

Other cases illustrating methods for single centrals and laterals, cuspids and bicuspids, are shown in Figs. 404, 419, 421, 423, 430, 434, 437, 437 a, 443, 447, and 464.

FIG. 477.

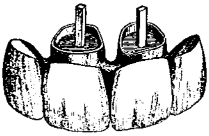
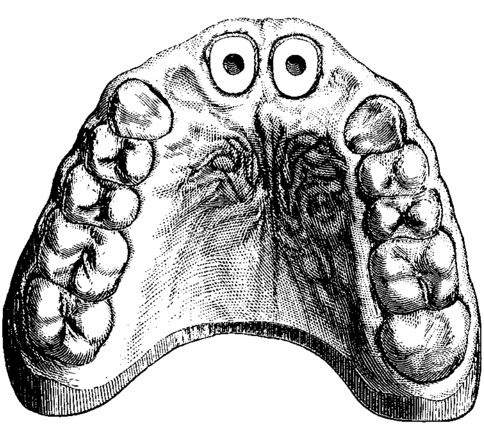


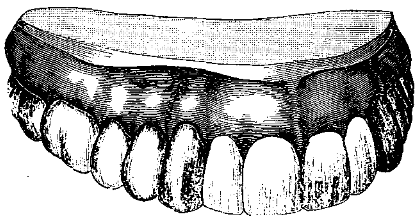
FIG. 478.



Centrals, Laterals, or Cuspids Combined.—Two laterals supported by two central crowns are illustrated in Figs. 477 and 478. Spurs might be additionally formed on the laterals to rest on the cuspids. When approximal crowns, as in this case, are united to support bridge-work, a free space should be preserved at the neck between their respective collars to admit the gum-septa.

Figs. 479, 480, 481, and 482 show a bridge of the incisors supported by two collar crowns on the cuspid roots. Shell crowns can also be used for this purpose, according to the preference of the operator. Figs. 483, 484, and 485 illustrate a case with shell crowns for supports. In its construction the best method of pro-

FIG. 479.



cedure is to form and fit the caps or crowns to the cuspids, remove them in plaster impression and bite, make models, and then bridge between the shell caps or crowns with the incisors. The edges of the collars of these shell caps should be beveled and burnished close to the teeth. If properly done they will

FIG. 480.

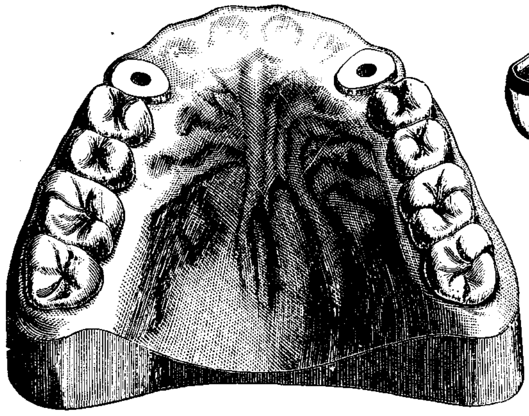
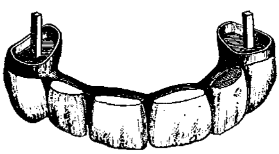
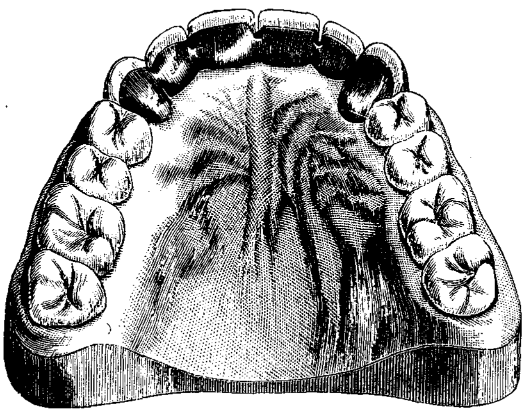


FIG. 481.



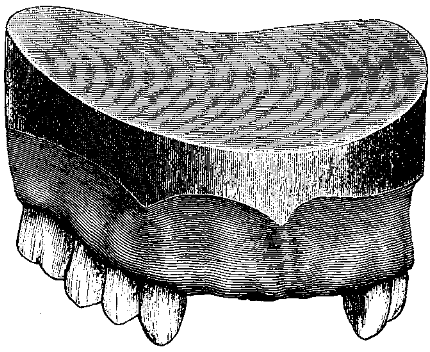
resemble gold fillings. When these shell caps become loose from disintegration of the cement they should be immediately reset. It would be well if cases of this style could be removed once a year and re-cemented. Gutta-percha cement, alone or used in combination with zinc oxyphosphate, by covering the natural crowns with a film of oxyphosphate mixed thin just before the final insertion of the bridge, with the heated gutta-percha in the caps, is to be recommended for these cases. Other cases of this character are illustrated in Figs. 370, 393, and 459.

FIG. 482.



Cuspids, Bicuspids, and Molars Combined.—Figs. 486 and 487 show bridge-work supported by cuspid and molar cap or crown. If the cuspid contains a living pulp, the natural crown

FIG. 483.



should be preserved, and an all-gold or shell crown should be used in preference to the form illustrated, or the pulp should be destroyed and a partial cap with a long pin inserted in the canal. Figs. 403 and 433 illustrate other cases.

Bicuspids and Molars Combined: Use of Partial Cap.—Fig. 488 represents a bridge on the lower jaw from the first bicuspid to the second molar. The inclination of the teeth toward each other suggests the construction of the bridge in the form illustrated.

FIG. 484.

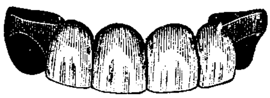
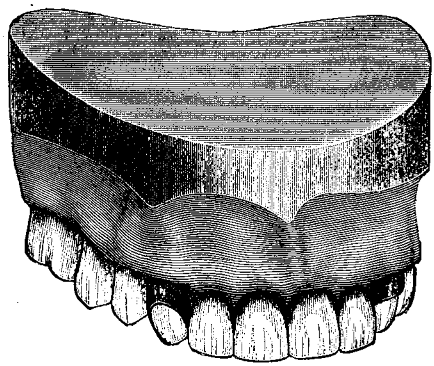
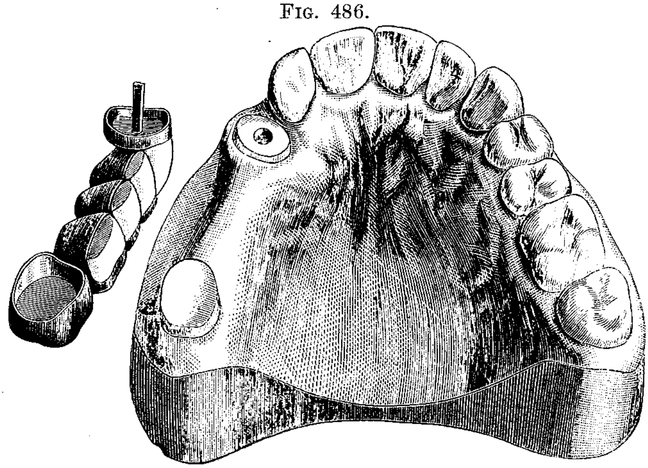


FIG. 485.



The molar is covered entirely with a cap, the bicuspid only on the occlusal surface, with the gold extending about half down the coronal section of the natural crown (A). A pin inserted in the cap fitting a hole drilled in the sulcus of the occluding surface of

FIG. 486.



the bicuspid will secure this cap in position. This method is very suitable to a case where the crown of the bicuspid is long and the root slightly exposed. Molars under similar circumstances can be capped for bridge-work in like manner.

Fig. 489 illustrates a case of bridge-work supported on an abraded bicuspid and molar by partial caps or gold "tips" with

FIG. 487.

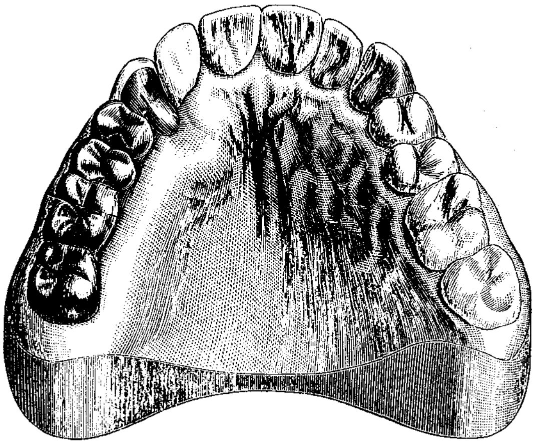


FIG. 488.

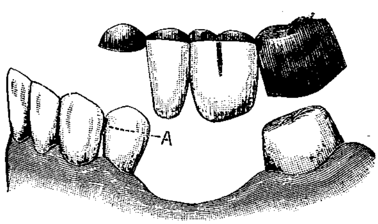
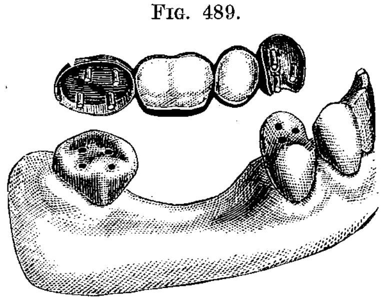


FIG. 489.



pins, the construction of which is described on page 157. It will be noticed that the molar tips forward considerably.

Fig. 490 represents a practical case in which the upper third molar and the first bicuspid were utilized for the attachment of a bridge, to supply the loss of the intervening teeth.[1]

FIG. 490.

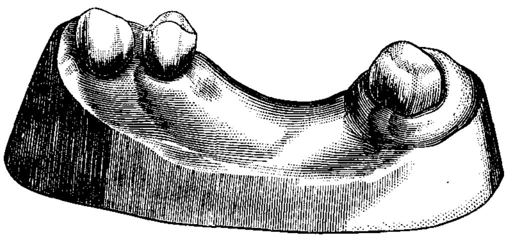


Fig. 491 represents the case as prepared for the bridge. A, the inner cusp of the bicuspid cut down to allow the placing of

FIG. 491.

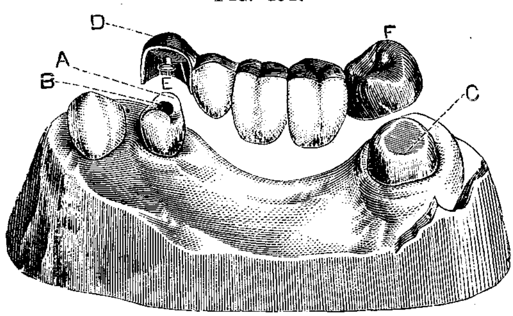
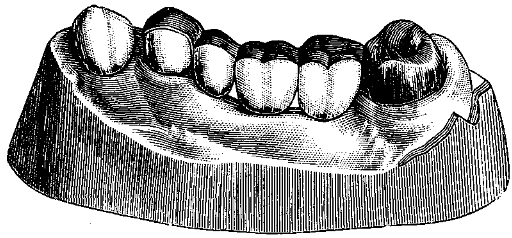


FIG. 492.



a sufficiently thick crown-plate; B, a cylindrical undercut opening between the cusps for a retaining-pin; C, the third molar, made uniform in size from neck to grinding-surface, the latter

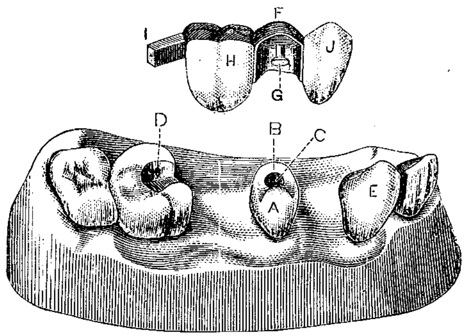
[1] Dr. W. F. Litch.

also being considerably retrenched; D, a partial cap, so constructed as to cover every portion of the tooth except its buccal surface, the free edge passing up under the gum; E, a retaining-pin adapted to the opening B; F, the gold cap for the molar.

Fig. 492 represents the bridge anchored in position with cement.

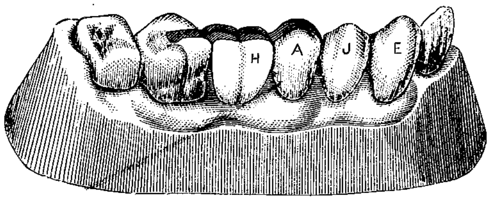
Fig. 493 represents another case in which a bridge was at-

FIG. 493.



tached by a bar, partial cap, and retaining-pin. A is an upper second bicuspid (without antagonist); B, its inner cusp, cut down; C, opening for retaining-pin; D, second molar, with slot for bar; E, cuspid; F represents the partial cap; G, the retaining-pin;

FIG. 494.



H, a molar tooth of gold, with porcelain front; I, a platinum bar attached to the tooth H and made to fit into a slot at D; J, a plain plate cuspid, heavily backed and strongly soldered to the partial cap, but left without attachment to or contact with the cuspid.

Fig. 494 shows the bridge anchored in position.

As the gold attachments and backings were out of sight, the appearance presented was natural. There is this fact to be considered in regard to the use of the partial caps, that many patients can be induced to consent to their employment who would refuse to submit to more radical measures, and thus, even when the latter would be advisable, the former may be employed as a compromise, or even as a temporary expedient. Having once tested the advantage

FIG. 495.

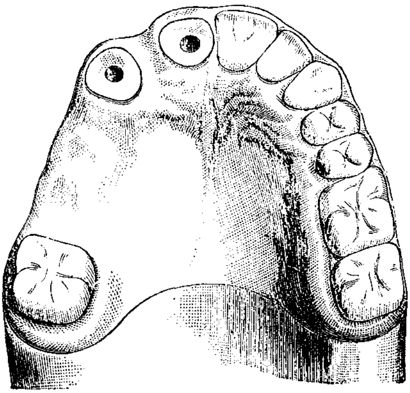
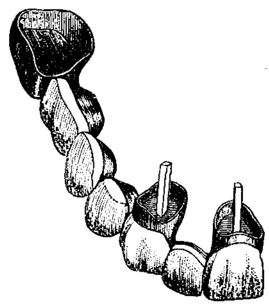


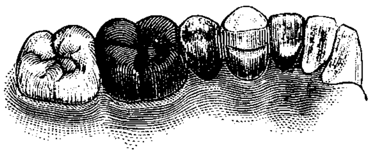
FIG. 496.



of a well-fitting bridge, at some future time the wearer is much more likely to consent to whatever measures are necessary to give it security and permanence.

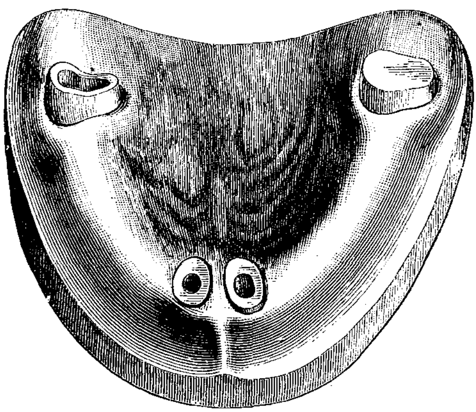
Incisors, Cuspids, Bicuspids, and Molars Combined.—Figs. 495 and 496 represent a piece of bridge-work extending from a

FIG. 497.



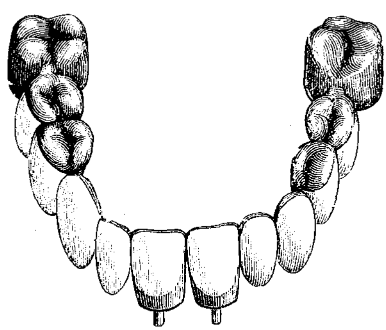
central incisor to a molar. In such a case the best method of procedure usually, and specially the one most likely to prevent misfit from warping, is to construct the front section, consisting of the central, lateral, and cuspid, first. Next form the molar cap, fit it with the front section of the bridge in position in the mouth, remove in plaster impression and bite, and construct the bicuspid and molar dummies between the cuspid crown and molar crown. In a bridge of this character, if the natural cuspid is intact, a shell crown may be used. Fig. 497 gives the palatal view of a

FIG. 498.



piece of bridge-work consisting of a gold cap on the molar and shell cap on the crown of the cuspid, supporting a single bicuspid and a lateral incisor.

FIG. 499.

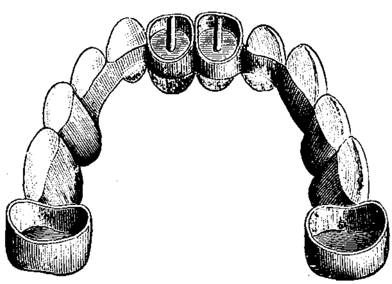


Extensive Applications of Crown- and Bridge-Work.

The following illustrations of cemented bridge-work, by Dr. H. A. Parr, show extreme cases in the way of large operations in which the system has been applied:

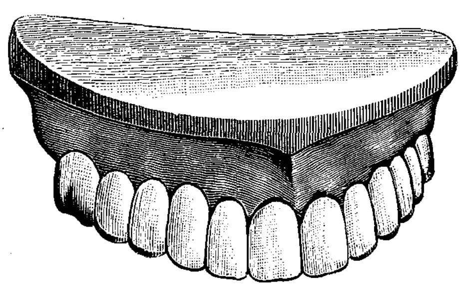
Figs. 498, 499, 500, and 501 represent a case in which the roots of the two superior centrals, a partially decayed right first molar, and a badly decayed, pulpless left first molar were all that remained of the upper natural teeth. On the two central roots were mounted collar crowns, and on the two molars all-gold cap-

FIG. 500.



crowns. These four crowns, acting as abutments for the bridge denture, bore between them, proportionately on each side, the force and leverage of occlusion. The contour of the arch in the region of the cuspids was restored by a skilful and artistic placing of the artificial teeth, which are prominent and long.

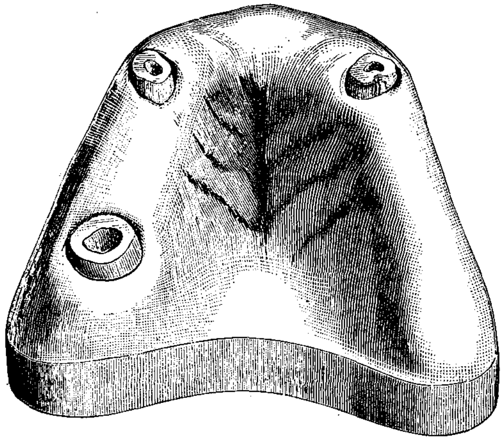
FIG. 501.



Figs. 502, 503, 504, and 505 represent a case in which two large and firm superior cuspid roots, and a right pulpless molar, with a saddle on the left side, support a large bridge.

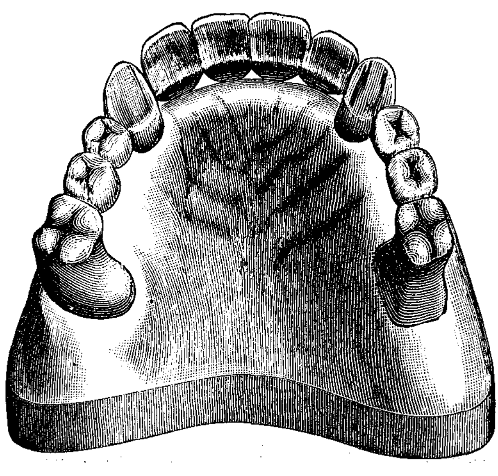
In the case illustrated by Figs. 506 and 507, two superior molars and a second bicuspid on the right, and a first bicuspid and a saddle under the "dummy" representing the first molar on the left side, form the abutments. Prior to the insertion of the bridge-work, the patient had worn artificial teeth on a plate. The advisability

FIG. 502.



of extensive permanently cemented bridge-work, such as is shown in this and the two cases preceding it, is very questionable. The

FIG. 503.



permanency of the latter probably, and most certainly that of the former, cannot be assured.

The lateral force of mastication, exerted on the bridge, will especially affect the side on which the saddle is used, and in time is certain to loosen and destroy the abutments. Cases such as these, where the bridge is so extensive and the abutments so few, are more properly served by inserting what are termed removable plate-bridges, which have alveolar support in addition to the abut-

FIG. 504.

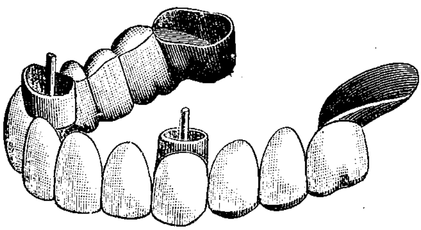
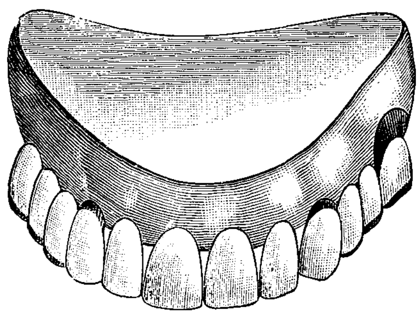
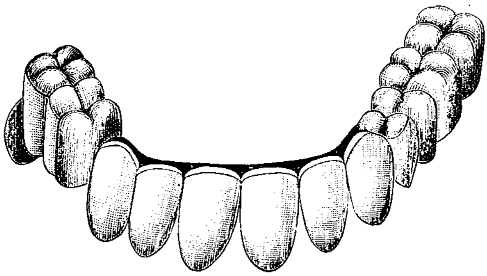


FIG. 505.



ments. The insertion of bridge-work in cases of this character to avoid the presence of a plate can only be regarded as a temporary expedient to afford a respite from that annoyance. It is therefore a method not to be indorsed, as the patient in a short time will

FIG. 506.



have to resort to a plate and again experience the initiatory unpleasantness attending its insertion.

In the bridge-work illustrated in Figs. 508, 509, and 510, crowns on a second bicuspid, a pulpless molar, and the roots of a cuspid and lateral constitute the abutments.

FIG. 507.

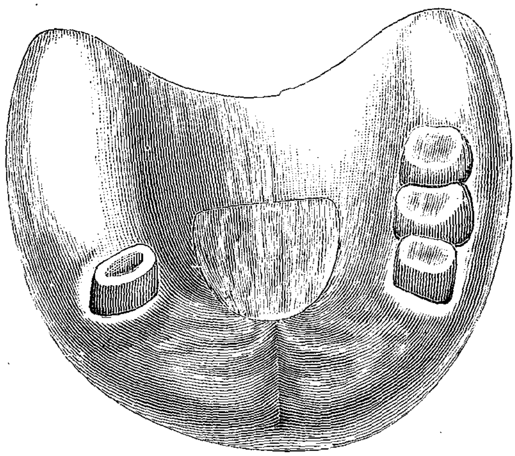


FIG. 508.

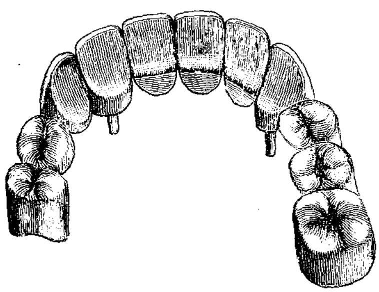
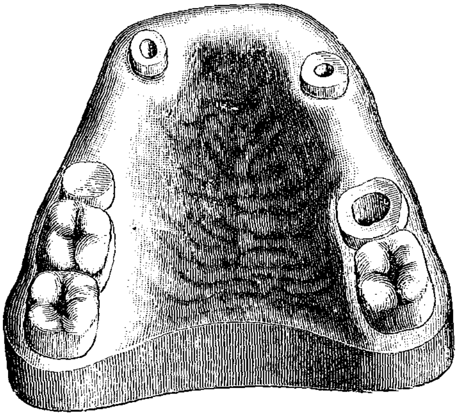
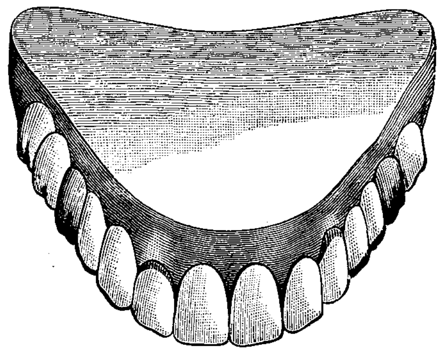


FIG. 509.



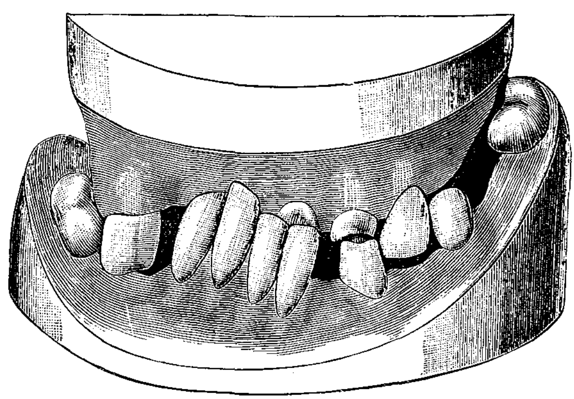
Figs. 511 and 512 illustrate an extensive case of artificial replacement by crowning and bridging operations. Fig. 511 represents the case as presented for treatment. The few remaining superior and inferior natural teeth had no corresponding antago-

FIG. 510.



nists, which caused the interlocking and abnormal condition in regard to occlusion shown. The superior right bicuspid, the left central, and the left cuspid were crowned, the bicuspid being short-

FIG. 511.



ened and the cuspid lengthened in the operation. The intervening lateral root between the central and cuspid, having been treated and filled, was allowed to remain. With the three crowns to serve as abutments, the intervening spaces were bridged with arti-

FIG. 512.

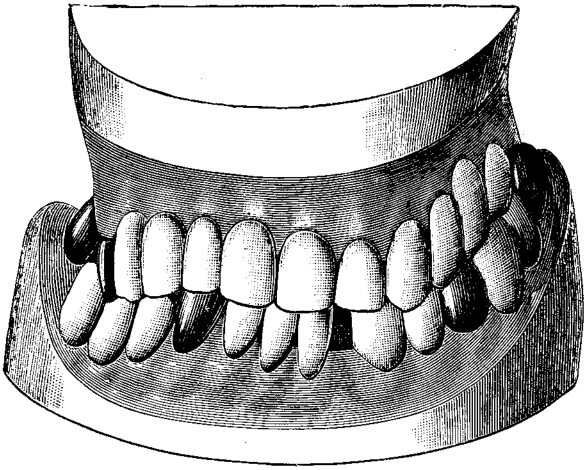
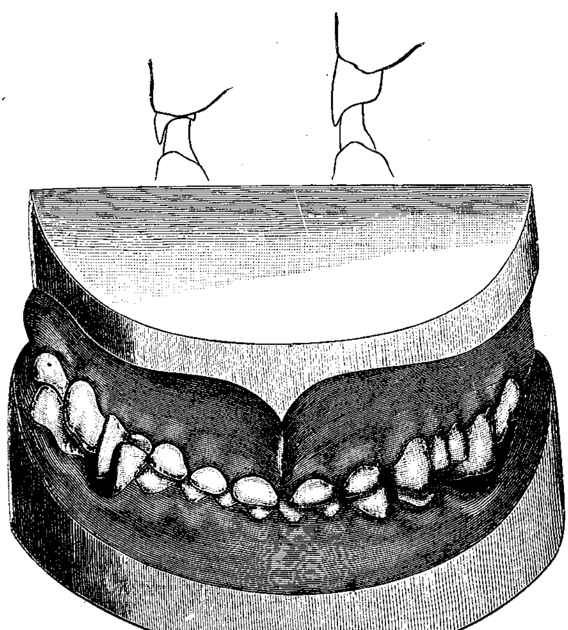


FIG. 513.

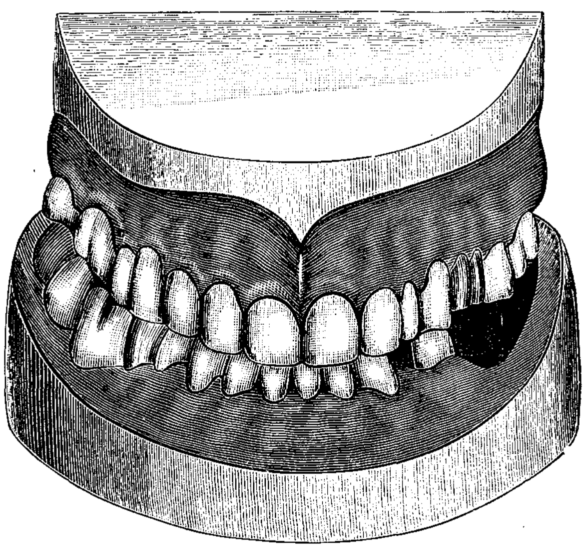


ficial teeth, the extension on the left side being supported by a saddle. The spaces between the inferior cuspids and molars on both sides were bridged, the bicuspid on the left supporting the bridge, instead of the cuspid, as on the right; the left cuspid was crowned and the incisal edges of the incisors trimmed even.

Fig. 512 illustrates the finished case, and shows the complete artificial restoration of the parts.[1]

Figs. 513 and 514 represent an extensive case of crown- and bridge-work. The occluding surfaces of the teeth were affected

FIG. 514.



with abrasion. Gold crowns with porcelain fronts which presented laterally the form illustrated in Fig. 513 were mounted on the incisors and cuspids, the pulps of which were preserved. The posterior teeth were crowned with all-gold crowns. The missing teeth, except those on the lower left side, were artificially restored with bridge-work.

Criticism of.—Permanently cemented bridge-work of the extensive style illustrated in some of these cases is seldom now con-

[1] Fifteen years after the performance of these operations, this case was examined by the author, and seemed to be in a very fair condition.

structed. Removable forms affording alveolar support are adopted in preference. Where the abutments are numerous and offer suitable supports to permit the bridge-work to be constructed in sections around the arch, permanently cemented bridges are permissible. The attachment between the sections of a bridge is made by anchoring the end of one to the abutment of another by the use of a spur anchorage such as is described on pages 223 and 228, or some one of the devices in Chapter XIII.

CHAPTER IX.

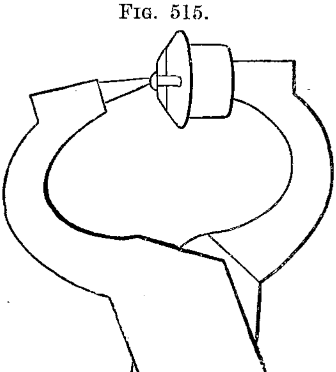
Repair of Crown- or Bridge-Work.

THE ORDINARY METHOD—DR. SHRIVER'S METHOD—DR. W. W. WILLIAMSON'S METHOD—DR. STARR'S METHOD—DR. E. A. BRYANT'S METHOD—ADVANTAGES OF DETACHABLE BRIDGE-WORK—REMOVAL OF CROWNS OR BRIDGES CEMENTED WITH ZINC PHOSPHATE—REMOVAL OF CROWNS OR BRIDGES CEMENTED WITH GUTTA-PERCHA—REPAIR OF A GOLD CROWN.

The fracture of a porcelain front to a permanently attached bridge is an annoying incident for both patient and dentist. It is usually attributable to failure to properly protect the incisal edge or occlusal surface of the porcelain with metal, a precaution rendered necessary by the rigid character of the resistance offered the antagonizing teeth through the abutments, or by exposure of the porcelain in time through loss of the protective metal by attrition. In most cases the porcelain can be replaced without the removal of the bridge, but the attachment is not usually so reliable as in the original piece.

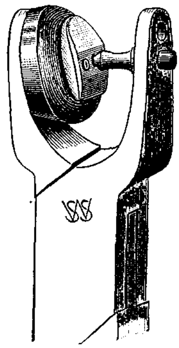
The Ordinary Method.—The following is the method commonly adopted with incisors or cuspids: The pins of the broken facing are cut off and the surface of the backing trimmed level. Mark the position of the pins of the new facing on the backing by drying and flowing over the surface a film of beeswax, then with small pliers placing the facing in position and pressing the pins in the wax; or place a little rouge and oil on the end of the pins and mark the backing with them. At the points marked drill holes in the backing to receive the pins of the porce-

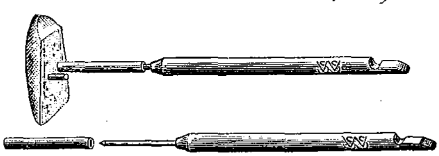
Fig. 515.

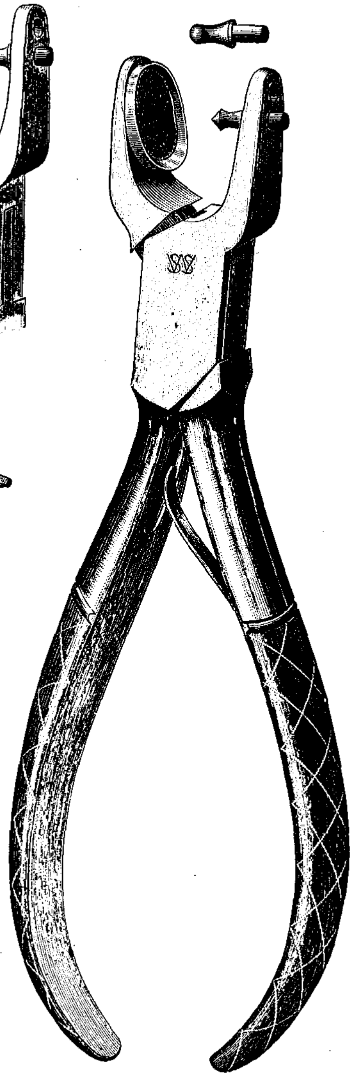


lain front, countersinking the holes at the palatal side. After the backing is drilled, grind the porcelain to fit it as perfectly as possible, place it in position, and grind off the pins so they slightly protrude. If a suitable long-pin tooth is not procurable, the short pins of an ordinary tooth can be lengthened by bending a piece of platinum wire in the form of a semicircle, and soldering

FIG. 516.







its end to the ends of the pins with pure gold. The wire is then cut in the center, and the lengthened pins trimmed as required. The pins are then riveted on the palatal side into the countersunk holes of the backing. The riveting is best done with punch forceps having a large punch, the porcelain front being protected by a piece of lead placed against the labial aspect (Fig. 515). The heads of the pins should then be burnished smooth with a revolving burnisher. In case of the fracture of the porcelain front of a bicuspid crown or dummy, a corresponding front is selected with very long pins, and ground to fit. Holes are drilled in the gold, in proper positions, to receive the pins their full length. The pins are then roughened a little with a sharp instrument, and pins and front are cemented to the gold. Should the holes extend through the gold at the palatal side, the cement and the ends of the pins should be covered with gold foil or amalgam. If any gold is present to protect the occluding edge of the porcelain, it should be burnished against the surface.

Dr. Shriver's Method.—Dr. F. M. Shriver's method of fastening the pins in the backings of incisors and cuspids is as follows: After having fitted the porcelain facing and shortened the pins as described, remove the porcelain facing and with the sleeve drill, shown as used in Fig. 516, countersink the end of the pin; with the cone bur—for right angle—countersink the holes on the palatal surface of the backing. Prepare a small quantity of thin cement and spread it over the backing, after which place the porcelain facing in position, and with a pair of pliers firmly press the facing close to the backing. Warm a small piece of modeling compound, place in the cup on the riveting pliers; then set the riveting point (see Fig. 516) in the countersunk end of the pin, gently pressing the facing into the modeling compound; remove and cool compound with ice-water. Replace, and with a firm hand hold the compound closely to the facing, and with a gentle pressure on the riveting point and a slight lateral motion spread the pin; then burnish it down with the round point.

Dr. W. W. Williamson's Method.—Another method to replace a porcelain front is the following: Back the porcelain front around the pins with platinum foil, bend the pins down together on the platinum, and hammer them flat. Invest and flow a little gold plate over the pins and platinum, and file the metal down close to the porcelain. Drill a hole in a strong part of the backing on the bridge at a central point, square the hole, and fit to it a piece of square platinum wire. Attach the end of the wire to the backing of the porcelain front with an atom of wax cement, and while warm insert the wire through the hole in the backing on the bridge, and adjust the porcelain front in correct position. Chill, and remove front and wire. Invest, and solder wire to backing on porcelain front with 18-carat gold solder, and then remove all metal from back of porcelain, except what is necessary to secure the end of the wire to the pins. Countersink the gold backing on the bridge sufficiently to permit the front to come in position. Slit the end of the wire, cement the porcelain front in position to the backing, and bend the ends outward into two slightly grooved places on the backing. Fill the slit in the wire with gold or amalgam, and smooth the surface.

Dr. Starr's Method.—Dr. R. W. Starr's method differs from the preceding, in that he uses round instead of square wire, cuts the pins of the porcelain front off short, making corresponding depressions in the backing on the bridge to receive them and pre-

FIG. 517.

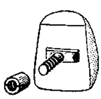


FIG. 518.

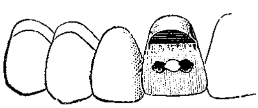
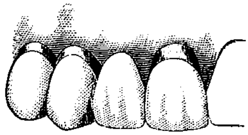


FIG. 519.

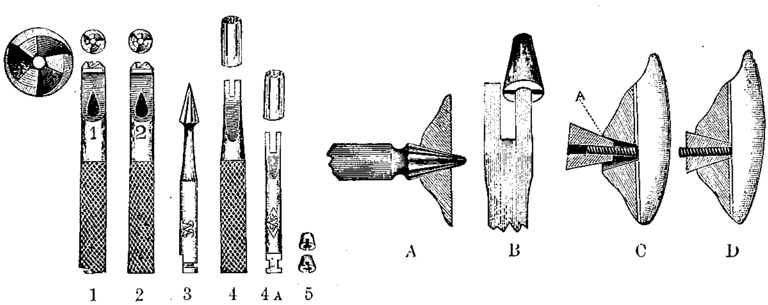
FIG. 520.



vent rotation, and solders the end of the wire to retain the front between the pins. He then cuts a screw-thread on the wire, and secures it in the backing with a nut on the palatal side screwed into a depression reamed to receive it. Figs. 517, 518, 519, and 520 illustrate this method.

Dr. Bryant's Method.—Dr. E. A. Bryant describes a method[1] of repairing bridge-work by the aid of a set of tools, now made and

FIG. 521.



sold for the purpose, which easily accomplishes the results obtained in the preceding example. Dr. Bryant's method and tools are briefly described as follows: Each pin of the selected tooth-facing is to be screw-threaded, first oiling the pin, starting with die No. 1, Fig. 521, and finishing with die No. 2. The pin-holes in

[1] *Dental Cosmos*, June, 1894, page 370.

the bridge backing are countersunk from the rear with the right-angle engine reamer No. 3. (See A.) With the nut-driver No. 4 or 4 A (No. 4 for hand manipulation, No. 4 A for engine work), one of the gold nuts No. 5 is caught on one prong (see B), and started on one of the pins (see C), and then the other nut is likewise started. Turning one after the other, the nuts are screwed tightly on (see D), and then with engine-points the projecting pins and nuts are ground flush with the backing.

Advantages of Detachable Bridge-Work.—If the character of the breakage will not permit repair in the mouth, the bridge must be removed and reinserted. Under such circumstances the advantages of a detachable form are evident.

Bridge-work can be made with replaceable porcelain fronts which can be easily substituted in case of fracture. A description of their application will be found at page 239.

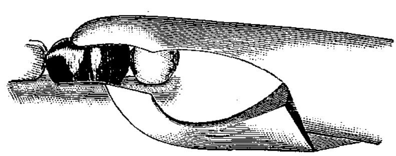
The additional time required to render some cases of bridge-work suitable for cementation with gutta-percha cement is trifling compared to that which would be consumed in the construction of the same work with replaceable porcelain facings.

The results following the repair of single crowns in the mouth will seldom repay the labor attending it.

Removal of Crowns or Bridges Cemented with Zinc Oxyphosphate.—When it becomes necessary to remove an artificial crown, whether inserted singly or as a support for a bridge, incisors or cuspids are detached by grinding the gold or porcelain away at the palatal section over the post, which when exposed is severed, and the attachment of the cement broken up. The collar can also be slit and bent aside if found necessary. If previous to cementation the post of the crown is covered with a film or sheath of gutta-percha, as described in the process of cementation on page 165, the detachment of the post is usually effected easily. In an all-gold cap-crown on a posterior tooth a hole drilled in the grinding-surface will give access to the cement, a sufficient quantity of which can then be removed to loosen the attachment; or, the collar can be divided and pried up from the root by first making a groove with a small rubber and corundum-disk, and then cutting the gold with a sharp instrument. A crown-slitter, an instrument made for the purpose, will facilitate this part of the operation. (See Fig. 522.) With care and patience in the operation, the crowns will not usually be injured beyond repair.

Removal of Crowns or Bridges Cemented with Gutta-Percha.—In cases of metallic collar or cap-crowns, *first slightly raise the edge of the collar,* especially if burnished over a projecting point. Protect the membranes and spread a napkin across the mouth over the lower lip. Heat a crown-heater almost to a red heat. Place your finger against the artificial crown and apply the crown-heater. For bicuspids and molars, apply the crown-heater to the occlusal surface, and for incisors and cuspids, at the palatal side toward the incisal edge. As the crown receives the heat, it is indicated to your finger. When the heat is raised to a point as high as your finger can comfortably bear, the crown-heater should be removed for an instant until the crown slightly cools, then it should be applied again. In heating a crown it is well to notify the patient to raise the left hand, should the heat at any time become painful. The application of the heat must be continued as directed for at least three minutes until the cement is thoroughly

FIG. 522.



softened, which proceeds slowly, owing to its contact with the natural crown or root. In a case of bridge-work, as soon as one crown is heated, instantly pass the crown-heater along the surface of the bridge, to other crown or crowns, and then back and forth, until all the attachments are uniformly heated. When this has been effected, start the bridge at one end and then at the other, or at both together, and lift it from position.

Repair of a Gold Crown.—A hole or slit in a gold collar or crown is repaired easily by first placing a piece of soft wax in the hole or slit on *the outside of the gold,* adapting a piece of platinum foil larger than the aperture on the *inside* close against the gold, and attaching it to the wax. The interior of the crown is next filled with investing material, and solder flowed over the platinum and gold on the outside of the collar or crown. The crown should be heated slowly, to allow the plaster to dry out before the soldering is begun.

CHAPTER X.

The Hygienic Condition of the Mouth as Affected by Bridge-Work.

CONSIDERATION OF THE SUBJECT—REQUIREMENTS—METHODS FOR CLEANLINESS AND HEALTH.

Consideration of the Subject.—The probable future condition of a mouth in which a piece of bridge-work is permanently fixed is a matter of the deepest interest to both patient and operator. There is no valid reason why an artificial structure in the mouth should be more hurtful than that which is natural, provided that correct conditions are observed in its construction and proper measures are taken for their maintenance. The natural teeth demand care on the part of their owners, and all forms of artificial dentures require attention to secure their cleanliness and thus preserve the health of the adjacent tissues. What will result from the wearing of a permanently fixed bridge is almost wholly dependent, in the first place, on the proper application of principles and correct formation in every detail of construction of both crowns and bridge-work; and in the second place, upon the maintenance of cleanliness. Neglect of a single requirement will so far detract from the usefulness of the work, and may influence the final result disastrously.

