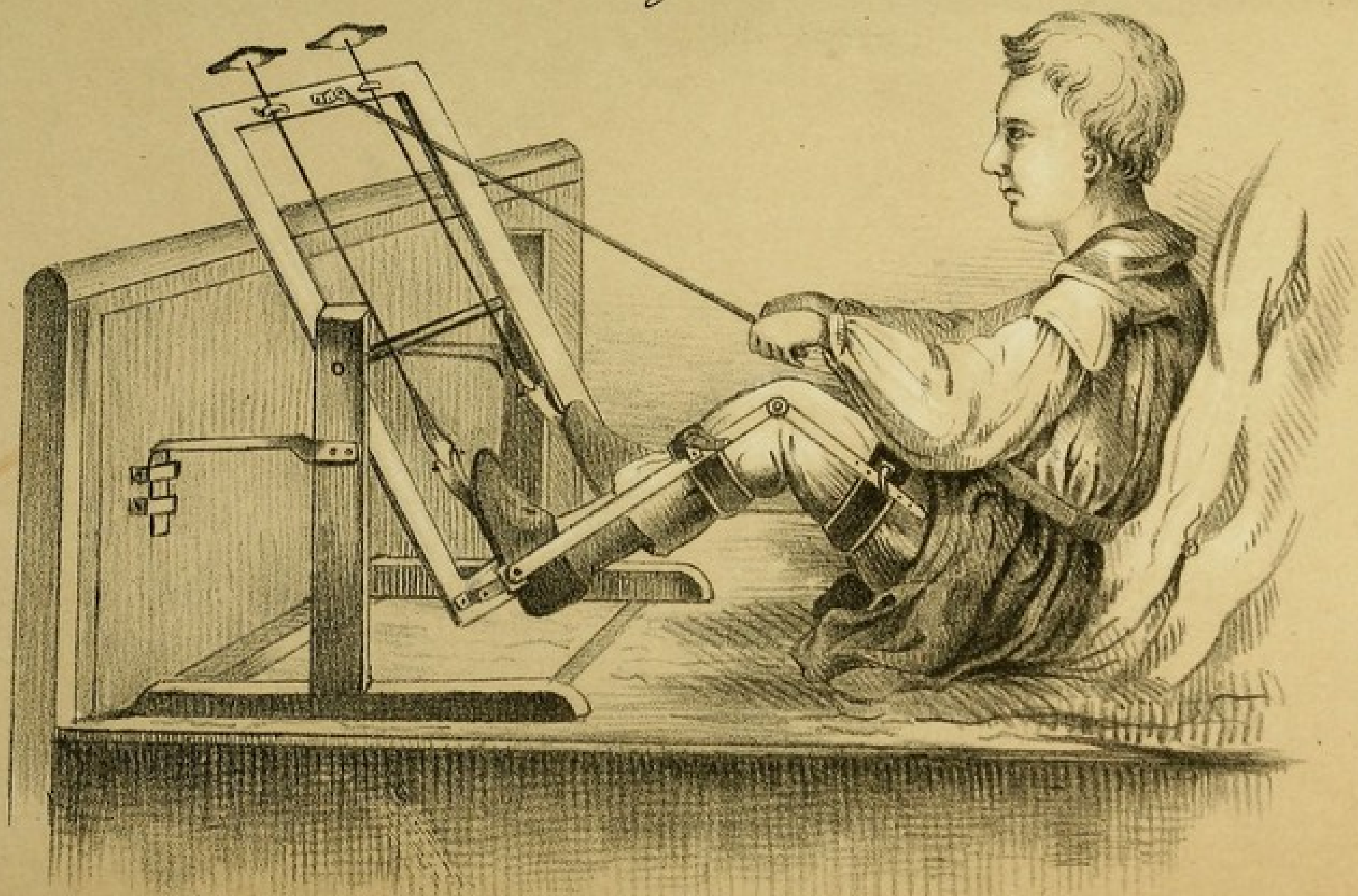
To
The Lotos Club
with the Compliments
of the Author

Oct 26th 1901

Fig. 29.



Lith. u. gedr. v. G. Küstner.

A PRACTICAL TREATISE

ON

ARTIFICIAL CROWN- AND BRIDGE-WORK

AND

PORCELAIN DENTAL ART.

BY

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SIXTH EDITION, REVISED.

WITH 651 ILLUSTRATIONS.

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1900.

THE PATTERSON AND WHITE CO., PHILA.

To the Members

of the

First District Dental Society of the State of New York,

this Book is respectfully dedicated

by

THE AUTHOR.

PREFACE TO SIXTH EDITION.

TWELVE years have elapsed since the first edition of this book was presented to the dental profession. During that time several successive revisions have been made to better adapt it to meet the requirements of a practical treatise for college and post-graduate study, and of a book of reference for the practitioner. The endeavor has been at all times to make the text comprehensive without being bulky, and concise without sacrificing clearness for brevity. Descriptions of rarely practiced or unimportant methods have been curtailed from time to time, obsolete matter omitted, and repetition avoided as much as possible.

Practitioners of to-day seek methods which will permit the attainment of the desired results in crown- and bridge-work without the devitalization of pulps, with the least possible mutilation of the natural teeth, and the smallest exposure of metal, and which are least complex in construction.

These ideas have largely influenced the conduct of the revision of this edition. Many changes have been made in the text by the elimination of old matter and the introduction of new in the description of methods and details of construction. Some special methods of little general service in crown- and bridge-work are still presented because they may occasionally furnish suggestions for construction by which some existing obstacle or difficulty can be readily overcome.

Crown- and bridge-work, having been fully recognized as a legitimate branch of dental prosthesis, is listed as a special branch in the curriculum of every dental college. In application it approaches a fine art. 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 proportionate injury instead of benefit. Criticism of failures should therefore be governed by these considerations. 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 money on the part of the patient as in plate-work. There is no such relation between these two methods of procedure.

The advances in porcelain inlays and porcelain bridge-work have been so conspicuous during the past year or two that it has been deemed desirable, in order that they might be properly presented, to give them a distinct classification under the title, "Porcelain Dental Art."

Acknowledgment is specially made by the author to Dr. F. J. Capon, of Toronto, Canada, for suggestions on porcelain crown-work, personally given; to the writings of Dr. C. L. Alexander, of Charlotte, N. C., on crown- and bridge-work, in the *Dental Cosmos;* to Dr. W. H. Taggart and Dr. H. J. Goslee, of Chicago, papers and discussions on porcelain bridge-work in the *Dental Review;* to Dr. J. L. Williams, of London, Eng., and Dr. Joseph Head, of Philadelphia, writings on porcelain inlays in the *Dental Cosmos;* to Dr. W. A. Capon, of Philadelphia, for suggestions personally given and writings on porcelain dental art; Dr. N. S. Jenkins, of Dresden, Germany, for personal suggestions and writings on porcelain inlays.

GEORGE EVANS.

55 WEST 39TH ST., NEW YORK.

August 27, 1900.

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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, and they not the oldest, 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.

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 the position in dental art which it merits.

PART I.

PREPARATORY TREATMENT OF TEETH AND ROOTS FOR CROWN-WORK.

PREPARATORY TREATMENT OF TEETH AND ROOTS FOR CROWN-WORK.

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 therapeutical 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.

CHAPTER I.

THE PULPS OF TEETH—THEIR PRESERVATION OR DEVITALIZATION—PULP-CAPPING.

THE preservation of the vitality of the pulps of the teeth is a matter of as much importance in connection with crown- and bridge-work as in any other class of operations, though the excision of natural crowns for the purpose of utilizing the roots as abutments for bridge-work is extensively practiced, and is defended by some on the theory that the vitality of the dentin is to some extent maintained by the cementum after the extirpation of the pulp, and by others on the plea that in a fully developed tooth the pulp, being the formative organ, is of no further value when root-canal treatment is properly conducted.