Requirements.—Firm, properly selected abutments will not redeem incorrect conception or faulty construction; neither will the best construction remedy that which is wrong in principle or application. Self-cleansing spaces, if improperly formed, have exactly the contrary effect from what is intended, by becoming receptacles for particles of food *débris*, instead of preventing their accumulation.

Inaccessible spaces or interstices, which are always apt to cause uncleanliness, should be avoided. Continuity of structure of the several parts is also essential to fully insure perfect hygienic conditions.

Methods for Cleanliness and Health.—The health of a mouth containing a piece of bridge-work constructed under these precautions can be readily maintained. For this purpose a suitably formed tooth-brush and properly shaped bristle points in a carrier which will reach places not cleaned by the brush with a dentifrice are necessary. Floss silk can be passed through apertures around the necks of crowns by the aid of a slightly curved blunt-pointed needle and drawn along the gum under the bridge to remove accumulations of *débris* otherwise inaccessible. A solution of a detergent and disinfectant mouth-lotion in water, injected with a dental syringe, can be used advantageously to wash out such places and maintain a healthy condition of the gums. In addition to these measures, the crown and bridge should be thoroughly cleansed by the dentist at regular intervals.

So cared for, a permanently fixed bridge will not militate against the absolute wholesomeness of the mouth; but it can hardly be expected that the insertion of bridge-work will insure a state of the mouth which for cleanliness will be superior to the presence of the natural teeth. Neglect on the part of the patient to perform such duties as are necessary to preserve the natural teeth in a healthy state will have about the same effect on an artificial denture. The attention required to be given to bridge-work is not greater than is commensurate with the advantages which it confers on the wearer.

CHAPTER XI.

Removable and Detachable Bridge-Work.

LIMITATIONS—REQUIREMENTS—REMOVABLE INCISOR OR CUSPID CROWN —SPLIT OR SPRING POST—THE TUBE—UNION OF TUBE AND CAP—TAPERING SPRING POST—CROWN-POST, DETACHABLE OR REMOVABLE CROWN—REMOVABLE BICUSPID AND MOLAR ATTACHMENTS—REMOVABLE COLLAR AND PARTIAL CAP—FLANGED COLLAR ATTACHMENT—SPUR COLLAR SUPPORT—REMOVABLE CLASP AND PARTIAL CAP ATTACHMENT: CUSPIDS: BICUSPIDS—CONNECTING BARS—FOR THE UPPER FRONT TEETH—CONSTRUCTION OF REMOVABLE BRIDGE-WORK.

The evident advantages of bridge-work early stimulated the inventive genius of dental mechanists to improve the methods and forms of its construction and to extend its application. With these objects in view, methods have been introduced by which bridges are so constructed as to be removable by the patient or detachable by the dentist. The construction of bridge-work in either of these forms in some cases overcomes the chief objections urged against the system.

Large bridges are much more easily made in a detachable or removable form than are the smaller pieces, which present some of the best features of the permanently attached methods.

Limitations.—Some forms of small bridges cannot be made removable. To so construct many others would interfere with their practicability. Besides, in a large proportion of cases where properly constructed bridge-work is applied, the removable feature would be of no benefit, so far as regards the health of the abutments or of the adjoining teeth; neither would it be of any great advantage respecting cleanliness. These reasons, together with the fact that removable bridge-work is most intricate and laborious in construction, combine to restrict its use in practice to the form termed removable plate bridge-work. Much that is here stated concerning removable bridge-work might be applied to the detachable form. The necessity, on the part of the dentist, for using the latter in preference to the former is limited to a very small sphere, owing to the fact that gutta-percha, alone or combined with oxyphosphate, can be used practically as a cement in most cases, thus at any time permitting the removal of a bridge without much difficulty.

Requirements.—In the construction of removable bridge-work a prime requisite is that the posts and collars, or other form of attachment used, shall be so formed that the piece shall move evenly on or off the supporting roots or crowns in adjustment and removal. To secure this, the post-cavities and the gold crowns should be so shaped that the lines of the cavities and of the sides of the gold crowns shall be as nearly as possible parallel to one another. To facilitate this, a post of wood or metal may be first accurately but loosely inserted in any root-canal intended to receive a post, and left protruding a quarter of an inch, and an impression taken. On the model made from this impression the post will be found placed as in the mouth. The position and shape of the natural teeth or roots can be thus studied, and their plaster forms trimmed as a guide. Gutta-percha or impression-compound, fitted to the model and removed with the posts in position in it, can then be used to guide the operator and gage the preparation of teeth or roots in the mouth. Posts, or the tubes inclosing them, should be placed as nearly as possible in the lines of the root-canals to avoid weakening the side or sides of the root.

When a molar leans forward, the removal of a portion of the mesial side usually restores its perpendicularity sufficiently, as does the cutting away of the distal side of a bicuspid which inclines backward.

The methods and forms of attachments most commonly used in the different styles of removable bridge dentures are in principle very similar. A preliminary description of these and of their constructive details is therefore first in order.

Removable Incisor or Cuspid Crown.—A removable gold crown with a porcelain front is frequently used in connection with removable bridge-work where incisors or cuspids form abutments. The *cap and tube crown* is the style (Fig. 523) preferably applied.

It consists of a cap for the end of the root with a tube attached extending up the root-canal, and on the cap the crown with a post fitted tightly to the tube is adjusted. To the crown so formed (Fig. 524) the bridge is joined in the usual manner. The end of the post can be formed with a slit which will permit this portion to be slightly expanded, making what is termed a spring-post. The constructive details of this crown are as follows: The root is first prepared and capped the same as for a collar crown. The collar can be formed of gold and the cap section of platinum, No. 32 gage (A, Fig. 525).

FIG. 523.

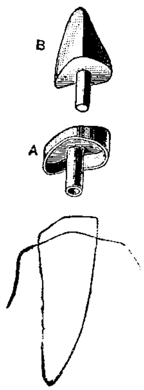
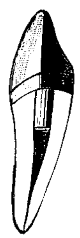


FIG. 524.



Split or Spring-Post.—A substantial piece of gold and platinum wire, from No. 16 to No. 18 gage (the number being regulated by the size of the root), is slit for about one-eighth of an inch to form a spring-post. This is easily done by placing the wire in a vise and steadily cutting it downward from one end through the center to the required depth with a saw-edged strip of very thin steel (Fig. 526). This takes only a few minutes, and is preferable to the method sometimes adopted of partially joining two pieces of half-round wire.

The wire is then tapped together at the slit, burnished smooth, and rounded just at the end (B, Fig. 525).

The Tube.—The tube for this post is formed by once encircling the post with a piece of iridio-platinum plate, No. 34 gage, the edge of which is beveled and cut to meet the plate even and close (C). The post is then withdrawn, and the seam is touched along its length with the smallest possible quantity of borax. The proper way to use borax in fine work is to grind it, mixed with water, on a slab, to a cream-like consistence, and apply with the point of a camel's-hair brush. A very small piece of pure gold is placed in the seam, and the tube is held in a Bunsen flame. When a sufficient degree of heat is reached, the gold will flow along the seam and form a joint without obstructing the inside passage for the post. The post is then inserted, and the tube trimmed (D), and gaged in a gage-plate. With a drill just the size of the tube the root-canal is enlarged so that the tube will fit tightly (Fig.

527). This plan prevents weakening of the root by too great enlargement of the canal.

Union of Tube and Cap.—A hole the size of the tube is made through the cap, and cap and tube are then adjusted, waxed together, and, the post being withdrawn, they are removed, invested, with the investing material inserted in the tube, and soldered. The second or outer cap is then constructed for the root-cap, of platinum about No. 34 gage. It is perforated in the center, and the post fitted in proper position. At the palatal and approximal sides, if desirable, the platinum can be slit and bent over the edge of the root-cap to form an inner partial band or flange, or a half band can be formed of a piece of plate, the open space at the labial side being filled with the porcelain tooth. The outer cap and the

FIG. 525.

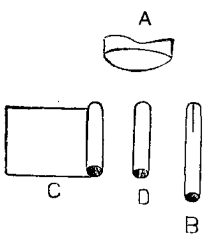


FIG. 526.

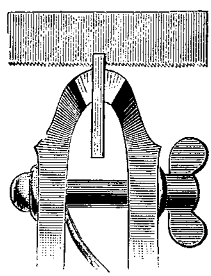
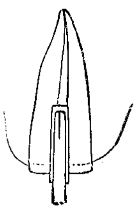


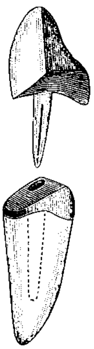
FIG. 527.



post are cemented with wax, removed, invested and soldered together. As the point of the post may have to filed, it is well to place it so that the line of the slit shall cross the tooth from mesial to distal side. On this outer cap the porcelain front is fitted and soldered. The end of the tube is closed with a little gutta-percha, and the root-cap cemented on the root with oxyphosphate and the crown placed on it, which helps to bring the root-cap to its place and insures the intended position of the crown. When necessary, the split post can be tightened in the tube by slightly springing it open. Fig. 524 represents the finished crown. The incisal edge of the porcelain does not necessarily require to be protected with metal as in fixed bridge-work.

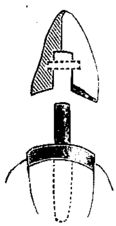
Tapering Spring-Post.—A tapering or square post, either solid or split in some cases, is preferred to the form above described, especially in the root of a cuspid. When a tapering split post is used, the points should be soldered together. The lower section of the post can then be alone expanded and tightened in the tube (Fig. 528). To receive this style tube and post, the canal should be deeply opened with care and then shaped with a reamer, such as is illustrated at Fig. 96.

FIG. 528.



Crown-Post, Detachable or Removable Crown.—A cap for the end of the root with a root-post (Fig. 529, in section) is first made and a porcelain front fitted and attached with wax. Plaster is applied to the cap and labial surface of the front to form a matrix and the wax removed. An iridio-platinum post, about No. 15 to 16 gage, incased with a tube of platinum foil, is fitted in position back of the front on the cap between the pins, if possible without removing any of the porcelain between them. The end of the post is cemented with wax to the cap, the platinum foil post removed, and cap and post invested and securely joined with solder. A disk of platinum foil is next perforated and adapted to the cap. The tube is again fitted on the post, the front lined with platinum foil, placed in position, and attached with wax to tube and disk, removed, invested, and soldered. This forms a crown for the root-cap which can be used to support one end of a detachable or removable bridge if the other end is more securely held by a bicuspid or molar crown.

FIG. 529.



Removable Bicuspid and Molar Attachments.—Bicuspids and molars, especially the latter, in all cases where possible, are the teeth selected and most depended on to support all forms of removable bridge-work.

Removable Collar and Partial Cap.—This is a form of attachment made to fit over a natural tooth, or more frequently a gold crown.

The sides of the natural tooth are to be first trimmed as nearly as possible straight and parallel to the sides of any other supporting crown or line of attachment. If the tooth is to be first capped, a straight-sided gold crown is made and fitted. A fusible-metal die of the gold crown is then made; or, better still, the gold crown is removed, a strip of damp paper wound around it, and fusible metal melted and poured in crown and paper tube. This forms a die of the crown, with a shank as seen in Fig. 530. When the natural tooth is not crowned with gold, a die of the tooth is made in a manner similar to that described in Part V, Chapter III, and in Part II, Chapter VIII. The crown is then encircled with a strip of pure gold, about No. 30 gage, one part of which, B, will extend above the rest in the form shown in Fig. 531.

The sections of the gold at A A are to reach from the edge of the neck of the crown to or slightly above the occluding surface. The gold is fitted evenly, but not tightly, around the crown, the ends being placed at the side opposite to that where the collar will be joined to the bridge if the space permits. The collar is then removed and the ends soldered together (Fig. 532). The collar is readjusted on the crown, and the part at B, Figs. 532 and 534, bent down over the occluding surface, so that it nearly meets the collar section A. On the outside of the collar a slightly narrower strip of gold clasp-plate, No. 30 gage (Fig. 533), is next

Fig. 530.

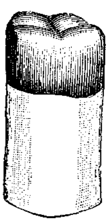


Fig. 531.

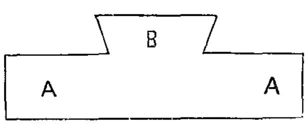
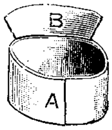


Fig. 532.



adjusted in the position shown at the lines C, Fig. 534, then removed, and the seam, which had best be located at the point C, Figs. 533 and 534, soldered together. It is readjusted on the gold collar, removed with it, and soldered to it. The collar can be invested for this purpose, but the work is more easily done by holding it in a Bunsen flame and placing small pieces of solder in position in the seam. Only enough solder should be used to unite the parts, any surplus being carefully avoided. Painting the inner surface of the collar with whiting, or the use of dampened marble-dust, will prevent the solder flowing there.

The collar section of the removable cap is then trimmed smooth. The flap section at B can be adapted to the occluding surface of the gold crown now and reinforced with solder, or preferably after the collar section has been united to the bridge, and its relative position on the gold crown when cemented in the mouth accurately determined. Fig. 535 shows the gold crown and the finished removable partial gold cap over it.

The gold crown is freed from the fusible metal by dropping it with the die into a ladle containing a quantity of melted fusible metal. The portion within the crown will melt in with that in the ladle and leave the crown, which should then be removed and immersed in nitric acid to remove any traces of the fusible metal still adhering to the gold. If the fusible metal will melt below 200°, boiling water will remove it.

Flanged Collar Attachment.—Fig. 536 shows another form of removable partial cap. In this the entire edge of the collar is bent over on the occluding surface of the crown, and thereby supported in position. In the construction the edge of the pure gold collar should be shaped to form the flange.

FIG. 533.

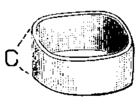


FIG. 534.

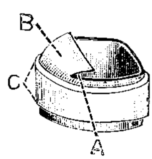


FIG. 535.

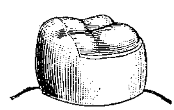
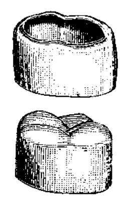


FIG. 536.



This form of collar may also be made entirely of clasp-gold, No. 28 gage for molars, and of No. 29 to 30 gage for bicuspids. The process is: An accurately fitting collar is first made. The collar is then, by tapping with a small horn or copper hammer, aided by frequent annealings, shaped on the gold crown or die of the tooth. The flange section can be slightly thinned with a small corundum-wheel, and then or subsequently brought to position over the gold crown, or the tooth, and stiffened with solder. When the collar is shaped over the gold crown, the crown should be first filled with fusible metal as previously described.

Spur Collar Support.—Fig. 537 illustrates a form in which a straight-sided removable collar is maintained in position by a lug or spur on the side of a gold crown.

Removable Clasp and Partial Cap Attachment: Cuspids.—In this form a partial cap in combination with an elastic gold clasp, encircling only a portion of the crown, is used instead of a collar. Its application is principally confined to a cuspid or bicuspid tooth or an artificial crown.

The attachment is best constructed on a metallic die, either of the natural tooth or of the artificial crown mounted on a model. In the case of a cuspid a piece of pure gold, No. 31 gage, is adapted to the palatal surface and partly over on the approximal side, in the form shown at A, Fig. 538. In some cases it may be extended to the incisal edge. A gold clasp of at least No. 24 gage is fitted over the gold partial cap in the position shown in Fig. 539, the cap being beveled to an imperceptible edge on the sides at the points where the clasp passes forward, to assure perfect adaptation. Cap and clasp are next cemented with wax, then removed and joined at the approximal sides with a very small quantity of solder. The attachment is then ready to be connected to

FIG. 537.

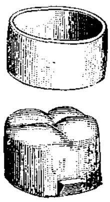


FIG. 538.

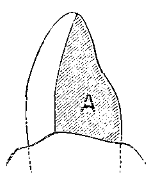


FIG. 539.

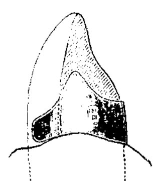
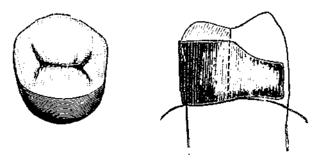


FIG. 540.



the bridge denture, which should be done by soldering the clasp portion only at the point B, Fig. 539. This method allows the soft gold of the cap portion to be again adapted to suit any position the clasp may assume in a later adjustment of the denture in the mouth. When this has been done, the bridge and clasp should be again invested, and solder flowed over and between the cap and clasp.

Bicuspids.—Fig. 540 illustrates the form the attachment just described usually assumes in cases of bicuspids. The dotted line marks the boundary of the partial pure gold cap. The construction follows similar lines to those laid down in the case of a cuspid. If preferable, the cap section can be burnished down against the crown; and, if necessary, it can be slit, and solder can be flowed over it at the final adjustment of the bridge. This form of attachment is especially useful in cases where a natural tooth tips out of line so as to render it difficult to entirely encircle it with a continuous band. Such an attachment is seldom applied to a molar.

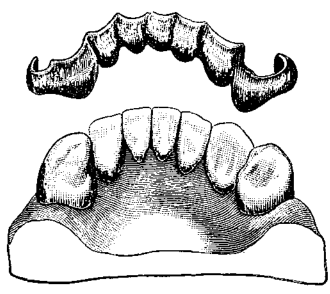
Pure gold has been given the preference to thin platinum in the construction of these partial caps, for the reason that the form and the position of the gold are less liable to be altered in soldering, an advantage which is relatively more important than the non-fusible quality of the platinum.

The forms of attachments described for removable bridge-work are those most generally applied in practice. The methods for their construction, which, as given, are the results of practical experience, may in some respects differ from those followed by others. In application, as will be shown, they enable the operator, by the methods of their construction, to overcome difficulties often encountered in obtaining a proper adjustment of removable bridges on the abutments and alveolar border. Special forms of attachments not in general use will be described in the succeeding chapters, in their application to practical cases. Their use in combination with the forms already explained may at times prove advantageous.

Connecting Bars.—Connections between the different sections of a removable bridge are formed in the following manner: An impression of the case or of the part to be spanned is taken in plaster, and a cast made by pouring into it fusible metal which melts at a point less than or not over 200°. The cast must correctly represent the lingual or palatal surfaces of the teeth. Upon this cast a strip of pure gold, No. 30 gage, about one-quarter of an inch in width and of the proper length for the required connecting bar, is burnished over the palatal or lingual surface of the teeth intervening between sections of the bridge or attachments to be connected. Wax is placed on the gold, and the gold removed and invested. The wax is next removed, and pieces of gold clasp-plate a trifle narower than the strip of pure gold, one to each tooth, are bent and shaped to fit over the lingual surface of each. Twenty-carat solder is then flowed over the gold in quantity sufficient to join the parts, level the surface, and make a rigid bar capable of resisting such force in use as would tend to destroy its shape in the slightest degree. When the bar is formed on the metallic cast it can be transferred to the plaster model, and then, or in the subsequent construction of the work, connected to the attachments; or the bar can be adjusted in the mouth, cemented with wax or ligatured on the teeth, the attachments placed in position, and the bar and attachments removed in their relative positions in a plaster impression. On the model made from this impression they will be found the same as in the mouth. The construction of the bridge can then be continued. Fig. 541 represents a bar of this character to span the lower front teeth and connect attachments on the cuspid and bicuspid.

For the Upper Front Teeth.—Where a bar narrower than the one described is required, the strip of pure gold should be cut proportionately, and pieces, one to each tooth, of half-round iridio-platinum or gold clasp-wire used to form and stiffen the bar, instead of gold clasp-plate. Iridio-platinum wire may be used without the pure gold base, but in such a case the sections of the wire are best soldered with either pure gold or 22-carat plate.

FIG. 541.



Methods for connecting sections of a bridge are illustrated in Figs. 390, 470, 472, 474, 546, 550, 560, 648, and 652.

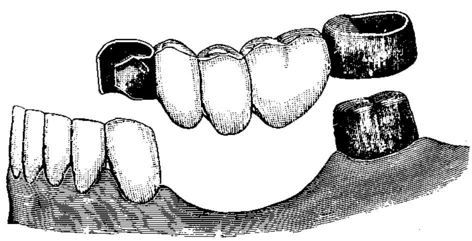
Construction of Removable Bridge-Work.—In removable, as well as other styles of bridge-work, the method of procedure is governed entirely by the conditions presented in each case. Therefore directions given regarding bridge-work embracing certain teeth and attachments in one instance may vary considerably from what is required for the same tooth in another; consequently the process of construction can only be outlined in somewhat general terms.

A case frequently presented, involving the loss of a portion of the lower teeth, as shown in Fig. 542, will be taken to illustrate the method generally adopted for the construction of removable bridge-work.

The molar is shaped to receive a gold crown. The anterior approximal side is trimmed parallel with the line of the posterior side of the cuspid. Removing a little of the enamel on the distal side of the cuspid will assist the operation and straighten that part of the tooth. A straight-sided gold crown is made for the molar. A bite is first taken in wax for articulating model and then a plaster impression, which will remove the gold molar crown in position, and a cast is made as follows: The form of the cuspid and the gold crown are first filled with fusible metal, and the remainder of the impression with pure plaster, as described in Part V, Chapter III.

A die is then made of the gold crown and a removable cap for the gold crown on this die, and a gold partial cap and clasp attachment are made on the metallic form of the cuspid. If the conditions suggest it, the gold band should be made to entirely encircle

FIG. 542.

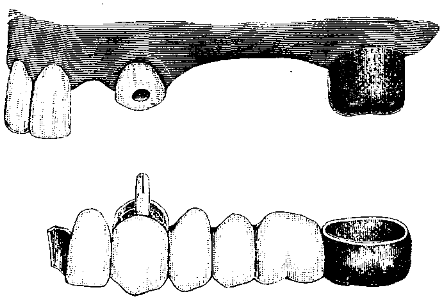


the cuspid by passing between it and the lateral. Dummies are then fitted and soldered together, placed in position, and joined to the attachments with wax cement. The bridge is then removed from the model, invested, and soldered together. In the removal of this style of work from the mouth or from a model, should the wax not hold the parts reliably together, plaster should be placed over them, so that when removed they can be accurately readjusted in the plaster. Connection with the attachment is only to be made at the collar section. The gold crown and fusible metal are then separated from the model and the fusible metal removed from the crown in the manner described on page 276.

The molar crown and the bridge are then fitted to the mouth. The crown is next cemented on the molar and the bridge immediately adjusted over it, pressed into position, and allowed to remain until the cement has set. The partial cap section of the attachments is burnished down on the bicuspid and the gold crown on the molar, while the bridge is kept firmly pressed against the gums. The bridge is then removed, invested, and the partial cap sections made rigid by flowing gold solder over them. The final trimming, finishing, and polishing of the bridge are then performed, and it is ready for insertion.

The procedure in the case described can be varied by making the entire model of fusible metal, or by placing a little wax in the interior of the grinding-surface of the gold crown, making a plaster model, removing the gold crown and filling it with fusible metal, making the attachment, and replacing the gold crown on the model. The cuspid attachment can be formed on a fusible-metal cast of the tooth.

Fig. 543.

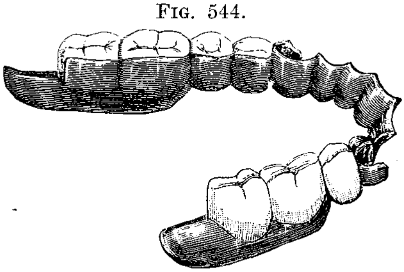


The methods of construction as above given may be still further varied by first forming the gold crown and attachments to it and the collar attachment for the cuspid, fitting them in position in the mouth, taking a plaster impression which will remove them in position, and then making a model of plaster and calcined marble-dust. On this the dummies can be fitted and soldered to the attachments. The gold crown is to be removed from the model after the position of the attachment on it is secured by the investment material, and the cavity thus formed is then to be filled with more investment material. This is probably the method most practiced.

Removable bridge-work is best constructed with the bases of the dummy teeth pressing firmly on the tissue of the gum, or resting on a saddle of platinum the size of the base of the artificial teeth. If the collar of the molar attachment should prove difficult to remove from off the gold crown when first inserted, it should be slit at the posterior section, slightly expanded, and reunited with solder, when the cap sections of the attachments are stiffened in the final process of soldering. A small piece of gold plate can be inserted in the aperture of the collar to aid the gold to unite the ends.

In Fig. 543 is illustrated a form of removable bridge-work that could be constructed for a favorable case. In the construction, a gold crown is made for the molar, with a removable gold cap and collar attachment and a removable cuspid crown, with a cap and a tube cemented in the root-canal for the cuspid. The crowns are adjusted in position in the mouth and an impression and bite are taken in plaster. When removed from the mouth, the crowns and attachments are to be replaced in position in the

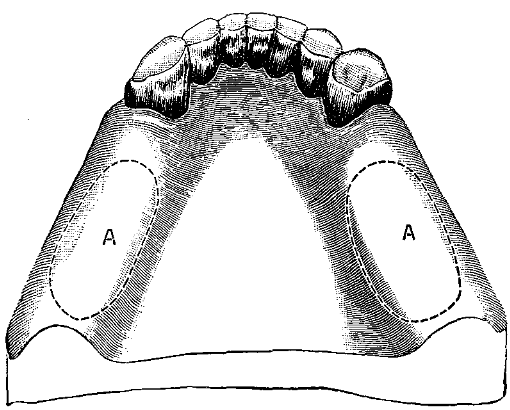
FIG. 544.



impression, and a model of plaster and calcined marble-dust made, and also an articulating model in plaster. The lateral and bicuspid and molar dummy teeth are next fitted in proper position on the model. A piece of pure gold, or thin platinum, is fitted against the lateral, and burnished over the palato-approximal side of the central to form the flange. The case is then invested, the gold crown slipped out of the attachment, the place it occupied is filled with additional investment material, and the parts are all soldered together. The construction can be varied by first making the bridge from the molar to the cuspid, and then adding the lateral and flange. When finished, a suitable quantity of cement is placed in the gold crown, the crown is fitted on the molar, the bridge adjusted in position, and the teeth occluded and so allowed to remain until the cement sets. Removable bridges for cases such as that just described require deep root-canals for the posts and teeth of considerable length for the collar attachments, for proper retention.

The denture illustrated in Fig. 544, a case of Dr. A. S. Richmond's, was made to restore a loss of teeth which is frequently met with, but one not suitable for the insertion of cemented bridge-work. The application of a removable denture combining bridge- and plate-work is a method possessing some advantages over some ordinarily practiced. In brief, the constructive details are: A connecting bar is formed as described on page 278. After the bar is formed the pure gold is extended over the cuspid and bicuspid and gold clasp attachments or collars made connected with the bar. The bar and clasp or collar attachments are inserted in the mouth, and an impression taken in plaster. Two pieces of

FIG. 545.

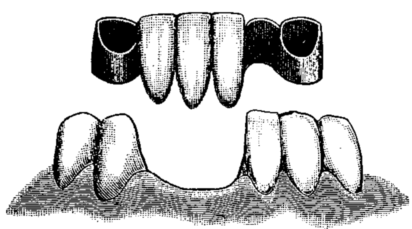


sheet lead, about No. 26 gage, are placed on the surface of the impression where the saddles are to rest, for the purpose of causing an equal displacement on the plaster model and thus securing an even pressure for the saddles on the alveolar ridge. (See page 219.) A model is next made with the attachments and bar on it in position. Metal casts are also made of the parts at A A, Fig. 545, and two platinum plates struck up. The teeth are then arranged in position, the bicuspids resting on the gums and the molars on the two plates or saddles, and the denture completed as shown in the illustration. In this case the extension of the saddle, so as to cover the alveolar ridge under the bicuspids, would have afforded more support and without perceptibly increasing the size of the denture. (See Removable Plate Bridge-Work, Part III, Chapter XII.)

Removable bridge-work offers peculiar advantages for artificial replacement of lower incisors in cases similar to that illustrated in Fig. 546. A portion of the contour of the approximal sides of the right cuspid is removed. Shell caps for the right and left cuspids are then formed of pure gold, No. 36 gage, reaching nearly to the margin of the gum. The caps are encircled with a slightly narrower piece of stiff gold plate or clasp-metal, about No. 36 or 37 gage, which is soldered to the caps as described on page 275 in the construction of molar partial caps. The caps are next adjusted in the mouth, and an impression and bite taken in plaster and the caps removed in it.

A model of about three parts plaster and one of marble-dust and an articulation in plaster are then made. Porcelain incisor teeth with straight pins are fitted in position, backed, and a broad bar ex-

FIG. 546.

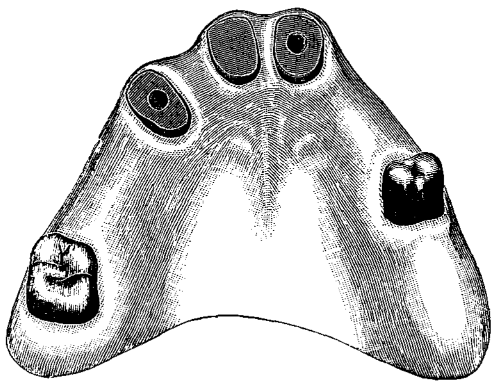


tending from the linguo-approximal side of the gold cap on the left cuspid around to the distal side of the lateral is formed of a strip of platinum, adapted to the parts, overlaid, and soldered to a slightly narrower strip of gold clasp-plate. The different portions are then cemented together with wax, invested on the model, and properly united with solder. When finished and inserted in the mouth, it constitutes a denture that can be worn without inconvenience by the patient, and removed daily and cleansed, which last especially is a great advantage, as in a case like this the teeth replaced have usually been lost by recession of the gums and those remaining are often inclined to be affected by the same trouble. The natural teeth, if loose, are in a measure steadied and supported by the appliance.

In the case represented in Fig. 547, gold crowns with removable partial cap and collar attachments are made for the molar and bicuspid, and removable crowns with partial collars at the palatal sides for the centrals and cuspid. The right central can be capped and the crown fitted over it without a post, if, in the opinion of the operator, the posts in the other two crowns will afford ample security.

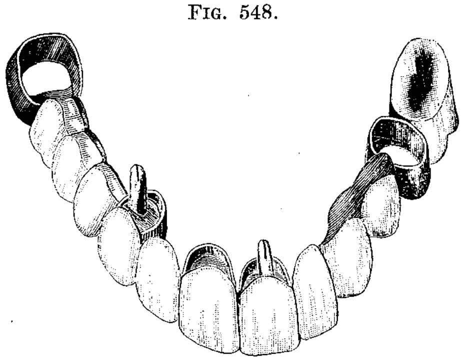
The root-caps of the centrals and cuspid are cemented on each

FIG. 547.



root with oxyphosphate. The central crowns are cemented together with wax, adjusted in position, covered with a small quan-

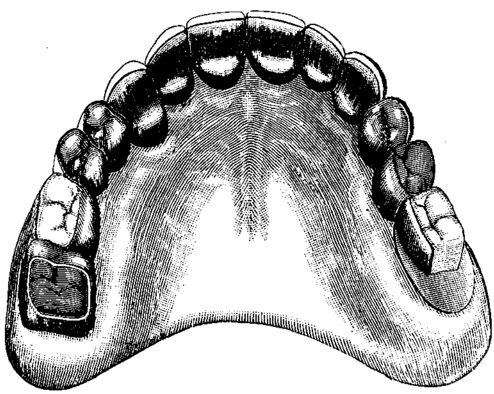
FIG. 548.



tity of investment material, removed, more investment material added, and the crowns soldered together.

The centrals and the cuspid are then adjusted in the mouth, a lateral is backed, fitted, and waxed between them in position, the whole removed in investment material, and the process of investing and soldering proceeded with to join the parts as before described. This bridge of four teeth is fitted to the mouth, and the points of the posts trimmed on the side and in the direction which will best favor their entrance into the tubes in each root, so that the bridge will readily slip into position. The dummy bicuspids and molar on the right side between the cuspid and molar are then added by first taking an impression and bite of that section, and then proceeding with the construction as described in previous cases. The section of the bridge with the extension on the left side is next added in a similar manner by taking an im-

Fig. 549.



pression of the part while the portion of the bridge already constructed is in position, removing bridge and impression together as described on page 283, and making a model. A piece of pure gold or platinum is shaped to the model by alternately burnishing and annealing, to form a base for the molar. The one molar will exert as much leverage on the abutment of the bridge in mastication as can safely be borne.

Fig. 548 shows the bridge completed, and Fig. 549 the piece in position. Very long substantial abutments are required for the support of a piece of bridge-work constructed as above described. At the present time the "Griswold" attachments are generally used in such cases. (See page 309.)

CHAPTER XII.

Removable Plate Bridge-Work.

FORM OF CONSTRUCTION—METHODS OF CONSTRUCTION—VARIOUS STYLES—DR. BONWILL'S METHOD—DR. DAVENPORT'S CASE.

Form of Construction.—In this style of work a plate is used to span the space and support the artificial teeth between the abutments. Attachments similar to those used in connection with removable bridge-work are also applicable to removable plate-bridges. Removable plate bridge-work is really plate-work secured in position by removable bridge-work attachments, and is intended to combine in a denture the advantages of both systems. In the construction of removable plate bridge-work, removable crowns, caps, or attachments are made for the supporting teeth in the same manner as for removable bridge-work, though clasp attachments may be somewhat more freely used.

Methods of Construction.—An impression of the part is taken, from which a plaster model is made. On the model an outline of the size of the required plate is marked and the edge of the space scraped sufficiently to insure a slight pressure for its margins. A metallic die and counter-die are cast, and a gold plate of the proper size swaged.

In all forms of removable plate bridge-work, when the attachments are brought to their proper position on the crowns or teeth supporting them, the plate constituting the bridge should not merely rest on but should press on the alveolar border intervening between them, especially when first constructed. This result is obtained by methods practiced in the application of the plate in the following manner: Pressure is exerted along the central portion of the plate with a broad-pointed instrument which will not slip. Take a britannia impression-tray and cut a slot in the side extending to the center of the bottom of the cup, of such a size and shape as will permit the cup to be inserted and an impression taken without interfering with the instrument when held against the plate. Fill the impression-tray with plaster. Exert direct pressure on the plate with the instrument sufficient to whiten the tissue at the edges where the model was scraped and insert the impression-tray and plaster. Maintain the pressure with the instrument until the plaster has set, then remove all together, including plate, attachments, and instrument, and run a plaster model. On the removal of the model the plate and attachments will be found on it in the same relative position as they were in the mouth. Cement the attachments to the plate with wax, remove, invest, and solder together.

Another method is to make the model of marble-dust and plaster and solder the plate and attachments together on the model and so avoid their removal until united.

FIG. 550.

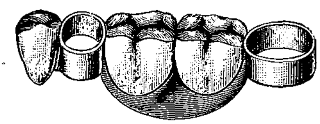
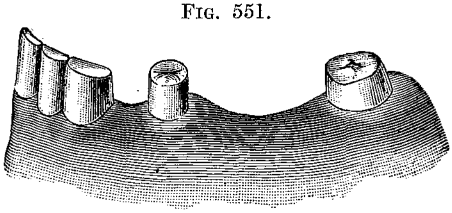


FIG. 551.



The plate and attachments are next fitted in the mouth, wax is placed on the plate, and a "bite" taken in the usual manner. An articulating model is made, and also a model run for the plate and attachments to rest on, if the original model has been destroyed by investing the plate and attachments on it when they were soldered together.

Pressure of the plate on the tissues in cases of small plate bridge-work can be obtained, but less reliably, in the following manner: Cement the attachments to the plate with sticky wax, adjust in the mouth, press on the plate, chill the wax with ice-water, remove, invest, and solder the attachments to the plate.

Another method is: First strike upon a die of the case a plate of lead, No. 24 to 32 gage, according to the hardness of the tissues and the pressure desired. Take a plaster impression with the attachments in position. Place the lead plate in the plaster impression and run a model. When the model is made, remove the lead and substitute gold plate in its place in position on the model and connect the attachments with solder. By this method a uniform pressure of the plate on the membranes to any desired degree is obtained. The first described method is generally the best one to pursue.

The plate and attachments having been united, the case is then finished with plain or gum teeth, attached with vulcanite or gold, as circumstances may suggest. Should a clasp attachment cause decay or abrasion of a tooth, the part can be excavated to a slight

FIG. 552.

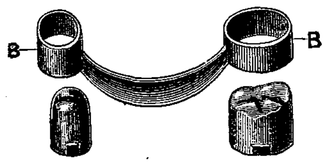
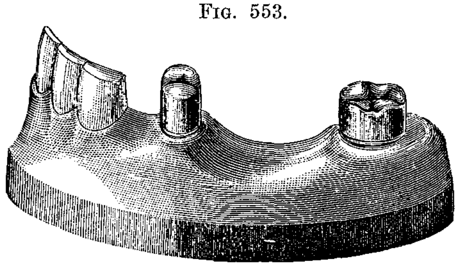


FIG. 553.

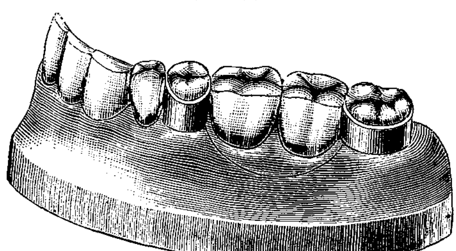


depth under the clasp, and filled with gold. This is best done by making a few retaining-pits, filling them with a hand-plugger, and then inserting the main body of the gold in the ordinary manner, the Herbst method being useful in condensing the foil. Such a filling inserted at any time will prevent injury from a clasp. A denture of this style can be made to pass intervening teeth.

Various Styles.—In the artificial replacement of the lower teeth in a case such as is illustrated in Figs. 550, 551, a plate-bridge possesses many advantages. In the construction of such a denture, the teeth are first properly shaped. Gold crowns (Fig. 552), with sides as nearly as possible parallel the one with the other, are then made and fitted to the bicuspid and molar. This operation is frequently facilitated by shaping the external surface of the crown with metal. On the crowns, at the buccal sides (Fig. 552), a narrow shoulder (A) is constructed to sustain the collars and bridge in position. In some cases this shoulder is placed on the approximal side to better advantage. Collars B B, Fig. 552, reaching from the cervical to the occluding edge, are fitted to these crowns.

The collars, though fitting accurately, should move easily over the crowns, as they can be readily tightened when the case is finished. If the collar is troublesome to adjust and remove, cut the side opposite to that attached to the plate, and spring it open a little. After fitting the teeth it can be again united when they are being soldered. This collar and shoulder form a support

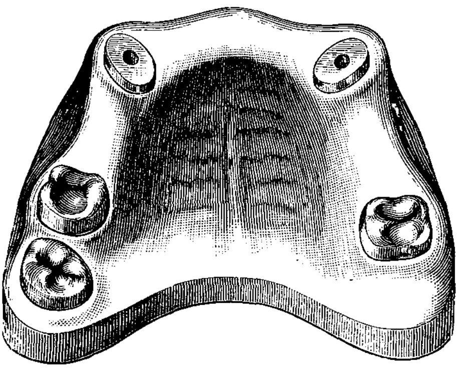
FIG. 554.



in some respects preferable to a partial or an entire double cap, being less difficult to keep clean. A collar is more easily constructed, and also permits the position of the bridge to be altered by the removal of a little of the shoulder or of the cervical edge of the collar, and is a secure but less rigid attachment than is provided by other methods. The other constructive details of this denture are conducted in accordance with removable bridge-work methods. In a case such as just described, the artificial first bicuspid is best attached with gold to the side of the removable collar which fits on the second bicuspid, and the molars with vulcanite to the plate. If iridio-platinum plate is used in the construction instead of gold, and platinum solder used for soldering, porcelain body can be used. When ready to be inserted, the crowns are adjusted with cement, and then the bridge, which is left in position until the cement sets. By burnishing the collars they can be made to clasp the crowns as firmly as desired. Fig. 554 shows the denture in position.

Figs. 555 and 556 represent an upper removable plate-bridge. In its construction the cuspid roots are first capped, tubed, and pivoted, and the molars crowned. The plate intended to connect

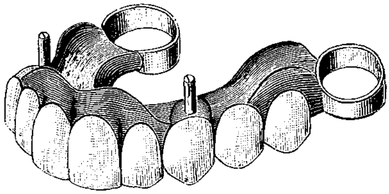
FIG. 555.



the abutments is then adjusted in position as has been described. An impression is next taken and a model made. The cuspids are then double-capped and collars formed on the molar crowns.

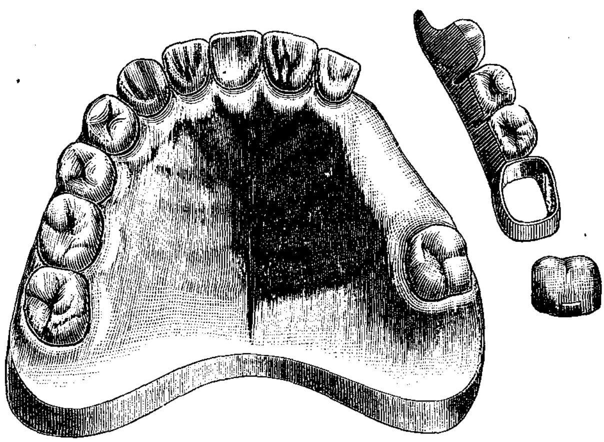
The molar collars are first soldered to the plate. The molar crowns are removed from the model, placed in the mouth, and the collars on the plate fitted over them. The plate is pressed firmly against the tissues, and the line of the edge of the collars toward

FIG. 556.



the gum-margin marked with a sharp instrument on the buccal surfaces of the gold crowns, and the crowns removed. At the lines marked on the gold crowns shoulders, such as are shown in Fig. 552, are next soldered. The plate and all the caps are again adjusted in the mouth. The plate is pressed firmly against the tissues, the double caps on the cuspids attached to the plate with cement, or plaster instead can be placed over them and the adjacent surface of the plate, and plate and cuspid double caps removed, invested, and soldered to plate. The artificial teeth are attached with vulcanite, the gum section being formed with pink. In order to avoid any warping, which might readily occur in the construction of so large a denture as this, the plate may at first be swaged up, as in ordinary artificial dentures, to cover the entire hard palate. A shallow groove can be made around the palatal side on the plaster model where the plate is to extend. This

FIG. 557.



groove being reproduced in the metallic die will also form a groove in the swaged gold plate. After the final soldering the plate can be cut along the line of this groove, the portion covering the palate being removed. The groove will insure a close fit for the palatal edge of the plate.

In the case represented in Fig. 557 the natural teeth were very short. The posterior approximal side of the molar was decayed to such an extent that the pulp was nearly exposed, and considerable irritation of the investing gum-tissue had been caused by the clasp of a plate worn by the patient working upward against it. The patient declined to have a plate made which would extend across the palate. The lateral was hardly strong enough to support a permanent bridge. The molar was capped with gold, and a removable collar was made to fit over the gold crown and rest on a spur placed on the mesial side. The lateral was notched and clasped for the anterior support. Figs. 558 and 559 are two views of the appliance in position.[1]

Fig. 560 represents a case in which the bicuspids and a molar are replaced, and also a central, on an extension of the plate,

FIG. 558.

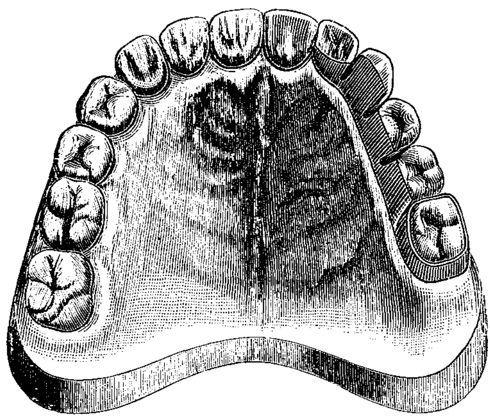
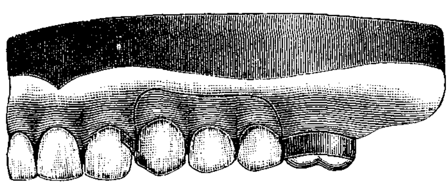


FIG. 559.



the cuspid being nearly encircled by a clasp with a shoulder resting on the palatal section of the tooth. Fig. 561 shows the denture in position.

Fig. 562 represents a case in which a bridge-plate was inserted without crowning either of the abutments. The clasp of a plate which had been worn for some years had worked upward and abraded the distal section of the cuspid to such an extent as to expose a large portion of the root and superinduce decay. The

[1] This denture the last time seen had been worn thirteen years.

cavity was filled with gold, and the gingival border, by treatment, brought nearly to its normal position on the tooth. A plate-

FIG. 560.

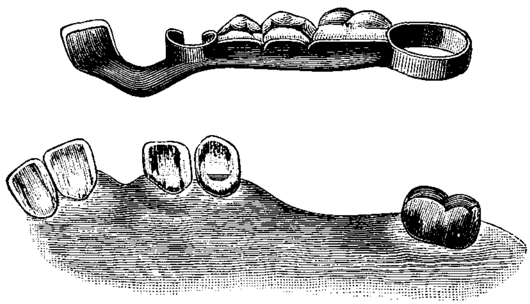
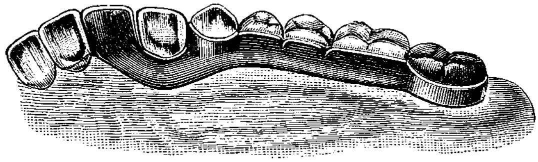


FIG. 561.



bridge, such as is represented in Figs. 563, A, and 563, B, was constructed. Clasps, with flanges resting on little shoulders formed at A A, Fig. 562, support and retain it. A flange such as was

FIG. 562.

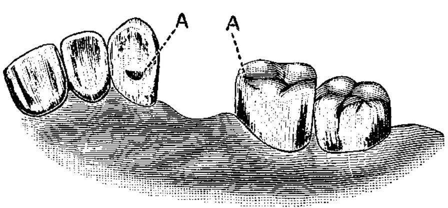


FIG. 563, A.

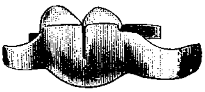
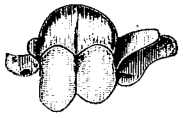


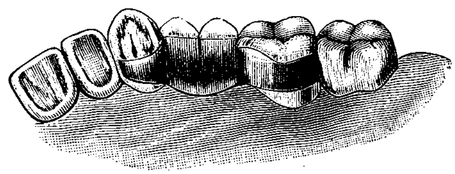
FIG. 563, B.



used in this case is best made subsequent to the construction of the plate and clasps, by burnishing a piece of platinum foil in the mouth to the form of the shoulder and the side of the tooth upon which it is to rest, adjusting the clasp over it, and cementing with wax, then removing, investing, and soldering. Wherever the platinum is placed, the solder will flow and fill all the space between it and the clasp. This gives the clasp the exact form of the tooth.

Fig. 564 shows the denture finished and in position. If the teeth are dense in structure, an attachment of metal held in proper

FIG. 564.

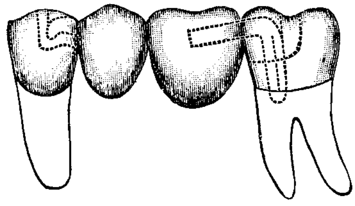


position against the lower portion of a natural crown will be worn a long while before it causes injury to the parts. Filling, or crowning, if necessary, can be resorted to subsequently.

By a correct application of the methods just explained and illustrated, a piece of removable bridge-work of this style can be devised for many cases.

Inlay Attachment.—Fig. 565, A, illustrates Dr. F. A. Peeso's inlay attachment. The main support of the bridge is obtained

FIG. 565, A.



by the use of a split pin in a tube inserted in an inlay cemented in the mesial section of the molar. The anterior end of the bridge is supported and steadied by a substantial hooked wire spur which rests in a groove in a filling inserted in the bicuspid.

The method of construction is as follows: The molar is devitalized and cut out on the occlusal surface about one-half its length and down on the mesial side sufficient to allow space for a heavy round bar of about No. 13 gage with a good thickness of gold between it and the walls. The shape to be given the cavity is illustrated in Figs. 565, B, and 565, C, which show the sides curved and non-retentive. The pulp-chamber is filled with gutta-percha. Pure gold, No. 34 to 35 gage, is then burnished into the cavity as for an inlay, care being taken to have the margin perfect. A hole is next made through the matrix near the distal end into the gutta-percha to the floor of the pulp chamber. In this hole is placed an iridio-platinum tube large enough to take a No. 13 or No. 14 wire pin. The tube is waxed securely to the matrix and removed. A piece of pure gold is placed across the front of the matrix against the wax so that it can be entirely filled at that point in the soldering. The matrix is next invested and filled with 22-carat gold. This forms a gold inlay with the tube in position extending through it, Fig. 565, D.

FIG. 565, B.

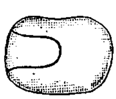


FIG. 565, C.

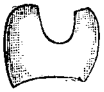


FIG. 565, D.

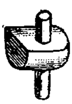
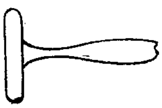


FIG. 565, E.



A groove is next cut from the orifice of the tube through the inlay to this mesial side. The bulk of the cutting is quickly done with a thin round-edge carborundum wheel. (Fig. 565, E.) The groove can then be finished with a fissure-bur of the same size as, or slightly larger than, the inside diameter of the tube. The entrance to the tube is to be slightly rounded with an oval-shaped finishing-bur, a slight downward curve being given to the mesial side to permit the bent portion of the bar to be more easily set into the groove and to avoid the projection of the remainder above the surface of the inlay or the cusps of the dummy. Fig. 565, F, shows a section of the inlay and tube in position in the tooth with the bar and pin in place.

The combined bar and pin is made of half-round iridio-platinum or platinized gold wire, bent double and soldered to within about a quarter of an inch from the end. (Fig. 565, G.) A flake of isinglass should be inserted between the ends of the wire at the part to remain unsoldered. It is next trimmed or turned to exactly fill the tube and groove and then bent and fitted to lie closely in the groove and filed so the pin end can be slightly opened to give it a spring that will hold the piece firmly in position.

The bicuspid is prepared with the grooved and countersunk filling. The gold must be very dense and well anchored. The antagonizing tooth should be trimmed to favor the filling and bar in occlusion.

FIG. 565, F.

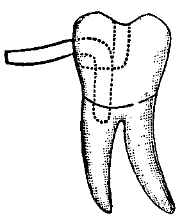
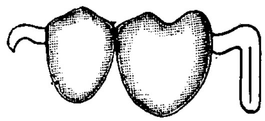


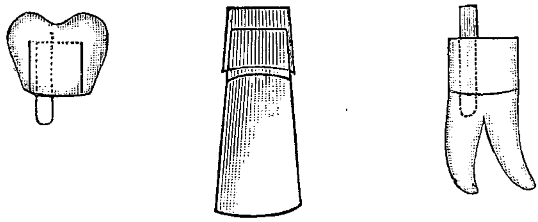
FIG. 565, G.

FIG. 565, H.



The inlay with the pin in position is next placed in the tooth and a combined impression and articulation taken in plaster, the inlay coming away in the impression on removal. A model and articulating model are made, which will give the position of the gold inlay, and show the groove and slot in the bicuspid. The spur to fit the latter is to be made of either iridio-platinum

FIG. 565, I.



or platinized gold wire, No. 14 to 16 gage. The construction of the bridge is next proceeded with and the bar and spur are solidly soldered into it. (Fig. 565, H.) The sides of the gold inlay are to be slightly grooved or roughened. It is then cemented to place in the molar while in position on the bridge as though it were a fixed piece. The spur resting in the groove in the bicuspid filling with the point in the slot, prevents lateral motion of the bridge and spreading of the teeth.

Inlay attachments are applicable to a variety of small removable bridges supported by central incisor, cuspid, or bicuspid teeth. Fig. 565, I, shows the splint pin and tube used in connection with a removable double cap-crown on a molar and outlines the construction.

Dr. Bonwill's Method.[1]—The special feature of this method is, the manner of connecting the clasp attached to the plate with a piece of stout gold and platinum wire on the side of the tooth offering the least resistance to the insertion and removal of the clasp. This, for instance, should be on the buccal side of a lower molar if it tips inward or forward. The clasp is thus left free to spring over any portion of the crown out of line.

The clasp is surmounted with a flange or spur placed at a point free of the occluding teeth, and the plate is made of heavy gold plate or of two thin plates soldered together. A description of the following practical cases will explain the method:

Fig. 566 is a model for the first upper bicuspid, left side. A filling of gold was placed in the distal surface of the natural cuspid, with a hole, *c*, drilled into the filling for the pin *c*, Fig. 567. The second bicuspid had also a large amalgam filling, around which the clasp was placed, so that it would not show in the mouth. Fig. 567 shows the plate with a tube-tooth or porcelain crown thereon, held by a post soldered to the plate. The clasp has a flange attached to it at *h; i* is a heavy platinized gold bar, showing how it forms a free attachment between plate and clasp; *c* is a pin, soldered directly to the plate, which enters the hole in the gold filling shown at *c* in Fig. 566.

Fig. 568 is a skeleton plate with the attachments without the tooth made for the case—left side, lower jaw—shown in Fig. 570. *e* and *e*, Fig. 568, are flanges to prevent the plate pressing too hard on the gum. One rests on the molar independent of the clasp, and the other on the bicuspid. A small spur is placed under the flange that is to rest on the bicuspid to fit in a groove in an amalgam filling shown at *d*, Fig. 570, to keep the anterior portion of the plate in position. The clasp is connected to the plate at the lingual side by the bar marked *i*. Fig. 569 shows the finished case with the artificial crown cemented over the pins or vulcanized on.

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[1] *International Dental Journal*, vol. xiv, page 94.

Fig. 571 shows the replacement of a second bicuspid, right side, lower jaw. The bar *i* is soldered to the plate and clasp on the buccal side of the first molar. The artificial tooth is made entirely of gold, and the flange resting on the first bicuspid is soldered directly to it. The anterior surface of the gold tooth is made concave to fit the distal surface of the first bicuspid and so prevent lateral movement.

In this case a gold crown is used as the artificial tooth, as it facilitates the soldering, adds to the strength, is easy to repair, and is not seen. The rear flange, which rests on the molar, might have been soldered to the gold tooth also, and less strain would thus come on the clasp.

Fig. 566.

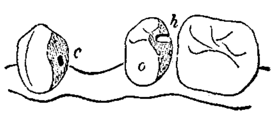


Fig. 567.

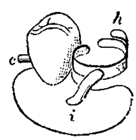


Fig. 568.

Fig. 569.

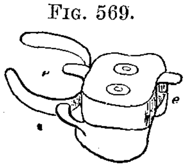


Fig. 570.

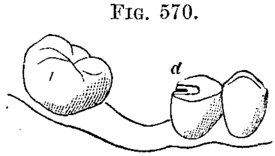
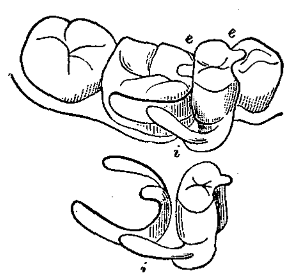


Fig. 571.



Dr. Davenport's Case.—This case of Dr. J. L. Davenport's is presented to show the various methods which may be practically adopted in the construction of plate-bridges.

"The patient was a gentleman about fifty-five years of age. The upper jaw contained the six front teeth, the three molars on the right side, and the first bicuspid on the left. The lower jaw contained all but the left central incisor, the second bicuspid, the three molars on the right side, and the first and third molars of the left.

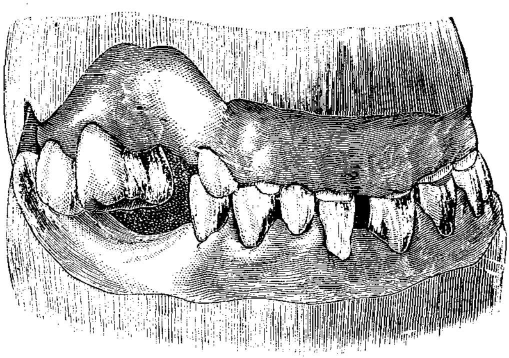
"In consequence of this lack of occluding back teeth, mastication had been performed solely by the front teeth, causing attrition so great on the upper ones as to entirely obliterate their crowns, while the lower ones suffered but little loss, as will be seen by reference to Fig. 572.

"The patient had managed for a long time to masticate, though imperfectly, upon these stumps, but latterly could eat scarcely anything but soups and soft foods.

"The restoration of the lower teeth being completed to the extent of about one-eighth of an inch on an average, to make them of uniform height, my attention was directed to the upper incisors and cuspids, nearly all of which I found with dead pulps, and some of them in a condition of active abscess.

"The two superior cuspid roots were dressed down nearly to the gum, and fitted with 22-carat gold cap-crowns. After these

FIG. 572.



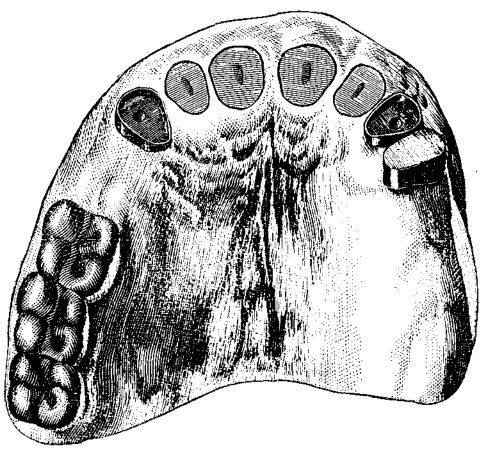
had been placed in position, a hole was drilled through each cap of a size suited to that of the pulp-canal, and a tube of iridium and platinum was adjusted in the root and cap and waxed in position. The cap and tube were then taken off and soldered, great care being taken to have the tubes enter both roots perfectly parallel. These were permanently secured in the roots with gutta-percha, and to prevent the caps being pulled off the top of each tube was slit down a trifle, and after insertion was bent back into the gutta-percha with a warm instrument.

"The incisor roots having been dressed down even with the gum and filled, a plaster cast was taken and a narrow 20-carat gold plate was swaged to fit over the ends of the incisors and the capped cuspids, making it a little broader where it had to rest on the gum back of the first left bicuspid root. A hole in the plate was then made to expose the root of the first left bicuspid. This was fitted with a bifurcated iridio-platinum pin, having notched sides and a hammered head upon its lower end, which came down below the root about three-eighths of an inch.

"A thin iridio-platinum band was then made to encircle the root, passing just under the gum and being slightly longer than the headed pin. This band was perforated with two rows of holes, from without inward, giving the inner surface a roughness similar to that of a nutmeg-grater. The band and pin were then made secure to the root with a non-shrinkable copper amalgam.

"Fig. 573 shows the upper jaw ready for the plate.

FIG. 573.

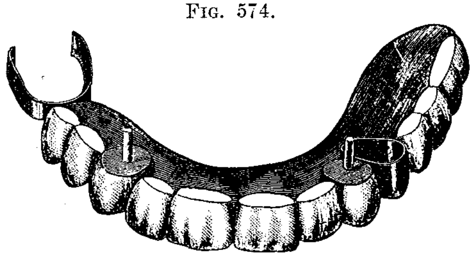


"After the amalgam had become hard and the end and sides had been polished, a gold crown was fitted over all just up to the margin of the gum, and in close contact with the end of the band and amalgam. This crown was loose enough to admit of its sliding on and off, though with just enough friction to hold it in place when at rest. This gold crown was then placed in position, the plate also inserted, and hard wax used to firmly join the two in the mouth. They were then removed and soldered.

"Gold pins were then placed through holes drilled in the plate into the tubed cuspids; then soldered to the plate, the pins being of a size to fit the tubes accurately. The plate was also provided with a wide clasp encircling the first molar on the right.

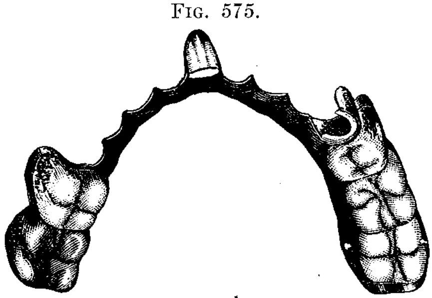
"The plate was then provided with a gold bar about one-eighth of an inch wide, occluding perfectly with the lower teeth, and plain teeth soldered in place, hiding the bar, and just meeting the gum in front of the incisor roots. The plate rested squarely against the capped cuspids, each of which showed a narrow band

FIG. 574.



of gold when the plate was in position. As finally completed (see Fig. 574), this was the most perfectly fitting piece I ever inserted, requiring great care in its removal, and yet by a little practice the gentleman was able to remove and replace it quite easily. It was also as firm as any permanent bridge could have

FIG. 575.

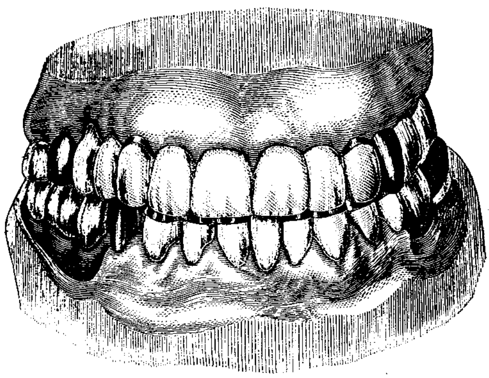


been, though it had no support on the left side back of the first bicuspid.

"The lower jaw was supplied with a double 20-carat gold plate, having a wide clasp on the first right bicuspid, which, after being built up, presented a cone-shaped top, about which the clasp fitted so as to rest firmly upon the end of the tooth, thus preventing injury to the gum during mastication.

"The only other peculiarity was that the second left inferior molar, being abnormally short, though well formed and standing straight upright, was fitted with a wide clasp, extending almost one-eighth of an inch about the tooth, and a piece of gold plate with gold cusps was soldered into this clasp, covering the molar

FIG. 576.



crown and occluding with the molar on the upper plate. (See Fig. 575.) This not only prevented the plate from being bitten down unpleasantly on the gums during mastication, but enabled me to use a shorter molar upon the upper than I otherwise could have done, and allowed better the antero-posterior and lateral movements of the jaws.

"Fig. 576 shows the case as completed."

CHAPTER XIII.

Special Forms of Detachable and Removable Bridge-Work.

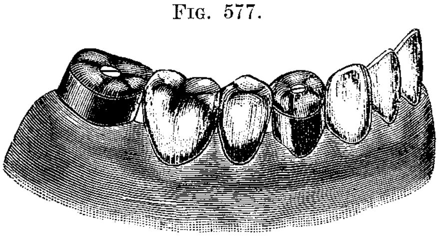
SECTIONAL CROWN METHODS: DR. WINDER'S—DR. SPENCER'S—CASE OF DR. ALEXANDER'S—DR. LITCH'S METHOD—DR. PARR'S DOVETAIL FLANGE ATTACHMENT—THE GRISWOLD SYSTEM.

A description of a few special forms and methods of constructing detachable and removable bridge-work is given in the following pages, as practiced by the introducers.

Sectional Crown Methods.

Dr. Winder's.—In this method the crowns forming the abutments are constructed in sections, the bridge being attached to the detachable section.

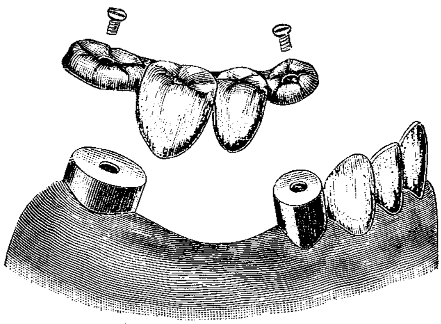
Fig. 577.



Figs. 577 and 578 illustrate a case of bridge-work made in this manner. The collar section of the artificial crown is capped and cemented on the natural crown or root, the gold forming the occluding portion of the crown, when the bridge is adjusted in position, being secured to it with a screw.

In constructing this style of bridge, the crowns with their sectional occluding surfaces are first made and placed on the teeth or roots and an impression and articulation are taken which will remove them in position. A model and articulating model are then made. The teeth or dummies are then formed in the usual manner and cemented with wax to the detachable occluding sections of the crowns and the screws that secure them loosened. The dummies and the removable occluding sections are removed in investing material, in an impression-cup, or by placing the investing material in position on the bridge, leaving the collar sections of the crowns on the model. After being removed, more investing material is added and the bridge and crown sections soldered together.

FIG. 578.



The occluding surfaces of the porcelain can be capped with gold as in permanently attached bridge-work, or they can be formed of the porcelain, which latter lessens the labor of construction, as the bridge is easily detached from the abutments for the purpose of repair. When the bridge is finished, the root and collar section of each crown is first cemented on in position in the mouth; the surface of the detachable section of the crown ap-

FIG. 579.

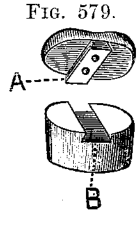
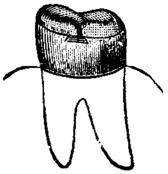


FIG. 580.



proximating them is then heated and the surface covered with a mere film of gutta-percha. The bridge is then adjusted in position and secured by the screws. The gutta-percha prevents the secretions invading the interstices between the sections of the crown.

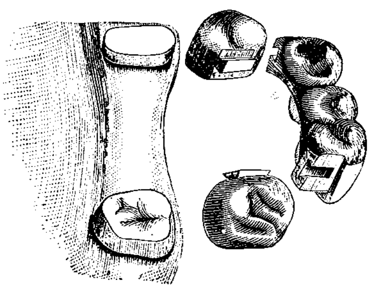
Dr. Spencer's.—Fig. 579 illustrates another method, devised by Dr. W. R. Spencer, of constructing the sections of the crowns in this style of bridge-work. The part A slides in the groove B. The dovetail flange A is made of a thick piece of plate, fitted to the groove B. The flange A is soldered to a piece of platinum adapted transversely across the cap, which is then soldered to the removable section of the crown. Fig. 580 shows the section of the crown in position.

Case of Dr. Alexander's.—Fig. 581 illustrates a bridge made by Dr. C. L. Alexander, in which dovetail slides are placed on the sides of the crowns.

In either of these forms gutta-percha can be used to securely attach the bridge so that it shall be detachable only by the dentist.

An advantage possessed by these styles of bridge-work is the facility they afford for the ready utilization of irregular teeth as

FIG. 581.



abutments, no matter how much they converge or diverge, or lean in or out of the line of the arch.

Dr. Litch's Method.—Dr. W. F. Litch's method of constructing detachable bridge-work consists in forming a shell anchorage over posts permanently fixed in cuspid roots, and anchoring the ends of the bridge with bars in slots formed in natural or artificial crowns.

Figs. 582, 583, and 584 illustrate a bridge similar to the one illustrated in Fig. 367 (page 196) with this style of attachment applied. The anchorage for the cuspids is constructed as follows: The root is first capped and pivoted as for a collar crown. On the palatal portion of the collar is soldered a flange (A, Fig. 585) made of gold, No. 16 gage, beveled off to the upper edge of the collar under the free edge of the gum, the object being to give a larger surface to the top of the cap. On this cap, which covers the end of the root, the anchorage post B, which is formed of iridio-platinum wire, No. 9 gage, is soldered, over and back of the pin (C) which enters the root-canal, so as to allow room for the porcelain front D. The porcelain front is ground in proper posi-

FIG. 582.

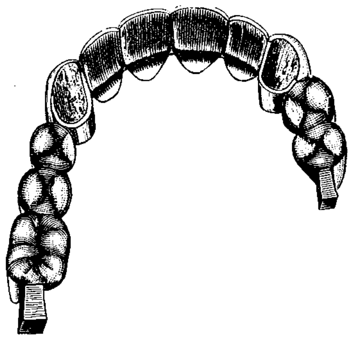
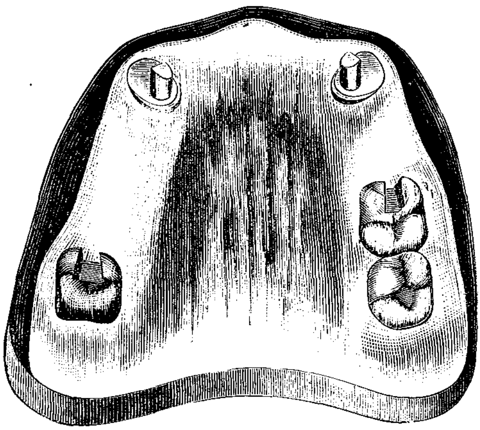


FIG. 583.



tion on this cap, backed, attached with resin and wax, and removed with the cap. The cap is next invested in plaster to the

FIG. 584.

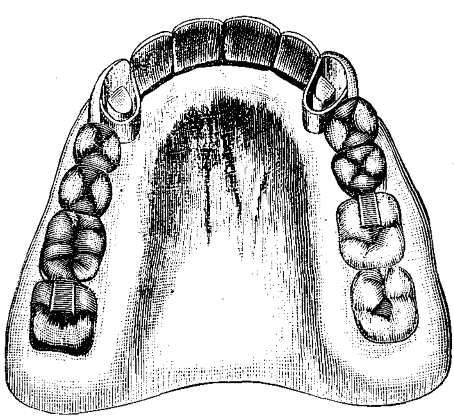
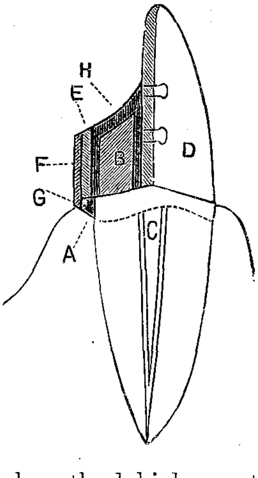
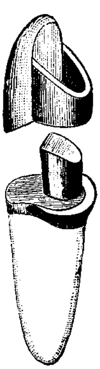


FIG. 585.



edge of the collar, and a little plaster is placed on the labial aspect of the porcelain front in the form of a matrix, so as to allow the porcelain to be removed and replaced. A piece of heavy iridio-platinum plate (E), about No. 20 gage, is then shaped into the form of a half-ring, with the ends of the plate against the backing of the porcelain front, and of sufficient size to rest on the flanged edge of the cap when completed. On the outside of this half-ring is fitted and soldered a thin strip of gold (F) of No. 28 gage, which will cover the half-ring and extend beyond its cervical margin, slightly overlapping the flange of the collar (G). This forms a brace or edge on the anchorage cap as it rests on the root-cap. The half-ring is then fitted to the tooth, attached with wax, and removed with the tooth out of the plaster matrix from the root-cap, invested, and securely soldered on the inside to the backing of the tooth. The tooth and half-ring are then adjusted to the root-cap, over the post of which the ring must slide easily (Fig. 586). To this ring the bridge is soldered the same as to a crown.

FIG. 586.



When the bridge is inserted, the cap for the root, with the post, is first cemented on with oxyphosphate. After the cement has set, the anchorage ring is filled with more cement and pressed into position upon the cap over the anchorage post. The surface of the cement (H, Fig. 585) can be protected by a metallic filling.

This form of attachment permits the bridge to be easily removed by affording access to the cement around the pin. The bar ends of the bridge are anchored in the crowns with gold or amalgam fillings, which likewise are not difficult to remove.

Method of Forming Anchorage Cavity for a Bar in a Gold Crown.—The anchorage cavity for a bar in a gold molar crown for use over a tooth with a living pulp is best made by cutting out the gold to the form of the slot required, and inserting in its place a piece of platinum plate, about 32 to 34 gage, of the shape of the walls of the anchorage cavity. The crown is then filled with investing material, and the metal forming the anchorage cavity soldered to the crown at the edges of the cavity.

Dr. Parr's Detachable Dovetail Flange Attachment.—Fig. 587 illustrates a case of this style. The teeth forming the abutments lean toward each other posteriorly and anteriorly over the space to be bridged, as shown on the original model, Fig. 588. The bridge is supported by two shoulders on the abutment crowns, which slide into grooves in the dummies (Fig. 589). These supporting shoulders and slots are made by shaping two pieces of platinum plate to the form shown in Fig. 590, so that one shall telescope the other. The inner one is then invested on the outside surface and filled in with gold plate. The outer piece is then filled inside with investing material, and gold plate is flowed over the outer surface. The shoulders are first soldered to the crowns, and afterward the slots are adjusted to them and soldered in position in the bridge.

FIG. 587.

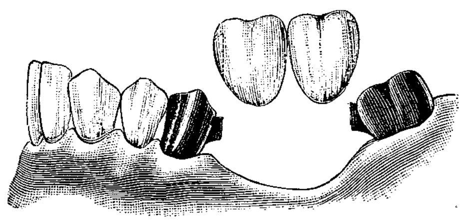


FIG. 588.

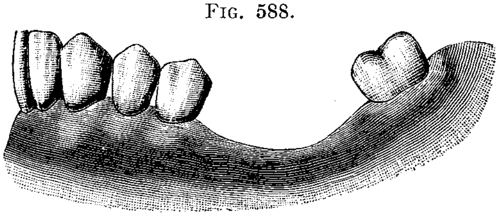


FIG. 589.

FIG. 590.

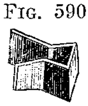


Fig. 591 shows a bridge constructed with the attachment just described at one end and a double-cap attachment at the other.[1]

The Griswold System.—The attachments for removable bridge-work which have been described, owing to their intricacy and the time necessary for their construction, also their ineffectiveness at times in retaining a denture in position, have been largely superseded by manufactured (ready-made) attachments.

The Griswold system consists in the use of a manufactured attachment by a special method which includes tools for its application.

The attachment consists of a catch and socket, termed by the manufacturer, the spring and box respectively. The spring (Fig.

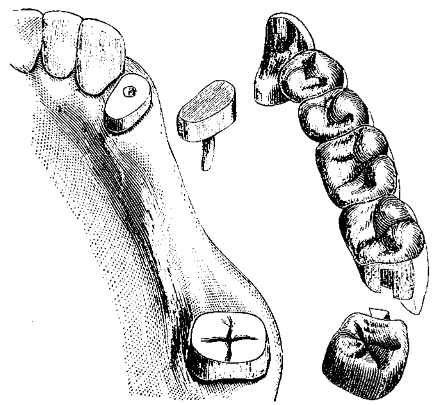
[1] Case of Dr. C. L. Alexander, described page 27, *Dental Cosmos*, vol. xxxiii.

592) fits inside the box (Fig. 593), and is attached to the crown and the box to the denture, as illustrated in Fig. 594.

The metal composing the spring is a special alloy of platinum, iridium, and base metals. It possesses strength and resiliency and fuses at a high heat. The box is made of iridio-platinum. Both alloys are made into plate, and the spring and box are formed by stamping each out of a piece of the plate without soldering.

The spring and box are of triangular form, with corresponding corrugations on the sides, to serve as a locking device (3, Fig. 592, and 2, Fig. 593). A flange of the metal from one side of the spring is lapped over on the end which comes next to the gum, for the purpose of closing it (2, Fig. 592).

FIG. 591.



The box is slightly flared at the lower end (1, Fig. 593) to form a finder or guide for the patient in setting the box over the spring when adjusting the denture.

The steps in the construction of a piece of bridge-work with the Griswold attachments are as follows:

Make crowns in the usual manner, either seamless or in sections, using 20-carat, 22-carat gold, or hard-flowing solder in their construction, so that subsequent soldering of the attachments to the crowns can be done with 18-carat solder. Cap-crowns with porcelain fronts on roots should be made with long, substantial pins. Gold solder applied in the construction of all-gold crowns should not be trimmed until the springs are attached, as the amount of solder necessary to be removed is then better determined and soldered seams are less liable to be opened up.

Plate bridge-work is most commonly used with these attachments. A plate is accordingly swaged, the crowns placed in position in the mouth, and the plate fitted between them. An articulating impression or bite is taken and laid aside. An impression is next taken in plaster while pressure is exerted on the plate, as described on page 287, and the plate and crowns removed in the impression. Flow a thin film of wax inside the crowns and root-caps, and over the surface of each post and then run a plain plaster model. When set, remove crowns in position on the model, adjust wax bite, and make an articulating model. A faint vertical line should be marked on the side of the crowns, extending onto the model, for possible future reference in replacement after removal. When the plaster is quite hard, warm

FIG. 592.

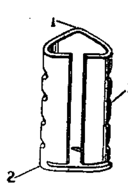


FIG. 593.

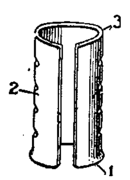
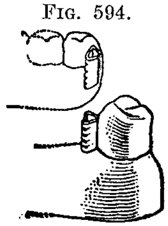


FIG. 594.



the crowns slightly and remove them, clean out the wax with boiling water, and replace them accurately.

Next mark on the crowns the most favorable locations for the attachments. The angle which they apparently will have to assume and the position necessary to accommodate the artificial and occluding teeth will determine this.

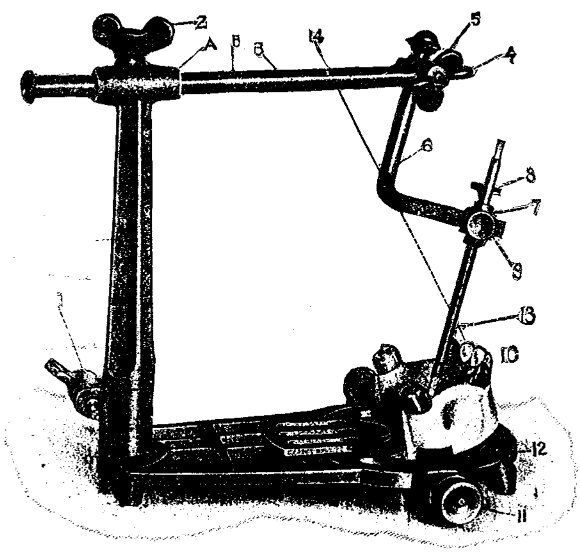
Fig. 595 represents what is called a soldering jig. It consists of a framework of iron, on the base of which the model is clamped, while the rod and arm of the instrument carry the springs in parallel lines against the side of each crown, so that the boxes which fit over them can be easily adjusted and removed when attached to the completed denture.

To set the model on the jig, as shown in Fig. 595, and place the springs of the attachments: First loosen the clamp-screw marked 1, which fastens the post, and swing the rod and arm section of the appliance to one side. Place the model on the base and clamp it securely by turning the thumb-screws on each side marked 11.

In the construction and use of the jig, the intention is that the large, upright post and the elongated rod are to freely *position* the small arm and chuck and the small arm when the upright post and horizontal rod are fastened to give range to the chuck that will carry and rotate the attachment on its point.

The upright post turns on its base and is fixed by the clamp-screw marked 1. The rod B twists and slides forward and backward, and is secured by the screw 2. The smaller section, arm 6,

FIG. 595.



can be tipped at any angle, forward or backward, and is controlled by the screws 4 and 5. The chuck 13 is connected with the arm by the screws 8 and 9.

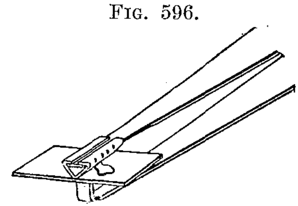
The different motions of the several parts of the jig permit the chuck to be placed and then moved in a parallel position to any part of the model.

To set the arm at the correct angle to locate the soldering chuck in proper position against the sides of the crowns: First loosen the different screws of the jig and position the chuck at the desired angle against the sides of the crowns with an attachment slipped on the point, and tighten all the screws; then to move the chuck with an attachment to the different crowns it is only necessary to loosen the screws 5 and 8.

In adjusting the attachments it may be necessary to shorten them in accordance with the bite or length of the crowns, but they should be left as long as possible.

Before the final placing of the springs in position against the crowns they must be soldered to reinforcing plates. This is done that the springs may be more easily and securely soldered to the crowns. The spring is placed on the soldering pliers, which are shaped to hold it as shown in Fig. 596, with the triangular edge of the back resting on a piece of thin platinum plate.

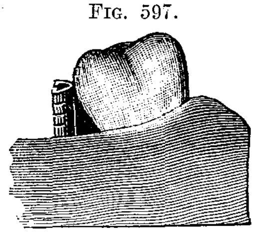
FIG. 596.



A piece of 20 or 22-carat or hard-flowing solder, not larger than a pin-head, is placed on each side of the spring, with a little flux, and the solder is melted by holding it in a Bunsen flame. Whiting or wet marble-dust applied inside the spring will prevent entrance of any of the solder. A moderate amount of solder should be applied, as an excess is liable to obstruct the adjustment of the box. The piece of platinum plate which is soldered to the spring should be large enough to reinforce the side of the gold crown it will be placed against and enable the crown to better resist the strain exerted on it in the insertion and removal of the denture.

The springs with their reinforcing plates are placed in position against the crowns, attached to them with hard wax cement, removed, invested, and soldered to the crowns with 18-carat solder. Frequently one end of the spring, owing to the angle it has to assume, stands out considerably from the side of the crown, as shown in Fig. 597. This space should be filled in during the soldering with pellets of gold foil or scraps of plate.

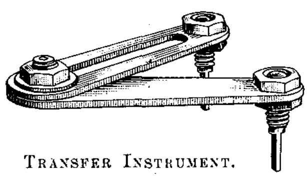
FIG. 597.



The crowns with the springs are next placed in their respective positions on the model. The springs are gently closed with pliers and the boxes placed over them. Should the solder used to attach the springs interfere with the adjustment, remove a little of the box metal on each side of the slot. The box should extend slightly beyond the spring toward the gum and be cut off at the other end flush with the top of the spring. At this end (3, Fig. 593) a small piece of platinum plate should be soldered across the top of the box to act as a stay for the end of the spring. The boxes are next attached to the bridge-plate with the wax cement, removed in position, invested, and soldered to it. The placing of the artificial teeth is done in the usual manner.

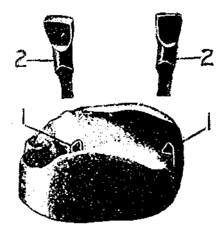
The cementation of the crowns is generally best done one at a time. The crowns and denture are first placed in position in the mouth. The denture and one crown are removed, cement applied to the crown and denture, and the crown inserted. When the cement has set, another crown or crowns can be cemented in a similar manner.

FIG. 598.



TRANSFER INSTRUMENT.

FIG. 599.



1, Impression.
2, Box-retaining chuck.

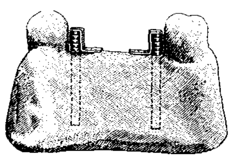
To tighten or loosen the attachment of the bridge, proportionately expand or contract the spring that fits into the box.

When the Griswold attachment is applied to ordinary bridge-work instead of the plate form described above, the impression is to be taken and the model and articulating impression made in the usual manner, with the exception that plain plaster is to be run in the caps or crowns, while plaster and marble-dust are used for the remainder of the model. After the attachments are united to the crowns, the artificial teeth or dummies are set in position. The artificial teeth and boxes are then either removed from the model for soldering or invested on the model, and the crowns with the springs removed from it before soldering.

The Griswold attachments can be applied to advantage to many of the cases which have been described in both removable bridge and plate bridge-work, alone or in combination with some of the other forms of attachment.

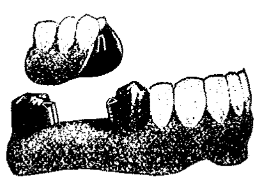
To Form the Bridge of Vulcanite.—When the springs are soldered to the crowns and the solder trimmed, set and cement the crowns in position in the mouth. To insure parallel lines for the springs as the crowns are adjusted with the cement, insert the points of the transfer instrument (Fig. 598) in the aperture of the springs while the cement is setting. When the cement *has set perfectly hard*, place the boxes, with a little piece of plate soldered across the top of each and small stubs at the backs for anchorage in the vulcanite, on the springs. Next take an impression in plaster, which will remove the boxes in position. Varnish and oil

Fig. 600.



Model, with Box Chucks Projecting in Correct Position for Boxes.

Fig. 601.



As Finished.

the impression and place a box-retaining chuck in each box (Fig. 599), to locate and retain the boxes in exact position on the model, which is next to be run in pure plaster. When the plaster impression is removed from the model, the boxes are generally also removed from the chucks. They are then replaced on the chucks, which are firmly retained in position by their shanks in the plaster (Fig. 600). The artificial teeth are next arranged in position on the model, the case waxed up, flasked, packed, and vulcanized. Painting whiting inside the boxes will prevent entrance of rubber. Fig. 601 shows the finished denture.

CHAPTER XIV.