The pulp after going through progressive changes which constitute its original function assumes a fixed anatomical character. It becomes 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 as described 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 assume the functions of the pulp and maintain circulation in the main body of the dentin. (See Plates I, II, III.)[1]

[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 I.

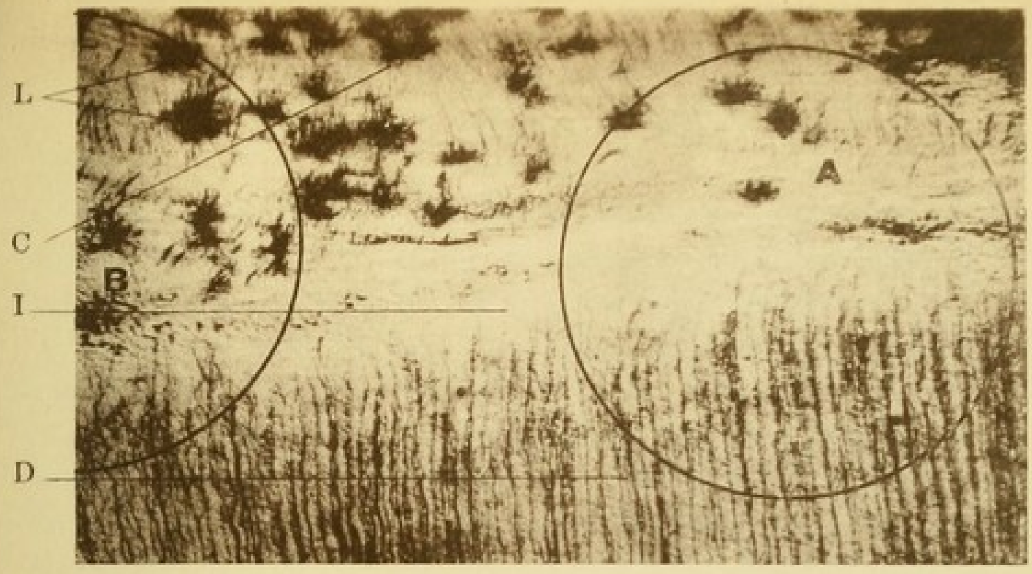
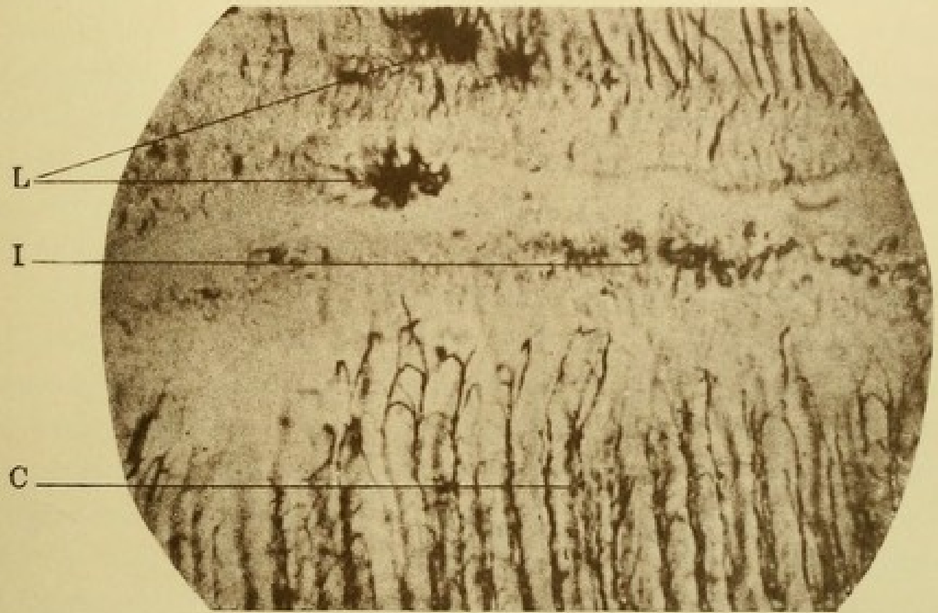


Plate II.



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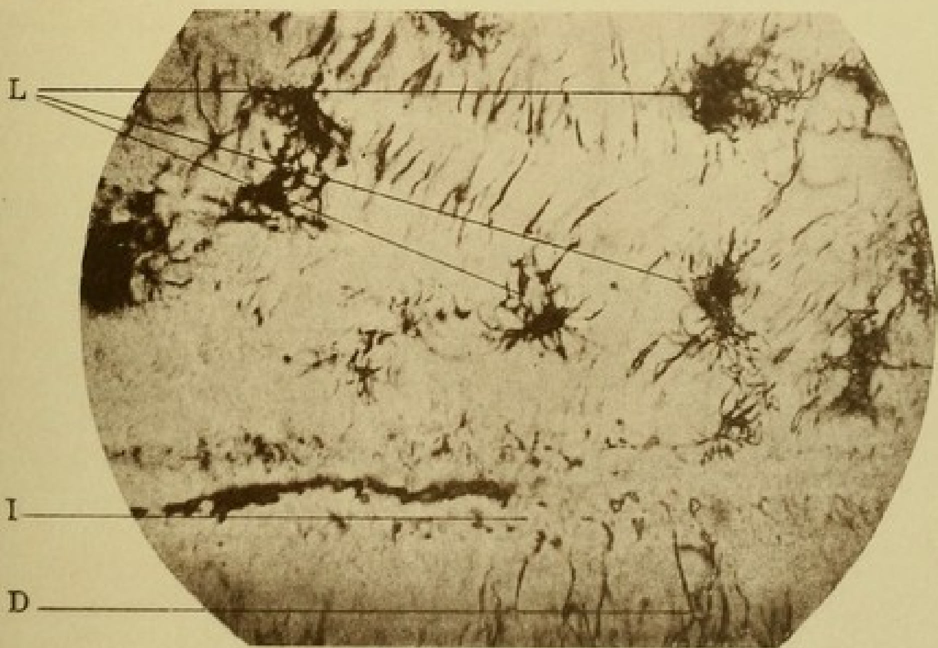

From Specimens made by M. H. Fletcher, M. D., Dentist. Cincinnati, Ohio.

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 has been thoroughly carried out, they are capable of generating septic gases which will exert an influence in producing irritation of the cementum and pericementum. An examination of the investing membranes of pulpless teeth as treated generally shows the existence of a percentage of abnormal conditions, by which their firmness is to some extent impaired, their susceptibility to acute inflammation increased, and their reliability as foundations for crown- or bridge-work greatly lessened when compared with teeth which have living pulps. Observation of gold-capped pulpless natural crowns of teeth also has shown the author that the dentin of such teeth in the course of years gradually softens to such an extent as to impair their strength.

In cap-crown work, facilities are afforded for the preservation of pulps in the posterior teeth. Thus, in a case verging on exposure, only partial removal of the decay is usually 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 in a large percentage of cases will also permit the anterior teeth to be used as abutments without the extirpation of their pulps or the excision of their crowns.

Extirpation is demanded for those pulps whose permanent preservation cannot be placed beyond doubt, as failure involves

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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.

[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.

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 the generally expressed opinion on the subject, 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 in cases of 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.

Pulp-Capping.—The operation of capping 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

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

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 very 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.[1]

The disinfected dentin over the pulp is then varnished with 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 oxychlorid of zinc 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

[1] 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.

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 difficult pulp-capping operations.

CHAPTER II.

DEVITALIZATION OF THE PULP.