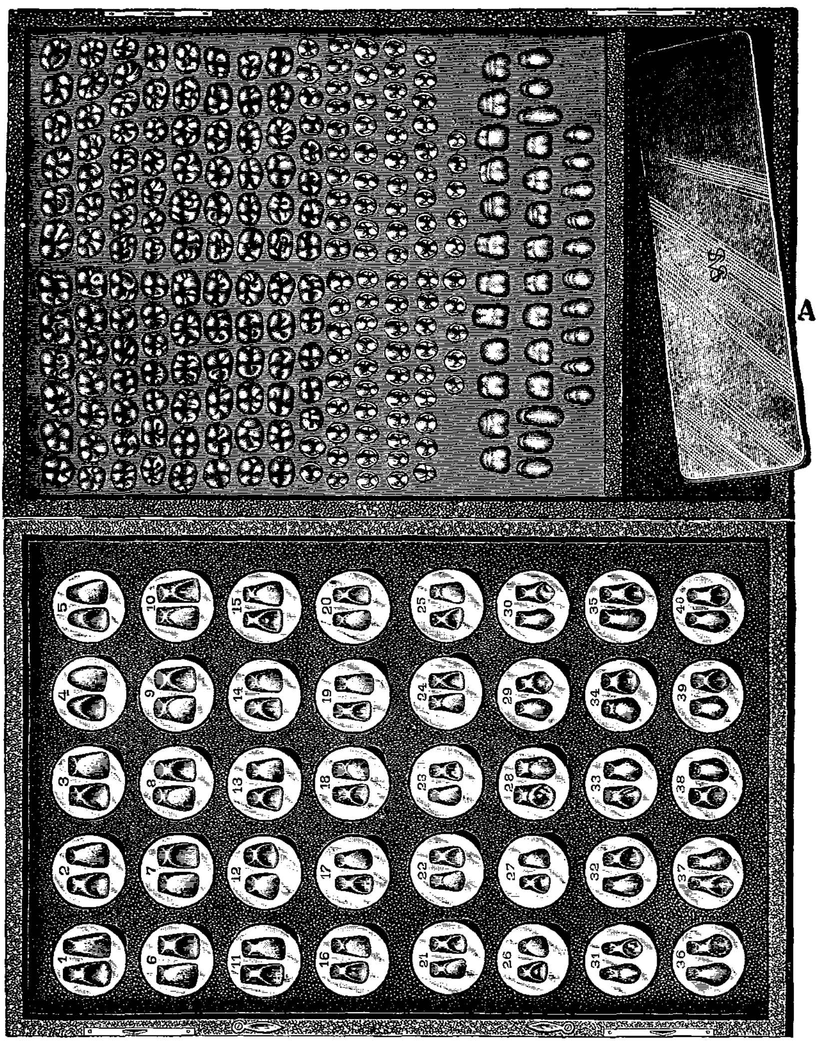
The Hollingsworth System.

CONSTRUCTION OF A GOLD CROWN (BICUSPID OR MOLAR)—SOLID GOLD CUSPS—GOLD CROWNS (CENTRALS, LATERALS, AND CUSPIDS)—INSERTION OF A PORCELAIN FACING—FORMATION OF THE GRINDING-SURFACE OF A BRIDGE IN ONE CONTINUOUS PIECE—FACING FOR ALL-GOLD BRIDGE.

The object of the "Hollingsworth System," like some other so-called systems which have been introduced, is to systematize and simplify the process of construction of that style of crown- and bridge-work in most general use. To this end the form of procedure is concisely outlined and some special methods and appliances introduced. The last mentioned consist of a set of 204 forms of solid metallic grinding-surfaces of bicuspids and molars, termed in the description "cusp-buttons," for use in forming grinding-surfaces for crowns or dummies; thirty-six facings for shaping the labial surfaces of all-gold bicuspid and molar dummies, and forty for labial and palatal surfaces of all-gold incisors and cuspid crowns. These collectively are to be seen in the case illustrated in Fig. 602; likewise (Fig. 602 A) some other appliances contained in the set. A brief description of the principal methods in connection with the use of the appliances is here given.

Construction of a Gold Crown (Bicuspid or Molar).—Construct a collar to fit the root in the ordinary way. Place the collar in the mouth (see Fig. 603), and cut off on a line where the adjoining teeth begin to turn to form the cusp. (See *c*, Fig. 603.) Place a small piece of wax inside the collar to assist in holding the cusp-button, which should be selected to fit the circumference of the collar, to articulate properly, and to correspond in shape with the other teeth. (See *b*, Fig. 603.) Remove the button, and place it on the molding-plate with the grinding-surface up. (See Fig. 604.) Place the small rubber ring around it, pour a sufficient quantity of Melotte's metal to nearly fill the ring (Fig. 605). As soon as the metal sets, chill the surface by

Fig. 602.



dipping in water for a moment, and then remove the rubber ring. When the heat begins to return to the surface, a quick rap of the

FIG. 602 A.

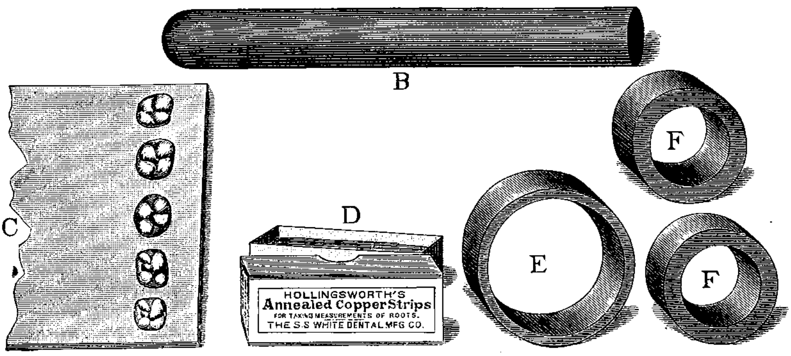


FIG. 603.

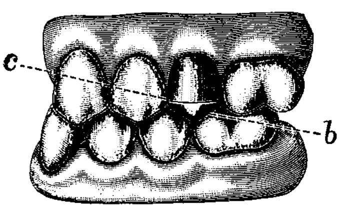


FIG. 604.

FIG. 605.

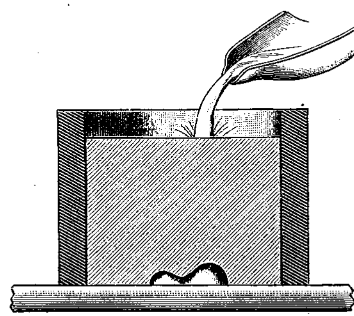


FIG. 606.

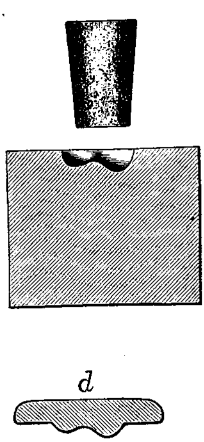


FIG. 607.

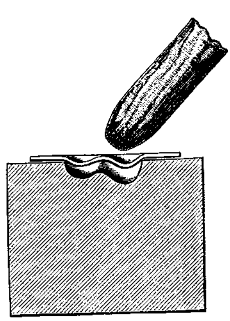


FIG. 608.

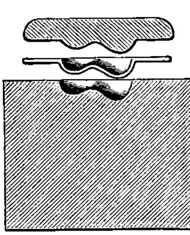
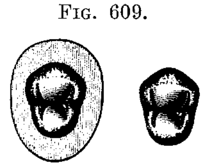


FIG. 609.



die on the bench will cause the cusp-button to drop out and leave the mold ready to form the gold cusp. Now take a piece of lead, for instance, a lead hub, and with a hammer drive into the Melotte-metal die (Fig. 606) to form the counter-die (Fig. 606, *d*).

Anneal the gold plate, and start the swaging process by coaxing the plate into the die by hand-pressure (Fig. 607), using a piece of wood which makes a depression for the lead counter-die to rest in. Then place the counter-die on the gold plate (Fig. 608), and drive to a fit. Cut the surplus metal from the hollow cusp with shears (Fig. 609), filing up the edges when necessary, and rub down the under surface on a smooth file until it fits the collar made for it (Fig. 603). Wire the cusp and crown together (Fig. 610), place flux and solder in the cap, and hold over a lamp until soldered. Then finish in the usual way.

FIG. 610.

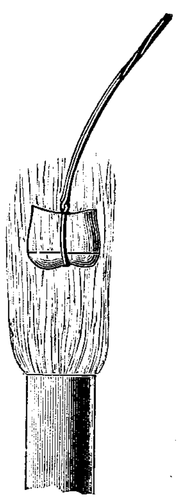


FIG. 611.

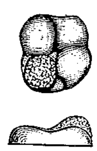
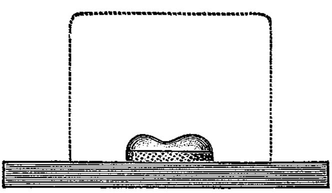


FIG. 612.



Note.—If the forms of cusp-buttons do not afford one which articulates perfectly, the difficulty is easily remedied by taking the button which most nearly answers, and building up the cusps with Melotte's moldine (Fig. 611). If a collar is accidentally cut too short, it can still be utilized. Place moldine upon the molding-plate, put the cusp-button upon it, press down and adjust to make up the deficiency of the collar, cutting away the surplus moldine. This will, of course, throw the soldering line a little farther up on the crown (Fig. 612).

Solid Gold Cusps.—Scrap gold can be utilized for making a solid gold cusp by casting in asbestos by the following method:

After selecting the desired cusp-button, instead of making a mold in Melotte's metal, as before described, take a piece of asbestos board about one inch square and one-fourth inch thick, moisten it, and with a hammer drive the cusp-button into it, flush with the surface of the button. (See Fig. 613 A.) Remove the button, and dry the asbestos in a flame (Fig. 613). When perfectly dry, place a sufficient quantity of gold scraps in the die made in the asbestos, and direct the blowpipe flame upon it until melted, inclining the carbon stick, as shown, against the die for the double purpose of confining the heat and warming up the carbon stick. When the gold is fused into a button, press it into the die with the carbon stick (Fig. 614). *Avoid the use of flux when working with asbestos.*

FIG. 613.

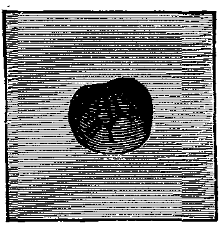


FIG. 613 A.

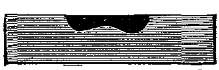
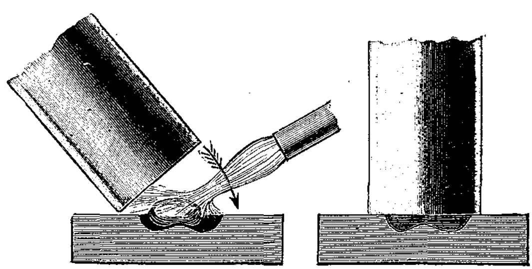


FIG. 614.



To build up a cusp to make a perfect articulation, in this method, sealing-wax must be used instead of moldine, as in swaging the cusp. Warm the button before applying the wax, and with a warm instrument shape the cusp as desired.

Gold Crowns (Centrals, Laterals, and Cuspids).—Select from the forty different forms in the set that which is most suitable to the case in hand (Fig. 615). (The forms are in pairs, showing labial and lingual surfaces.) Take the measurement of the root to be crowned with one of the annealed copper strips, binding the strip around the tooth with pliers (Fig. 616, *a*). Take this measurement and cut it through the center (Fig. 616, *b*), then bend the respective halves over the lingual and labial forms selected, at the necks, with the cut ends of the strips resting on the flat of the plate (Fig. 617). If the measurement is larger than the form selected, build the latter up with moldine until the space between the form and strip is filled (Fig. 617, *b*). Avoid getting moldine on the approximal surface. Remove the strips, dry out the moldine, by passing through a flame a few times, then place the form on the molding-plate with a rubber ring around it.

Pour Melotte's metal into the ring as in forming the molar or bicuspid cusp, which makes a die of the two sections, lingual and labial. Make a lead counter-die and proceed as directed in the making of a molar cusp, swaging both sections (Fig. 618). Trim off the surplus plate (Fig. 619), and square the opposing edges of the two sections by rubbing them over a dead smooth file.

FIG. 615.

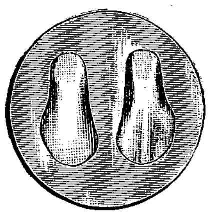


FIG. 616.

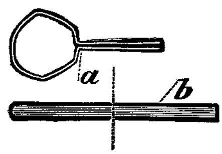


FIG. 617.

FIG. 618.

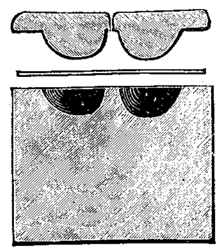


FIG. 619.

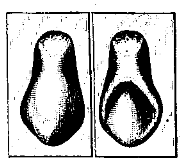


FIG. 620.

FIG. 622.

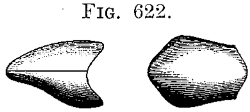
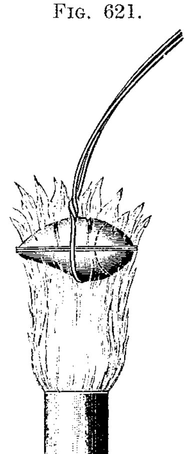


FIG. 621.



Bind the two sections together with wire with sufficient solder and flux inside (Figs. 620 and 621), and proceed as in soldering an ordinary collar. With a small mechanical saw cut off the upper portion where the tooth begins to slope back (about the dotted lines in Fig. 621). This leaves the crown as shown in Fig. 622, approximal and labial views. Fit on the root. If too small, place on the horn of an anvil and enlarge by hammering; if too large, collar the root in the same manner as for a Richmond crown, grinding the tooth to fit.

To Insert a Porcelain Facing.—Make the gold crown as described. Select a porcelain facing suitable for the case (Fig. 623). Place the crown on the root in the mouth, and with an excavator mark on the face where the porcelain is to appear. Remove the crown and saw out, so that the facing will fit loosely. With a knife bevel the inner edge or seat for the facing (Fig. 624). Grind the facing to fit (Fig. 625). Back up the facing

FIG. 623.

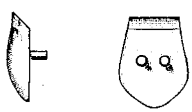


FIG. 624.

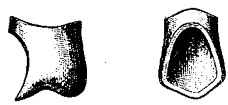


FIG. 625.

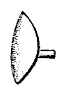


FIG. 630.

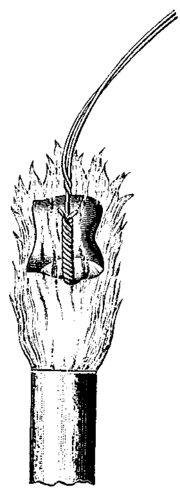


FIG. 626.

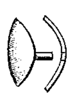


FIG. 627.

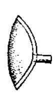


FIG. 628.

FIG. 629.

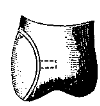


FIG. 631.

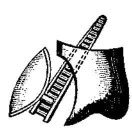
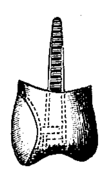


FIG. 632.



with No. 34 or 36 gage pure gold, punching holes in the backing for pins, annealing as required to readily conform it to the tooth (Figs. 626 and 627). With a sharp knife cut a barb on each side of the pins in the facing, and press the barbs against the backing (Fig. 628), which keeps the backing in place. Burnish down the edges well, being careful not to let the backing overlap the facing.

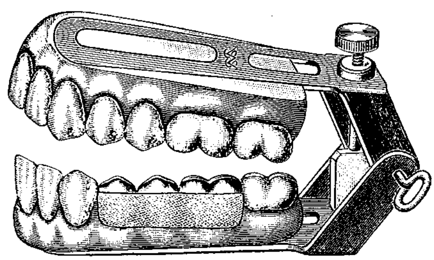
Place the facing in the space prepared for it in the crown (Fig. 629), and bind them together (not too tightly) with wire, wrapping the wire directly over the facing with asbestos to prevent discoloration of the porcelain. Flux and solder by holding over a lamp as in case of a collar (Fig. 630). Finish in the usual way.

If it is desired to use a platinum pin for anchorage, as, for instance, a Logan pin, bend the pins in the facing sufficiently to clamp the anchorage pin, and insert the pin through the gold crown (Fig. 631), finishing as before described. Fig. 632 shows a finished crown so made.

Formation of the Grinding-Surface of a Bridge in One Continuous Piece.—After having crowned the teeth for the attachment of the bridge, take a bite in modeling compound, remove the compound, place the crowns in their impressions, make a cast of sand and plaster, and place on an articulator; now put moldine between the abutments instead of wax, and get the articulation with cusp-buttons the same as for plate teeth (Fig. 633).

Then, to remove the buttons without destroying the articulation, make a cup by pouring Melotte's metal, as cool as it will

FIG. 633.



flow, on the face of the cusp-buttons. Heat the pouring lip of the ladle and use it to smooth out the half-congealed metal, much as a soldering iron is used (Fig. 634). Then place a thin coating of moldine upon the molding-plate. Remove the cup from the articulator with the cusp-buttons in place (Fig. 634, *a*). Transfer the cusps by inverting the molding-plate (Fig. 635), and turn the cusp-buttons out upon the moldine on the plate with the grinding-surface up (Fig. 635, *a*), and they will occupy the same relative positions as when on the articulator.

Now place the large rubber ring around the buttons on the plate, and proceed to make a die with Melotte's metal, as before described (Fig. 636). When cool, remove the buttons and coat the face of the die with whiting. Invert the die and raise the rubber ring sufficiently high on it, and make a counter-die with the same metal by pouring as cool as possible (Fig. 637). This gives the male and female dies with which to swage the continuous grinding-surfaces. Then proceed to swage the gold plate in one piece (Fig. 638), annealing as often as necessary. Trim off the surplus plate (Fig. 638, *a*), and place in position on the articulator. Cut the cusps out on the buccal face to avoid showing the gold (Fig. 639), grind the porcelain facings to fit the cusps, and back with gold, No. 34 or 36 gage, letting it come to the cutting-edge, the same as in a single crown, as before described.

FIG. 634.

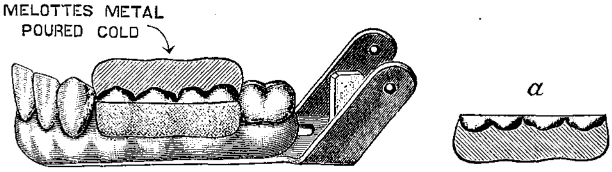


FIG. 635.

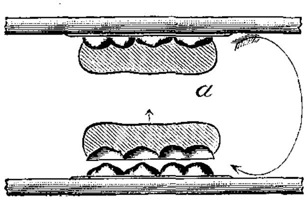


FIG. 636.

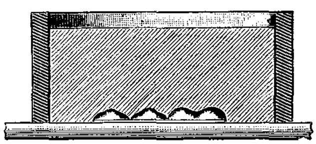


FIG. 637.

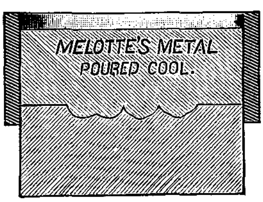


FIG. 638.

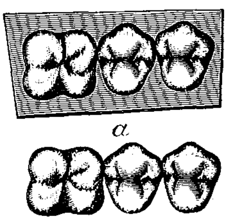
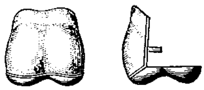


FIG. 639.



If there is a space between the cutting-edge and the porcelain, place a little wax in the joint to keep out the plaster investment, invest, remove the wax from between the joints, flux, and solder.

Facings for Making All-Gold Bridge.—If it is desired to make an all-gold bridge, select the proper facings from the set, make a die of Melotte's metal, and swage up, the same as in the continuous bridge before described, and mount gold facings in place of porcelain.

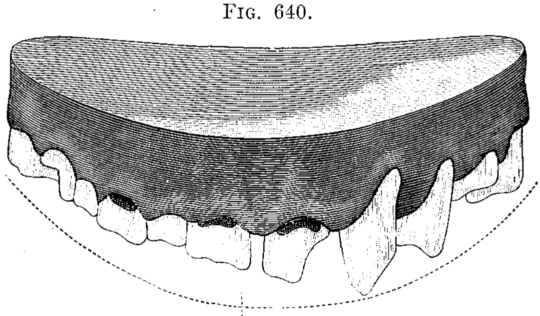
CHAPTER XV.

Crown- and Bridge-Work Combined with Operative Dentistry in Dental Prosthesis.

SYMMETRY—CASES SHOWING THE RESULTS OF COMBINED OPERATIONS.

In crown- and bridge-work, artistic skill on the part of the operator can frequently be most advantageously displayed in the conduct of operations. An appearance of symmetry should be imparted as much as possible to the upper front teeth. The contour of the arch, the labial aspect and length of the teeth, singly and collectively, on one side of the mouth in comparison to those on the other, should be observed and studied. That most appreciable results are thus possible of attainment is demonstrated in the following two cases:

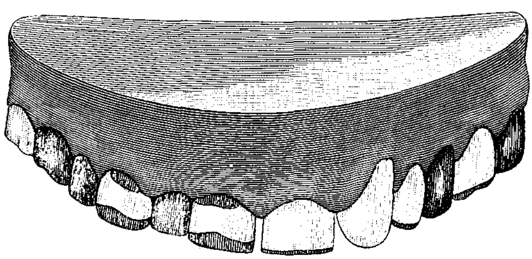
Fig. 640.



Symmetry.—In the case presented in Fig. 640, that of a gentleman of about sixty-two years of age, is to be seen the irregularity of the teeth present and the unevenness of their incisal edges and occluding surfaces, the condition having arisen from the combined effects of decay, erosion, mechanical abrasion, and malocclusion. The operations performed were as follows: On the right side the second molar was restored by filling; the first molar and the bicuspid crowned with gold; the cuspid and central were lengthened with solid gold tips, each tip being anchored with three pins; and the lateral was crowned—at the request of the patient—with gold. On the left side the central was crowned with a gold crown with porcelain front, the cuspid shortened and filled on the palatal side, and the bicuspid crowned with gold and the spaces bridged.

Guided by a line at right angles to the median line (Figs. 640 and 641), the teeth and crowns on one side were formed to correspond as much as possible in length, shape, and appearance to those on the other. Those teeth affected with pyorrhea were treated. The results of these combined operations, conducted with a view to the artistic as well as the restorative effect, are plainly to be seen in the finished case illustrated in Fig. 641.

FIG. 641.



What can be quickly accomplished by judicious trimming and shaping of the teeth, in combination with other operations, is well illustrated in the following case: The patient's upper front teeth presented the appearance shown in Fig. 642. The right central and left lateral were pulpless. The central was badly discolored and the lateral slightly so. The central had been bleached, but in a few years gradually resumed its former appearance. The other teeth with living pulps and light in color contrasted most unfavorably. The incisal edges of the centrals were affected with atrophy. The laterals, especially the right one, were elongated from pyorrhea. The length of the incisors contrasted unfavorably with the cuspids. The patient, a lady, was so annoyed at the appearance of the teeth, which she considered a permanent disfigurement, that she had positively decided to have all the incisors crowned or extracted and artificially replaced. A most satisfactory compromise was effected, enabling the patient to avoid either of these extreme measures by the performance of the following operations: The pyorrhea was treated, the left lateral was bleached and refilled, the right central natural crown excised and an artificial one (style described on page 132) inserted, and the atrophied incisal edge of the left central removed, all the incisal ends of the other teeth being trimmed to properly correspond in length and shape. The improvement effected is apparent in the illustration of the finished case, Fig. 643.

The method of procedure respecting trimming and shaping as described in these cases might often be applied advantageously in

FIG. 642.

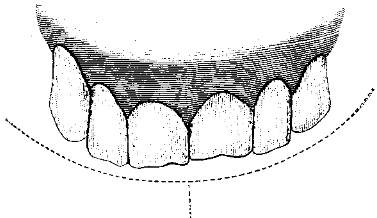
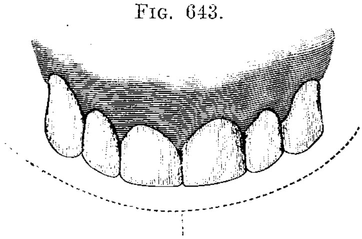


FIG. 643.



cases of fracture of the incisal edge of the front teeth too small to reliably restore with porcelain.

The results in dental prosthesis which can be accomplished by a combination of operations on the natural teeth with crown- and bridge-work commend the plan strongly to the experienced practitioner. A few more cases are adduced in illustration.

Cases Showing the Results of Combined Operations.—A case which was interesting, owing to the conditions presented and the various operations connected with it, is illustrated in Fig. 644. Fig. 645 shows the methods and operations practiced, and Fig. 646 the case completed.

The upper front teeth show the effects of abrasion on the incisal edges and occluding surfaces. The bicuspids and molars were affected with pyorrhea alveolaris. The four incisors and the left cuspid were pulpless, and alveolar abscess existed at the roots of three of the incisors. The abscesses and root-canals were

FIG. 644.

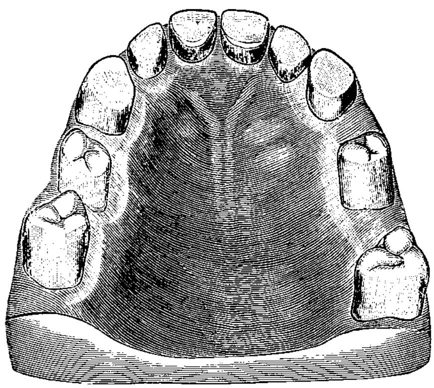
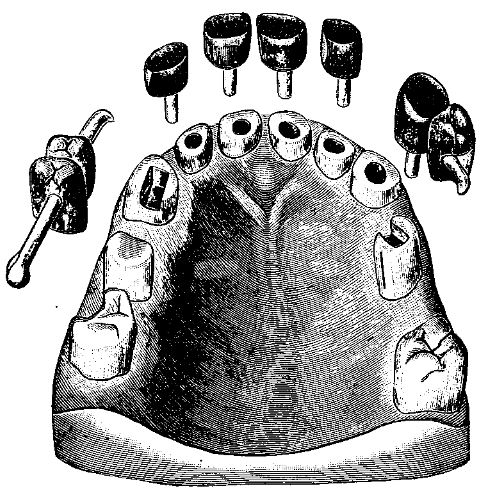
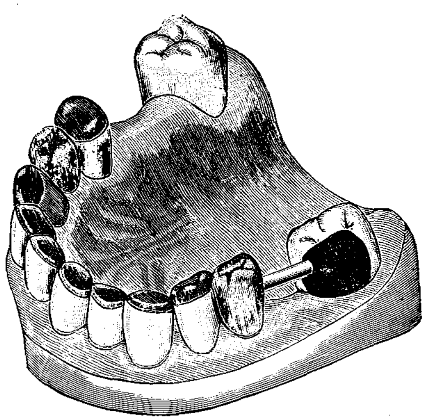


FIG. 645.



properly treated. Gold collar crowns with porcelain fronts, having flat incisal edges which perfectly protected the porcelain fronts and slightly opened the bite, were made for the incisors and left cuspid (Fig. 645). The bicuspids and molars were placed in as hygienic a condition as possible by treatment. On the left side a dummy bicuspid with a bar which fitted in a slot formed to receive it in the occluding surface of the second bicuspid was attached to the cuspid crown. When the cuspid crown with the dummy bicuspid was cemented in position, the bar was anchored in the slot in the second bicuspid with amalgam. The cuspid root being very firm, stability was thus imparted to the natural bicuspid, which was quite loose because of absorption of its socket. On the right side the second bicuspid was entirely capped with a gold seamless crown. On the anterior side of this gold crown an artificial tooth was attached as a dummy first bicuspid, with a bar extending from its anterior side and fitted

FIG. 646.

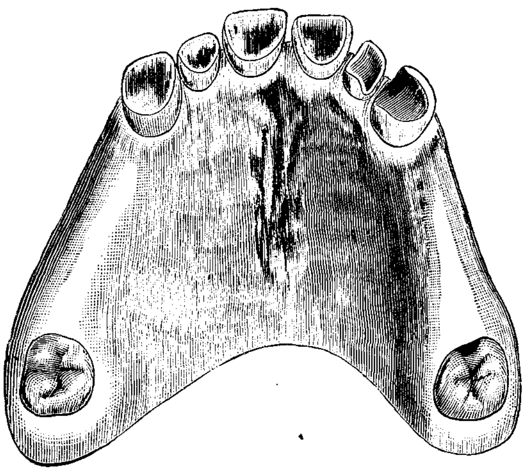


into a slot formed in the incisal surface of the natural cuspid crown. From the posterior side of the second bicuspid gold crown a bar was extended backward into the side of the molar. When the gold crown was cemented in position on the second bicuspid, the anterior bar was firmly anchored in the cuspid with a gold filling, which also lengthened the incisal edge, and the posterior bar was fixed in the molar with amalgam. The reasons for this form of construction were: The second bicuspid was very loose in its socket, and the molar, though comparatively more stable, was also similarly affected. The attachment of the bar in the cuspid supported the dummy bicuspid and steadied the second bicuspid, and the extension of the posterior bar into the molar likewise afforded additional support to the bicuspid. The pulp of the molar being exposed, was devitalized, removed, and the canals properly filled. Fig. 646 shows the completed case.

The lower teeth, in comparison with the upper, were but slightly abraded. The cuspids and one of the incisors were tipped with gold. The molars on the left side were absent, so that bridge-work on the upper jaw on that side between the bicuspid and molar would have been to no purpose.

In the case presented in Fig. 647 the operative procedures were confined to the upper jaw, the lower teeth of the patient being in good condition. The bicuspids and the first and second molars of both sides of the upper jaw had been lost many years before,

FIG. 647.



and the incisors and cuspids showed the effects of extensive abrasion. The occlusion was sustained and the principal part of mastication performed by the incisors, as the third molars had been forced backward and antagonized only very slightly on one side.

The patient, a gentleman, had had a plate inserted, to the presence of which he had vainly endeavored to accustom his mouth. The abrasion of the incisors and cuspids was of the rapidly progressive character. These teeth were contoured with gold foil to the form shown in Fig. 649, and a wire post was inserted in the right lateral, which was pulpless. At the occluding section of each filling, the layer of gold, after being packed with the plugger, was additionally condensed and hardened with a Herbst agate-point burnisher to enable it to better resist the aggressive force of the lower teeth. The third molars were capped and lengthened with gold crowns, the lines of their sides being made parallel, to admit of a proper adjustment of the supporting collars for a removable plate-bridge, by adding gold on their external sur-

FIG. 648.

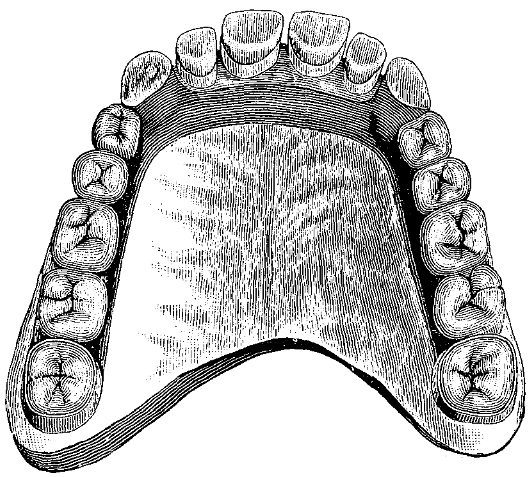
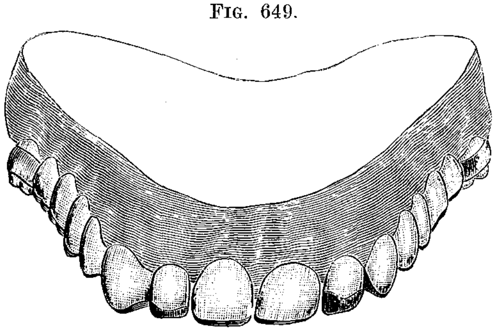


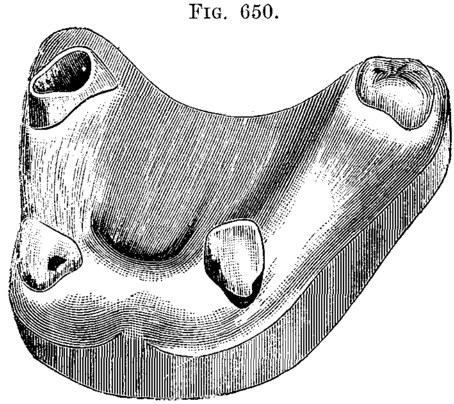
FIG. 649.



faces. The plate-bridge was employed because of the space between the abutments, which suggested the idea of utilizing the alveolus to assist in supporting it. A narrow shoulder was formed on each crown to support the collars. The attachments to the cuspids rested by means of a little shoulder on the occluding portions of the fillings inserted. Fig. 648 shows the completed denture, and Fig. 649 an anterior view of the same.[1]

In the case illustrated in Fig. 650, the patient, a lady, had previously worn a plate, the clasp of which had entirely abraded the sides and cervix of the right cuspid of enamel, and caused recession of the margin of the investing gum. The decay which followed the abrasion extended in a circle around the tooth. As the patient objected to crowns of any kind being applied to either of the cuspids, the decay was removed and the edges of the cavity given a retaining form. A gold filling was then introduced in three sections, two of which embraced the approximal and palatal sides, while the third surrounded the labial wall, joining the other

FIG. 650.



two sections at that point, the three thus completely encircling the tooth with gold. A portion of the filling was brought over the edges of the cavity to better shape the tooth for the attachment to be applied, and also to protect the sides from future injury. When this operation was completed, the tooth presented very much the appearance of having had a close-fitting shell crown applied. Gold fillings were introduced in the palatal and approximal surfaces of the left cuspid, to protect it from the attachment. Gold crowns were placed upon the molars, one of which, the left, was pulpless. The appearance of the teeth after these operations is shown in Fig. 651.

[1] Case operated on in 1888. At the present time the author would suggest "Solid Gold Tips," in preference to fillings for the front teeth, and the application of the Griswold attachment to the molars instead of collars.

A plate-bridge (Fig. 652) was then constructed, the attachments for which were collars on the molars, and half-collars or clasps on the cuspids. The former rested on shoulders formed on the gold crowns, and the latter on the palatal curves of the cuspids.[1]

FIG. 651.

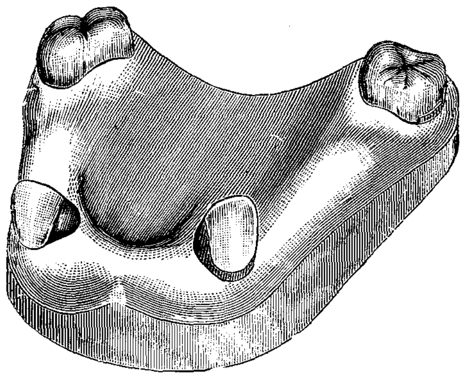


FIG. 652.

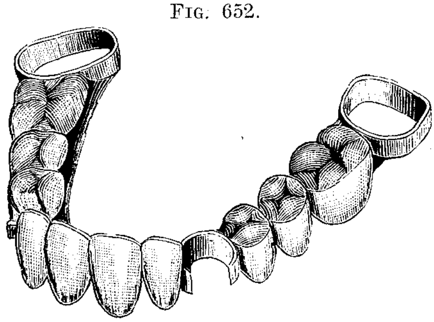


FIG. 653.

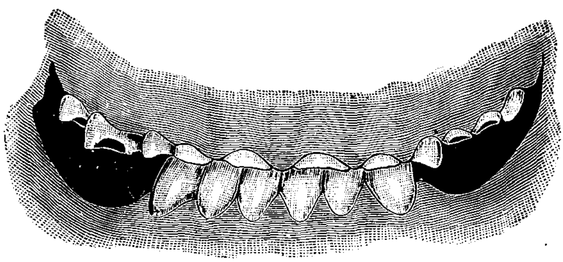
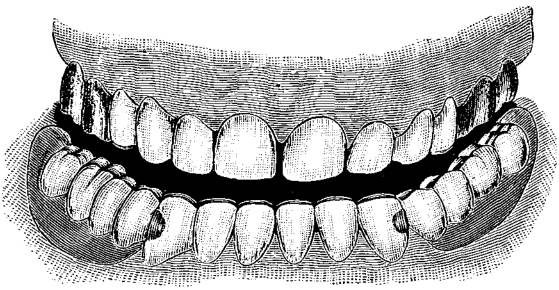


Fig. 653 illustrates a case as presented for treatment to Dr. H. A. Parr. The loss of the posterior teeth of the lower jaw

[1] Case operated on in 1890.

and the abrasion of the anterior teeth had resulted in the abnormal occlusion shown. The incisal edges of the lower teeth were lengthened with gold contour fillings. Gold collar crowns with porcelain fronts were placed on the upper anterior teeth, to lengthen them sufficiently to restore the occlusion. The upper

FIG. 654.



molars, which were all more or less decayed and broken down, were restored in form with gold crowns. The space representing the loss of the left bicuspid was filled with a bridge-tooth having a porcelain front, attached to the approximal gold crown. In the lower jaw a partial set was inserted on each side to substitute the lost posterior teeth. Fig. 654 shows the appearance of the case when completed.

PART IV.

PORCELAIN DENTAL ART.

PART IV.

PORCELAIN DENTAL ART.

By porcelain dental art is here meant, not the well-known processes by which porcelain teeth bought from the manufacturer are mounted on metal or vulcanite base, but the actual working of the material porcelain, from the mixing of body and colors to the final baking. It involves the making by the dentist of partial crowns (including inlays), entire crowns, and even bridges, of porcelain. It is, in some degree, a return to the old vogue, when the dentist made the porcelain teeth which he mounted for his patients; but the present practice is upon a much higher plane, in which the artistic is one of the principal features.

Porcelain dental art, as here defined, is an outgrowth largely of the common adoption during late years of modern methods of crown- and bridge-work. At first, its possibilities not being clearly seen, its application was confined to a limited field, its sphere of usefulness widening as the processes became better understood and improvement after improvement was brought out. Recent methods in the manipulation of porcelain leave little to be desired in special operations, so far as artistic merit and real value are concerned. Nor can the permanency of these operations be doubted. They are no longer to be classed as experimental. They have been accepted as having a legitimate place in dental prosthesis. It is by no means intended to be suggested that the processes involved in porcelain dental art have been finally perfected. Improvements are quite possible, and may be expected as more and more attention is attracted to this desirable field of work.

The successful practice of porcelain dental art is not easy, as will be speedily appreciated by those who enter upon it. There is demanded a technical and manipulative skill and a judgment equal in degree to those required in any other class of dental operations, a fact which will serve only to stimulate the attainment of perfection in its methods.

In presenting the subject we shall deal first with the composition, properties, and methods of manipulating the porcelain compounds at present in use in this line of work, and then with inlay-, crown-, and bridge-work.

CHAPTER I.

Porcelain Compounds or Bodies.

INGREDIENTS: THEIR CHEMICAL AND PHYSICAL CHARACTER—LOW- AND HIGH-FUSING PORCELAIN BODIES—COLORING OF PORCELAIN COMPOUNDS—GUM ENAMEL—FOUNDATION OR BASAL BODY—PREPARATIONS OF PORCELAIN BODIES—SELECTION OF THE COLOR OF THE PORCELAIN BODY—SAMPLE SHADES—VARIATION IN SHADE—SPATULA AND BRUSHES USED—PREPARATION OF PORCELAIN BODY FOR USE—USE OF GUM TRAGACANTH OR STARCH—APPLICATION OF PORCELAIN BODY.

Porcelain Compounds or Bodies.

Ingredients: Their Chemical and Physical Character.—The requirements of this line of work have developed a demand for a special class of porcelain bodies or compounds, made up of ingredients similar to those from which porcelain teeth are made and to those commonly used for continuous-gum work, but differing from them in that they are lower fusing, are very finely ground, and arranged in various colors. Inlay- and crown-work body is composed of silica, silex—the dioxid of silicon; feldspar, a double silicate of aluminum and potassium; kaolin, a silicate of aluminum, decomposed feldspar, and a mineral "flux," generally composed of either flint or Bohemian glass or their compounds. Flint glass is made of silicate of potash, or soda and lead oxid; Bohemian glass, of a silicate of potash and lime. Glass of borax also is sometimes used as a compound in the "flux."

Silica is highly infusible. It is used in a very small proportion as the foundation ingredient of porcelain to assist in retaining the body in shape during the fusing, and imparts structural strength.

Feldspar is quite fusible. It forms a much larger proportional part in the formation of porcelain than the other ingredients combined. It serves to agglutinate the particles of the more refractory compounds, silica and kaolin, and imparts a semi-transparent appearance to the porcelain.

Flux is incorporated to modify the infusibility of the other ingredients of the compound. A flux of the character of flint glass is much more effective in lowering the degree of fusibility of a porcelain body than one of Bohemian glass. The character of the flux and the skilful proportioning of it to the other ingredients govern the fusibility, while maintaining the other characteristics of a porcelain body.

Low- and High-Fusing Porcelain Bodies.—Porcelain body so compounded as to fuse below the melting-point of gold and so permitting the use of a gold-foil matrix in inlay-work is termed "low-fusing." One which fuses above that point and requires the use of platinum for the matrix is termed "high-fusing."

Coloring of Porcelain Compounds.—Porcelain compounds are colored to imitate the shades of the natural teeth by thoroughly incorporating certain proportions of titanium oxid and preparations of oxids of gold, tin, platinum, iron, cobalt, uranium, manganese, silver, and zinc. The exact proportions or combinations of these materials to effect the desired shades in the different preparations of porcelain bodies is a matter of knowledge and skill which is confined to the individual manufacturers.

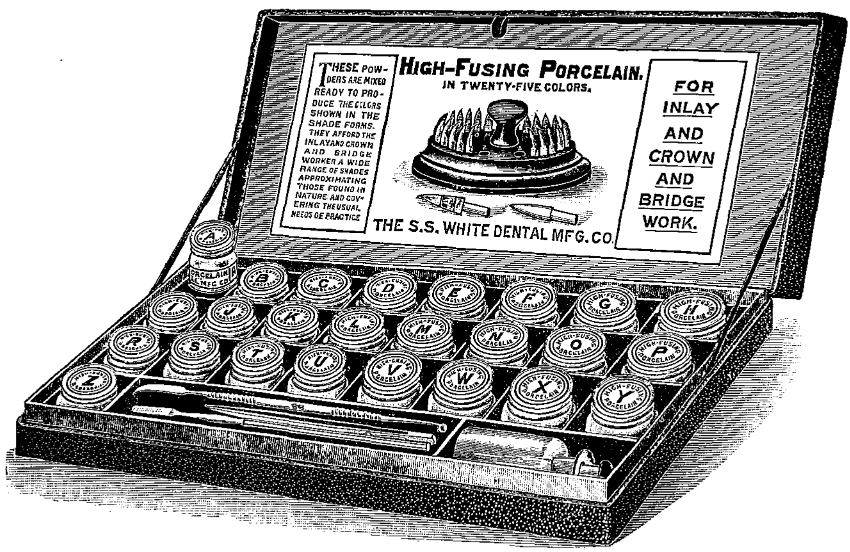
Gum Enamel.—Gum enamel is composed of oxid of gold (purple of Cassius), feldspar, and flux. The proportion and character of the flux incorporated in the compound regulates the fusing-point in this as well as in all porcelain enamels. Gum enamel gives surface form to an artificial gum as well as imparts color. It fuses at a slightly lower heat than the porcelain it is applied to. In this respect the gum enamel used in the manufacture of porcelain gum teeth and in the construction of continuous-gum and porcelain bridge-work differs from what is termed pink or gum color stain, which latter is very finely ground and fuses at a comparatively low heat. As gum enamel fuses but imperfectly on the surface of platinum, the metal has to be first covered with a layer of porcelain body, which should receive what is called the primary bakes before the application of the gum enamel.

Foundation or Basal Body.—Foundation or basal body is a term used to designate a preparation of porcelain body that is applied first to form the base or foundation of an inlay, crown, or bridge. The "Close" porcelain body used so extensively in continuous-gum work is an example of a foundation body.

The use of foundation body is usually confined to the foundation or internal portion of the work, although certain parts at times may be entirely constructed of it. Any moderately high-fusing porcelain body may be used as a foundation in association with one fusing at a lower temperature applied afterward. A foundation body is generally a shade darker than the body subsequently applied to accord in color with the portion of the work—the dentin of a tooth, for instance—it is calculated to represent.

Preparations of Porcelain Bodies.—Porcelain body is prepared and sold in bottles or jars in a set of about twenty-five different shades, arranged in a case, such as is shown in Fig. 655,

FIG. 655.



accompanied by a set of samples showing the colors which the various bodies assume when fused. Some sets additionally contain a bottle of gum enamel and one of foundation body.

Selection of the Color of the Porcelain Body.—The proper color of porcelain body should be selected from the samples while the tooth is wet, as dryness affects the shade. In inlay-work for approximal cavities in the incisors it is well to select a color a trifle lighter than that of the natural teeth, as shadows and the cement have a tendency to darken the appearance of an inlay. Should none of the colors shown by the samples correspond with the color wanted, it is customary to mix different shades of the porcelain body to obtain the one desired. Whatever color is required, first ascertain the basal color and to this add the toning material. For instance, taking yellow as the basal color, a variety of shades can be formed by the addition of white, others still, by the use of blue, and so on. To test a mixture of colors, drop a small pellet of the body, say about the size of an intended inlay, on a piece of blotting-paper to absorb the moisture, and bake it in the furnace. This can be done in about two minutes, and will positively decide the question of suitability. Insufficient fusing will render the porcelain a trifle darker than the true shade, and excessive heat will lighten it.

Sample Shades.—Special sample shades can be made at different times, and the formulæ entered in a book and numbered. Taking, for instance, of the S. S. White colors, which are lettered

FIG. 656.

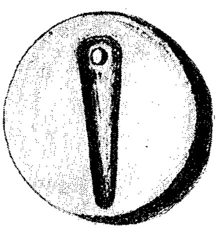
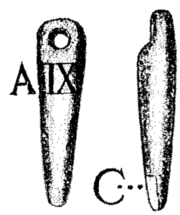


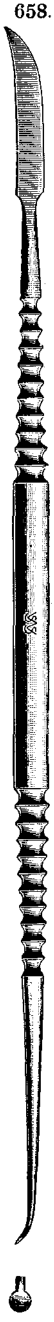
FIG. 657.



from A to Z, one part of M to three parts of G, the combination may be numbered IX, and is written 1 M + 3 G = IX. The colors are mixed to a doughy consistence on a slab, and a mold made of fusible metal, as suggested by Dr. V. W. Gilbert, such as is shown in Fig. 656, slightly oiled, is pressed down on the mass and removed. The surplus is then trimmed at the edges and the porcelain baked, resulting in a sample such as is shown in Fig. 657. A simpler way for many, though, will be to shape the mass of porcelain on a flat piece of platinum plate, approximating the form shown at A in Fig. 657. Flatten one end, and make a hole with an instrument. Flaws can be repaired by a second baking. The sample shade can be marked, as shown in Fig. 657, in Roman numerals with a disk. If the point of the sample is ground, as shown at C in Fig. 657, the indentation can be covered with oxyphosphate, and change of shade, if any, will be exhibited.

Variation in Shade.—A difference in shade between the re-

Fig. 658.



gion of the cervix and that of the occluding section, the latter being lighter and more translucent, is characteristic of the human teeth. An imitation of this variation of shade in any small inlay is unnecessary, but in the case of an incisor where the operation involves the restoration of a large part of the side of the tooth including the incisal edge, it is desirable. To effect it in an inlay, the same method is practiced as in the formation of American artificial teeth. The first application of body to form the upper and inner section is made yellowish in shade[1] to imitate the dentin of the tooth, and the succeeding one, especially toward the incisal edge, of lighter and more translucent shades.

Stability of Shade in Use.—Stability of shade in use is assured in high-fusing porcelain, while change is liable to occur in the low-fusing as time passes, especially should the oxid of lead be used as an ingredient in the flux.

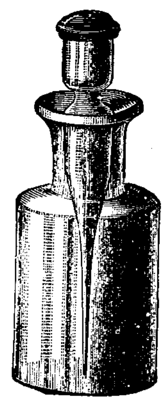
Spatula and Brushes Used.—A small tapering-pointed spatula of the ordinary form, or one with a corrugated handle for the purpose of vibrating the shank or handle of the appliance supporting the work during the application of the body, is the most suitable (Fig. 658). Camel's-hair brushes, such as artists use for water colors, are also necessary. They should be of three sizes, the smallest for carrying and applying the mixed body, especially small portions where an application or addition is to be very delicately made, to some desired spot of the work; also for whisking an edge or small corner free of surplus particles of the body. The medium-sized brush may be similarly used, or in the same manner as the large size, which is only applied dry for brushing the surface of the body and metallic framework.

Preparation of Porcelain Body for Use.—In the preparation of porcelain body for use absolute cleanliness is necessary, as the introduction of the slightest particle of foreign matter is liable to destroy the appearance of the work. The required quantity of the powder is placed on a flat or slightly concave glass or glazed porcelain slab and

[1] The "Close" body when used for this purpose should be ground finer than it is as sold by the manufacturer.

mixed with distilled or, in its absence, filtered water, applied from a drop, or pipette bottle (Fig. 659). The consistence of the mixture should be that of a soft dough. To obtain this consistence the surplus moisture can be absorbed by light pressure of the corner of a napkin or a piece of blotting-paper against the body. Alcohol is directed instead of water for mixing the Jenkins porcelain, but rapid evaporation is all there is to recommend it, and this is an objection in the application of the body in some styles of operations.

Fig. 659.



Pipette Bottle.

Use of Gum Tragacanth or Starch.—In contour work a small proportion of a solution of gum tragacanth or starch is sometimes added by operators to aid in holding the particles of the body in form as the moisture is evaporated.

Application of Porcelain Body.—The porcelain body is carried and positioned on the work with the pointed portion of the spatula or with brushes. In the application as thorough a condensation or packing of the particles as possible is desirable. This is best effected by placing the mixed body, of a dough-like consistence, and a little at a time, and then precipitating the particles by vibration. This is done by tapping the shank or handle of the clamp or tray holding the work with the side of the spatula or by drawing over it the corrugations on the handle of one such as is shown in Fig. 658. After each vibration the moisture that appears on the surface is absorbed with a small piece of blotting-paper. The further details of the process will be given when the application of the body to the different forms of the work is reached.

CHAPTER II.

FURNACES.

GAS—GASOLINE—ELECTRIC—USE OF FURNACES—ADVANTAGES OF THE ELECTRIC FURNACE—DENTAL FURNACE PYROMETER.

Furnaces.—A proper furnace is essential in baking porcelain. Small gas, gasoline, or electric furnaces or ovens specially designed for use in connection with crown- and bridge-work operations are the styles used. A furnace to meet all the requirements for general work should be capable, if necessary, of generating a heat approximating 3000° F., as some operations in porcelain may require a degree of heat approaching that.

Gas.—The gas furnaces are made with platinum muffles with an open flame. The draft should always be sufficient to entirely consume the gas and carry off the products of combustion. If this is neglected, or if the furnace is defective, gases are liable to penetrate the interior of the muffle and affect the color and character of the porcelain by "gassing" it, a condition only to be corrected by substituting new material. Platinum muffles, made seamless, are used in preference to clay, as the required heat can be obtained in them in from three to five minutes. A platinum muffle, although seamless, will not assure against the gassing of porcelain. Fig. 660 illustrates the "Land Midget Gas Furnace," operated with foot-bellows.

Gasoline.—The gasoline furnace is now being given preference over the gas. The maintenance of heat production is dependent on a pneumatic pump. The muffle is made of either fire-clay or nickel, the latter, of which the Brophy, illustrated in Fig. 661, is an example, being given the preference.

Electric.—In electric furnaces or ovens the heat is generated by means of the resistance of fine platinum wire coiled free of contact around a fire-clay muffle. The wire is imbedded as it encircles the muffle or passed through small holes in the clay, and the muffle is inclosed in a framework of fire-clay or iron or both combined. The electric current is controlled with a rheostat, through which it is applied gradually to prevent fusing the platinum wire. The handle of the rheostat should not be moved beyond the first button for at least one minute. After that it may be further advanced more rapidly on the other buttons, until the required heat is generated. The platinum wire around

FIG. 660.

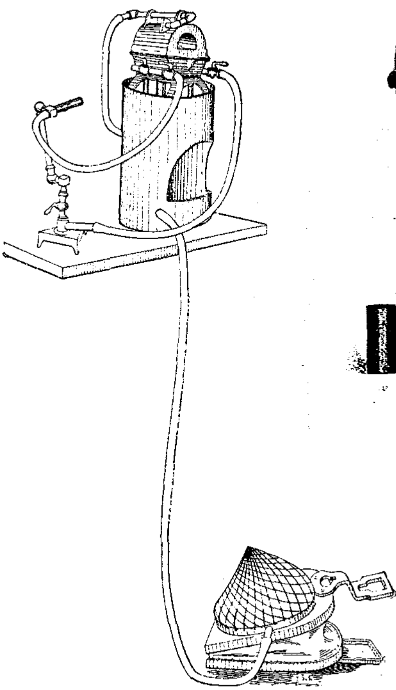
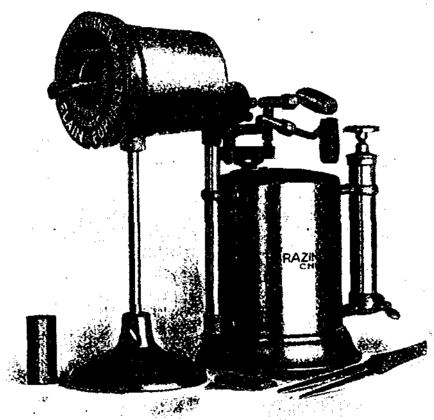


FIG. 661.



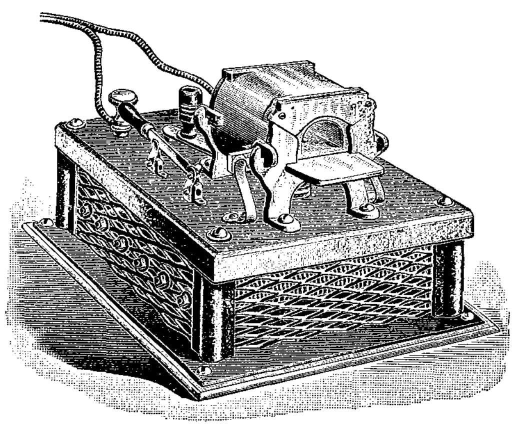
the muffle needs to be renewed at intervals, the necessity for renewal depending on the frequency of use, the amount of current, and the care exercised in its application. Fig. 662 illustrates a Hammond No. 2 electric furnace, a size suitable for inlays and crowns, and large enough to accommodate small bridges.

Use of Furnaces.—The gas or gasoline furnace requires to first be well heated before being used. In the use of electric furnaces, owing to the purity of the heat generated, this precaution is not necessary. The work may be safely allowed to cool gradually in any of these forms of furnaces by turning off the heat supply.

Advantage of the Electric Furnace.—The electric furnace, owing to the form of its construction, places the heat under perfect control and admits of its regulation by the pyrometer to a certainty. In these respects it possesses advantages over the other styles in use.

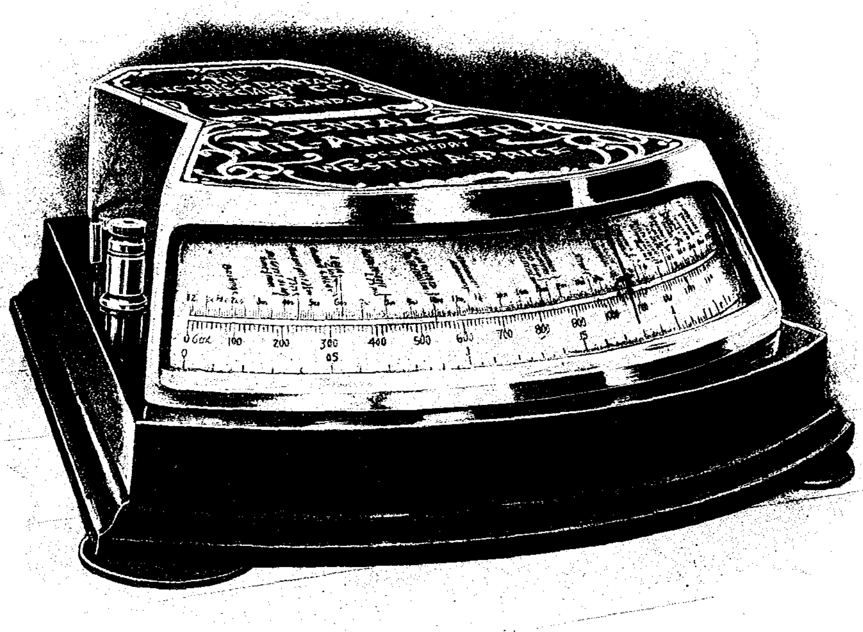
The Dental Furnace Pyrometer.—The pyrometer is an instrument which indicates the degree of heat in the muffle by a needle

FIG. 662.



on the scale of the register. It can be attached to any style of furnace, but is commonly used in connection with the electric. By the aid of the pyrometer the gradual increase and exact degree of heat is determined with a certainty that is impossible by other means, and more especially by the eyes in such small muffles as are used for porcelain inlay- or crown-work. Fig. 663 illustrates the Price Pyrometer. The Fahrenheit and Centigrade scales are printed on the register. The needle which registers the degree of heat is operated by an extremely mild current of electricity generated by a thermo-electric couple inserted through the back of the muffle. The couple is composed of platinum and rhodium brazed together. It is claimed that the combination of these two metals is the most effective for the purpose. The instrument shows delicacy of construction and precision in registration. When the furnace is in use, if the door is opened or the current shut off for a moment, the change is instantly indicated by the needle on the scale of the register.

FIG. 663.



CHAPTER III.

Fusing of Porcelain.

IMPORTANCE OF THE OPERATION OF FUSING—SHRINKAGE—BAKING OR FUSING—FIRST BAKE—SECOND BAKE—FINAL BAKE—COOLING, ANNEALING, OR TEMPERING—DIFFICULTY ATTENDING THE PROPER FUSION OF SMALL MASSES OF BODY—METHOD USED TO INDICATE POINT OF FUSION—ADVANTAGES OF THE PYROMETER IN INDICATING FUSION ACCURATELY.

Importance of the Operation of Fusing.—The baking or fusing of the porcelain body is one of the most important factors in porcelain work, as the result, as a whole, depends on its successful performance.

Density, strength, shade, and surface gloss and finish are affected by, and dependent on, the proper conduct of fusing.

Too rapid heating or overfusing will affect the density and strength by causing porosity and brittleness; and insufficient fusion will impair its crushing strength and gloss.

The given shade of any porcelain compound depends on its fusion at exactly the heat intended for that special preparation.

Twenty-five degrees higher or lower comparatively lightens or darkens it.

The glaze is defective if insufficient heat has been applied, and a glass-like appearance is imparted to the edges by overfusing.

Shrinkage.—All porcelain compounds shrink in fusing. The tendency of the low-fusing is to ball or assume a spherical form, and of the high-fusing to contract from the edges.

These tendencies are attributable to the proportion and especially the character of the flux of the two grades, that of the low-fusing being largely composed of the component parts of glass. In the construction of work most of the shrinkage occurs in the first fusing, in which it ranges from nearly 40 per cent. in the low- to 25 per cent. in the high-fusing, as exhibited in the chart, page 357.

The shrinkage of all grades of porcelain bodies is much lessened by a thorough condensation or crowding together of the particles as they are applied before the fusing.

Baking or Fusing.—All grades of body require at least three bakings or fusings to allow the several shrinkages which occur to be corrected and to effect a proper vitrifaction of the particles.

The first fusing is termed the "biscuit bake;" the first and second, "primary bakes;" and the last, the "final bake."

The character of the work at times may require more than two primary bakes before it is ready for the final bake.

Requirements in Baking.—In the first bake, and likewise in all subsequent ones, the work should be first slowly heated so that all moisture in the freshly applied body is evaporated by degrees and not suddenly forced out by its expansion as steam.

If such care is not taken, particles or sections of the body are liable to be loosened and misplaced or blown off, thus impairing the form of the work and engendering porosity. The work should be first set on a small fire-clay slab, or in a tray, and placed on the shelf a little to one side of the muffle, and very slowly heated to effect evaporation of moisture, which is indicated by the dry and lightened shade of the body. It is then moved to the center of the shelf, heated by degrees, and then introduced into the muffle. If an electric furnace is used, the work may be placed in the muffle before the furnace is heated and the electric current connected, the voltage gradually increased, and the work allowed to heat up with the muffle; a method, however, which should not be attempted with any other furnace. When the body has assumed a red heat, it may be moved quickly to the center of the muffle or a trifle beyond it, to a point which is generally the center of the greatest amount of heat.

First Bake.—In the first or "biscuit bake" the body for inlay- or crown-work should be fused a trifle more than is generally accepted as sufficient in the corresponding baking of porcelain teeth or continuous-gum work. The fusing process should be so conducted as to cause the maximum shrinkage of the body and the particles to become solidly united, but with the mass still slightly rough and glossy on the surface, though not glazed. To accomplish this the work must be carefully watched and instantly removed at the proper time or the heat shut off. If allowed to remain in the furnace until the fusing point is reached, the quality and appearance of the porcelain are liable to be impaired by the final bake.

The heat required for the biscuit bake is graduated to be about 100° F. for the low- and 200° F. for the high-fusing below their respective actual fusing points.

Second Bake.—For the second bake, the shrinkage which takes place in the first is compensated by the application of additional body, and the work is again baked, using the same precautions in heating as before.

In the second bake, more heat may be applied than in the first. In the case of a low-fusing porcelain, the heat may be raised to within 25° to 50° F. of the actual fusing point, and in the high-fusing to within about 100° F.

Final Bake.—For the final bake, body is again applied at all imperfect points, and the work is gradually heated until the actual fusing point of the body is reached. It is then allowed to remain at that heat until the porcelain assumes a smooth, glazed appearance, when it should be immediately removed or the heat shut off. The time required to glaze the porcelain after the fusing point is reached is about ten to twenty seconds.

Cooling and Annealing or Tempering of Porcelain.—After each bake, and especially the final one, the porcelain should be cooled slowly. This can be done by removing the work from the furnace and inclosing it in a cooling muffle or by placing it under a small cover to protect it from the air. A better plan is to turn off the heat of the furnace and allow the work to cool in the muffle until the red glow has disappeared before removing. After the last bake the porcelain is annealed or tempered, as it is termed, by turning off the heat of the furnace and allowing the work to slowly cool in the muffle of the furnace. All porcelain, after the final baking and cooling, should be dipped in water before handling.

Difficulty Attending the Proper Fusion of Small Masses of Porcelain Body.—In the baking of porcelain body of a size such as is applied in bridge- or continuous-gum work, the process of fusing can be more easily watched and its progress more surely determined than in the case of a crown or inlay. A small mass of porcelain body of the size of an inlay is more quickly affected by the heat than a larger one. To always regulate the degree of heat by the eye alone and also determine the fusion of the high-fusing porcelain body in such cases with certainty is impossible.

Removal of the work from the muffle to examine it instantly cools such a small mass, and several removals for inspection are very injurious to the porcelain.

Method Used to Indicate Point of Fusion.—The melting points of gold and its alloys with platinum have been used to indicate the fusing of porcelain compounds by first making experimental comparative tests. The fusing point of the metal requires to be a few degrees below that of the body for the biscuit bake. The gold or its alloy is fused in a globule and then flattened out on an anvil with a hammer. The metal, after being tested with the porcelain, is placed upon the slab with the inlay or crown. When the metal assumes the spherical form, which can be seen by glancing in the muffle, it indicates that the fusion of the porcelain body has commenced. The globule of metal can be used continuously in subsequent bakings by flattening it out each time.

Merits of a Pyrometer.—The introduction of the use of a pyrometer obviates the need for such methods as are described above. By the pyrometer the progress of the increase of the heat and every variation of it are instantly and correctly indicated to the operator. Any degree of heat can be accurately applied and regulated for any specified length of time. The various bakings accordingly can be conducted so as to result uniformly. Doubt and uncertainty regarding fusing are removed and the work simplified.

In baking with an electric furnace associated with a pyrometer, as soon as the work is placed in position in the muffle, the door is closed and it is hidden from view. The voltage is then gradually increased by manipulation of the rheostat, and the progress of the heat is indicated by the needle on the scale of the instrument. When the needle has registered the required degree of heat, the current is shut off, the door of the furnace opened, and the work allowed to cool. The subsequent and final bakes can in like manner be given without variation from the proper degree of heat and time required for them, without once opening the muffle for the purpose of examination. Chilling of the work, irritation of the eyes by the glare and heat of the muffle through opening it for examinations, and loss of time are consequently avoided. Irregularity in the application of the degree of heat in the fusion of the body of porcelain work is the direct cause of a large percentage of failures. Improper conduct of a primary bake cannot be entirely remedied by subsequent fusings, and the final bake may destroy the previous part of the work. The best results respecting strength, appearance, and shade in the use of any particular porcelain compound can only be obtained by fusing it at the degree of heat specially designated for it. In view of the facts presented, the introduction of the pyrometer, especially in the use of high-fusing porcelain, is an important innovation.

CHAPTER IV.

Staining of Porcelain.

CHARACTER AND PURPOSE OF MINERAL STAINS—USE OF THE COLORS —APPLICATION—GRADATION OF SHADE—FUSING.

Character and Purpose of Mineral Stains.—Mineral stains are porcelain enamels colored with oxids of the metals, very finely ground, and fusing at a low heat. They are applied to reproduce the effect of conditions found in nature; as, for instance, staining of edges and cusps to simulate the wear through mastication; of the fissures of bicuspids and molars to represent the discolorations which appear in these places in the natural teeth; producing variations in color, such as the darker shade of cuspids when compared with centrals or of the cervical surface with the incisal edge or occlusal surface; the white specks often noticeable in the natural teeth; and, in general, the modifying or darkening of a single tooth or a number of teeth.

The Brewster mineral stains are mixed with oil, and those of The S. S. White Dental Mfg. Co. with water. The colors of The S. S. White Dental Mfg. Co. are seven in number—brown, yellow, gray, blue, white, and green, and pink for gum shading. By combining them one can get a great variety of shades. Mixing brings out the colors very nearly as they will appear when fired, the firing merely intensifying and fixing them. By the skilful application of these stains artistic effects can be produced. Their successful use, however, requires practice and care. More than a little experimental work is necessary, and tests on a discarded tooth should first be made, as it takes but a few minutes.

Use of the Colors.—In applying the stains, if the tone of the tooth is yellow, the addition of brown will at first darken the yellow, then, as more and more is added, bring out a more and more decided brown.

If the tone is blue or gray, brown at first merely deepens it, but on the addition of a considerable quantity produces a decided brown.

The white spots frequently seen in the enamel of natural teeth can be imitated by applying a thin layer of white, stippling, and firing in.

For representing the wear of mastication the teeth are ground and the cutting-edges and fissures stained brown.

Defects in the enamel, as pits or grooves, can be imitated by drilling out,—use a diamond drill for this,—applying the color, and firing.

A combination of the green with the brown will give a natural-looking stain similar to that found upon the teeth of inveterate "smokers."

Inlays or crowns, the color of which fails to match their surroundings, can be quickly brought to the desired shade by the addition of the proper color and firing.

Natural "cutting-edge" effects may be obtained by using either gray or blue as an underglaze color, *i. e.*, after applying and firing the color, cover the same with a colorless medium- or high-fusing porcelain and again fire.

The pink or gum color will be found useful in covering platinum bands which are exposed below the gum line, also in coloring that portion of an inlay which lies under the cervical margin, and in disguising the necks of porcelain teeth whose cervical margin is above or below the adjoining teeth.

Application.—The enamel stains are applied with a small brush and evenly distributed over a given surface with a stippling brush, both of which accompany the outfit of stains. The colors are intended for use on perfectly fused surfaces, but they may also be applied after the biscuit bake or primary bake, and the tint then modified by the translucency of the additional body, which will be distributed over the part for the subsequent bakes.

A change of shade of only a part of a facing toward the incisal edge in the construction of a crown or dummy may be effected in this way by the application of the stain to the palatal side of the porcelain.

Gradation of Shade.—Gradation of shade is controlled by varying the thickness when laying on the color. This can be effected by placing on the color with the small brush and then graduating it with the stippling brush. It can also be done by wiping the color off with the fingers. To effect gradation of shade, for instance, around the neck of a tooth with perfect accuracy, the color can be first evenly applied to the part and given a primary bake. The surplus color toward the edge is then removed with a sandpaper disk, making it gradually lighter, when the final bake is given and the enamel glazed.

Fusing.—In fusing the applied mineral stains, place porcelain teeth with the pins downward on a fire-clay slab, or, if a crown, set it upright. Apply the heat gradually until it reaches a dull red, and hold it at that point for two or three minutes. Cool gradually. These colors, though glazing at a low heat, will well retain their shade when fused on or with porcelain at a much higher point.

CHAPTER V.

Character and Suitability of Low- and High-Fusing Porcelains for Inlay- and Crown-Work.

REQUIREMENTS—COMPARATIVE MERITS—TESTS OF DENTAL PORCELAINS—SUITABLE APPLICATION OF EACH GRADE.

Requirements.—The value of the respective grades of porcelain for the work in hand is governed by their imitation of tooth-substance, density, strength, permanence of structure, retention of form in the process of fusing, close adaptation of the finished inlay to the margin of the cavity, and lastly,—a most important factor,—practicability in application. Porcelain dense and strong enough for use as an ordinary labial inlay might be deficient in the properties requisite to the formation of, for instance, an incisal edge for an incisor tooth, which would demand the greatest possible strength that can be obtained in porcelain. Neither would porcelain body designed to form an incisal edge, approaching in character body such as composes porcelain teeth—the pulverized porcelain tooth used at times by some for the purpose requiring a most intense heat to fuse it—be as suitable, even judged from a practical standpoint, for forming an inlay.

Comparative Merits.—The comparative merits of low- and high-fusing porcelain for the work in hand is a matter as to which considerable difference of opinion prevails. This is probably attributable to the fact that the knowledge or experience of many operators is confined in a measure to the grade they have in use and the methods connected with that use. Skilful proportionment and preparation of the various ingredients of a porcelain body realize the best results in the fused porcelain. In this way the fusing point of some preparations may be lowered, yet their comparative qualities be maintained. The following gives the fusing point, percentage of shrinkage, and crushing strength as recently determined by Dr. D. O. M. LeCron in a series of experiments with a number of the best-known dental porcelains. In studying the results of these tests the resistance or crushing strength should be considered more than shrinkage, for while the latter complicates the use comparatively, the former concerns the reliability and permanence of the operation.

Tests of Dental Porcelains.—

	Fusing Temperature.	Percentages of Shrinkage.	Crushing Strength, Pounds Per Sq. In.
Allen's Foundation	2340° F.	22½	26,950
Close's Foundation	2288° F.	21¾	45,640
Consolidated Dental Mfg. Co.'s Foundation	2200° F.	21½	30,390
The S. S. White Dental Mfg. Co.'s High-Fusing Inlay	2254° F.	23½	32,205
Brewster's Foundation	2218° F.	23¾	20,320
Consolidated Inlay	2138° F.	31	15,080
Whiteley's	2138° F.	31	16,000
Brewster's Enamel	2084° F.	33	22,990
Ash's High-Fusing	2012° F.	34¾	22,810
Jenkins'	1580° F.	38¼	28,305

Suitable Application of Each Grade.—According to the conditions discussed, in the present development of the art the use of low-fusing porcelain is best confined to inlays at labial and approximal surfaces. It is inferior to a moderately high-fusing porcelain for inlays at or extending to the occluding surface or incisal edge, and for porcelain and platinum crown-work, where a porcelain as nearly analogous in structure to the usual artificial tooth in part or whole is required.

CHAPTER VI.

Porcelain Inlays.

THE EARLIER METHODS—MODERN INLAYS AND THEIR MERITS—INSTRUMENTS AND MATERIALS USED IN THE ADAPTATION OF MATRICES—PREPARATION OF CAVITIES—FORMATION OF GOLD MATRICES FOR THE LOW-FUSING PORCELAINS—PLATINUM MATRICES—TO FACILITATE THE SHAPING OF A MATRIX—MOLDS AND DIES FOR—OXYPHOSPHATE IMPRESSIONS—PROCESS OF SHAPING A MATRIX BY A MOLD OR DIE—DISCUSSION OF PROPORTION OF DISPLACEMENT BY A MATRIX—REMOVAL OF A MATRIX: GOLD—PLATINUM—METHODS TO AID REMOVAL—INVESTING THE MATRIX—APPLICATION OF PORCELAIN BODY—THE JENKINS LOW-FUSING: APPLICATION, FUSING—USE OF ELECTRIC FURNACE IN BAKING LOW-FUSING PORCELAIN—ESTIMATED DEGREE OF HEAT—HIGH-FUSING PORCELAIN: APPLICATION—FIRST BAKE—SECOND BAKE—FINAL BAKE—COMPARATIVE HEAT OF THE FINAL BAKE—REMOVAL OF A FOIL MATRIX—PREPARATION FOR CEMENTATION—METHODS OF ETCHING WITH ACID OR A DIAMOND—USE OF A LENS—TO AID ADJUSTMENT IN CEMENTATION—REQUIREMENTS: EFFECT ON COLOR—OPERATION OF CEMENTATION.

Porcelain Inlays.

The Earlier Methods.—The first operations in porcelain inlays or fillings consisted in shaping pieces of porcelain as nearly as might be to the form of the prepared cavity, into which they were then cemented. These inlays were cut from porcelain teeth, which were selected to match the natural teeth into which the inlays were to be inserted. Various forms of inlays were then put upon the market by the manufacturers to meet the needs of this class of work, which, however, never attained any special prominence. A little later, slightly tapering round rods of porcelain were supplied for filling labial cavities in front teeth. The cavity was made perfectly round, to fit the end of a rod corresponding in size, which was fitted tightly, cut off, cemented in place, and when the cement had set was trimmed evenly with the surface of the enamel of the tooth. This latter method is still employed, being especially adapted to very small cavities on the labial surfaces.

Then we had glass inlays, of which a number were brought before the profession, but they failed to show the permanent value requisite, mainly because the inlays, besides lacking the necessary strength, showed a decided tendency to discolor in actual service. They were, nevertheless, an important step in the progression which led up to the modern porcelain inlay.

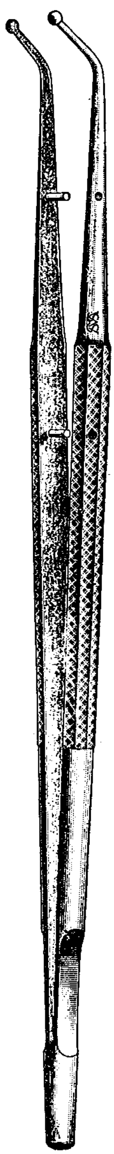
Modern Inlays and their Merits.—The porcelain inlay as now used is a dental porcelain fused in a carefully made matrix of the cavity to be filled, of the exact form and size required. The two grades of porcelain for inlay-work are the low-fusing, for which a gold matrix is used, and the high-fusing, requiring a matrix of platinum. Their respective merits for inlay-work have been much discussed, without deciding the difference of opinion concerning them. The characteristics of both and the methods of their manipulation and their application to the various operations will be impartially presented.

Properly made and inserted, porcelain inlays afford the very decided advantage of restoring lost tooth-structure not only in substance, but in appearance. Porcelain inlays are used principally on the labial, buccal, and approximal surfaces of teeth from bicuspid to bicuspid. They are also used on the occlusal surfaces of bicuspids and upon the anterior approximal sides of molars where the tooth immediately in front is missing. In combination with the cement used to fix them they add strength to a frail tooth and prevent thermal shock in sensitive cavities.

The first requirement in a porcelain inlay is that it shall accurately conform to the shape of the cavity, with an absolute fit of the orifice or of the orifice and side-walls. The cement with which it is luted fills in all parts of the cavity not occupied by the porcelain, including deep recesses and undercuts. The inlay is consequently held in position by the adhesion of the cement.

In cases of cervical decay extending under the gum-margin, the cavity should be previously packed with cotton or gutta-percha and the gum pressed from its normal position sufficiently to fully expose the edge of the cavity and admit of the perfect adaptation of the matrix. In approximal cavities the teeth should be previously separated well apart—more so, as a rule, than for gold filling-operations—so that the adaptation of the matrix shall not be obstructed or its removal interfered with in the slightest degree.

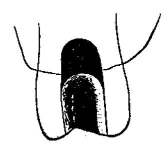
FIG. 666.



When the decay extends further under the gum than it is desirable to extend the inlay, the cervical section of the cavity may be first restored with amalgam (Fig. 664) and then the coronal portion shaped and inlaid with porcelain.

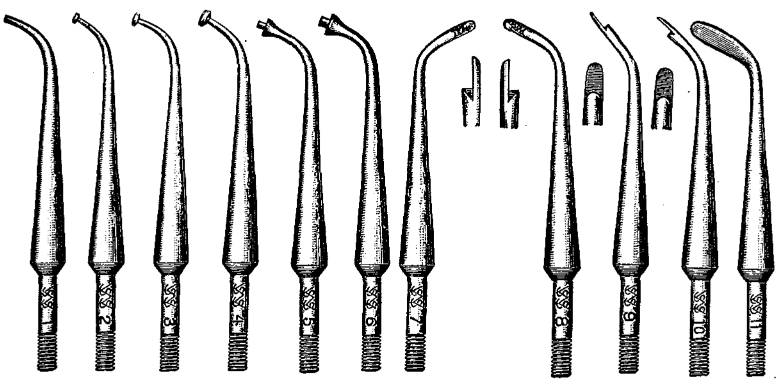
Instruments and Materials Used in the Adaptation of Matrices.—Small-pointed and specially-shaped burnishers are necessary for the proper adaptation of matrices to cavities. Fig. 665 illustrates a set devised by Dr. LeCron. Nos. 1 and 11 are for general use; Nos. 2, 3, and 4 for the interior of cavities; Nos. 5, 6, 7, 8, 9, and 10 for the margin of the cavity and the surface of the tooth combined. Fig. 666 shows round-pointed tweezers for carrying pellets of spunk or cotton used to compress the foil for the matrix into the cavity of the tooth. They may also be used as a burnisher.

FIG. 664.



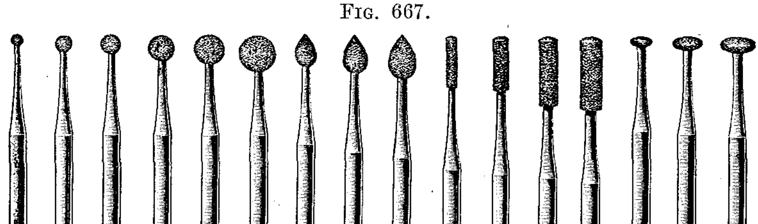
Preparation of Cavities.—Cavities for porcelain inlays are to be excavated more as for plastic work than for gold, and without undercuts. The effort should be to give a cup-shaped formation with the orifice a little larger than the bottom, so that the matrix of gold or platinum when adapted to the cavity can be removed without disturbing its shape. This ideal form is not to be obtained by excessive removal of the walls or enamel. Unnecessary cutting away of tooth-substance is to be avoided. When the decay has proceeded in such way as to form deep recesses, it is not desirable nor necessary to cut away the tooth to make the ideal cavity form include them. After removing the carious portions from such recesses, they can be filled with cement so that the cup-shaped form for the matrix shall include only the main cavity, the cement where it joins the main cavity being dressed to conform to the proper contour. The exception to this rule is where a bar or horn-like formation of the porcelain is made at some point as an anchorage to an inlay which involves restoration of the contour of the working surface of the tooth, as of an incisal edge. The orifice of the cavity should be given a slightly oval or oblong form, with one end or side differing somewhat in shape from the others, to define the exact position the inlay is to occupy when inserted in the cavity. The margins should be trimmed evenly and the side-walls inclined at nearly a right angle to the line of the enamel surface, especially at a point where the force of mastication is to be withstood. The surrounding edge of the enamel should be sharp and well defined.

FIG. 665.



It is well to polish around the margins inside the cavity with soft iron burs charged with diamond dust, or with points of Arkansas stone kept wet during the polishing. A set of forms such as are

FIG. 667.



illustrated in Fig. 667 are suitable for the purpose. The use of sandpaper disks or strips across the surface of the enamel should be avoided, as it is apt to make a coarse joint.

Figs. 668, 669, 670, and 671 illustrate teeth with prepared cavities and their inlays of the classes commonly involved in the practice of porcelain work.

Fig. 672 outlines, in section, the preparation of an ordinary cervical cavity. The line A, A represents the prepared cavity; B, B the point where the undercut—though this is generally better omitted—may be made when the porcelain is ready for insertion. C, C is the gold or platinum matrix. Such cavities require to be moderately deep, in order that the inlay shall be of sufficient thick-

Fig. 668.

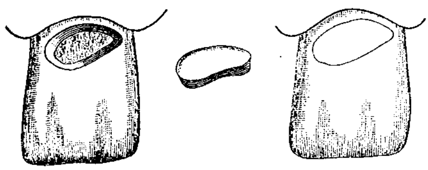


Fig. 669.

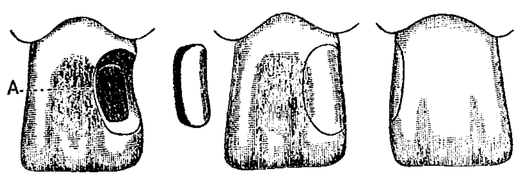


Fig. 670.

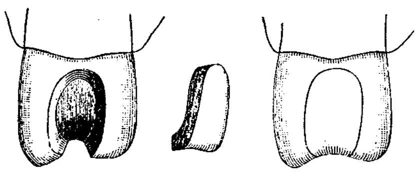
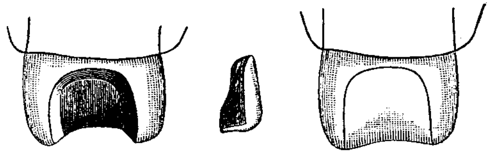


Fig. 671.



ness to overcome the effect of the cement, which would otherwise modify the shade, owing to the translucency of the porcelain. A cavity of this character, if not located very close to the gum-margin, being one of the most simple, is generally the best to begin practical work on.

FIG. 672.

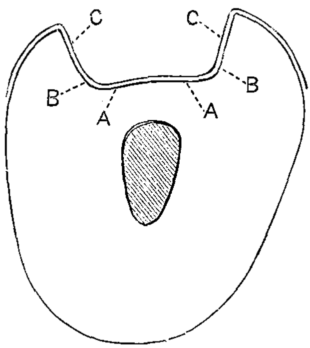
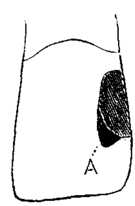


Fig. 673 represents a typical cavity in the approximal side of an incisor. The dark portion, A, in the sectional view, represents a recess in the cavity made necessary by extension of the decay in that direction, which recess must be filled with cement to give proper form to the matrix. In the case of approximal cavities, ample space is required for the proper manipulation of the matrix and the insertion of the porcelain filling. The necessary room must be obtained by preparatory wedging or by the use of a separator, or by combining both methods. There must be sufficient space to permit the matrix, after it has been perfectly conformed to the cavity, to be lifted out without disturbing its form in the least, and also to allow the porcelain to be freely inserted.

FIG. 673.



In the upper incisors, when a portion of the palatal wall can properly be removed, as shown at A, Fig. 669, less space is required, and removal of the matrix and insertion of the inlay are considerably facilitated. Cavities in bicuspids and molars, such as are illustrated in Figs. 670 and 671, involving the approximal and grinding-surfaces, usually permit the matrix to be more easily removed than when only an approximal surface is involved.

Formation of Gold Matrices for the Low-Fusing Porcelains.—Rolled gold No. 30 is used for ordinary cavities and No. 40 for those which are extremely large or complicated in shape. The foil should be cut round or oval, large enough to cover the walls of the cavity and extend over the adjacent surface of enamel one-fourth of an inch, more or less, according to the location, character, and size of the cavity, to permit it to be immovably held in position during its adaptation. The surplus foil, when shaped to the contour of the tooth around the cavity, serves to outline the contour to be given the inlay when the porcelain body is inserted in the matrix. The foil is placed over the cavity, the edges of which are defined, and is first brought gently down into the center of cavity with a bit of spunk or a pellet of cotton held in a pair of tweezers (Fig. 666), or when necessary by a ball burnisher, as No. 2 of the set illustrated in Fig. 665, and then against the walls. Remove the spunk, see if the adjustment of the foil to the

FIG. 674.

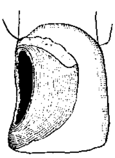


FIG. 675.

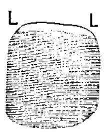
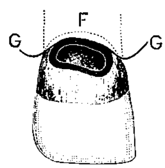


FIG. 676.



G G represents line of gum-margin; F. line of foil under the gum.

cavity is satisfactory, then replace the spunk, holding it in place with the left hand, by pressing in the center with a ball burnisher. Next, with another piece of spunk held in tweezers in the right hand, bring down the foil over the edges and on the surface of the enamel around the cavity, and burnish it with a burnisher, such as No. 1 or No. 11 in Fig. 665. In the adaptation of the foil to the cavity, and especially for holding it in position in the center while the marginal section is being manipulated, the author has found that a wisp of cotton, tightly twisted around an old-fashioned, long-handled cavity bur, is very serviceable. The ball-pointed tweezers illustrated in Fig. 666 are recommended for this part of the work. The foil should then be burnished to the sides and margins of the cavity and over the surface of the tooth to impart the greatest possible amount of rigidity to it before its final removal. In a mesial cavity of a superior central the foil appears about as illustrated in Fig. 674, and in a cervical one as shown in Fig. 676.

Gold foil is seldom removed and annealed during its adaptation. A little vaselin may be applied to the surface of the gum, enamel, and cavity to prevent adhesion of the foil. In cases where the cavity closely approaches to or extends under the gum-margin, rigidity will be imparted to the portion of the foil placed there (see Figs. 674 and 676) by folding the edge over before adaptation, as shown at L L, in Fig. 675. The foil when adapted should be so positioned that a slight space will exist between the lap-over edge and the margin of the cavity, about as is also shown in Fig. 674.