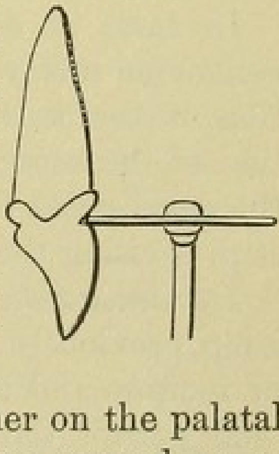
In preparation for crown-work two methods of devitalization are practiced: the heroic,—instantaneous devitalization, or extirpation,—and gradual devitalization by arsenical treatment.

Instantaneous devitalization 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, is 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. Subsequent treatment should be such as will complete the devitalization and extirpation of the pulp.

Cataphoresis.—In cases of actual exposure of the pulp the rubber-dam can be applied, the exposed pulp obtunded with hydrochlorate of cocain, applied in saturated solution; the diffusion may be hastened with 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 wall, close to the gum, with a rapidly revolving corundum or rubber and corundum 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 quickly driven with a 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. In this operation only trifling pain is experienced 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.

Fig. 2.

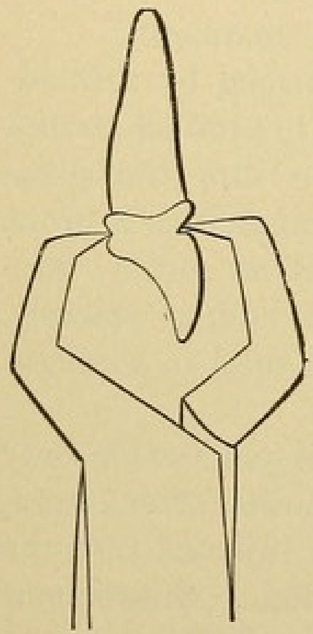
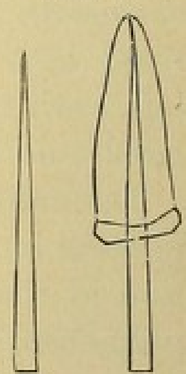


Fig. 3.



The objections to this operation 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; but, expertly performed, it is advantageous in many cases, though it should be confined to cases where the pulps are in *normal* condition.

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 in excising the crown.

Devitalization with Arsenious 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 arsenious 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. The residue of the infiltration, after the devitalization of the pulp, to some extent remains in the tubuli, and increases the difficulty of producing an aseptic condition of the dentin. It is asserted that in some cases arsenic affects the vitality of the cementum, while after instantaneous extirpation of the pulp, when arsenic is not used, vitality is assured.

Practical experience shows that usually instant devitalization or extirpation is the most satisfactory in general and final results. 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.

The use of arsenic, combined with agents which are non-coagulants of albumen, is recommended in preference to combining it 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:

℞—Arsenious acid, ʒ i;
Muriate of cocain, ʒ ii;
Lanolin in quantity sufficient to make a stiff paste.

The application should be kept in position no longer than is

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

necessary to effect the devitalization of the pulp, twelve to forty-eight hours being sufficient for the purpose. 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. At the end of that time, in favorable cases, the pulp can be removed entire. The saliva should be entirely excluded, the rubber-dam being applied when practical, and peroxid of hydrogen or absolute alcohol, instead of water, used in the treatment.[1] 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 peroxid of hydrogen, 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.

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[1] See *Dental Cosmos*, vol. xxxiii, page 138.

CHAPTER III.

PULPLESS TEETH—PREPARATION OF ROOT-CANALS—THEIR TREATMENT, DISINFECTION, AND FILLING.

THE treatment of pulpless teeth or roots consists in as thorough a performance as possible of the following operations:

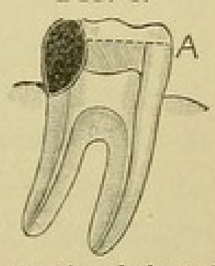
First. Removal of the contents of the canals.

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

Third. Closure of the apical foramen.

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. (See Plate IV.)[1] 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. An opening is first made into the center of the pulp-chamber in a line with the root-canals sufficient 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

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.

[1] 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.

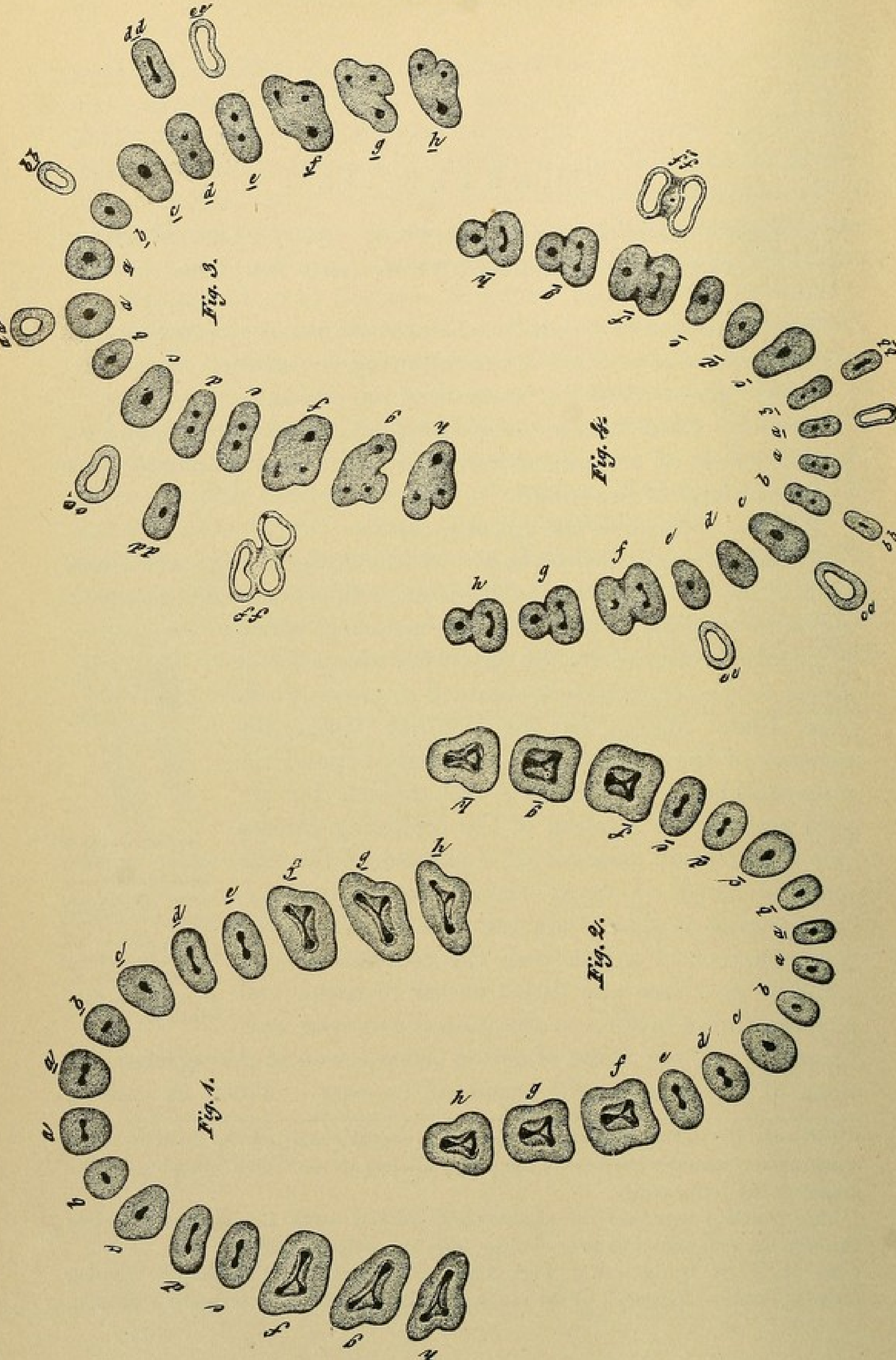
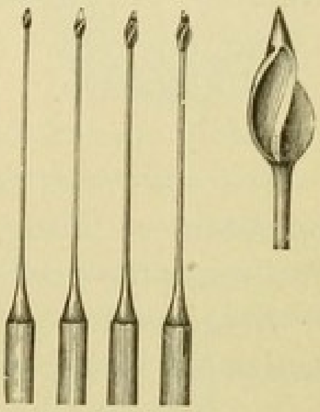


Fig. 1.
Fig. 2.
Fig. 3.
Fig. 4.