Platinum Matrices.—Platinum foil 1/1000 of an inch in thickness is the gage most generally used for the high-fusing porcelain matrix. To render the platinum soft enough for the purpose it should be previously annealed at a white heat in the muffle of a gas furnace, or, preferably, on a piece of lime in an electric furnace. Annealed by the latter method it becomes nearly as soft and pliable as gold. A direct gas flame is not suitable, as the desired softness cannot be obtained by that means and the platinum becomes slightly carbonized. The foil is placed across the cavity and cut large enough to extend on each side a little more than if of gold foil, so that it can be held securely in position. In the case of a labial cavity the platinum is allowed to extend over the surface of the adjoining teeth. If the cavity is on the side or at the incisal edge, the foil is brought over on the labial and palatal surfaces. The foil is first carefully and gently pressed into the cavity in such manner as not to tear it, and the side portions are then brought down in position against the surface of the tooth or adjoining teeth should the platinum extend there. While being firmly held in position against the slightest movement, the foil is carefully adapted to the cavity by burnishing. This process is begun at the edge of the cavity with a circular motion of the burnisher around the margins. As the platinum sinks into the cavity the metal is gradually brought down against the sides and finally in the center. If the metal was first pressed down in the center, as gold foil is, the platinum would be torn to an extent that would spoil it as a matrix. At this stage of the formation of the matrix, if desirable, the foil is removed, annealed, and replaced in the cavity, reburnished to the cavity and then to the edge and surface of the enamel, and removed. Before finally removing the matrix it is advisable to uniformly compress its entire surface to the walls of the cavity and adjacent surface of the tooth to remove any slight spring or warpage should such exist. This is done by introducing into the cavity and placing over the surface of the tooth pieces of spunk and pressing uniformly at the same time on the entire mass. It may be done also by stretching a piece of rubber-dam tightly over the foil. The spunk is first removed and then the foil carefully started and lifted from the cavity.

Platinum foil as light as 1/2000 of an inch requires to be adapted to the cavity in a manner very similar to gold foil.

Should either gold or platinum foil tear slightly in the center of the cavity, it is not a serious matter, as the porcelain body will draw from the edge in the first fusing.

Platinum foil has the advantage that it can be adapted to the surface of a tooth under a gum-margin more easily than gold.

To Facilitate the Shaping of a Matrix.—To facilitate the shaping of either a gold or platinum matrix, the foil may be placed on the surface of a piece of soft fine-grained cork, and with a ball-shaped burnisher the center may be pressed into the cork and given a cup-shaped form approximating that of the cavity. A slit placed in the foil at about the point A, Fig. 669, has also been suggested, but this is preferably to be avoided.

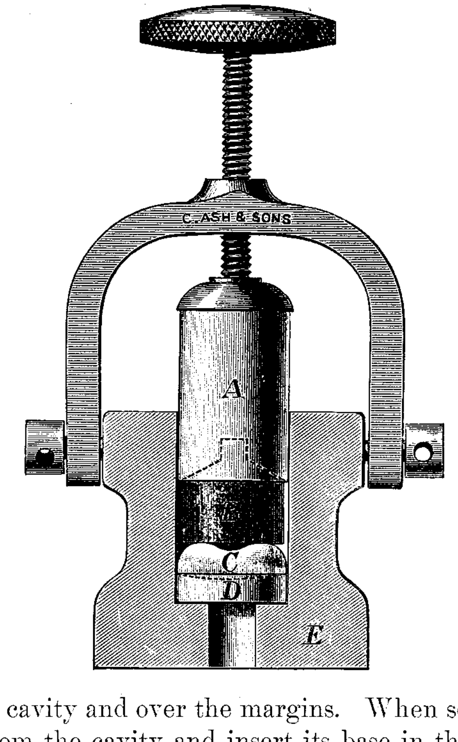
Molds and Dies.—Various methods to shape or aid in shaping the foil to the form of the cavity with molds are practiced. The following is simple and quickly performed. In the case of a cervical cavity, take an impression of the cavity on the end of a cone of impression-compound. For an approximal cavity fit a small piece of impression-compound in the cavity, chill with water from a syringe, and withdraw or tip out with the point of an excavator. A mold of the cavity is then made by again chilling the impression with cold water and pressing it against and into the surface of another small piece of softened impression-compound, chilling the compound, and separating impression and mold. The foil is then shaped in the mold thus formed and fitted to the cavity in the tooth.

Another method, but one which takes more time, used by some to shape the matrix without fitting to the tooth in the mouth, is to make a mold with plaster from the impression-compound and then boil the plaster in stearin to toughen it.

A much preferable method is to place oxyphosphate cement over the impression-compound and immediately add a mixture of plaster sufficient to shape up the mold. This gives a mold with sharply defined margins, and walls which will perfectly withstand any ordinary adaptation of the foil without chipping or fracturing.

Oxyphosphate Impressions.—Oxyphosphate is also used to take the impression of the cavity as well as form the mold. The method of procedure is as follows: Dry the cavity and surface of the tooth and dust with soapstone applied with a camel's-hair brush, or wipe with vaselin, being careful to remove all surplus. Mix a ball of oxyphosphate moderately stiff, knead with the fingers, and

FIG. 677.



press into the cavity and over the margins. When set, remove the impression from the cavity and insert its base in the surface of a small mass of plaster trimmed either round or square. The surface of the die is next oiled, and a small mass of oxyphosphate mixed to a plastic consistence is pressed over it. When the oxyphosphate has set, it is first separated from the die, then replaced, and enough plaster added to complete the form of the mold. By this method a very accurate mold of the cavity is obtainable.

Process of Shaping a Matrix by a Mold or Die.—The process of shaping a metallic matrix to the mold of a cavity is similar in principle to that used in a cavity of a tooth in the mouth. To facilitate the operation of swaging, the water-bag method is to some extent used. The apparatus is illustrated in Fig. 677. The mold is mounted on the bed-plate D. The foil to form the matrix is placed in position over the mold and carefully depressed into the cavity with a ball of cotton. Bed-plate, mold, and foil are next set in position in the *cylinder* C D, the water-bag B placed over them, and the plunger A screwed downward on the water-bag, pressing it into the cavity and over the surface of the mold and swaging the foil evenly and accurately to form.

Discussion of Proportion of Displacement by the Matrix.—A matrix swaged in a cavity represents on its outer surface the exact form and dimensions of that cavity and on the inner surface the same dimensions minus the thickness or displacement of the foil. A matrix swaged on the surface of an impression or die drawn from a cavity will be of the same size as the cavity on the inner surface and plus the thickness or displacement of the foil on the outer surface. It has been contended that a closer and more accurately fitting inlay would be made from a matrix the exact form and dimensions of the cavity on its inner surface. Theoretically this would seem to be correct, but practical experience goes to show that the result is not satisfactory, for should the slightest irregularity exist on the surface of the inlay, not having the allowance of the thickness of the foil as it would if made in the usual manner, its adjustment is liable to be affected, and besides a slight space for the cement is wanting.

Removal of a Matrix.—The removal of the matrix requires most gentle, delicate manipulation, as it must be accomplished without the slightest alteration of the form. On account of its greater rigidity, platinum foil is more easily removed than gold. The cavity will generally have one wall inclined slightly more than the remainder; a conformation which is easily made.

Gold.—For the removal of a gold-foil matrix, deep in the cavity, at the slanting side, insert a fine-pointed hoe-shaped instrument into the foil, and loosen and gently coax it from its position. When loosened, take an edge of the foil in the tweezers and lift the matrix from the cavity.

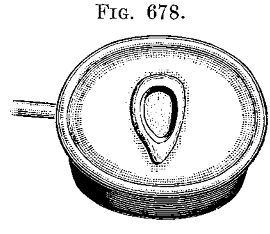
Platinum.—A platinum-foil matrix is generally best loosened first at the extreme edge of the burnished surface.

Methods to Aid Removal.—The removal of a matrix, especially if of gold, is much simplified, and alteration of its form assured against, by filling it with wax. Soften and roll up a pellet of hard, tough wax, a trifle larger than the cavity; introduce the pellet of wax into the cavity of the matrix and press it down with a flat burnisher (No. 11, Fig. 665), covered with pulverized soapstone to prevent adhesion of the wax to the instrument. In approximal cavities the pressure is best exerted with a strip of tape covered with the soapstone. The pressure should be steady and direct. The wax should extend over the edge of the cavity onto the foil, but at no point beyond its margin, as adhesion of the wax to the tooth would interfere with the removal of the matrix. A stream of cold water from a syringe is next thrown on the wax, and the matrix is then started and removed from the cavity. The wax in the case of a platinum matrix can be removed by seizing the edge of the foil with tweezers or clamp and holding it open end downward for a moment in a cup of water that is simmering just at the boiling-point, or, the matrix can be invested in marble-dust and plaster and the wax then removed.[1]

Investing the Matrix.—In the use of a 1/1000-inch platinum-foil matrix, for high-fusing porcelain, investment of the matrix is not generally practiced. Gold-foil or a 1/2000 platinum-foil matrix is usually invested, owing to the great shrinkage which occurs, especially in the fusing of the first application of the porcelain body. Dr. Jenkins's method of investing a gold-foil matrix, in connection with the use of his low-fusing porcelain, is given below:

Mix finely powdered asbestos with water to the desired consistence, and place in the platinum cup, which is included in his outfit and is illustrated in Fig. 678, sufficient of it to imbed the matrix. Lay the gold-foil matrix on the surface of the asbestos, slightly tap the cup, and the matrix will settle down in place in the asbestos. Should some of the walls stand high, a little of the asbestos should be carried under them with the point of a camel's-hair brush, or an ivory spatula, so that the matrix is everywhere equally supported. Fig. 678 shows an invested matrix.

FIG. 678.



For high-fusing porcelain, or when wax is used in a gold matrix

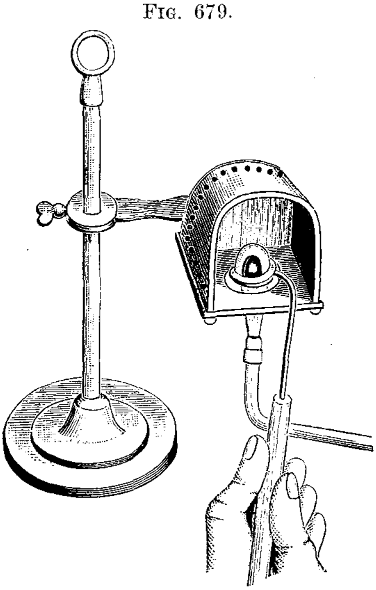
[1] Gum-camphor has lately been recommended in preference to wax. The camphor is compressed in the matrix and removed by alcohol or heat.

to assist its removal, the matrix must be invested just as for the formation of a gold inlay, in marble-dust and plaster. Take very finely ground calcined marble-dust two parts, and plaster one part. First thoroughly mix them, and then add enough water to form a moderately thin paste; place a proper quantity of the investing material on a piece of paper on the bench, set the matrix on the center, and let it settle into the investment. A few taps on the bench alongside, sufficiently hard to jar it, will assist the settling. When the investment has set, the wax is washed out with a stream of boiling water and the investment trimmed as small as it properly can be. Next, dry and heat over a Bunsen flame until the investment approaches a red heat, then let it cool, and the matrix is ready for the application of the porcelain.

Application of Porcelain Body.—The methods of procedure in applying the body with low- and high-fusing porcelains are quite similar, irrespective of the degree of heat required. A description of the use of one style will, in a measure, explain the subject for both.

The Jenkins Low-Fusing: Application and Fusing.—This is a porcelain introduced by Dr. N. S. Jenkins, of Dresden, Germany. As indicated by the pyrometer it fuses at 1580° F. It forms a dense, hard porcelain, with a considerable degree of crushing strength, and resembles in appearance the porcelain of an English tooth more than that of the American. The following is an explanation of the use of the Jenkins porcelain and the appurtenances connected with it. which are illustrated in Fig. 679. Place upon the agate palette the required quantity of the body of the selected color, and mix it with absolute alcohol. With the small, thin blade of the spatula carry the well-moistened body into the matrix and fill it up *to but not over the edges.* If in applying the powder it becomes too dry in the matrix, drop on its surface from the point of the

Fig. 679.



glass drop-tube a little more alcohol. During the packing aid the precipitation of the particles of the body by a few light taps on the side of the fusing-cup or on its handle.

Method of Fusing.—Put the cover on the fusing-cup, with the opening toward the handle. Hold the cup over the hole in the heater and turn a very fine flame from the gas blowpipe onto the handle, about an inch from the fusing-cup, for the purpose of gradually imparting heat to the asbestos and slowly evaporating the alcohol. This must not be done hurriedly, as the moisture is to be evaporated, *not boiled out*. Next, turn the flame upon the bottom of the cup, slowly and gently increasing both flame and draft from the foot-bellows. (See Fig. 679.)

The process of fusing can be seen clearly through the opening of the platinum cover. When the powder begins to fuse, hold the flame and draft as it is, and do not try to accelerate the melting by rapidly increasing the heat. When the work approaches the fusing stage, the fact is indicated by a dark shade which for a moment passes over the porcelain body, caused probably by combustion of a small quantity of starch introduced as an ingredient to assist in holding the particles of the compound together. The body then again assumes a light shade, and at about a red heat fuses sufficiently for a primary or biscuit bake, when the application of heat must be instantly stopped. To cool the investment remove the cover of the cup. The cooling can be hastened by holding the bottom of the cup against the surface of cold water, but care must be taken that the water does not enter the cup. In the first fusing the body globulates and contracts nearly one-half the size of the cavity of the matrix, a characteristic of low-fusing bodies. The fused body in the matrix is moistened with alcohol and more body is applied to fill the vacancy caused by the shrinkage. If the investment is wet with the alcohol in the application, it will not injure it.

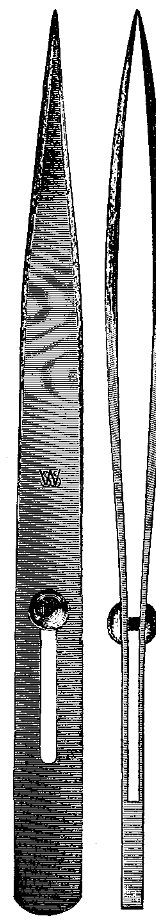
For the second bake apply a small flame at first on the handle and presently a blue flame from the alcohol will appear at the opening of the cover. Let it burn until quite consumed and then fuse the porcelain body as before. A third application of body is necessary for exactness of edges and contour. In the third or final bake, the heat is carried higher than in the previous ones, up to the actual fusing-point of the porcelain body, a "glazing heat," to impart a glossy surface. It is well to examine the inlay with a magnifying glass, to be sure that the edges are exact, both in applying the body and after fusing. The tendency on the part of the operator, in the beginning, is to build out too much, but after some experience he learns to get exactly the form and fullness desired. After the final baking it is better to let the piece cool somewhat slowly.

Use of Electric Furnace for Baking Low-Fusing Porcelain.—This style of porcelain can be baked to advantage in an electric furnace. The heat of the muffle is raised a little above the required fusing point of the porcelain, the tray containing the work, uncovered, is gradually introduced, where being exposed to view the process of fusing is seen and determined. Aided by the pyrometer, the heat can be accurately defined and fusing of the porcelain conducted without the expertness required in the use of the gas method.

The Jenkins porcelain fuses at about 1580° F. Guided by the pyrometer, the primary bakes can be made at 1480° to 1500° F., and for the final one the heat raised to 1580° F., at which degree it should be held for about ten seconds and the current instantly turned off.

The Application of High-Fusing Porcelain Body.—The application of high-fusing porcelain body to platinum matrices, though similar to that described in relation to low-fusing, differs in important minor details. The shade of body selected is wet with distilled or filtered water and dried with blotting-paper to the consistence of a paste. The matrix may be invested or not. If not invested, it is held by the edge with pliers or clamp-tweezers. (See Fig. 680.) The porcelain body, of a dough-like consistence, is carried on a spatula, or preferably the point of a very small camel's-hair brush, a portion at a time, and dropped in position in the matrix, and by sharp taps on the back of the tweezers, or by vibrations caused by drawing the corrugations on the handle of the spatula shown in Fig. 658 across them, the body is settled down in the matrix. This tapping or vibrating packs the particles of porcelain closely together and sends the moisture to the surface at each tapping, when it should be absorbed with a piece of blotting-paper trimmed to a point. Through this condensation of the porcelain body, the shrinkage which naturally occurs in the baking is reduced to the minimum, and porosity is avoided. The first application of body should not be allowed to come quite to the edge of the cavity of the matrix. The matrix if not invested is set on a bed of silex on a small fire-clay slab or in a platinum pan, such as are now made and sold for the purpose.

FIG. 680.



First Bake.—The slab is placed on the shelf in front of the muffle to evaporate the moisture from the body. It is then slowly advanced into the muffle and the body given the primary bake, which should be, as gaged by the pyrometer, from 150° to 200° below the actual fusing-point of the make of porcelain body. Some high-fusing compounds fuse nearly 200° above others. The primary bake under such condition must be calculated accordingly, or determined by testing. The heat should be only sufficient to well unite the particles and give the body a slight glaze. In this primary bake considerable shrinkage takes place. The larger the matrix, the more noticeable the shrinkage will be.

Second Bake.—The matrix is again placed in the cavity, and while firmly held in position by pressure exerted on the center of the porcelain, the platinum, which is always slightly drawn from the margins by the contraction of the porcelain, is reburnished at the edges of the cavity. In this second burnishing the platinum, which is then extremely soft from the annealing it received in the baking of the body, is additionally thinned at the margins of the cavity and is adapted with great accuracy. More body is applied, filling the matrix to the edge, and a second bake given at a heat a few degrees higher than the previous one.

Final Bake.—For the final bake all new imperfections in the porcelain are filled in and a heat applied sufficient to perfectly coalesce the particles and give the work a uniform glazed surface. For this final bake the heat should be run up exactly to the fusing-heat of the porcelain and maintained there for from fifteen to twenty seconds, and then instantly shut off and the work gradually cooled.

Comparative Heat of the Bake.—Should the circumstances require more than two primary bakes, the full fusing-heat of the porcelain should be avoided until the final one.

Removal of a Foil Matrix.—When the inlay is cool, always first wet it with water before handling, then, if invested, remove it from its investment. With tweezers gently and slowly bend back the foil from the edges and it will usually strip off in one piece. If any shreds of foil adhere to the inlay, remove them with a fine excavator.

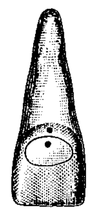
Preparation for Cementation.—For the purpose of retention of inlays, a few grooves are made on the bottom and sides in the porcelain with a small diamond disk (see Fig. 681) or the gloss removed with a small cone-shaped "Gem" point to facilitate adhesion of the cement.

FIG. 681.

Methods of Etching with Acid or a Diamond.—If the inlay is too small to handle conveniently, the gloss can be removed by covering the face and margins of the base with wax and applying hydrofluoric acid for a few minutes. An inlay can be quickly etched over the entire surface except at the extreme edge where it meets the margin of the cavity, with a diamond point in the engine hand-piece, aided by a lens to magnify the part. The lens, for convenience, should be mounted on a stand like that used by wood engravers. By this method nearly the entire cavity-surface of the porcelain is divested of its glaze and roughened. The adhesion of the cement to such a surface, which is much more porous than when merely acted on by hydrofluoric acid, is absolute, and displacement of the inlay from lack of attachment of the cement is positively assured against. Excessive and deep indentation of an inlay with disks weakens it and renders it liable to fracture in insertion or use. In shallow inlays it is liable also to affect the shade.

To Aid Adjustment in Cementation.—In the cementation of an inlay it is well to be able instantly to insert it correctly in the cavity, as its removal and reinsertion after the cement is applied are objectionable. The inlay after the fitting is completed may be laid upon the operating case in such wise that there will be no uncertainty in carrying it straight to its correct position. Another way is to insert the inlay before the cement is applied, and after drying the surfaces mark corresponding parts of tooth and inlay with a fine-pointed pen, drying the ink with hot air. (See Fig. 682.) The marks form an unerring guide to the proper relative position of the inlay. A few grooves may be made in the walls of the cavity to favor the cement, but this is not always considered necessary.

FIG. 682.



Cementation.

Requirements: Effect on Color of Porcelain.—Oxyphosphate cement is almost universally used for the cementation of porcelain inlays. Its adhesiveness to both tooth-structure and unglazed porcelain renders it most suitable for the purpose, but its solubility at the edges of an inlay is what chiefly raises the question of durability of this class of operations. The durability of porcelain inlay-work depends on the *closeness of the meeting edges of inlays with those of the enamel at every point.* The opaqueness of this cement, owing to the translucency of the porcelain, frequently very materially affects the shade of a cemented inlay. The effect of the cement on the shade can be quite accurately determined previously by first mixing a little of the powder of the cement with water, placing it in the cavity, and inserting the inlay. The shade of the cement should accord well with that of the inlay or tooth, but be a trifle lighter.

Operation of Cementation.—Successful cementation of inlays largely depends on the manner in which the oxyphosphate is used, as well as on its quality. The cement should be most thoroughly mixed, and its consistence should be as nearly that of a thick paste as possible without too great an impairment of its adhesiveness. A cream-like consistence, such as is used for gold cap-crowns, is not reliable. A cement which can be mixed thick and still retain its adhesiveness, and yet in that condition easily ooze out from under and around an inlay at the edges under properly exerted pressure, is the most suitable. As the action of phosphoric acid on the ordinary steel spatula is liable to affect the color of the cement, one formed on the end of an orange-wood stick is the most suitable to use for the purpose of mixing the cement.

The inlay and cavity having been dried perfectly, a little of the cement is smeared in every part of the cavity and on the sides and bottom of the inlay, and especially in any groove present. The inlay is then placed in the cavity and gradually pressed home. Before it is quite in place, the surplus cement should be removed from the surface, the inlay carefully examined to see if it is exactly in proper position, and the final pressure given with a properly shaped piece of wood. The final pressure should be gentle and elastic, and exerted on the center of the inlay, until all surplus cement has oozed out. In approximal cavities a piece of tape or floss silk may be used to press an inlay to place, but a wedge-shaped piece of wood is to be preferred. If the rubber-dam is used, leave it on until the cement has set. Varnish should be painted over the inlay. At a subsequent sitting, particles of oxyphosphate which may be still clinging to the tooth or inlay should be removed. If on examination the porcelain should be found to improperly project beyond the surface of the enamel at any point, it should be reduced with finishing disks or strips, or Arkansas stone points.

CHAPTER VII.

Special Operations, Rod Inlays, and Points to Bear in Mind.

LARGE CONTOUR INLAYS—USE OF PIECES OF PORCELAIN TEETH—USE OF SUCCESSIVE GRADES OF BODIES—SUBJECT OF OCCLUSION—PORCELAIN INLAYS IN COMBINATION WITH GOLD OR AMALGAM FILLINGS—ATROPHY AND EROSION—PORCELAIN TIPS—PORCELAIN SHOULDERS PREFERABLE TO PINS FOR RETENTION—WIRE LOOP.

Rod Inlays.

PREPARATION OF THE CAVITY—THE ROD INLAY—CEMENTATION AND FINISHING—USE OF PORCELAIN TEETH TO FORM INLAYS.

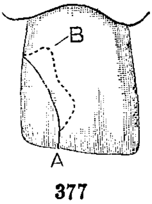
Points to Bear in Mind.

TO FACILITATE MATRIX ADAPTATION IN CERVICAL CAVITIES—TO OVERCOME CONTRACTION OF BODY—TO AID REMOVAL, AND REMEDY TEAR OF MATRIX—ADVANTAGES OF THE USE OF A FOUNDATION BODY IN CONTOUR OPERATIONS—USE OF LENS—POROSITY OF PORCELAIN—TIME-SAVING IN INLAY WORK—EDGES OF INLAYS—SMALL INLAYS—EFFECT OF CEMENT ON SHADE—REQUIREMENTS IN INLAY-WORK—CONSERVATIVE LIMITATIONS OF INLAY-WORK.

Special Operations.

Large Contour Inlays.—When considerable contour is given or a corner is built out, for instance, in a case such as is represented in Fig. 683 and others of that character, the porcelain should always be set at a right angle to the biting or incising edge of the tooth under treatment, as shown at A, or chipping is liable to occur. In this and all such cases a projecting horn of the porcelain (B) will make a much stronger anchorage than a platinum pin. A platinum pin in a

Fig. 683.



small mass of porcelain has a tendency to weaken it by breaking up the continuity of its structure.

Use of Pieces of Porcelain Teeth.—In building up corners of large contours a piece of a porcelain tooth of the exact shade can be placed in the matrix, and the body built around and over it. The applied piece of fused porcelain by its presence lessens the usual proportion of shrinkage of the inlay baking and simplifies the construction of a sharp corner. In the use of the high-fusing porcelain, after it has been baked in position in the matrix, the work may be adjusted in the tooth, its position examined, and, should any point of the piece of porcelain project excessively, it can be trimmed off with a corundum-wheel. The porcelain should then be washed and cleaned of the *débris* resulting from the grinding.

Use of Successive Grades of Bodies.—The use of successive grades of high-fusing porcelain, commencing with a very high-fusing foundation, and followed by lower and still lower-fusing bodies, often simplifies the operation of building out a difficult corner. In such a case each application should be biscuited and fused before the next lower-fusing grade is added.

Occlusion in Close Bite.—When a large corner is built on an upper incisor, if the bite is close, the porcelain should be depressed at the point of occlusion with the lower teeth, and enough of the incisal edge of the lower antagonizing tooth should be ground off to leave a slight space—say that of thin cardboard—between.

Fig. 684.

Porcelain Inlays in Combination with Gold or Amalgam Fillings.—In a case of combined approximal and cervical decay, where the shape is unfavorable to the formation of an entire porcelain inlay, or undesirable, fill the approximal cavity with cohesive gold, extending it into the cervical cavity, trim the edge of the gold, and then form and insert the inlay partly in the latter, as illustrated in Fig. 684. Large amalgam fillings, especially in either the bicuspids or molars, may be treated in a similar manner.

Atrophy and Erosion.—In atrophy of the enamel, as illustrated in Fig. 685, porcelain inlay-work is specially suitable. In cases of erosion, where shrinkage of the gum causes exposure of a portion of the root, as shown in Fig. 686, the section of the inlay over the root can be enameled with gum-colored porcelain. Gum enamel fuses at a lower heat than the porcelain it accompanies, and is to be applied after the final baking of the inlay, but before removal from the matrix.

Fig. 685.

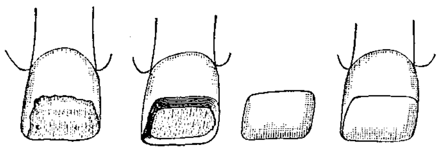
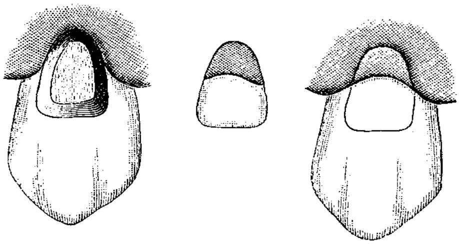


Fig. 686.



Fractures.

Porcelain Tips.—Porcelain work is specially adapted to the restoration of portions of natural teeth which have been broken off and of those which have suffered through some form of abrasion.

Fig. 687.

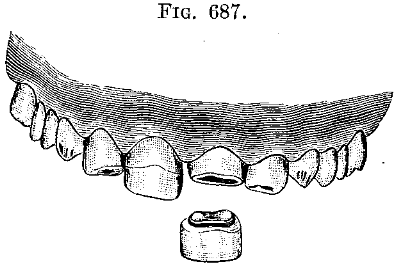


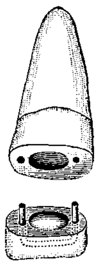
Fig. 687 illustrates a case of atrophy in which the tips of the central incisors were contoured with porcelain. The right central shows the porcelain in position, the left the porcelain tip ready to be adjusted. A dovetailed cavity was first formed in the central portion of the section to be tipped or contoured. A piece of platinum foil was adapted to the cavity, and high-fusing porcelain body baked thereon as already described. The platinum foil was then removed and the tip cemented in position.

To form an extremely strong porcelain tip, Dr. Land selects an S. S. White Dental Manufacturing Company's porcelain tooth of the correct shade, pulverizes finely the portion corresponding to the part to be restored, and uses the powder as the body to form the tip. A very high heat is required to fuse the porcelain of artificial teeth, but the greatest possible strength in a porcelain tip is secured by the use of such a body.

Porcelain Shoulders Preferable to Pins for Retention.—For the retention of a porcelain tip, a shoulder of the porcelain, such as is illustrated in Fig. 687, is preferable to forming the tip with a loop of wire or with platinum pins, which are to be cemented in holes drilled in the tooth-substance. The presence of pins, as before mentioned in regard to other operations, weakens so small a piece of porcelain by breaking up the continuity of its structure. The pins do not form for it as secure or strong an attachment as a porcelain anchorage of moderate size.

Wire Loop.—In cases of fracture in which porcelain tips are required, and the existing conditions do not permit of the removal of sufficient tooth-structure to form a porcelain anchorage, the use of pins must be resorted to. In such a case, after the holes have been formed,—there should not be more than two,—and the parts properly prepared, the surface of the fractured part is capped with platinum foil punctured over the holes and the pins inserted. The wire to form the pins should be of about No. 21 gage. It should be first rolled under a fine flat file to slightly roughen its surface. The pins should extend from the foil, or the wire forming them be shaped in a loop, as shown in Fig. 688. While the platinum cap and pins are in position on the tooth, a small quantity of a very high-fusing porcelain or foundation body is applied to the center of the cap and closely around the pins. The excess of moisture is absorbed with blotting-paper and the surplus body removed with a small brush from around the margins of the cap. The wire or loop is then seized and the whole gently removed from the mouth and given a biscuit bake. On removal it is readjusted on the tooth. The shrinkage of the foundation body is compensated for by the addition of more body, and it is again inserted in the furnace and then given a bake at the fusing-heat of the porcelain. If the extension of the loop of wire above and across the surface of the cap occupies more space than the size and form of the part to be restored will allow, the loop should be bent down a little against the surface of the cap or be partly or entirely

FIG. 688.

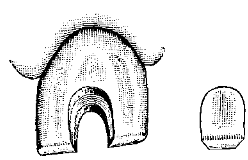


removed by grinding, leaving only the pins. Should the latter course be necessary, the pins will then be held in position by the foundation body which has been fused around them. The cap is next placed on the tooth and the margins of the platinum burnished closely around that of the fracture and the formation of the tip completed with porcelain body which fuses at a lower heat than that already used. After the final fusing of the porcelain the foil is torn from the base. It will not adhere to the pins, not having been soldered to them. The burnishing of the foil at the margins of the cap after the first baking slightly reduces its gage in comparison with the central portion and tends to effect a closer fit for the porcelain at that part.

Small Fractures.—Fractures of the incisal edges of the incisors, of the character and as small as those illustrated in Fig. 689, cannot be restored with porcelain. The fractured part is

FIG. 689.

FIG. 690.



usually of enamel entirely, and the area to be operated on is so small that a reliable anchorage for the porcelain is seldom obtainable.

When an imperfection of the enamel, decay, or a fracture involves only the central section of a moderately thick incisal edge of an incisor or cuspid, that part may be inlaid with porcelain by shaping the cavity as illustrated in Fig. 690.

In cases where the fracture or imperfection involves a loss of nearly one-half of the natural crown, an artificial crown is preferable.

Rod Inlays.

The use of rod inlays is specially adapted to fillings such as are too small to be formed by fusing porcelain in a foil matrix of the cavity, or in circular cavities or in those which can be shaped round, on the labial surfaces of the upper incisor teeth.

Preparation of the Cavity.—The cavity to be inlaid is shaped with a fine-cut wheel-bur of the style shown in Fig. 691, perfectly round, with straight walls, over one-thirty-second and approximating one-sixteenth of an inch in depth. As an inlay of this style cannot very well be manipulated of a diameter less than No. 20 gage, the cavity requires to be enlarged to at least that size.

The Rod Inlay.—The inlay is made from a portion of one of the porcelain rods (Fig. 692) or circular pieces of porcelain (Fig. 693) manufactured for the purpose. The porcelain is mounted with shellac on either end of one of the mandrels, Fig. 694, marked 1, 2, 3, and gradually ground down in the hand-piece of the dental engine to fit the cavity, using a flat piece of corundum as shown in Fig. 694, and fine sand or emery paper in the final reduction. A micrometer gage is an aid in measuring the size of the bur to be used and the diameter of the inlay during the reduction and fitting.

Fig. 691.

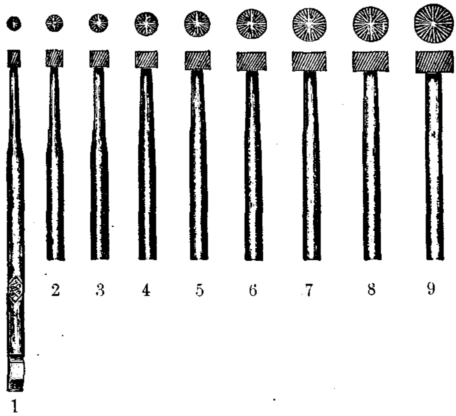


Fig. 692.

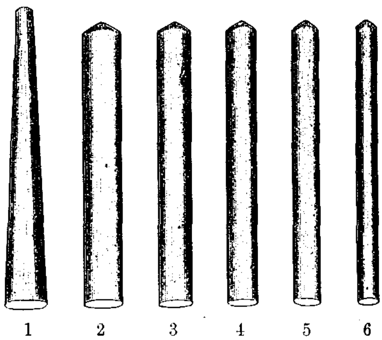
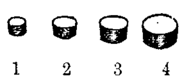


Fig. 693.



Cementation and Finishing.—The inlay when fitted is detached from the mandrel, the cavity very slightly undercut, and the inlay, without being ground or notched,—cement will adhere tenaciously to the surface of the ground porcelain—cemented with oxyphosphate. When the cement has set perfectly, the porcelain which protrudes above the surface of the enamel is ground level with small corundum-points or wheels and finished with Arkansas stone points. Figs. 696 and 697 show inlays that are best inserted by this method where imperfections or cavities exist.

Use of Porcelain Teeth to Form Inlays.—Where the por-

FIG. 694.

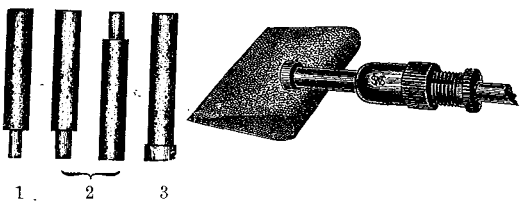
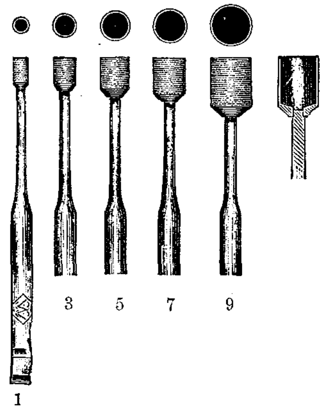


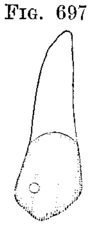
FIG. 695.



tion of the tooth to be inlaid is in the region where blending of shades or colors occurs, a porcelain tooth may be selected matching the natural tooth, and the inlay cut from the corresponding location. The work of cutting the required section of the porcelain can be much simplified by the use of diamond trephine burs manufactured for this purpose (Fig. 695), which correspond in size with the set of burs made for shaping the cavities.

FIG. 696.

FIG. 697.



Points to Bear in Mind.

To Facilitate Matrix Adaptation.—In the adaptation of a matrix in an approximal cavity the process is greatly simplified by the presence of abundant space and freedom from interference by the gum-septum. In cases where cervical decay extends under the gum-margin, the cavity should be previously packed with cotton or gutta-percha, and the gum pressed from normal position sufficiently to fully expose the edge of the cavity and admit perfect adaptation of the matrix. The method of packing the cavity of the matrix with wax, in such a case, is to be recommended.

especially if gold foil is used, as the wax will maintain the position of the foil should any point press against the gum.

To Overcome Contraction of Body.—In the use of any grade of porcelain body the most extensive shrinkage occurs in the first baking. The body contracts from the sides toward the center. To cause the contraction to take place from the center toward the sides it has been suggested to place the body in a ring around the sides of the matrix; this, however, is seldom practical. Instead, a little of the body may be removed from the center of the filled matrix. The effect of shrinkage is controlled to a considerable extent by serrating the body, thus dividing it into several small sections.

To Aid Removal, and Remedy Tear of Matrix.—The removal of a matrix from a cavity is often facilitated and the presence of a large tear in the bottom overcome by filling the matrix with the porcelain body, on the same principle that wax is often applied, before removing it from the cavity. The body is placed in the cavity and compressed with a strip of tape or pellet of cotton to condense it and absorb the moisture. The surplus is then brushed off with a camel's-hair brush, and the matrix removed and baked. In the use of high-fusing porcelain in such cases a foundation body had best be applied, especially when the matrix is torn.

Advantages of the Use of a Foundation Body in Contour Operations.—In contour operations it is advisable to use a foundation or basal body in the first baking, as it fuses at a higher heat than the body used to construct the remaining portion. The use of a basal body is advisable especially in a case where the bottom of the platinum matrix is cracked or broken. In the first baking it covers over the breaks and remains intact during the application of the remainder of the lower-fusing porcelain which is applied to shape or build up the inlay, and gives form and rigidity to the base. As a basal body fuses at a higher heat than that subsequently applied, it should be both "biscuited" and thoroughly fused before the application of the additional lower-fusing body.

The Use of a Lens.—The use of a 3-inch lens magnifying about two diameters, mounted on a stand so that the work can be held under it and viewed at pleasure, will prove of great assistance, especially in the manipulation of the porcelain body in the matrix.

Small camel's-hair artist's brushes will be found very serviceable for brushing and removing particles of the porcelain body around the edge of the matrix, and at times adjusting small portions of it in proper position.

Porosity of Porcelain.—Porosity of porcelain is attributable to imperfect packing, gassing, heating too quickly, or overheating. Brittleness will result from the same causes and from cooling too rapidly.

Time-Saving in Inlay-Work.—Experts in the formation of porcelain inlays seldom use a die or mold of the cavity farther than to assist in shaping the matrix. If time at the operating chair is to be considered, the best plan in the simpler operations of this class is to fill the matrix with wax, remove and invest (see page 369), then dismiss the patient, and have the inlay formed by the next appointment.

Edges of Inlays.—In all inlays it is preferable to have the edges a little too low rather than too high. If the porcelain is too high it can be ground down and still give good results, but the original gloss is to be preferred.

Small Inlays.—Good edges are difficult to obtain in porcelain inlays smaller than a pin-head when made in a matrix. In such cases the use of the porcelain rod method is preferable.

Effect of Cement on Shade.—In small labial inlays, unless the cavities are deep, the cement will show through the porcelain in such wise as to mar the intended effect.

Requirements in Inlay-Work.—An inlay should fit the cavity so that the edges shall be absolutely exact and not perceptible. It should not rock or move when inserted in position, and the occlusion should be correct. Slight rocking of an inlay when the fusing is completed and it is fitted in the cavity is often occasioned by a rent which existed in the bottom of the matrix, causing an unevenness at that part. This may be effectually corrected by trimming.

Conservative Limitations of Inlay-Work.—Porcelain inlays, in the opinion of the author, should be limited to that class of operations where the question of the exposure of a metallic filling to be avoided is viewed from an esthetic rather than from a practical standpoint. The advantages and durability of gold and amalgam fillings, as tooth-savers, have been too long and too well established to properly permit of their supersedure by a cemented inlay, formed of an unyielding material like porcelain, except where the question of esthetics is a factor. If around the entire circumference of a porcelain inlay when cemented in the cavity there exists a single point where the adaptation is imperfect, that point is vulnerable with even the best cements so far offered to the profession. A corresponding imperfection in a gold inlay, if formed according to most recent methods, may be remedied by the burnishing given its feather edge against the margins of the cavity before and after cementation in the final finishing of the inlay.

CHAPTER VIII.

Porcelain and Platinum Crown-Work.

STRUCTURAL REQUIREMENTS—PLATINUM SOLDER—NATURE OF ADHESION OF PORCELAIN FUSED ON PLATINUM—APPLICATION OF PORCELAIN BODY IN CROWN-WORK—BAKING—DEGREES OF HEAT—PROCESS OF CONSTRUCTION OF COLLAR CROWNS—PARTIAL COLLAR-CAP—BICUSPIDS AND MOLARS—PRACTICAL METHOD TO FORM OCCLUDING SECTION—CROWN WITHOUT A COLLAR: LIMITATIONS—JACKET-CROWN—INCISORS AND CUSPIDS—APPLICATION OF THE PORCELAIN VENEER—PROTECTION OF INCISAL EDGE—PORCELAIN AND PLATINUM BICUSPID CAP-CROWN WITH PORCELAIN OCCLUDING SURFACE—PORCELAIN AND PLATINUM CROWN WITH METALLIC OCCLUDING SURFACE—PORCELAIN AND PLATINUM TUBE-CROWN—APPLICATION TO CASES OF FRACTURED CROWNS—READY-MADE CROWNS ON CAPPED ROOTS—LOGAN CROWN ON PLATINUM BASE WITHOUT A COLLAR—THE DAVIS CROWN ON A CAPPED ROOT—VENEERING OF SEAMLESS GOLD CROWNS WITH PORCELAIN BY THE AID OF LOW-FUSING PORCELAIN BODY.

Porcelain and Platinum Crown-Work.

Structural Requirements.—In porcelain and platinum work, the metallic structure constitutes the foundation and the porcelain the part to be restored. The metallic part consequently should be made strong and rigid and of a character that will furnish the best possible support and attachment for the porcelain. The line of union or joints of the sections composing the metallic part should be closely fitted so as to insure perfect contact. Pure gold is used ordinarily as a solder to unite the parts. Gold alloyed with the baser metals is unsuitable, as their presence would stain the porcelain. Only the smallest possible quantity of the gold that will effect the object should be used, as subsequently in the baking of the porcelain it is entirely absorbed by the platinum. Small spaces are thus liable to be created under the porcelain at points which tend to weaken the structure of the crown. In the absorption of the gold, the sections of the metal which touch where it was applied become sweated together in such manner that they will not be separated by any degree of heat subsequently applied. This absorption of the gold solder consequently may, in a measure, be effected at the time of soldering by applying sufficient heat. This is allowable in soldering invested sections of the metal alone, but when porcelain is included the intense heat is liable to cause etching of the porcelain from its contact with the investing materials. Etching may, in a measure, be avoided by varnishing the surface of the teeth with shellac previous to investment.

Platinum Solder.—Platinum solder, 25 per cent. platinum to 75 per cent. gold (see Part V, Chapter V), is recommended in preference to pure gold, as it is not absorbed in the baking of the porcelain, and strengthens as well as unites the parts. The compound oxyhydrogen blowpipe flame is required to fuse platinum solder, the use of which is described in Part V, Chapter IV.

Nature of Adhesion of Porcelain Fused on Platinum.—Porcelain body fused on platinum adheres to the surface, but the adhesion is only mechanical. Consequently, should any change occur in the form of the metallic base, the porcelain is liable to become detached. This fact should be kept in mind regarding this class of operations. The surface of the metal that is to receive the porcelain should be roughened or serrated with a sharp-pointed instrument, and at parts that suggest it, and where it is permissible, either indented or punctured.