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, as they will move forward of themselves. Under pressure the formation of a false passage in a curved root is possible, or the 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 when 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 canal. They should be gently given a slight forward and 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 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. Donaldson pulp-canal instruments are also useful in the upper portion of canals or in those of very small caliber. A fifty per cent. aqueous solution of sulfuric acid

FIG. 5.



pumped into the orifices of root-canals with cotton wound on a 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 the introduction of a Donaldson barbed broach, 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.

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 a healthy or non-putrescent pulp has 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.

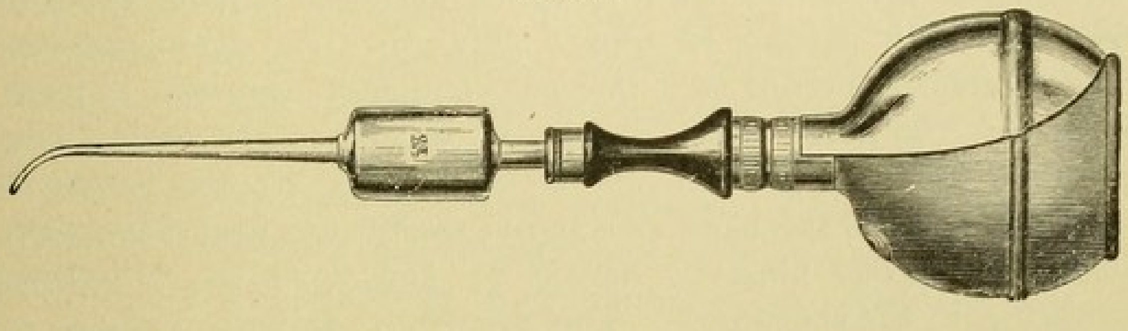
3. Where the pulp is found diseased or in a putrescent condition.

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 maintenance, 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, peroxid of hydrogen 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

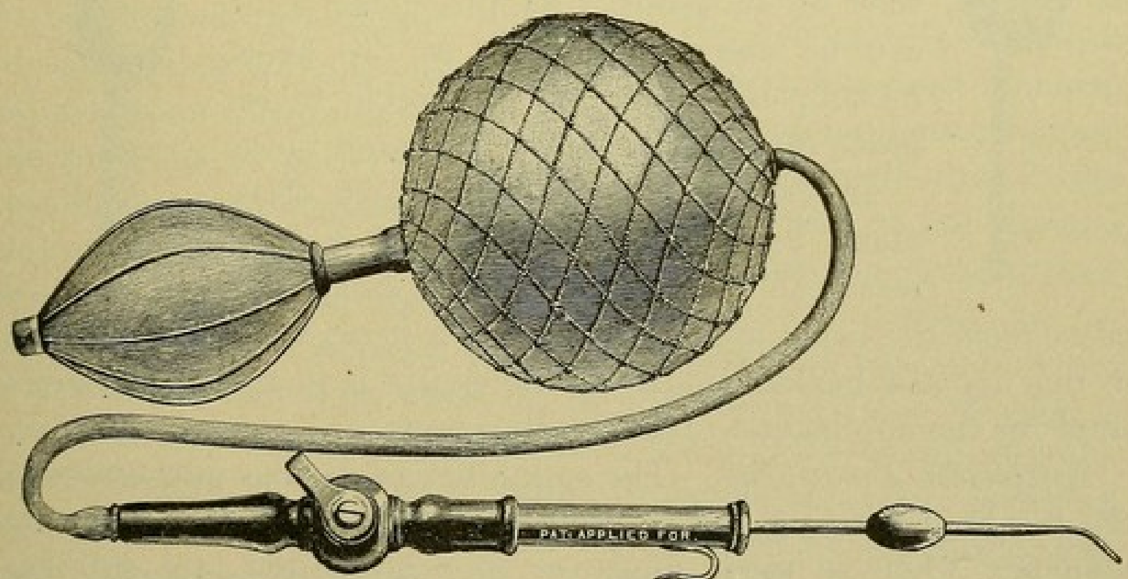
Fig. 6.



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 peroxid of hydrogen, and wiped out with absorbent cotton. The use of sodium peroxid is

Fig. 7.



recommended by Dr. Kirk at this stage to open up the ends of the tubuli. The next point in the conduct of the operation is to secure as thorough a state of dryness in the pulp-chamber by an ordinary (Fig. 6) or an A. S. Richmond (Fig. 7) hot-air syringe, at a temperature higher—as it leaves the nozzle—than is comfortable for the finger. A root-canal dryer, 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 escape of any gases present in the root-canals and the open ends of the tubuli. The point of the root-canal dryer 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 or rendered inert.

FIG. 8.

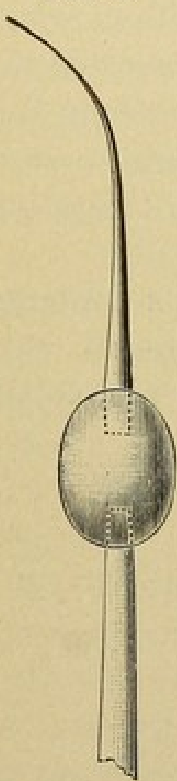
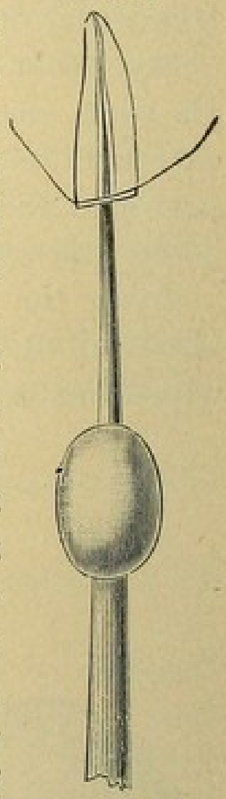


FIG. 9.



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.

Antiseptic Treatment.—The suitability of various antiseptics to the needs in treating tooth-structure, their effectiveness and permanency when so used, singly or in combination, are subjects on which great diversity of opinion exists, and which have of late been made the object of clinical study and scientific investigation and discussion. Many antiseptics in common use being coagulants of albumen obstruct the dentinal tubuli, and consequently limit or retard diffusibility throughout the dentin. This is the objection to the use of carbolic acid, creasote, and like agents, additionally to which may be named their inefficiency to accomplish in certain conditions the end sought, and as well their eventual absorption from the dentin. Recent investigations seem to give preference to such antiseptics as are non-coagulative in their action. Of this character are the essential oils, many of which according to Miller, Harlan, and others, possess antiseptic power much greater than has been commonly attributed to them. Acidulated solutions of bichlorid of mercury, peroxid of hydrogen, sodium peroxid, especially in preliminary treatment, and various preparations of iodin, which exert chemical action and retain their antiseptic properties for a great length of time.

The selection of antiseptic agents is important, and is indicated by the conditions presented in a pulpless tooth. Cases in which a healthy pulp has just been extracted, or the canal is aseptic, are different from those with sepsis of dentin or diseased or putrescent pulps. In the first-mentioned condition, with or without antiseptic treatment, favorable results usually follow root-filling, the advantage of a reliable antiseptic agent in the canal being only to better insure the continuance of a state of asepsis. In the second condition the state of the dentin, and consequently the treatment to be effected, are entirely different. We need the intervention of agents that will not only destroy ptomaines, but 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 pressure and expansion 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, in such a condition exert no chemical action on these gases, merely disguising their odor, though by repeated dressings of cotton saturated with one of these agents the gases are absorbed by the cotton, and to an extent slowly eliminated. What is required is the action of agents 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, the use of iodin is indicated and preference is given to its use in practice to that of 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 he favors the oils of cloves, cassia, and eucalyptus, considering the oil of cloves more sedative in action than the others. He makes it a point to flood the canal with the solution, thereby to some extent saturating the heated dried dentin as well as the cementum at the apex. A more effective saturation can be accomplished by again drying and heating the dentin and applying the solution, or by filling the canal with cotton saturated with the solution, hermetically inclosing it and letting it so remain for a day or two.

Coagulants, such as creasote or carbolic acid, are not entirely non-diffusible in devitalized dentin or cementum, as decomposition or putrefaction effects elementary changes in the contents of the tubuli, but their action is slow and limited compared with that of the essential oils. They have also the objectionable feature of being irritants, and unsuitable where acute or chronic inflammation of the peridental membranes is present. When a healthy pulp has just been extirpated, and immediate root-filling is practiced, the use of carbolic acid, creasote, or solution of chlorid of zinc is best indicated, the condition then presented being entirely different from that where the pulp is diseased or putrescent, or the canal is in a septic state. When a healthy pulp has been removed, its 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, such as carbolic acid, is in fact then indicated, 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 mentioned as they are not miscible in water, and are easily eliminated. Their use consequently will better tend to perpetuate an antiseptic condition.

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 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 applying the alcohol on the dressing, instead of the agents previously employed.

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 to prevent the entrance of the fluids through the foramen, and to avert, in case of the formation of gases, irritation of the peridental membranes by their pressure or presence. Gutta-percha and oxychlorid of zinc are generally accepted as most suitable for the purpose. Either gutta-percha in the form of chloro-gutta-percha, or the oxychlorid of zinc 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 oxychlorid of zinc 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. Wood and metal shaped to fit the canal are also much used to fill root-canals, but unless a small quantity of chloro-gutta-percha or oxychlorid of zinc is placed in the extremity or on the point used, the entire 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 oxychlorid of zinc previous to insertion. Asbestos is given preference to cotton by some. Tin or gold foil is difficult to insert without vacuoles. Paraffin in combination 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; sodium peroxid 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 dryer can be flowed into the ends of the tubuli or into a minute canal not considered safe to open up. Balsamo del Deserto can be used in the same manner. Dr. Delos Palmer's method of using this preparation is to carry a small quantity into the cavity upon the point and sides of a broach connected with a small metallic bulb, which can be heated by electricity at the will of the operator to melt the Balsamo, and thus secure its proper diffusion.

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 gauged

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[1] Cotton or wood points may be sterilized by immersing them for a time in a solution of bichlorid of mercury or a saturated solution of iodoform in ether, and then drying. The prepared points should be kept in a tightly-corked bottle. When this plan is followed, the odor of iodoform is avoided in the operating-room.

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, is recommended in the final treatment when chloro-gutta-percha is not used, as better adhesion of the gutta-percha to the walls of the canal is thus obtained.

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.

A pulpless tooth presented for crowning, the roots of which have been treated and filled in some previous operation, should be carefully examined, and 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.

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.

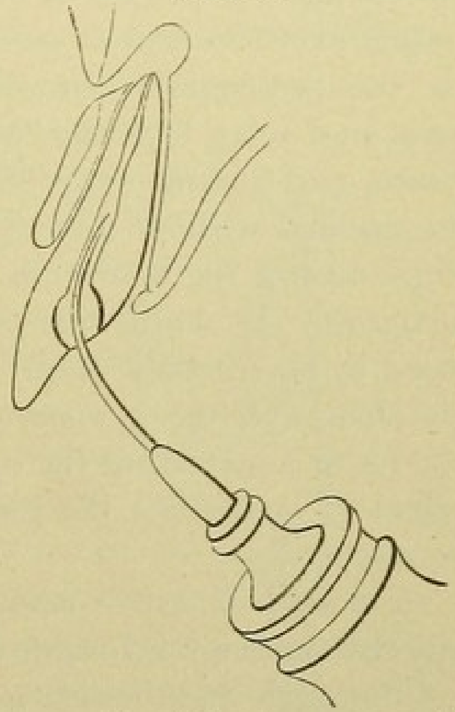
The cause of chronic alveolar abscess will be found in a continuation of those conditions which originally produced the acute form. The tooth or root being pulpless, septic gases, generated by the decomposition of organic matter in the root-canal and in the tubuli of the dentin, find an outlet through 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.

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 fifty per cent. aqueous solution of sulfuric acid pumped into the extremity of the canal with cotton on the end of a broach will often enable a broach to instantly effect a passage. Tepid water is then forced through the foramen with a fine-pointed syringe (Fig. 10) 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. Peroxid of hydrogen 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 if necessary. The abscess should then be thoroughly injected with peroxid of hydrogen, 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 is usually sufficient to cure an abscess; but when the foramen is closed and the abscess is treated through the gum, several injections are sometimes necessary.

FIG. 10.



In case of "blind abscess," the third form, first clean and disinfect the root-canal, then at intervals inject the abscess through the foramen with peroxid of hydrogen until the formation of pus ceases, placing cotton saturated with oil of cloves loosely in the canal sealed with gutta-percha. 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.

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

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

desired to make the opening, and napkins are so placed as to keep it dry. Then a plugging-instrument with fairly sharp serrations and of convenient shape is selected. The point of this is dipped into a ninety-five 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, any further treatment considered necessary being 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.

After the abscess has been cured, the root-canals are filled as described on page 27.

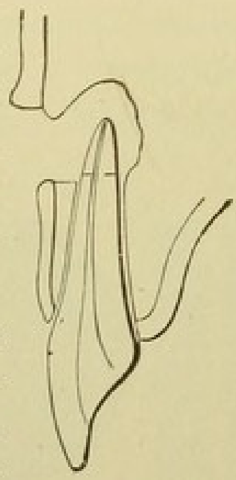
Aromatic sulfuric acid is a powerful astringent and germicide.

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 peroxid of hydrogen, sublimate solution ($\frac{1}{1000}$), 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. 11.



In such cases, 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 32, and gradually enlarged with a tent of lint or cotton until the diseased territory is fully exposed (Fig. 11), when the devitalized end of the root and any necrosed bone in the territory are removed, and the end of the root smoothed. The canal should be filled solidly with gutta-percha or oxychlorid of zinc 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.

The orifice of the cavity in the gum should be kept open and

[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.

daily injected 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.

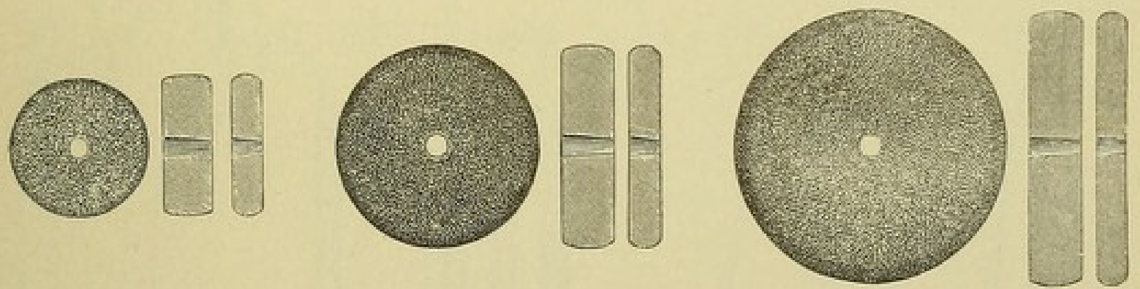
CHAPTER V.

SHAPING TEETH AND ROOTS FOR CROWN-WORK.