Submitting the surface of the platinum to the action of aqua-regia, also sprinkling coarse platinum filings on the surface of a section of the metal and attaching them with an atom of pure gold, furnishes a means of secure adhesion for porcelain body. By such means quite a reliable attachment of the porcelain to the metal is obtained, as is demonstrated in the construction of artificial plates of porcelain on platinum—the form termed continuous-gum work.

Application of Porcelain Body in Crown-Work.—The metallic structural framework of the crown should be thoroughly cleansed of borax with acid and washed free of all particles of foreign matter. Any sharp edges or points that are liable to be exposed in the finished crown are to be rounded and smoothed. The method of selecting shades and applying porcelain body in crown-work is similar in principle to that explained respecting high-fusing body used in inlay-work. The porcelain body should be placed on a clean glass or porcelain slab and mixed with pure water to a dough-like consistence. The addition of a small quantity of dissolved gum tragacanth is used to glutinate the particles of the body in difficult contour-work. The crown is held by the post in a pin-vise, as shown in Fig. 698, during the application of the body. By tapping the handle of the vise with the mixing spatula as the body is applied it is packed into the interstices of the work and the moisture is brought to the surface, to be absorbed with

FIG. 698.

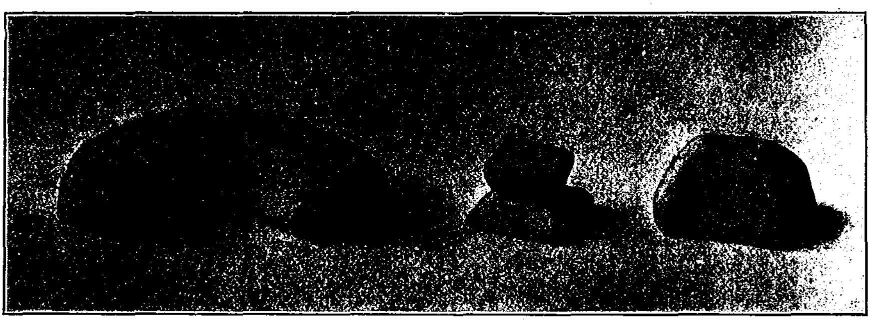
blotting or bibulous paper. More body is then gradually added until it assumes the general form and proportions desired in the finished crown. The work is then ready to receive the first fusing.

Baking.—The baking of porcelain body in crown-work is conducted as described in Part IV, Chapter III, "Fusing of Porcelain," and very similar to that in "Porcelain Inlays," Part IV, Chapter VI.

The first bake should be the "biscuit bake," effected with a heat which will cause the body to shrink and become hard but not glazed, though the mass is covered with shining particles. If the work is allowed to remain in the furnace for the first baking until the fusing-point is reached, porosity and imperfections are liable to appear in the final application and fusing. After the crown has received the biscuit bake it may be adjusted in the mouth or on the articulating model and the porcelain ground off or added to where necessary for proper occlusion and approximal contact.

For the second bake the seams and crevices are filled and the body added until the parts are slightly larger than is required. As in the previous application of body, all the moisture possible should be brought to the surface and absorbed. The less moisture allowed to remain and the greater the condensation of the particles each time, the less the shrinkage which will take place.

Fig. 699.



For the third or final fusing, after the necessary addition of body is made, the crown is slowly heated in the furnace and allowed to remain until the surface of the body assumes a smooth, glazed appearance corresponding to that of natural enamel.

After the final baking, the crown should be allowed to cool very slowly to temper the porcelain. Too rapid cooling will injure the crown-work, if not destroy it. If an electric furnace is used, the current can be turned off and the work allowed to remain until cool; or it can be removed and placed in a muffle provided for cooling purposes. When cool, the crown should be dipped in water before handling.

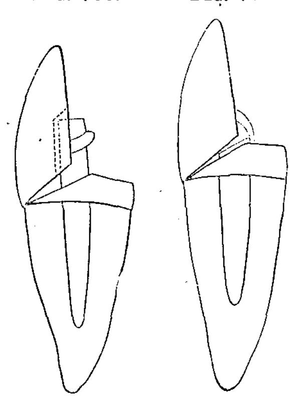
Fig. 699 illustrates forms of fire-clay supports on which a crown or bridge can be placed during the fusing of the porcelain.

Degrees of Heat.—In crown-work the heat as registered by the pyrometer for the first bake should be 200° below the fusing-point of the porcelain body used; that of the second, or other primary bakes, 150°, and the final bake the fusing-point, at which degree the crown should be kept for twenty seconds.

Porcelain and Platinum Collar or Partial Collar Crowns.

Process of Construction of Collar Crown.—The collar should be made of platinum, about No. 29 to 30 gage, and the piece which caps the collar of about No. 32 platinum plate. The collar or partial collar-cap is first constructed and fitted to the end of the root as illustrated in Figs. 700 and 701, according to one of the methods described at page 132. The post should be substantial, and in all cases be extended some distance above the surface of the cap as an attachment for the porcelain. It should be closely fitted to the cap at the orifice of the canal by perforating the platinum and forcing it to position and then united to the cap with pure gold or, better, platinum solder. A suitable cross-pin tooth is selected, and ground and fitted on the cap; a shade slightly darker than the corresponding natural tooth is to be preferred, as the color is generally lightened in the baking. Usually in the case of incisors and cuspids it will be necessary to reduce the dimensions of the post to permit it to pass between the pins, and in many cases also to grind a groove in the porcelain for its reception. This is necessary to allow the tooth to assume the proper position on the cap, as the bases of most porcelain fronts or teeth will be found when fitted to hang over the space occupied by the post in the root-canal. The pins should be bent around the post in such manner as to retain it in position during the application and baking of the porcelain; or, the crown should be invested and the pins soldered to the post with pure gold, which is generally the better method to pursue. If the end of the post is cut off nearly to the surface of the cap on account of the occlusion, the ends of

Fig. 700. Fig. 701.



the pins may be slightly flattened, and, when the case is invested, bent on the end of the post and substantially soldered to it with platinum solder. (See Fig. 701.) Should the ends of the pins not reach the post, fill in with a piece of plate. Both post-end and pins should entirely clear the occlusion of the antagonizing teeth.

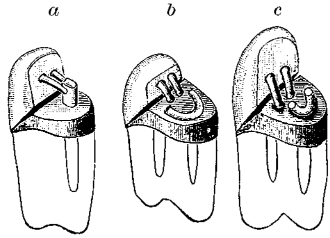
The crown when soldered is boiled in acid to remove the flux, and having been fitted on the model or in the mouth to determine the accuracy of the parts and then thoroughly cleansed, is ready for the application of the porcelain body.

In cases where the porcelain front projects, as shown in gold crown-work in Fig. 462, the part can be filled with porcelain. Should the cervico-labial section of a collar be exposed to view, a little of the porcelain may be extended onto the collar at that point so as to hide the metal, but it should be graduated off at the sides toward the approximal spaces.

Partial Collar-Cap.—When a partial collar-cap is used, should the cervico-labial margin of the porcelain front extend perceptibly beyond the line of the edge of the cap, the projecting portion of the porcelain should be trimmed and re-enameled in the baking.

Bicuspids and Molars.—Bicuspid and molar crowns can be constructed in a similar manner by using a suitable facing on the cap, and building up the occluding surface and cusps with the body. A small additional post or bar, to securely attach and support the palatal cusps, may be added and soldered to the cap, as shown in the case of a bicuspid in Fig. 702, *a*, *b*, and *c*.

FIG. 702.



Practical Method to Form Occluding Section.—The length of the palatal section of the crown and form of the cusps are quickly and accurately determined by placing the porcelain body—preferably for the first bake, foundation body—of a dough-like consistence, in a mass in position on the cap, packed against the facing, inserting in the mouth, occluding the teeth on the body, and removing. The occluding teeth in leaving their impression on the body, shape and outline the form the occluding surface of the crown should be. The porcelain body is then trimmed and properly shaped in accordance with the form of a natural crown, Fig. 703, and then given the biscuit bake. More body is again applied, guided by the occluding teeth, to compensate for the shrinkage and the usual bakes given. A, Fig. 704, shows the appearance of the crown after the first, and B after the final bake.

FIG. 703.

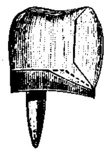
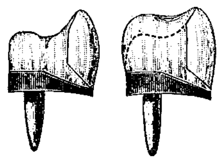


FIG. 704.



A B

Crown without a Collar.—A porcelain and platinum crown without a collar is made by fitting into the root a substantial iridio-platinum post, and capping the root with a disk of platinum as described on page 129. A porcelain front is then fitted and soldered to the post as before described. The disk of platinum should be about No. 32 gage, unless it is to be removed after the crown is baked; in such a case it should be made about No. 36 gage or thinner.

Limitations.—Porcelain and platinum crowns of the forms above described for either the front or back teeth are not suitable for a close occlusion, or, as ordinarily termed, a "close bite," as fracture of the porcelain is sooner or later quite certain to occur. Porcelain and gold construction in such cases should be given the preference for incisors and cuspids, and porcelain and gold or porcelain reinforced with platinum for the bicuspids and molars constructed as further on described.

Jacket=Crown.—This crown combines the good qualities of many of the best forms. In many cases it affords results which cannot be so well obtained by any other method. It permits the restoration by crown-work of a tooth without the exhibition of metal at the labial aspect, and without destruction of the pulp. It requires the least possible removal of tooth-structure to permit the mounting of the crown. Its natural appearance admits of the performance of operations of a most artistic character.

When the construction is so conducted that the incisal edge is protected with metal, it forms a crown which for strength approaches that of porcelain and gold. The post being cemented in the root independent of the crown much simplifies a necessary reconstruction of a crown.

The jacket-crown consists of a cone-shaped platinum and porcelain cap fitted over the natural crown or so much of it as remains.

Incisors and Cuspids.—The crowning of a central incisor will serve as a typical case. Fig. 705 represents the shape of the prepared tooth. If the crown is broken off or decayed to the gum-margin, a post is inserted in the stump and shaped with amalgam to a somewhat conical form. A collar of platinum (No. 30 gage), the full length the crown is to be, is made and fitted to the prepared tooth or root. The lines of the palatal and labial surfaces of the adjoining teeth are marked on the platinum. The palatal portion of the collar is cut away to this line, so as to clear the lower teeth in occlusion (Fig. 706). A piece of platinum, of the same gage, is soldered over the collar, to form the palatal wall. The cap is fitted in the mouth, and the labial section of the collar ground thin enough to enable the platinum to be pressed and burnished against the tooth or the built-up amalgam. If this cannot be done satisfactorily, trim off the platinum the same as on the palatal side and solder a piece of platinum foil over the part instead. It must be remembered that in this soldering only the least possible quantity of pure gold should be used. At this stage the cap will assume the form seen at Fig. 707.

FIG. 705.

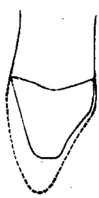
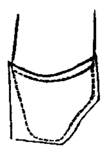


FIG. 706.



Application of the Porcelain Veneer.—In this style of crown-work teeth having living pulps afford so limited a space for the porcelain front as not to permit the use of one with pins for its retention on the cap during the application of the porcelain body. Fronts can be made of the porcelain body alone for a molar or second bicuspid, but the results respecting appearance would be unsatisfactory for the front teeth. Veneers formed from artificial teeth are preferably used for this class of work as a rule.

FIG. 707.

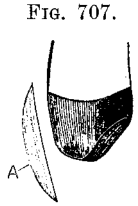


FIG. 708.

Pulpless teeth, and in some cases those with calcification of the pulp, will stand the removal of sufficient of the natural crown to allow of the formation of a cap which will permit the use of a front with pins which can be soldered to it.

A thin veneer of porcelain to represent the tooth is made by selecting an ordinary porcelain tooth of the proper size and shade, removing the pins and grinding it down as described in Part V, Chapter II, and illustrated at A, Fig. 707. The veneer is ground and fitted to assume a proper position on the cap. Porcelain body is then applied and the veneer pressed to place, surplus moisture absorbed, and particles of body removed. It is possible to fit the veneer held by the body on the cap in the mouth when desirable. The cap and veneer are removed and placed on silex on a slab, with the face of the veneer resting downward on the silex to retain it in position, and the whole is then placed, baked, and the body biscuited. Another method is to gently remove the veneer from the cap, disturbing the body as little as possible, and insert the cap without the veneer in the furnace. When the cap is baked the veneer will be found to fit in the indentation in the body. In this way the excessive shrinkage of the first baking and the consequent slight displacement of the veneer are overcome. The veneer is then placed on the cap with the necessary body to attach it and slowly heated and baked. The body should be placed over and on the incisal edge of the cap and around on the sides as far as permissible to secure the greatest amount of attachment for the porcelain.

After both the first and second bakes the work should be fitted in the mouth and any of the changes incident to shrinkage of the porcelain body noted and corrected. Any necessary slight alteration respecting the position or size of the veneer and the fused applied porcelain body should also be made at these stages of the construction so that the porcelain may be enameled in the final bake, which should be most carefully conducted in regard to heating and cooling. After the final bake the exposed surface of the platinum should be polished. Crowns of this style can only be well cemented with oxyphosphate. Fig. 708 represents the finished crown.

Protection of the Incisal Edge.—To protect the incisal edge of a crown of this style the palatal side of the collar is made of iridio-platinum plate instead of platinum, of about No. 30 gage or heavier, as the character of the occlusion suggests. The end of the strip is brought over the incisal edge in a manner to protect the porcelain in occlusion, as shown at P in Fig. 709,[1] the same as

[1] Dr. W. A. Capon's method.

in porcelain and gold work. In cases of jacket-crowns where the space will permit, a porcelain front may be used with pins and the pins soldered to the cap, as shown in Fig. 710.

Porcelain and Platinum Bicuspid Cap=Crown with Porcelain Occluding Surface.—When the natural tooth is broken down and pulpless, the following method can be practiced: A platinum collar is made and fitted, with the labial section prepared and a veneer adjusted in the same manner as in the method just explained. The edge of the collar should clear the occluding teeth about one-thirty-second of an inch. (See Fig. 711.) While the collar is in position, platinum foil is packed in, over, and around the end of the root or any part of the natural tooth present (A). Porcelain body is then packed in on the platinum foil, the space

FIG. 709.

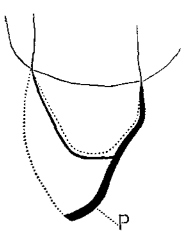


FIG. 710.

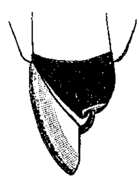


FIG. 711.

FIG. 712.

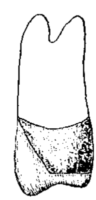
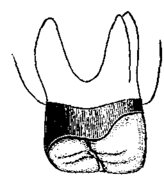


FIG. 713.



being filled even with the edge of the collar. The veneer is placed in position against the porcelain body and the body packed around it. The crown is then carefully removed and baked. After baking it is placed in the mouth, the occlusion noted, the cusps properly shaped with body by occluding the teeth on the applied body as described in relation to porcelain and platinum crowns, at page 392, and the final fusing of the porcelain performed. Fig. 712 illustrates the completed bicuspid crown. Fig. 713 shows a molar constructed by this method. The construction of this crown may be varied by soldering the foil, or a very thin piece of platinum plate placed inside the collar, to its sides, using a porcelain front instead of a veneer, and soldering the pins to the foil or thin plate. The porcelain forming the occluding section being encompassed by the metal, develops great strength. It is a form of crown that admits of extensive application.

A Porcelain and Platinum Bicuspid Crown with Metallic Occluding Surface is made as follows: The tooth or root is prepared the same as for an all-gold crown and enough of the labial section removed to allow for the veneer. (See Fig. 714.) If badly broken down it should be built up with a post and amalgam. (See page 40.) A collar of platinum is made and fitted the same as for an all-gold crown, and trimmed free of the occluding teeth. A suitable grinding-surface is made by stamping up a piece of annealed iridio-platinum plate, No. 30 gage, or heavier, if the case should suggest it for strength. The palatal half is soldered to the collar, but the labial portion is left unsoldered and free (see Fig. 715), to permit the front portion of the collar to be manipulated. The labial section of the collar is next ground thin and pressed inward against the tooth, to make room for the porcelain veneer.

FIG. 714.

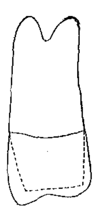


FIG. 715.

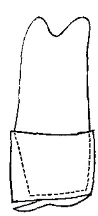


FIG. 716.

FIG. 717.

It will then appear as shown at Fig. 716. Puncture the thin platinum over the labial surface, and select and fit a porcelain veneer to represent the tooth. Pack in porcelain body and fit the veneer in position in the mouth. Carefully remove and bake in the furnace. Next refit in the mouth, make any necessary changes, add more body, and give the final baking. The platinum is then polished, after which the crown is ready to be cemented. Fig. 717 represents the finished crown.

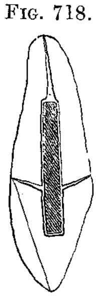
The form of crown just described can be used in bicuspids in all cases, more especially where there is a close occlusion. In bridge-work, a porcelain front backed with gold can be soldered to this form of crown to represent a first bicuspid, the precaution being used to heat and cool the investment slowly.

Porcelain and Platinum Tube-Crown.—This crown is for use in cases where the natural crown is absent to the line of the cervix and a metallic collar is not required.

The root is ground even with the margin of the gum. A How or an iridio-platinum post is fitted and cemented in the root, as seen in section in Fig. 718, and, if an excessive enlargement of the root-canal exists, amalgam is packed in the orifice of the canal around the post. In the case of a broken artificial crown where the post remains with its end protruding from the root, the tube is to be shaped to fit over the post. Take a piece of wire, of the gage of the post, and twist platinum foil around it so that the foil shall form a tube. Slip the tube on the post in the root. Cut a disk of platinum foil fully the size of the end of the root, puncture it in the center, and slip it over the tube on the post. Draw off tube and disk carefully, and solder them together with the smallest possible quantity of pure gold. This forms a combined tube and cap. Adjust in the mouth and burnish the edges of the platinum disk closely to the root. Pack porcelain body in a thick paste around the tube and fit a veneer (see Fig. 718) in proper position against the body, remove, and bake.

If a porcelain front having pins can be fitted and used, the pins may be soldered to the tube with a little pure gold to retain it in correct position before the application of the porcelain body; if not, the use of a veneer may be resorted to, the same as in the preceding cases. After baking, place the crown in position, burnish the platinum thoroughly at the gum line, and trim off the excess. Add body where required and give the final baking. It is optional whether the platinum is allowed to remain on the base of the crown or not, but the portion at the cervico-labial section is generally removed for the sake of appearance. Fig. 718 shows the finished crown in section. Should this crown fracture in use, it can be replaced without disturbing the post in the root.

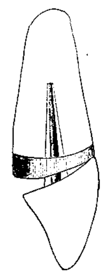
FIG. 718.



Application to Cases of Fractured Crowns.—The method just described can be applied at times to advantage in the case of an incisor or cuspid crown which has been broken off, leaving its post or attachment extending from the end of the root, and thus avoid the occasionally troublesome task of its removal.

Ready-Made Crowns on Capped Roots.—Logan and other ready-made porcelain crowns may be attached with porcelain to collar or partial collar-caps. The end of the root is first capped with platinum and the root-canal prepared to receive the post of the intended crown. At the palatal section of the crown a V-shaped piece is removed sufficient to fully expose the pin and base of the crown, as shown in Fig. 719. The cap and crown are cemented with wax, removed, invested, and cap united to post with a little pure gold. The heating and cooling should be done slowly to avoid fracture of the porcelain. The open slot permits the body to be applied and the shrinkage that occurs in the baking to be filled in so as to form a solid connection of porcelain between cap and crown.

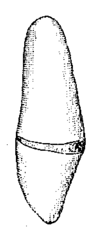
FIG. 719.



Logan Crown on Platinum Base without a Collar.—A Logan crown without a collar on a platinum base that will accurately fit the end of the root can be made with little labor in accordance with Dr. Gordon White's method, described on page 137, and illustrated by Figs. 271 to 275. In the use of porcelain the application of platinum foil to the base of the artificial crown is omitted. The disk of platinum fitted to the end of the root is first soldered to the post with pure gold, and porcelain body instead of gold solder is then used to fill in the triangular space between the root-cap and base of the artificial crown identified with this operation.

The Davis Crown on a Capped Root.—The Davis crown can be quite advantageously set on a platinum cap in the following manner: Cap the end of the root in the same manner as described on page 139, using gold instead of platinum to form the cap, and a round iridio-platinum post instead of the Davis post. Grind and fit a Davis crown in proper position on cap with a V-shaped space cut out of each of the sides, as shown in Fig. 720. These spaces are for the purpose of permitting the porcelain body to be properly placed and baked around the post and between the cap and crown. When the crown is fitted to the position it is to assume on the cap, the porcelain should rest on or touch the cap at a labial and a palatal point to steady it during the first baking of the body.

FIG. 720. FIG. 721.



To attach the crown and cap together for the first baking place some of the body mixed thin in the post hole of the crown, and settle it to place on the post and cap and absorb the moisture with bibulous or blotting-paper. At this stage the crown may be adjusted in the mouth to positively assure its correct alignment. It is then carefully removed and baked. The heat applied should only be sufficient to biscuit the body. It should then be adjusted in the mouth and any necessary trimming or polishing done, the parts thoroughly cleaned, and the final applications of body made. Fig. 721 shows the finished crown.

Veneering of Seamless Gold Crowns with Porcelain by the Aid of Low-Fusing Porcelain Body.—Gold seamless crowns made of a high grade of gold slightly alloyed with platinum, such as the ready-made "Evans Crowns," can easily be inlaid and veneered with the aid of the Jenkins or Ash's low-fusing porcelain. Properly fit and articulate to the tooth an Evans gold crown, or one made seamless of gold slightly alloyed with platinum. In some

FIG. 722.

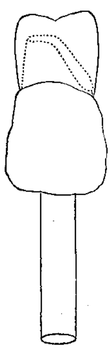


FIG. 723.

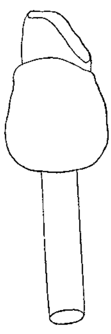


FIG. 724.

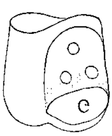
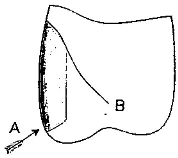


FIG. 725.



cases this will be facilitated by taking an impression of the prepared tooth in a tube with plaster, making a fusible-metal die, and giving the gold crown the exact shape of the tooth, as described on page 127, the operation requiring but little time.

Place the crown when fitted on the tooth in the mouth, with a sharp instrument mark the labial portion of the gold which is exposed to view, and remove the crown. Place in the interior of the crown a mixture of plaster prepared to set quickly, adjust it in the mouth, occlude the teeth, and when the plaster is set remove the crown. In the interior will be found an exact impression of the portion of the natural tooth which is to be capped.

To Form an Impromptu Die.—Taper and slightly notch the point of a piece of orange-wood. Warm the point of the wood and press around it a small piece of Ash & Sons' Dental Lac, or of impression-compound, shaped to a point. Wet the plaster in the interior of the crown, press in the lac or compound, and press the stick through it into the center of the crown, as shown in Fig. 722, chill with water, and remove. In this way a die is quickly made, as illustrated in Fig. 723, duplicating the form of the prepared natural crown. The patient can then be dismissed.

The plaster in the crown is next softened and easily removed by heating the crown and dipping it in water. The portion of the labial section of the gold crown that was marked in the mouth is thinned to about 1/500 of an inch with a small corundum-disk. The narrow strip of the collar at the cervico-labial portion which fits under the gum is left intact, as shown in Fig. 724. The thinned section of the gold is punctured in three places. The crown is placed on the die and the thinned gold is slit across the line of the occluding surface (C, Fig. 724), and then pressed in against the surface of the die, as shown at B, Fig. 725, to obtain depth and strength for the porcelain. The natural tooth must be previously trimmed to permit this allowance.

Prepare a porcelain veneer (see Part V, Chapter II), and fit it to the labial face of the crown.

The porcelain body is next applied as follows:[1] The body is moistened with water to a dough-like consistence. A portion is placed in the interior of the crown just as the plaster was, the crown is pressed on the die, the body which protrudes at the labial section is compressed, the veneer pressed to place, and the surplus body removed. The die is then carefully removed. In the interior of the crown will be found an exact impression of the natural tooth. Any loose particles of body are gently removed with a camel's-hair brush, and the crown is placed on a tray filled with asbestos, the veneer face upward, and given a biscuit bake (Fig. 726). In the baking the porcelain shrinks so that an easy adjustment of the crown on the die is insured, and some space is left for cement when finished.

The porcelain in the interior will usually show some imperfections caused by shrinkage. Those of a trifling character need not be considered, but if they are extensive a little body should be applied to the part and the die inserted to compress and shape it. Application of body is likewise made to imperfections on the ex-

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[1] The Jenkins New Prosthetic Porcelain is specially suitable for this work.

terior of the crown around the veneer, and it is again baked. For the finish, body is applied only to imperfections on the exterior of the crown, and it is then given the third or final fusing.

When the crown is finished, should any part of the interior obstruct perfect adjustment, the exact spot can easily be discovered by the application of a little rouge moistened with oil, either to the inside of the crown or to the surface of the tooth, and inserting the crown in the mouth. The obstructing spot will be marked on the crown or tooth, according to which the rouge was applied.

In the form of crown just described the porcelain, as illustrated at P B, Fig. 727, fills all the interior of the grinding-surface not occupied by the end of the natural tooth, and is joined to the porcelain front, V, which it anchors and secures. If the gold is worn away by the occluding teeth it only exposes the porcelain.

FIG. 726.

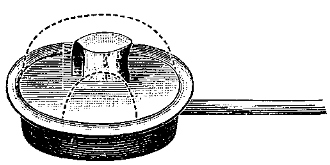
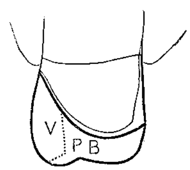


FIG. 727.



It will be noticed also that the greatest thickness of porcelain exists at the point of union (P B) between the section in the grinding-surface and that at the labial forming the front where the most strength is required.

Under favorable circumstances this method permits the easy performance of artistic operations in crown-work, but it is not suitable to apply in close "bites" or where the occluding teeth antagonize outside of the normal line.

Where a porcelain veneer is used in connection with a low-fusing body, there is not so much danger of changing its shade by repeated bakings, as with a higher-fusing body.

A seamless platinum crown can be inlaid in a similar manner with high-fusing porcelain body. Platinum imparts to the margins of the inlay a less agreeable shade than gold.

With high- and low-fusing porcelain on hand, and proper means of fusing, an ingenious dentist can find a multitude of ways to use both grades to practical advantage.

CHAPTER IX.

Porcelain Bridge-Work.

CHARACTER—LIMITATIONS—STRUCTURAL REQUIREMENTS—PROCESS OF CONSTRUCTION—CASES OF PORCELAIN BRIDGE-WORK.

Character.—Porcelain bridge-work consists of a base or framework of platinum covered with porcelain, which is fused to it. Owing to the unalterable character and continuity of its surface, and the incorruptibility of the material, it has advantages as a denture when permanently inserted. In comparison with gold work its construction is less laborious, but its insertion and attachment to the abutments are a more complex operation.

Limitations.—In practical application the scope of porcelain bridge-work is limited. This is owing to the form of pier supports required and to the fact that the occluding surfaces of the teeth forming the bridge are not—neither can they very well be—formed of or protected with metal, as in a case of combined soldered gold and porcelain work. In close bites and where great force is exercised in occlusion, or where the bridge is of great length, unprotected porcelain is unequal to the strain.

Structural Requirements.—In porcelain bridge-work the metal structural frame should be calculated on as constituting the strength of the bridge. It should be formed so as to interfere with the continuity of the structure of the porcelain in the least possible degree. By such an arrangement of the metallic section the greatest degree of strength is developed in the porcelain.

Figs. 728 and 729 represent an improper, and Figs. 730 and 731 the proper, placing of the bar in a tooth and in a bridge in porcelain-work. In Fig. 728 the continuity of the porcelain is broken by the presence of the bar in the center. Fig. 730 shows the bar at the base united to a cap or saddle. The bar as shown in Fig. 731, united to the caps and saddle, affords far greater strength and rigidity than either would separately, as illustrated in Fig. 729, largely through avoiding interruption of the continuity of the structure of the porcelain.

The metal portion of the bridge, consisting of the caps on the piers and the metal spanning the space between the abutments, must be so solidly united, rigid, and strong, as to provide independently of the porcelain the necessary strength for the structure. Should a platinum crown be used on one of the piers, the end of

FIG. 728.

FIG. 729.

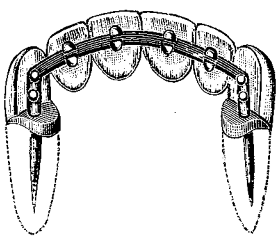


FIG. 730.

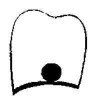
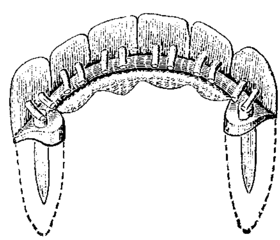


FIG. 731.



the bar must be flattened and extended well around on the palatal side of the crown, and securely attached with platinum solder.

Porcelain bridge-work is now almost universally constructed with the teeth forming the bridge resting on a metal plate or saddle of the width of their bases. In a case where a saddle is not used, a heavy triangular or half-round bar (A, Fig. 732) of

FIG. 732.

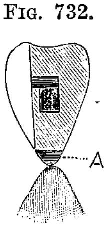
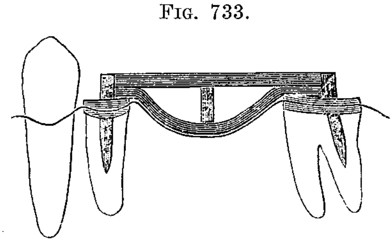


FIG. 733.



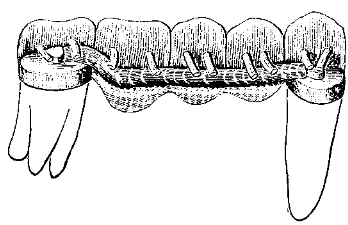
iridio-platinum, in connection with a flattened cross and upright bar, as shown in Figs. 732 and 733, may be used.[1] This latter style leaves a self-cleansing space under the bridge, which is not as desirable as a saddle, especially for upper cases of porcelain bridge-work. The contour of the palatal side in the saddle form is more agreeable to the patient, and experience shows that in most cases, where details of construction have been properly carried out, it is

[1] Dr. H. J. Goslee's method.

more cleanly. Experience also shows that the percentage of cases in which absorption of the alveolar ridge takes place to any great extent is so small as not to be considered, in view of the advantages that are otherwise obtained.

Process of Construction.—The case illustrated in Fig. 734 is presented as typical, to illustrate the construction of a piece of porcelain bridge-work. The cuspid and molar roots are capped with platinum, and iridio-platinum posts inserted, that of the molar cap in the palatal root. The caps and posts are to be soldered with 25 per cent. platinum solder. An impression is taken of the alveolar ridge, a model and metal model made, and a platinum saddle struck up to span the space and accurately meet the crowns. The platinum is cut to the length of the combined bases of the artificial teeth which are to rest upon it. The caps are placed in the

FIG. 734.



mouth, the saddle in position between the caps, and an impression is taken, and the caps withdrawn in position in the impression. In taking the impression, pressure should be exerted on the saddle during the setting of the plaster through a slot in the impression-tray. The impression with the saddle in position is filled with a mixture composed of two parts plaster, two parts shredded asbestos, and one part calcined marble-dust, to form a model. On the removal of the plaster impression, the platinum saddle with the crowns will be found in position on the model.

An iridio-platinum cross-bar, made of No. 14 gage round wire rolled to No. 16 gage and set on edge, is extended from the post of one cap to the post of the other, fitting closely against or on the posts, and resting on the caps and saddle. (See Fig. 734.) The saddle is next soldered to the caps, and the cross-bar to the caps and saddle, with 25 per cent. platinum solder. To retain the bar in position on the caps, a little investing material should be placed crosswise over the bar in the center of the investment;

as soon as the saddle and the ends of the bar are soldered, this little piece of investment is removed and the soldering of the bar completed. This framework makes a metal structural foundation for the bridge, the strength and rigidity of which will not be impaired in fusing on the porcelain body. Body such as "Close's" fuses at a temperature which will not melt a grade of platinum solder above 20 per cent. The piece is next adjusted in the mouth, the caps held solidly in position, and the platinum pressed and burnished against the tissues at any spots that seem to suggest it, and at the edges, sufficiently to make a white line at the margin, but not enough to cut into the tissues. This is done, not for the purpose of obtaining alveolar support, but for the exclusion of particles of food from under the bridge, a condition that is maintained even though slight absorption of the membrane should supervene. Impression-compound is next placed on the bridge and an impression of the occluding teeth taken, and the bridge with the compound removed. Next the interior of the caps and surface of the pins are coated with wax to render removal easy, and plaster articulating models are made. Facings, or suitable teeth with long pins, are selected and the under side of the pins ground flat, to present a larger surface of contact to the bar. The facings are ground, fitted, waxed in position, the bridge-work removed from the model, and invested in plaster and asbestos. The wax is removed, each pin is bent down in close contact with the bar, and soldered to it with the least possible quantity of pure gold; the case is then removed and boiled in acid. Pure gold is used for this soldering, as the heat required to flow platinum solder would be liable to etch the invested porcelain teeth. Fig. 734 shows the appearance of the bridge at this stage of the construction.

Porcelain body such as is used in continuous-gum work is applied in a similar manner to the case. Interstices are filled, grinding-surfaces and cusps which are to be formed are built up and contoured as much as possible for the first baking. For the next baking more body is added, shrinkage being allowed for and remedied. More than three bakings are seldom necessary. The heat should be sufficient to thoroughly fuse the body, give a glazed surface, and develop the strength of the porcelain. Fig. 735 illustrates the bridge ready for cementation.

A case of porcelain bridge-work, such as has been described, is best cemented with gutta-percha. (See Part II, Chapter XVII.)

Cases of Porcelain Bridge-Work.—Fig. 736 represents a porcelain extension bridge in which the support consists of a crown and bar combined.

FIG. 735.

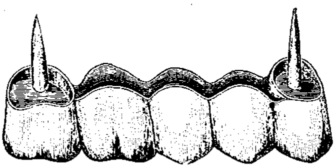
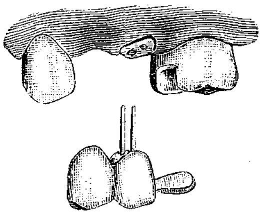


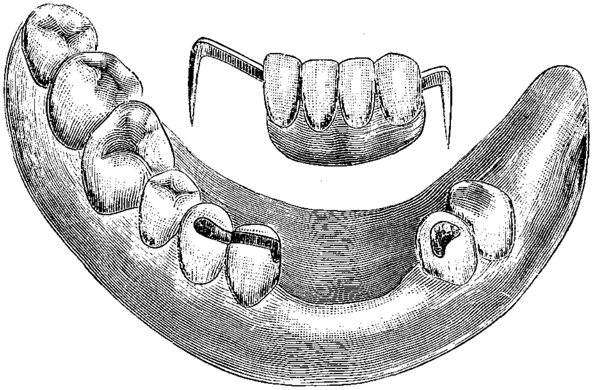
FIG. 736.



In porcelain bridge-work artificial gum to a moderate amount can be formed above the teeth of the bridge.

Fig. 737 is a lower bridge firmly supported on the right side by

FIG. 737.



passing the bar through the cuspid and inserting the end in the pulpless bicuspid as illustrated. The pulpless bicuspid on the left constitutes the other abutment. The absorption of the alveolar process was replaced with gum-enameled porcelain.

PART V.

MATERIALS AND PROCESSES USED IN CROWN- AND BRIDGE-WORK.

PART V.

CHAPTER I.

Plates and Solders.

PLATINUM—PLATINUM FOIL AND WIRE—PLATINUM AND GOLD COLLAR—IRIDIUM—GOLD—GOLD ALLOYS FOR PLATE—GOLD PLATINUM-LINED PLATE—PLATINIZED GOLD—MELTING AND REFINING OF GOLD SCRAPS—GOLD SOLDERS—HARD-FLOWING GOLD SOLDER—FLUXED SOLDER FILINGS—SILVER SOLDER—PLATINUM SOLDER—FLUX.

In the construction of crown- and bridge-work, gold, platinum, and iridio-platinum are used pure and alloyed in various forms as best suit the requirements of the work and the preference of the dentist.

Platinum.—Platinum retains its color and resists the action of the secretions of the mouth better than pure gold. For this reason and also because of its physical properties respecting malleability and ductility, as well as its extreme high fusing-point when formed in any gage of plate or foil, it makes a very useful material in many parts of the work. Platinum is valuable as an alloy to raise the melting-point of gold plate and increase its tensility.

Platinum plate Nos. 29 to 30 gage is used for forming seamless crowns for porcelain work, and from Nos. 30 to 32 gage for collars for crowns.

Platinum Foil and Wire.—Platinum in the form of thin plate from No. 34 gage to that of foil, and wire at from No. 21 to No. 16 gage, is used in various operations associated with the work.

Platinum foil can be made exceedingly thin by first rolling down to about 1/1000 of an inch, then oiling the surface, folding evenly, and again rolling down. By this method the metal is less liable to crack.

Platinum and Gold Collar.—In some cases platinum can be utilized for this purpose to advantage at from Nos. 33 to 34 gage. The collar when fitted can be stiffened by the addition of pure gold flowed over its outer surface after placing investing material, moldine, whiting, or dampened fine calcined marble-dust in the interior.

Iridium.—Iridium is used as an alloy for platinum, to which it imparts hardness and elasticity.

Iridio-platinum wire is used for pivots or posts when greater rigidity is required than is possessed by pure platinum.

Gold.—Gold plate, 24 carats, from No. 28 to No. 30 gage, is generally used for backing porcelain teeth and forming collars and caps where great flexibility of metal is required.

Gold plate, slightly alloyed,—about 23 carats fine,—in crown-work, if less flexibility of the metal is required.

Gold plate, 22 carats, No. 28 to No. 30 gage, in constructing collars for crowns with porcelain fronts, all-gold crowns made in sections, and seamless crowns.

Gold plate, 20 carats, in construction of bridge-work.

Gold for constructing collars should be of as high a carat as possible, to better resist the action of acids. A large proportion of copper as an alloy is objectionable, owing to its tendency to cause tarnishing of the collar where an acid condition of the mouth exists. For this reason, United States gold coin, containing 10 per cent. copper, to some extent used for collars, is not suitable. It is also too stiff, and collars made of it are not readily burnished to fit at the edges. Formulas with a less proportion of copper are decidedly preferable.

Gold Alloys for Plate.—An alloy of one part of coin and two parts pure gold is recommended for crowns constructed in sections, and one part coin to three of pure gold, as being more flexible, for seamless crowns.

The high color of these two alloys can be modified by reducing the quantity of pure gold, substituting in its place a percentage of pure silver, as follows:

For crowns constructed in sections:

Coin gold,	5	dwt.
Pure gold,	9	"
Pure silver,	1	"

For seamless crowns:

Coin gold,	5	dwt.
Pure gold,	13½	"
Pure silver,	1½	"

A formula for plate of the character of clasp-metal for stiffness is:

Pure gold,	10	parts.
Copper,	2	"
Silver,	1	part.
Platinum,	1	"

A slight increase in the proportion of copper and platinum will be productive of an increase of hardness and stiffness of the plate.

Gold Platinum-Lined Plate.—Gold plate, 24 carats, with a lining of platinum, can be used in any of the processess of crown- and bridge-work, and is recommended to the inexperienced, because the melting of a part of a crown in the soldering process is less liable to occur by its use. It is formed by placing together an annealed gold plate and a platinum plate (the gold about No. 20 gage and the platinum No. 30) and passing them through a rolling-mill, in which process the plates are welded and reduced to the desired thickness. In soldering the seam of union of a collar the two ends of the metal require to be clamped together until united by the solder, as the unequal expansion of the gold and platinum will spring them apart and open the seam.

Platinized Gold.—An alloy of pure gold and 2 to 3 per cent. platinum can be used to advantage in various operations. Gold so alloyed is but slightly affected in color, and is very flexible. As plate it can be used exceedingly thin with much less liability to being melted than pure gold.

Melting and Refining of Gold Scraps.—The conversion of gold scraps into plate is worthy of practice from an economical standpoint.

Passing a magnet through scraps or filings will remove particles of iron.

A moderate quantity of clean scraps, using plenty of borax, can be melted with a gas blowpipe and allowed to cool in a depression of a soldering-block.

For a large quantity use a small crucible well lined with borax and fuse in a gas or charcoal furnace and pour into a warm ingot-mold. The gold should be allowed to cool slowly and should never be removed from the ingot-mold and immersed in water while still hot.

When cool it should be boiled in acid, cleaned, hammered out, annealed, and rolled in a mill to the desired gage.

Should the scraps contain particles of solder they can be refined by the dry process.

This consists in placing the scraps in a crucible lined with borax, fusing at a high heat for a considerable time, and applying nitrate of potash (saltpetre).

Gold Solders.—The matter of solder respecting its grade and character is important in crown- and bridge-work operations. In fineness it should approach that of the plate used, should exhibit strength and elasticity when in plate form, and melt and flow smoothly under the properly applied heat of the blowpipe. The production of solder of uniform quality requires knowledge and skill only possessed by those constantly engaged in its manufacture. For this reason, although some operators alloy and make their plate and remelt their scraps, very few prepare solder, preferring to purchase it. As purchased, the name 18- or 20-carat solder does not imply that the solder will assay 18 or 20 carats fine, respectively, but that the figures give the grade of plate it is intended for.

18- and 20-carat solders are used for crowns and bridges, though some consider 18 carat too low for the purpose.

22-carat solder is seldom used except on the exposed outside surface of a gold crown.

14-carat solder is used only in filling the cusps of seamless crowns in single crowning operations.

Solder is made by some by alloying the same grade of plate upon which the solder is to be melted. For such alloy a soft quality of fine brass wire is the best. Spelter solder is also used. The following formula is an example:

22-carat plate,	4 dwt.
Fine brass wire,	12 grains.

Allowing for the alloy already present in the 22-carat plate, the result is a solder about 19½ carats fine. A smaller proportion of alloy added to the 22-carat plate will give a corresponding result; for instance, 2 grains to each dwt. will produce a solder about 20½ carats fine.

Dr. W. H. Dorrance recommends the following formula as an alloy for the formation of different grades of gold solders, the proportion of the alloy used determining the melting-point and fineness in carat of the solder:

Pure silver,	1 part.
Pure zinc,	2 parts.
Pure copper,	3 "

The silver and copper are first melted together in a crucible lined with borax, and the zinc added quickly in small pieces, stirring the mass meantime with a clay pipe-stem. It is then, on the fumes of the zinc passing off, immediately poured into an ingot-mold or into a large wooden pail filled with water; 4 grains of this alloy melted with 20 grains of pure gold will result in a solder fully 20 carats fine.