THE principles governing the process of shaping 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 gauged 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.

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. 12). Molars and

FIG. 12.



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 rubber and corundum disks (Fig. 13) and 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. 14) and wheels are best adapted. The corners are then rounded. The cervical portion, which includes the junction of the dentin and enamel, is trimmed so that the sides as illustrated at A, Fig. 15, are level and parallel with the line of the root, and as deep as the collar is to be placed (Fig. 16). For this work small corundum-points, trimmers, and files can be used. Fig. 17 illustrates a trimmer, made in three sizes, which in the ordinary hand-piece or in the right-angle attach-

FIG. 13.

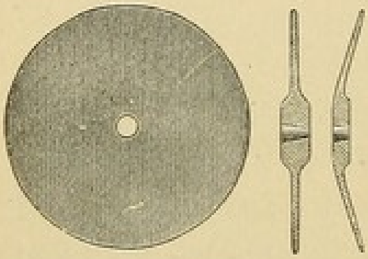
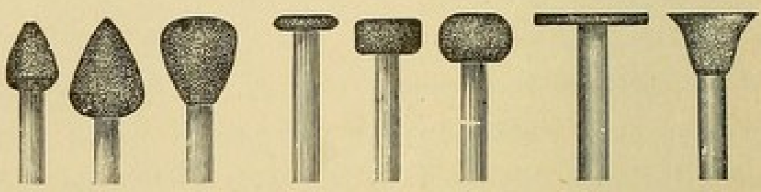


FIG. 14.



ment will easily and quickly accomplish this. Fig. 18 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 shaped as shown in Fig. 19 are useful in rounding angular portions. A smooth surface should be given the

FIG. 15.

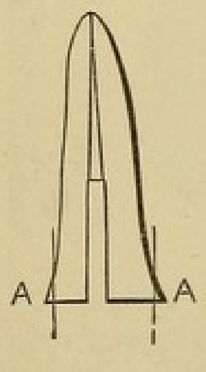


FIG. 16.

FIG. 17.

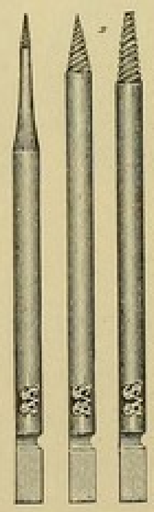


FIG. 18.

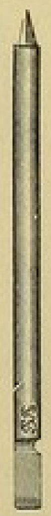
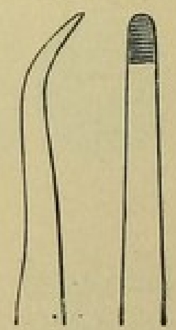


FIG. 19.



cervix. On approximal sides and the curves to the other sides, medium coarse corundum tape and wheels 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 plan 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. 20).

In preparing incisors and cuspids for gold collar crowns with porcelain fronts, where the pulp is to be preserved, the labial surface and incisive edge should be ground down as much as possible without exposing the pulp or subjecting it to irritation; the palatal portion at an angle from the cervical border to the incisive edge, enough to level its prominences of contour and form a slight space between it and the antagonizing teeth (Fig. 21). 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. 22.) Bicuspids which are to have porcelain fronts are given the same general form (Fig. 23).

Fig. 20.

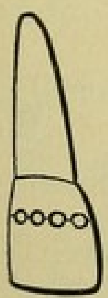


Fig. 21.

Fig. 22.

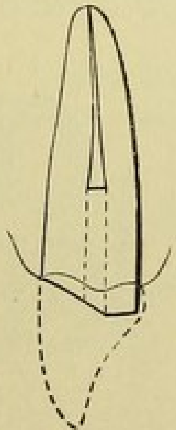


Fig. 23.

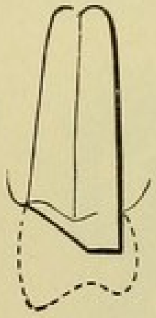


Fig. 24.

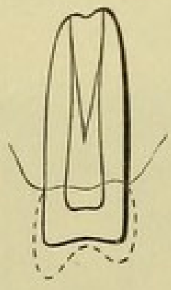
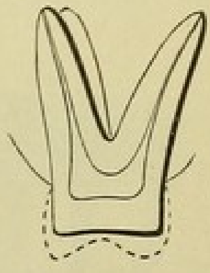


Fig. 25.



Bicuspids and molars with or without pulps, for all-gold crowns, should have as much of the natural crown left as possible, as it affords a more secure and more convenient attachment for the artificial crown than any other method (Figs. 24 and 25).

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 readily caused in excessive shaping, is relieved by drying the exposed dentin with hot air and applying carbolic acid two or three times as required.

For the porcelain system, roots are usually ground level with the margin of the gum. The palatal portion in some cases is left a trifle above the margin, and the labial aspect should be 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 pin to fit it tightly. (See the articles on Gates-Bonwill and Logan crowns.)

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, protrudes beyond the proper line of occlusion. When the approximal teeth crowd against and overhang the cervix of a root, so that the space for the artificial crown at the occluding surface is less than at the prepared cervix,—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, or a small portion of their interfering surfaces removed. (See Figs. 26 and 27.)

Fig. 26.

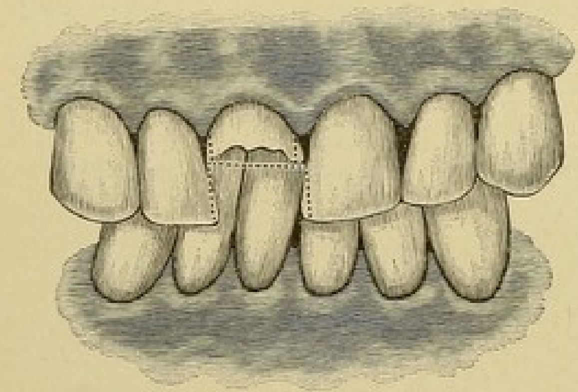
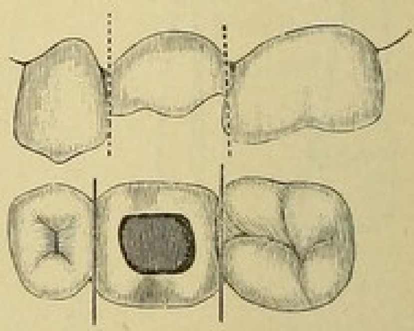


Fig. 27.



Corundum or composition wheels or points should be kept wet and cool during all such operations in the mouth. A piece of sponge, held against the wheel with clamping pliers, 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 or band, 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. When necessary to secure attachment for the gutta-percha, a plug of wood should 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 of the tooth (Fig. 28). In incisors and cuspids, when decay has 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, can be inserted up the root-canal and the upper end cemented in with oxyphosphate or oxychlorid, and the lower with the amalgam forming the filling on the side of the root. In such a case, the pin should be tapered at the end, and inserted in the canal as deeply as possible beyond

Fig. 28.

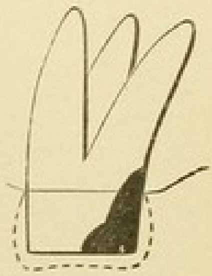


Fig. 29.

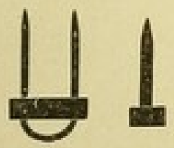


Fig. 30.

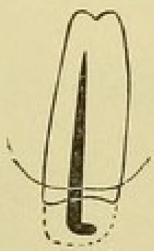


Fig. 31.

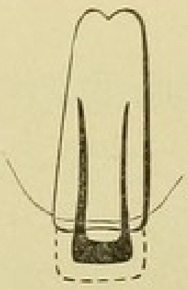


Fig. 32.

the end of the tube, to gain additional strength by distributing the leverage along the whole line of the root.

In setting a gold cap-crown on a badly broken-down tooth or root, a post of silver or iridio-platinum wire should be fitted to the root-canals (Figs. 29, 30, 31, and 32). The end can be bent or a piece of silver soldered to it. The post should then be barbed and the point first fastened in the root with a little oxyphosphate or oxychlorid of zinc, and the crown built down about two-thirds its length with a quick-setting amalgam, to be shaped when hard and then roughened to furnish a better attachment for the cement with which the crown is set. Screws may be used as posts to support the amalgam. In such cases it is presumed that the gold cap will entirely cover the amalgam.

PART II.

ARTIFICIAL CROWN-WORK.

ARTIFICIAL CROWN-WORK.

Artificial crown-work affords extensive facilities for restoring the crowns of natural teeth, and furnishes means of support for bridge-work.

Two general systems are presented,—the porcelain and the gold. The porcelain system will include ready-made porcelain crowns, applied with or without collars, and the gold system gold crowns with porcelain fronts, all-gold crowns, and special operations in crown-work.

THE PORCELAIN SYSTEM.

CHAPTER I.

PORCELAIN CROWNS.

Porcelain crown-work is practiced 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 intricate character of the construction of gold crowns, and objections to crowns with bands or collars.

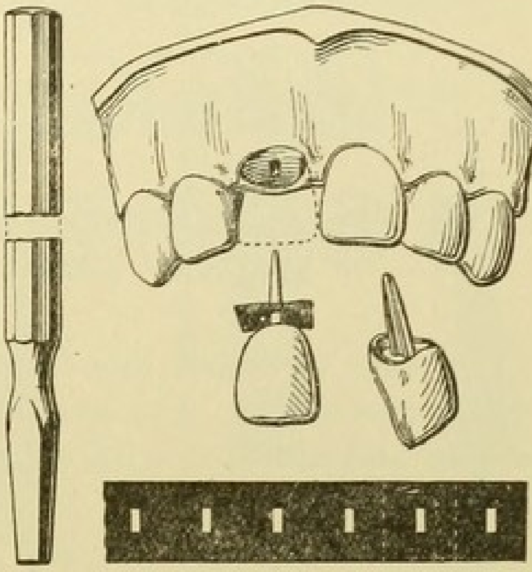
The advocates of the porcelain system claim for it natural appearance, restoration of contour, strength, and cleanliness, together with simplicity of construction and easy adaptation and attachment to the root, to which the crown is hermetically sealed.

Porcelain crowns are made in two general styles. In one 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 are the Gates-Bonwill, Foster, and Howland-Perry crowns. In the other style, one end of the pivot, or post, 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 crown is of this class.

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

The preparatory treatment of the roots respecting the process of grinding, trimming, and shaping is nearly the same for all porcelain crowns. 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-paper over the post or pin which is to retain the crown, and placing the crown in position on the root. (See Fig. 33.) Cut the paper in a strip, and, to admit the post, form holes with a punch as shown on margin of Fig. 33. 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. Crowns in which the post is cemented will first be described.

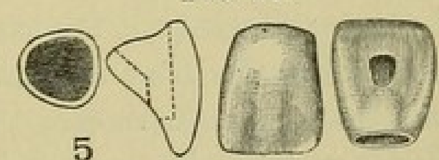
FIG. 33.



THE GATES-BONWILL CROWN.[1]

The Gates-Bonwill crown is made entirely of porcelain. It is molded with a concave base and with a triangular perforation for the reception of the post. The perforation passes from the bottom of the base to the center of the palatal or lingual surface in incisors and cuspids (Fig. 34), and to the center of the grinding-surface in bicuspids (Figs. 35 and 36). The molars have two perforations, placed in the uppers across the line

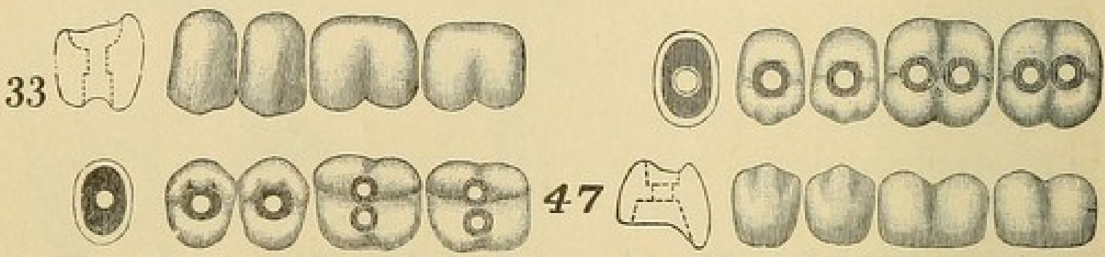
FIG. 34.



[1] Owing to their great similarity, the two crowns formerly known as the Bonwill and the Gates, from their respective inventors, have been merged in one, to which the name Gates-Bonwill has been applied.

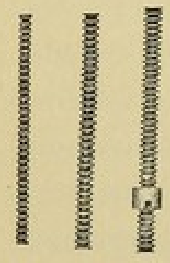
of the arch (Fig. 35), and in the lowers in that line (Fig. 36). The openings of the perforations upon the exposed surfaces are very slightly countersunk.

Fig. 35. Fig. 36.



The posts to secure this crown are first cemented or screwed into the root-canal. The crown is then fitted over the free end of the post and attached with cement, and in some cases, additionally, a screw-nut on post.

Fig. 37.



The incisors and cuspids, of course, require one post; the bicuspids usually one, sometimes two; the molars two posts. The form of post, the screw, most commonly used is illustrated in Fig. 37. They are usually made of an alloy of silver and platinum; gold and iridio-platinum are also used.

The method of preparation of the end of the root and canals to receive and retain one or more posts to mount the Gates-Bonwill crown is about the same as is used for all similar styles of crown. 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. A slight concavity is also formed on the end of the root, as shown in Fig. 40. The length of the root-canal is measured with a root-canal plugger and its flexible gauge. 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 gauge-plate, determine the size of the post, and with smaller-sized fissure-burs gradually ream the canal to a dimension which the post will fit tightly. The screw-post is then cemented in position with oxyphosphate or oxychlorid of zinc.

When the post is to be screwed in the canal, instead of being cemented, the How screw-posts and appliances, illustrated in Figs. 38 to 43, had best be used as here described.

Fig. 38.

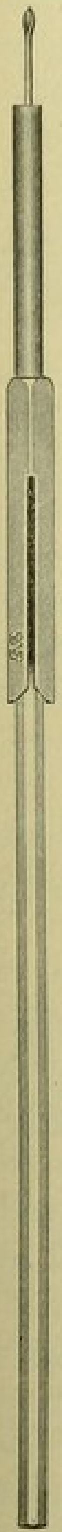


Fig. 39.

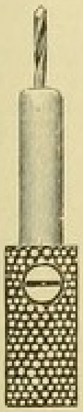


Fig. 40.

Fig. 41.

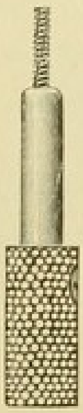


Fig. 42.

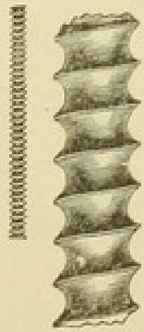
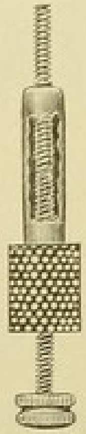


Fig. 43.



"1. Set gauge on a Gates drill (Fig. 38) to one-half the gauged depth of the canal, and drill to that depth.

"2. Set the twist-drill in its chuck (Fig. 39) to project the same length as the Gates drill, and drill the root to exactly that depth.

"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. 40, using square-end fissure-bur No. 59, and then with oval, No. 94, undercut a groove lingually and at the sides.