Hard-Flowing Gold Solder.—This grade of solder is for use in crown- and bridge-work. It is conveniently made by melting together, by weight, one-third 18-carat solder to two-thirds 18-carat gold plate; 20-carat solder and plate can be used in the same proportion to form a higher grade. The plate is first melted and the solder then added, and when cooled rolled out to the desired gage.[1]

Fluxed Solder Filings.—Fluxed gold solder filings are made by filing with a clean, flat plate-file a thick piece of solder held in a vise. The filings are allowed to fall into a box or on a sheet of paper placed to receive them. A magnet should be passed through the filings to remove any minute particles of steel. To five parts of the filings so made is added and well mixed with them one part of the prepared flux or finely pulverized vitrified borax. Solder prepared in this way is useful for strengthening crowns, and also in fine soldering operations, as the particles of the solder take the heat separately and fuse much more quickly than when the solder is cut in pieces. The flow of the solder is also more easily limited.

Silver Solder.—Silver solder is frequently used by the student and practitioner in the construction of experimental or specimen work in connection with coin silver, nickel, or German silver.

A reliable formula is:

Coin silver,	90 parts.
Zinc,	10 "

[1] This formula is the one used by the author, and is convenient and reliable.

Platinum Solder.—Platinum solder is made by alloying pure gold with from 15 to 30 per cent. of platinum. It is used to unite the platinum sectional framework of a crown or bridge for porcelain-work. The grade of solder is determined by the fusing-point of the porcelain used.

Flux.—Borax is the preferred flux for soldering dental work. For small fine soldering and deeply invested sections it should be ground with water on a slab and applied with a fine camel's-hair brush before heating the metal or investment. For application during soldering it should be first vitrified and then ground to a fine powder.[1] Vitrification divests borax of its water of crystallization, and in this vitrified form it can be sprinkled on the metallic sectional parts of the work and fused without disturbing their position through expansion, which is liable to occur when ordinary pulverized borax is used. Preparations of borax should be kept perfectly clean, as the invasion of foreign matter will cause pits in the solder. Jeweler's liquid flux is used to some extent in place of ground borax.

The object of flux is to prevent oxidation of the metal when heated and thus enable the portion which is fused to flow more freely and unite better with the surface of the higher fusing metal. The lower grades of alloys require more flux than the higher, as is evidenced in the soldering of platinum with pure gold. The quantity of flux applied to work during the soldering should be limited to the least which will accomplish the object of its use, as an excess by its presence obstructs the control and addition of solder, and is liable to reach and damage the porcelain by fusing upon its surface.

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[1] Dr. Parr's "Prepared Flux," a finely pulverized vitrified flux, can be used in this manner. It is also prepared in combination with wax cement. In the melting out of the wax when the case is invested and heated for soldering, the flux is carried into the interstices.

CHAPTER II.

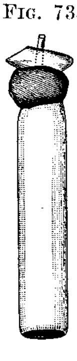
Porcelain Teeth.

ESSENTIALS—FRACTURES, CAUSES OF—VENEERS.

Essentials.—The qualities requisite in porcelain tooth body for use in crown- and bridge-work are density, strength, and the ability to withstand unaltered in form or shade any degree of heat to which they may necessarily be subjected. In these respects the porcelain teeth of our best American manufacture seem to excel, besides affording the most artistic imitation of the natural teeth in form and shade. They are also distinguished by the practical location of the pins.

In some crowning operations, where to imitate the conformation of a natural crown considerable alteration of the labial surface of a porcelain front is required, teeth of English manufacture may be used, as the texture of the porcelain more easily permits a polish being given to a ground surface.

Fig. 738.



Fractures, Causes of.—Teeth are sometimes fractured in soldering, from the contraction of the backing when adapted over the edges of the porcelain in a curve instead of at a right or slightly obtuse angle, or from melting solder on some part of the porcelain which is unprotected by a backing of metal. The solder, or the borax, as it cools, contracting on the porcelain, or a very thin edge of the metal covering it, will usually cause a fracture. The porcelain tooth has yet to be made that will, as a rule, endure such extreme treatment without breaking.

Fractures are also caused by too rapid heating, and quite frequently through impatience on the part of the operator by removal of the work from the investment before it has become perfectly cool.

Veneers.—A veneer consists of a thin piece of porcelain representing the labial aspect of the natural tooth.

To form a veneer select a porcelain tooth of the required shade and size. On the end of a piece of wood, about the size of the tooth, melt and attach a mass of shellac, heat the porcelain tooth and imbed the labial surface into the shellac, as shown in Fig. 738. Clip off the pins and with a corundum-wheel on the lathe uniformly grind down the porcelain until the ends of the pins are removed. Heat the porcelain, release the veneer, and remove all particles of shellac before application of veneer to case.

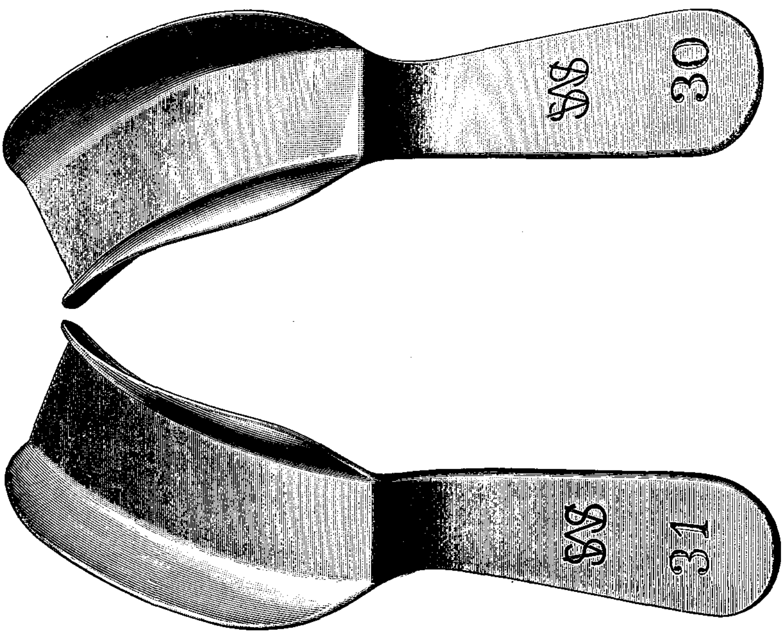
CHAPTER III.

Processes, Methods, and Materials.

IMPRESSION TRAYS — ARTICULATORS — IMPRESSIONS — SECTIONAL IMPRESSIONS—IMPRESSION-COMPOUND AND WAX—DENTAL LAC—MODELS—ARTICULATING IMPRESSION OR "BITE" AND MODEL—METALLIC MODELS OR DIES—FUSIBLE ALLOYS—MOLDINE—HOW TO QUICKLY MAKE A TUBE AND FUSIBLE-METAL DIE—COUNTER-DIE—COMBINATION PLASTER AND METAL MODEL—CUTTLEFISH AS A MOLDING MATERIAL—DENTAL LAC INTAGLIO DIES—WAX CEMENT.

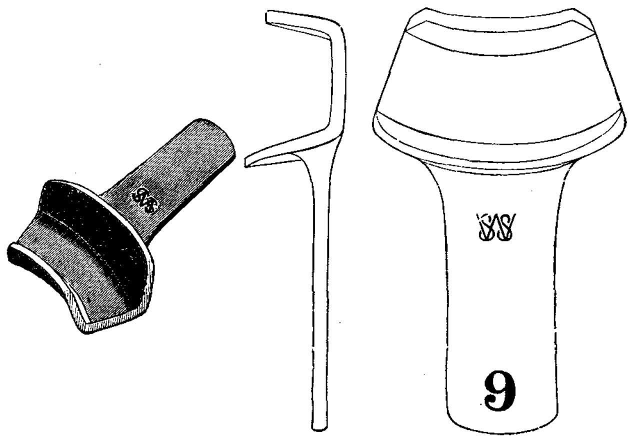
Impression Trays.—In crown or bridge operations, as an impression of only a portion of the teeth is generally required, partial impression trays are mostly used. Trays suitable for the right

Fig. 739.



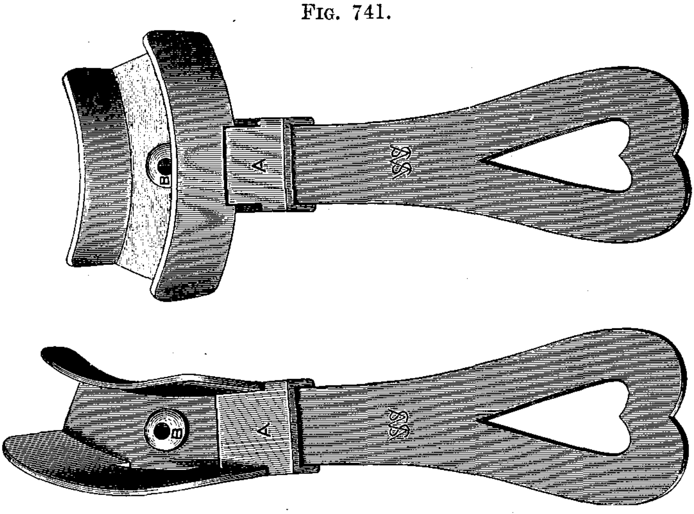
and left sides and front of the mouth are illustrated in Figs. 739 and 740. They are of forms which favor the replacement of a plaster impression in the tray should it break or be disturbed in removal from the mouth. Fig. 741 is an adjustable partial impression tray. This device conveniently takes the place of three trays. The tray proper rotates on a pivot B, and is thus perfectly adapted for use in the front or in either side of the mouth; and is firmly held in position by the sliding guard A.

FIG. 740.



Articulators.—The ordinary form of articulator is used in large bridge operations, but for small bridges or single crowns, the

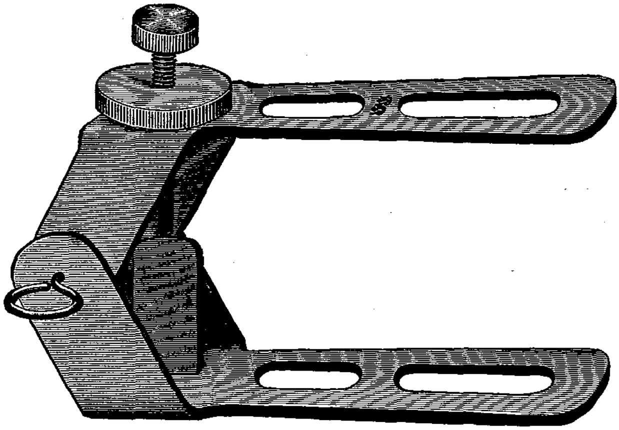
FIG. 741.



"partial" articulator with a graduating support, such as is illustrated in Fig. 742, is most convenient.

Impressions.—For the taking of impressions for bridge-work and most operations in crown-work, plaster is most suitable. To simplify the separation of the impression from the model, the former being harder, as a rule, a particle of carmine or other coloring material may be added to the plaster in the mixing.

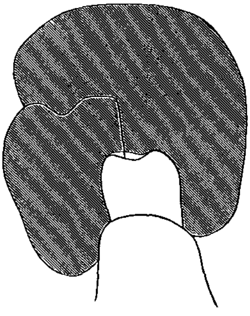
FIG. 742.



Potassium sulfate should be added to quicken the setting. The best method for the purpose is to dissolve a small teaspoonful of the potassium sulfate in a pint bottle of water, and in this way always have it ready for use in the proper proportion.

Sectional Impressions.—When the exact form of the contour of a tooth is required or when teeth tip toward each other in such manner that in the taking of an impression the mass of plaster which sets around or between them will not pull out, the best plan is to take the impression in sections (Fig. 743). Take palatal or lingual and part of the incisal or occlusal surfaces first, remove that section, trim and notch, oil, replace in position in the mouth, and apply plaster to form the remaining section. Separate the sections for removal, replace, and run the model.

FIG. 743.



An impression of this character may also be obtained by taking the palatal or lingual side first with impression-compound, and then the labial with plaster, so that it shall include the entire occlusal and incisal parts. This method will sometimes simplify the taking of a difficult impression for bridge-work.

Another method is to fit a piece of softened impression-compound accurately in position between the overhanging teeth, so shaped that it will pull out of the plaster impression on removal. The piece of compound is then removed from its position in the mouth and replaced in the impression to complete the mold. When the line of an inter-approximal space between certain teeth is required, it is best obtained by inserting between the teeth a strip of copper, in a single sheet, or doubled, which fits the space closely, leaving the ends protruding, before inserting the plaster, and then removing the copper in the impression.

For this class of work surfaces of all kinds of which impressions are to be run with plaster require to be thoroughly varnished and oiled.

Impression-Compound and Wax are for taking impressions of teeth for crowning purposes, especially by the seamless method. When with either material an impression of a small space between teeth is desired, it is best obtained by first placing and pressing a small, thin piece of the material used in the space or spaces to be taken before pressing the main mass in the impression-cup to position in the mouth.

Dental Lac is a preparation resembling sealing-wax. It is very hard and tough for a material of its kind, and softens and hardens very quickly under the application of heat and cold. It is softened for use by holding it in the heat above an alcohol or Bunsen flame.

Dental Lac is useful for taking impressions and various other purposes connected with crown- and bridge-work operations.

Models on which bridge-work is constructed or soldered require to be made of a material as non-shrinkable when heated as is practicable. Plaster and finely ground calcined marble-dust, mixed in the proportion of 1 part of marble-dust to 3 parts of plaster for large models, and 1 part of marble-dust to 4 parts of plaster for small models, meets this requirement better than any other material. Either slips of willow wood or brass pins may be placed in the impressions of such teeth as are liable to be broken in the removal of the impression. Should fracture in removal occur, a thin mixture of oxyphosphate is most suitable to repair the parts, as it leaves them stronger than before.

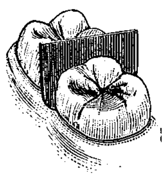
A hard surface is given to a model for bridge-work by first running in the impression a film of a thin mixture of pure plaster and then on the surface of this the mixture of plaster and marble-dust. This to be effective has to be dextrously done. The surface of models of plaster and marble-dust can be much hardened by the application of several coats of very thin sandarac varnish.

Articulating Impression or "Bite" and Model.—This impression is taken separately or at the same time with the impression for the model. When taken separately it has to be done with all the crowns or caps in position in the mouth previous to the impression for the model. Wax is generally used for the purpose in preference to impression-compound. Softened wax, sufficient in quantity to barely cover the parts, is pressed over the teeth and crowns to their form and the antagonizing teeth occluded. The finger or cheek is pressed against the outside of the wax and the patient is requested to press the tongue against it on the inside. The mouth is next opened, the wax chilled with cold water, and removed. It is generally best to trim the impression of overhanging superfluous parts and reinsert it a second time for accuracy. Pieces of pattern tin placed over the teeth which antagonize before inserting the wax will prevent their biting through the impression. The articulating impression is to be placed in position on the model with the caps or crowns, and the articulating model run.

When impressions for both model and "bite" are taken together, the plaster, mixed moderately thick, is with the aid of a spoon, or rolled in a mass with the fingers, which should be immersed previously in water to permit adhesion of the plaster, placed around in the mouth on the crowns, caps and parts to be included in the bridge, and the antagonizing teeth occluded tightly and so held until the plaster sets. The mouth is then opened and the plaster carefully removed. If the plaster breaks in removal, which is usually the case, all the pieces should be preserved and carefully readjusted in place. The crowns or caps are generally removed in the impression. If not, they should be transferred from the mouth to it. The plaster is then varnished and oiled, and on the side containing the crowns a model of plaster and marble-dust in the proportion already mentioned is run. When the model has set, it is mounted with plaster on an articulator and an articulating model run of pure plaster, and the opposite section of the articulator adjusted. The impression material is next removed. (For further details see page 188.)

Metallic Models or Dies.—Metallic models or dies of fusible metal can be easily and quickly formed for use in crown- and bridge-work. The melted alloy can be poured into a plaster, moldine, or gutta-percha impression taken in a tube or impression-tray. A piece of copper plate or of an old separating file, placed between teeth as shown in Fig. 744, and removed in position in the impression, will accurately outline the space between the teeth in the metallic model. When a tube is used, a strip of paper should be wound around it to lengthen the die.

FIG. 744.



Fusible Alloys.—The following fusible alloys of tin are suitable for the purpose:

Proportions of Metals.			Melting-Point of the Alloy.
Tin.	Lead.	Bismuth.	Fahr.
1	2	2	236°
5	3	3	202°
3	5	8	197°

Dr. G. Molyneaux's formula in parts is:

Bismuth,	5 parts.
Lead,	3 "
Tin,	2 "
Cadmium,	2 "

Melts at about 180°.

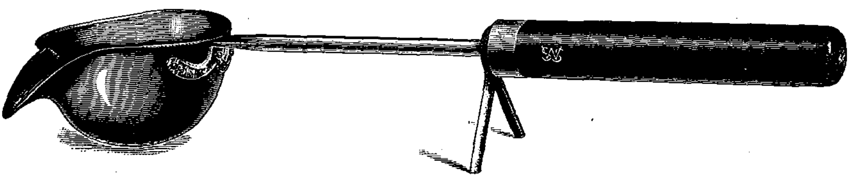
Dr. G. W. Melotte, of Ithaca, N. Y., to whom is accorded the credit of introducing the use of fusible metal and the compound called "Moldine" into crown- and bridge-work, gives the proportions of his alloy in parts as—

Tin,	5 parts.
Lead,	3 "
Bismuth,	8 "

Fusible metal should not be heated much beyond the melting-point, a matter which is not as a rule carefully observed. It should be allowed to cool moderately before pouring. In filling some forms of molds imperfections in the die are avoided by pouring the metal just before its congealment. A ladle, such as is illustrated in Fig. 745, with legs to prevent tipping while cooling, is a suitable form.

Dr. Melotte's Moldine, a preparation compounded of potter's clay and glycerin (to which, when needed to soften it, more glycerin can be added), is very useful in molding.

FIG. 745.



How to Quickly Make a Tube and Fusible-Metal Die.—Take a thin strip of copper plate, at least No. 35 gage, anneal, and bend it around the tooth in the mouth or its form on the plaster model. Both ends of the copper at the part lapped are next cut, as shown at A, Fig. 746, and turned over tight and close in the manner seen at B. This fastens both ends of the copper, which, when trimmed off at C, forms a tube. In this tube take an impression of the natural crown, either in the mouth with a little plaster or moldine or from the plaster model with moldine by trimming around the tooth or by separating it from the rest of the model. Encircle the tube with a strip of paper. Hold the paper and tube with a clamp. Melt and pour the fusible metal moderately cool, and immerse tube and metal in water. This gives a die with a long, narrow shank, which may require to be trimmed at the neck with a file. When impression-compound or gutta-percha is used, cool and then dry the surface with an air syringe before pouring the fusible metal.

FIG. 746.

Counter-Die.—A counter-die to a small cast or die of fusible metal is made by indenting a block of lead with a punch, and then driving the cast or die into it. Its use in crown-work is described on pages 103, 112, and 117.

A counter-die of fusible metal to a fusible-metal die may be made by chilling the die and oiling or vaselining its surface before pouring the metal.

Combination Plaster and Metal Model.—Dr. Melotte has introduced for special cases a novel method of forming a combination plaster and metal model, in which the parts representing the teeth are of fusible metal. The following is a description: The impression is taken in plaster. Iron pins to act as dowels are placed in the molds of the teeth. Pieces of a fusible metal which melts at a low point are then melted into each of the molds with a few puffs of the blowpipe. Plaster is then poured in the remainder of the impression. The advantage afforded by a model of this kind, when gold attachments or clasps are to be shaped to teeth, is obvious. The method applied in the construction of bridge-work is given on page 190. Dr. Melotte's formula for the fusible metal used in the above method is:

Bismuth,	8	parts.
Lead,	4	"
Zinc,	3	"
Cadmium,	2	"

Melts at about 150° F.

Cuttlefish as a Molding Material.—This material affords means of quickly and easily making dies of grinding-surfaces of teeth with zinc or Babbitt's metal as well as fusible metal. Press the model of the grinding-surface into the flat surface of the cuttlefish to the desired depth, withdraw model, and place a metallic ring pressed into the surface of the cuttlefish around the impression. Next pour in the metal to form the die.

Dental Lac Intaglio Dies.—Dental Lac can be used to make intaglio dies. Soften the Lac and press it against the form you wish to duplicate and chill with cold water.

To stamp a piece of gold plate with an intaglio die of Dental Lac place the gold over the die. First start the gold to the form by pressure from a pellet of cotton, then place the die and plate in a swager with a rubber plunger, and bring down the plunger. The Lac die will be found to maintain its form and perfectly shape the gold.

Wax Cement.—Wax cement is used in two forms,—adhesive and hard wax. Adhesive wax when moderately heated is quite flexible, adheres readily to metal and porcelain, and may be manipulated with the fingers without sticking to them, then, when chilled with cold water, it becomes quite hard. It is to be used during the adaptation of different parts of the work in and out of the mouth.

Adhesive wax of a suitable quality can be made of pure yellow beeswax 4 parts, resin 1 part, and gum dammar 1 part, by weight.

Hard wax requires more heat to soften it than the adhesive.

When sufficiently heated it is very soft and adhesive, but exceedingly brittle when cooled.

Hard wax is best used as a support to adhesive wax. The adhesive wax having been first applied in the preliminary adaptation of the work, as much as possible is removed without disturbing the position of the parts and replaced with the hard wax for the final adjustment.

Hard wax is made of yellow beeswax 1 part and resin 3 parts.

Wax cement in the form of sticks is the most convenient for use.

CHAPTER IV.

Materials Principally Used for Investments.

SMALL INVESTMENTS—LARGE INVESTMENTS—METHOD OF INVESTING—PREPARATION OF INVESTMENT—HEATING THE INVESTMENT—SOLDERING-BLOCKS—BLOWPIPE AND METHOD OF USING IT—PREPARATION, APPLICATION, AND FUSING OF SOLDER—SOLDER-POINTER—OPEN-FLAME SOLDERING—UNION BY SWEATING—SOLDERING WITH A COMPOUND BLOWPIPE FLAME—ANNEALING.

Materials Principally Used for Investments.—Calcined marble-dust, both finely pulverized, and coarse, common white sand, and asbestos, combined in proper proportions with plaster, are principally used to form investing material for crown- and bridge-work.

Small Investments.—For small investments such as single crowns, the proportions generally used are 2 parts of finely pulverized calcined marble-dust to 1 part plaster.

Large Investments.—For large investments, including pieces of bridge-work, 1 part finely pulverized calcined marble-dust, 1 part sand or coarse marble-dust, and 1 part plaster.

When used in the proportions just described, the sand or coarse marble-dust prevents the excessive contraction which takes place in large masses of investing material entirely composed of fine marble-dust, when subjected to great heat for considerable time. The fine marble-dust in combination with the plaster is more suitable to fill in interstices and the inside of caps.

Asbestos may be substituted for sand or coarse marble-dust in large investments, as the fibre helps to hold the material together, but trimming has to be carefully done, as the asbestos is not easily cut and displacement of the investing material and exposure of some part of the work is liable to occur.

Method of Investing.—In cases of bridge-work, especially if of any great size, a loop of iron wire should encircle the piece in the investment.

Potassium sulfate may be used to cause the mixture to set quickly and hard.

The model on which the bridge-work is being constructed should be trimmed as small as is safe without risk of fracture. It should then be soaked in water while the investing material is being thoroughly mixed.

The reduction of the model is for the purpose of securing the presence of the largest possible proportion of investment material in the investment to that of the model, and its immersion in water is to prevent absorption of water from the investment material and to obtain a better adhesion.

Preparation of the Investment for Soldering.—When it is desirable to remove the wax connecting sections of a crown or bridge in an investment before heating, it should be done by pouring boiling water on the parts. The removal of wax with an instrument is not advisable, as parts delicately held in position are liable to become displaced. The removal of the wax exposes the metallic portions of the work to be soldered. All surplus and especially overhanging investment material should be removed, but parts already soldered should be left covered.

The metallic parts to be soldered should be exposed as much as possible so as to be accessible to the direct flame of the blowpipe, as the greater their depression in the investment material, the more difficulty will be experienced in guiding and controlling the solder at that point with the blowpipe.

Care should be taken that all parts of the porcelain teeth are covered and all crevices between them filled with the investment material to prevent invasion of borax or solder, either of which is very liable to cause their fracture. The filling in with gold foil of small open seams between sections of metal facilitates their union in soldering. The filling in of large spaces under caps or tips to porcelain fronts can also be much assisted by packing in the spaces large pellets of foil or by placing in them pieces of plate or wire. A moderate application of flux may now be made to the deeply invested parts, as directed under article on "Flux," page 416.

Many prefer to trim the investment and let the wax burn out as the investment is heated. This is done when fluxed wax is used and the benefit of the flux is to be obtained. The objection to the burning out of wax is that owing to the resultant *débris* pits are more liable to be found afterward in the solder.

Heating the Investment.—In soldering crowns and bridge-work or sections of it containing porcelain fronts, the investment should be first uniformly, gradually, and thoroughly heated over a Bunsen flame until the bottom of the investment assumes a dull red shade.

A piece of heavy iron wire, about No. 8 gage, bent in the form of a scroll, as shown in Fig. 747, or a piece of sheet iron perforated with large holes placed across the top of a spider fitted to the burner, forms a good support. When heated, the investment should be removed to a soldering-block.

Soldering-Blocks.—A large round piece of charcoal, about 5 inches in diameter and 6 inches long, cut or burned out a little concave on one end, and with a thin covering of plaster to prevent soiling the hands, furnishes a good soldering support and one that will retain the heat. It is the form preferred by the author. Seams or cracks in the charcoal should be filled in with a mixture of sand or asbestos and plaster, to retard the burning out of the block. Two or three iron nails inserted in the concavity of the block, a little to one side of the centre, are useful at times to prop up an investment. Manufactured soldering-blocks, such as those shown in Fig. 748, are used preferably to charcoal by many.

FIG. 747.

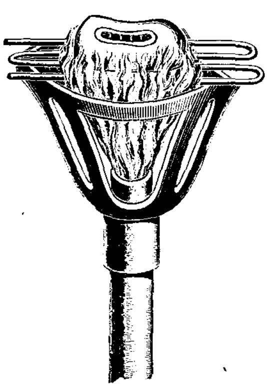
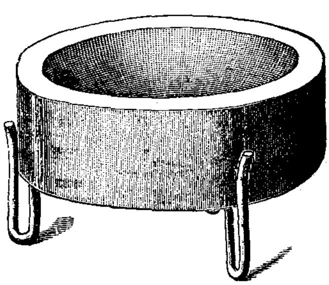


FIG. 748.



Blowpipe and Method of Using It.—A hand gas blowpipe (Fig. 749) operated by a foot-bellows of medium size and so constructed as to be under perfect control, especially respecting diminution of the flame to a very small point, makes the most satisfactory apparatus.

The full flame of the blowpipe should be directed at first under and around the sides of an investment, which should be slightly tipped or propped up at one side for the purpose. The investment should in this manner at first be uniformly heated to a point sufficient to melt the solder without pointing the flame. When the heat of the surface of a piece of metal is lower than that required to fuse the applied solder, the solder is liable to ball up and roll off. The tendency of melted solder is to flow to the hottest point. It is also affected by gravitation. By the application with the blowpipe of a greater degree of heat under an investment than on the top the solder can be drawn down into the deeply invested parts. But if after flowing solder to and in these parts a heat is still maintained more than sufficient to keep the solder in a molten condition, and a slightly greater heat is applied to the surface section of the investment, the solder is liable to be drawn upward. In this manner, in the soldering of a collar crown the solder that has been drawn down between the porcelain front and cap and around the collar on a line with the porcelain is liable to be largely drawn backward and absorbed in the final soldering of the backing and contouring of the crown; therefore in soldering the work, especially crowns and dummies with porcelain fronts, these points should be borne in mind. When certain parts of the work have been united and generally filled in with the solder under the effect of the large flame, the flame may then be reduced in volume and pointed for a moment to guide the solder to and better shape it at some special point. Proper position for the investment and correct application of the heat in soldering aid in accomplishing the desired result.

Fig. 749.

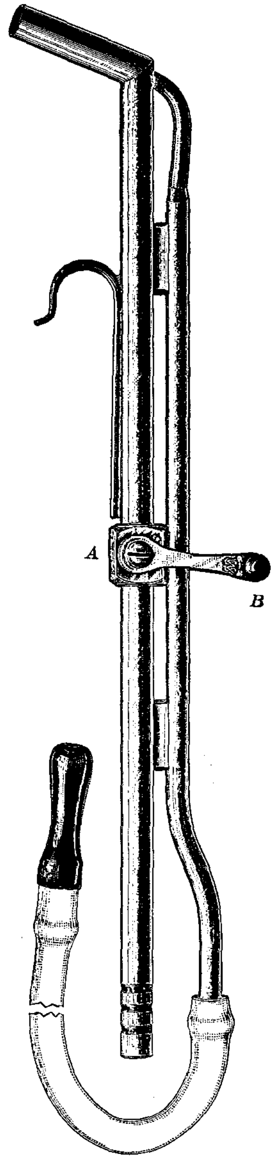


FIG. 750.

Preparation, Application, and Fusing of the Solder.—The solder should be cut in small square and oblong pieces and placed on the cover of a tin box within convenient reach of the points of the tweezers. The pieces may be coated with borax finely ground in water, but they should be allowed to dry before application. The solder should not be applied until the investment has been first brought to a red heat on the soldering-block with the blowpipe, and then only at the part where the soldering is commenced. It should be applied a little at a time. The portion placed in the investment should be first melted and flowed down into the interstices of the work, using the large flame of the blowpipe under and around the investment. More solder is then added by degrees, and, finally, as the parts become filled, by the use of a smaller flame applied directly to the part and the judicious use at times of a small-pointed flame and the addition of solder the parts can be given the desired form.

A pair of soldering-tweezers with a long reach and small curved points, as illustrated in Fig. 750, should be used to pick up and place the small pieces of solder.

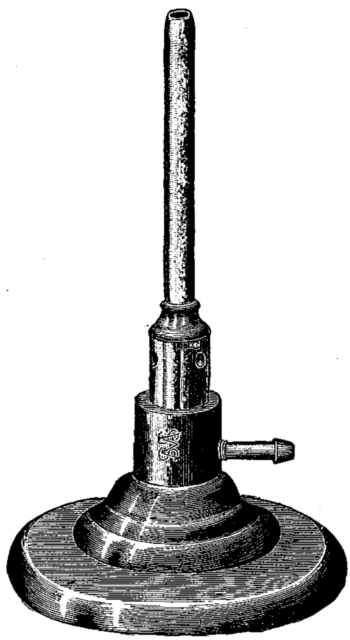
Solder-Pointer.—A small-pointed instrument with a long handle, termed a "solder-pointer," is useful at times to stir up, spread, and draw the solder to a desired point. The point of the instrument should preferably be made of platinum instead of steel.

In large pieces of bridge-work with considerable curve it will be found necessary to solder a portion at a time. This is best done by placing each portion as it is to be soldered in the deepest part of the concavity of the soldering-block, and when soldered, slightly cooling and changing the position of the investment, as gravity tends to carry the melted solder to the lowest point.

Open-Flame Soldering.—Open-flame soldering is done either in a Bunsen (gas) flame or the flame of an alcohol lamp. It is the method used for soldering small sections of the work, as the seams of collars, and caps to collars. A Bunsen burner of the form illustrated in Fig. 751 (one-half size) is a most convenient one for general use, as it permits the supply of air to the centre of the flame to be regulated.

The metal is held by a clamp and heated in the flame as shown in Fig. 144. The heat should be applied gradually, and the metal first held above the flame and then slowly brought downward into it, to a point just above the hollow, and held there as briefly or as

FIG. 751.



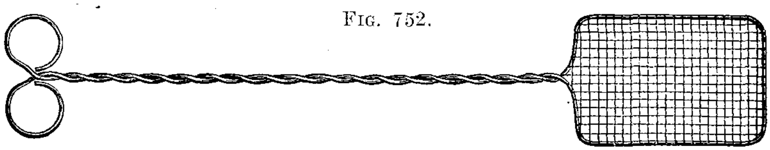
long as is necessary to effect the desired fusion. For soldering sections of the work which cannot be clamped together the wire frame illustrated in miniature in Fig. 752 is often serviceable. The parts to be soldered are laid with the solder in position on the centre of the wire network and introduced into the flame.

Dampened finely ground calcined marble-dust, applied in a thin layer on the inner surface of a cap or collar, will prevent an invasion of the solder. The marble-dust is afterward easily washed out, which is not the case with whiting, often used for the purpose.

Union by Sweating consists in uniting the edges or surfaces of two pieces of metal by heating them so closely to the fusing-point that union takes place without melting the main body of the metal. This process is sometimes used to unite the seam of a collar. The clean edges of the metal are brought together or lapped, flux is placed in the seam, and the heat carefully raised to the fusing-point. This is slightly facilitated by the flux, which by preventing oxidation causes the surfaces to fuse and unite before the main body of the metal melts.

Soldering with a Compound Blowpipe Flame.—Platinum solder requires a compound blowpipe flame to melt it. This can be improvised by connecting the air tube of an ordinary gas blowpipe to that of a cylinder of nitrous oxid gas. The flame of the blowpipe should be reduced to a very small jet and the volume of the nitrous oxid turned on very slowly until an amount of

FIG. 752.



pressure is reached sufficient to point the flame and effect perfect combustion.

A small compound blowpipe invented by Dr. Rollo Knapp is specially made for this purpose, and is described below, but the fusing of platinum solder can be effected quite satisfactorily with the ordinary blowpipe above described.

Dr. Knapp's Compound Blowpipe (Fig. 753) consists of a miniature blowpipe in which the ordinary illuminating gas (carburetted hydrogen or coal gas) flame is combined with a current of nitrous oxid from a cylinder of the condensed gas. The combination of these gases in combustion forms essentially a carbo-oxyhydrogen flame.[1] By means of a yoke and set-screw, the valve

---

[1] The ordinary compound oxyhydrogen blowpipe flame is produced by

2 volumes of hydrogen; 1 volume of oxygen.

Carburetted hydrogen consists of

2 volumes of hydrogen; 1 volume of carbon.

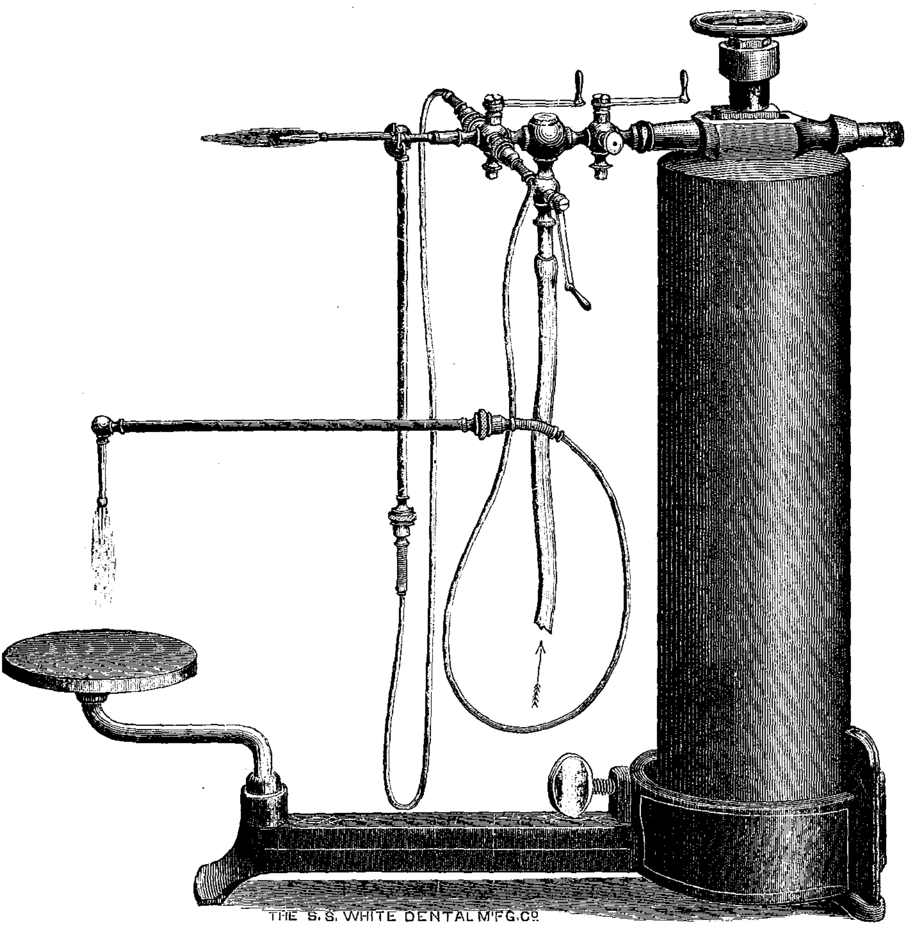
And nitrous oxid of

2 volumes of nitrogen; 1 volume of oxygen.

Consequently Knapp's blowpipe flame is produced by a mechanical mixture of 2 volumes of hydrogen; 1 volume of oxygen; 1 volume of carbon.

of the cylinder is connected with the tubes and valves of the blow-pipe, so that the proportions of the mixture of nitrous oxid and the illuminating gases are under perfect control. The flame-jet can be diminished to half an inch in length, and at that size will melt a small piece of gold plate.

FIG. 753.



Where illuminating gas is not available, an apparatus termed a carburetter can be used, which supplies the deficiency in a simple manner by vaporizing naphtha.

This blowpipe is useful for many purposes in the laboratory of the present time, especially in forming solid gold backings to dummies for bridge-work, strengthening seamless gold crowns, and forming solid gold crowns.

Annealing.—Annealing gold is done either with the open flame or the blowpipe, or in the muffle of a furnace; in the open flame, by holding the piece of plate with a clamp in the upper part of the flame, until as high a degree of heat is reached as the character or carat of the plate will permit without melting. Pure gold will permit a light yellow heat; 18 to 22-carat plate, from a dull to a bright red. Large pieces of gold require to be laid on a soldering-block and heated with a blowpipe.

Platinum is best annealed in an alcohol flame or in the muffle of a furnace. It requires to be brought to a white heat and kept there for a short time. In a gas flame platinum suffers deterioration by the formation of carbide of platinum, which in oxidizing later is liable to blister the metal.

The best results in annealing are accomplished by allowing the metal to cool slowly. Much time, though, is often gained by immersing in water. This, however, should not be practiced with ingots of gold or silver just melted.

Each time metal is bent, burnished, hammered, drawn, or rolled, its softness, flexibility, and ductility are impaired, but they are instantly restored by annealing. This fact should be borne in mind in the manipulation of metal in the construction of all forms of work.

CHAPTER V.

Instruments, Appliances, and Material Specially Required.

The dentist who intends to engage extensively in crown- and bridge-work, and who desires to practice it conveniently and successfully, should supply himself with all the necessary instruments, tools, and other appliances. These consist principally of:

Suitable drills and burs, including three or four sizes of the Gates-Glidden for root-canals; root-trimming and shaping instruments, gem and corundum-wheels and points, and vulcarbo disks. (See pages 34 and 35.)

Pliers for shaping collars (see page 75), and a pair of excising forceps.

Soldering-clamps (see page 104) and hand-vise.

Small-pointed shears.

Round and half-round plate files, very finely cut.

A small anvil.

Bunsen gas-burner and spider attachment for heating investments for soldering.

A gas blowpipe with bellows, and a mouth blowpipe.

Charcoal soldering-block.

Calcined marble-dust.

Potassium sulfate.

Melotte's Moldine and fusible metal.

The prepared wax cement, as described at page 426, or Parr's fluxed wax.

Dies and plates for forming gold caps for use in constructing crowns and capping dummies.

Copper plate Nos. 34 to 35 gage, copper wire No. 30 gage, fine iron binding-wire, and heavy iron wire to encircle investments.

Pure gold plates Nos. 28 to 30 gage, 22-carat gold plate Nos. 28 and 30 gage, and 18- and 20-carat gold solder.

Platinum plate Nos. 30 and 32 gage for collars, heavy and very light platinum plate and foil for backings, platinum and iridio-platinum wire Nos. 15 and 17 gage for posts, and fine platinum wire, about No. 19 or 20 gage, for pins in either gold tips or crowns.

A small assortment of cross-pin plate teeth of light, medium, and dark shades, consisting of incisors, cuspids, and a few bicuspid and molar fronts for dummies.

A small rolling-mill for plate will be quite an acquisition, as gold scraps can be remelted and formed into plate, and plate on hand reduced to any desired gage.

For porcelain-work, an outfit of preferably high-fusing porcelain body, as it can be used for both inlay- and crown-work.

Fig. 754.

Three camel's-hair brushes—small, medium, and large.

A small spatula.

A small slab or platinum tray for holding the work while baking.

Pulverized silex.

One dwt. of platinum 1/1000 gage.

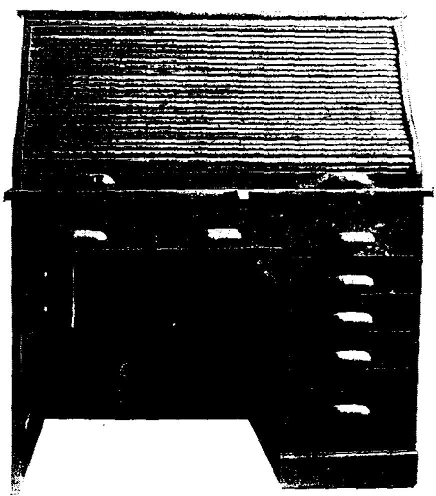
A set of suitable burnishers for adaptation of matrices.

An electric furnace, preferably with a pyrometer, or a gasoline furnace for the baking of porcelain.

The bench on which the principal parts of the work are done should be specially designed and reserved for it. It should be in the same room, and conveniently situated a little behind the dental chair, out of view of the patient. Everything connected with this bench should be kept in order and ready for immediate use. Such a bench, made of oak or black walnut, with a top that can be closed when not in use, making an unobjectionable piece of furniture, is represented in Figs. 754 and 755.

The Bunsen flame in the centre of the bench can be turned off and relighted instantly by a small jet at the side of the burner. The point of the socket of the gas bracket is formed so that when the bracket is pushed to one side for the purpose of closing the cover of the bench the gas supply is shut off. Although soldering

FIG. 755.



with the regular gas blowpipe may be done at this bench as well as that by the open flame, the laboratory is a more suitable place for the former, as the smoke emanating from the gas will soil the adjacent walls and ceiling.

An office lathe should be kept next to the bench, or a small lathe-head can be mounted on the bench and operated by an electric motor.

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