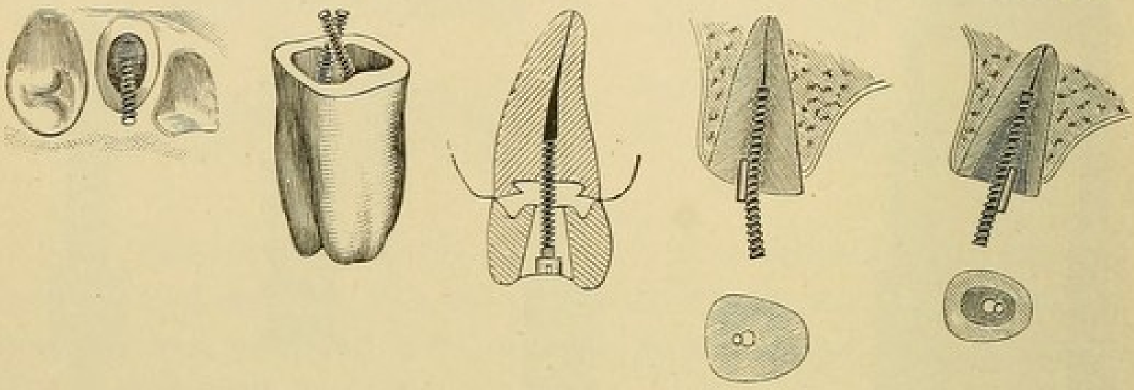
"4. Set the tap in its chuck (Fig. 41) a trifle less in length than the drill, oil it, and carefully tap the root to the gauged depth.

"5. Insert the post (Fig. 42) in its chuck (Fig. 43) to the exact gauge of the tap, and turn the thumb-screw down hard on the end of the post, then screw the post into the root, 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 and crowns is illustrated in Figs. 44, 45, and 46.

In single-rooted teeth, when desirous of locking the post in the root to prevent turning of either post or crown, Dr. How suggests to take a No. 2 round bur and drill less than an eighth of an inch into the root close to and cutting slightly into the post, and insert a quarter of an inch length of wire as shown in Fig. 47.

FIG. 44. FIG. 45. FIG. 46. FIG. 47. FIG. 48.



If a root is much wasted, leaving thin walls, the preceding gauging and locking process will result in the secure and safe setting of a screw-post to be packed around with amalgam, as shown in Fig. 48, and on this connection a suitable crown can be securely mounted.

When grinding the selected porcelain crown to position on the root, the end of the post should be bent or trimmed so as to allow the crown to assume any desired position. (Fig. 47.)

Attachment of Crown to Root.—Amalgam, oxyphosphate, or gutta-percha is used for the purpose.

To attach with amalgam, place the amalgam high enough up on the root and post to fill the base of the crown.

The crown should be tried on, and forced home with the aid of an adjuster, removing the surplus amalgam if too much, or adding to if not enough. Remove and dry the crown, and fill up simply the undercut cavity in the palatal face if an incisor, or the depressions in the crowns of bicuspids or molars, allowing a very little to extend into the cervical base, and force the crown home with the adjuster. It requires considerable force to set one of these crowns,—a force which cannot be applied with a mallet without danger of loosening or displacing the crown. Steady pressure with slight rotation will carry the crown into place. if the amalgam is not too hard or there is not too much of it. Next hold the crown with the fingers and through the hole in the crown pack amalgam mixed stiff around the pin, assisted by cotton or bibulous paper to remove the surplus mercury. If a nut is used on the end of the post, remove enough amalgam to make room for the nut, screw the nut to position and cover with amalgam. A quick-setting amalgam should be used.

Oxyphosphate cement is preferred at present to attach all crowns of this style. The posts are carefully dried, the cement mixed to the consistence of a thick cream, the crown adjusted on the root, and the nut placed on the post and screwed to position in the crown.

When a nut is not used on the post, the crown must be held in position until the cement sets sufficiently hard to prevent displacement.

Gutta-percha, when used, is heated together with the crown, and applied the same as oxyphosphate.

When the cement is set, any space around or above the nut on the post should be filled with either amalgam or gold to the surface of the crown.

THE FOSTER CROWN.

The Foster crown (Fig. 49), which in general form is similar to a crown introduced by Dr. H. Lawrence, of Philadelphia, in

FIG. 49.

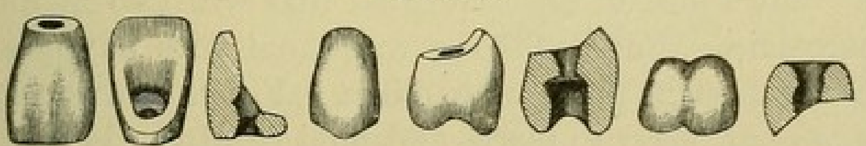
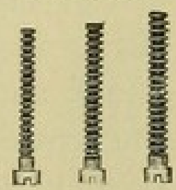


FIG. 50.



1849, also resembles the Gates-Bonwill, but has less concavity at the base. The crown is attached to the root by a headed screw (Fig. 50) or a screw with a nut.

The How screws and instruments (Fig. 51) are best adapted for use with these crowns.

THE HOWLAND-PERRY CROWN.

This crown, which is similar in principle to one originally introduced by Dr. C. H. Mack, was devised by Dr. S. F. Howland

and improved by Dr. S. G. Perry. It is attached like the Gates-Bonwill crown, with posts which are first cemented in the root and then in the crown. The base is given a curve approximating that of the line of the margin of the gum, with the labial portion projecting slightly above it, to include a little of the cervix. The cavity in the porcelain is given a size, form, and position which will receive the posts extending from the root without impairing the strength of the crown-walls. Thus they are made round in the incisors and cuspids (A, Fig. 52), and oval in the bicuspids (A, Fig. 53).

FIG. 51.

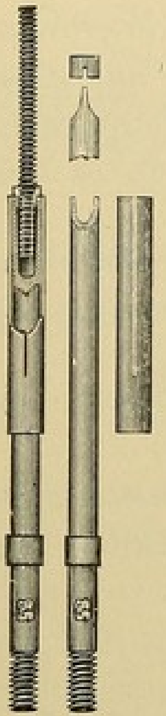


FIG. 52.

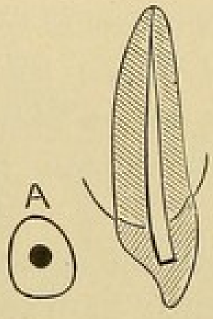


FIG. 53.

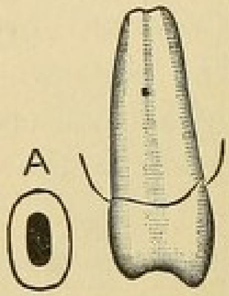
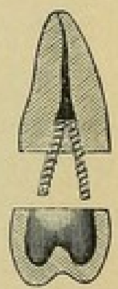


FIG. 54.



The method of setting this crown is to first shape the end of the root approximately to correspond to the base of the porcelain crown, and then accurately fit the porcelain crown to the end of the root. Fit a post to the root-canal that will also fit the cavity in the porcelain. Partly fill the root-canal with oxyphosphate, and press the post in place with pliers. Fill the cavity in the crown with cement, press to place, and hold carefully in position until the cement sets (Fig. 54). Some prefer to cement the post first and the crown afterward.

THE LOGAN CROWN.

In the Logan crown the platinum post or pin is baked in the body of the porcelain. The base of the crown is made concave, to facilitate its adjustment to the end of the root, and to give the cement a more reliable form.

The preparation of a root for a Logan crown is, in general, similar to that for the Gates-Bonwill crown. The root-canal is enlarged, and shaped so that the post, if possible, at least at its point, will fit tightly. Gutta-percha or oxyphosphate is used for cementing in preference to amalgam.

The Logan crown, now so extensively used, is the invention of Dr. M. L. Logan. The method of mounting is explained in all its details in the following article by Dr. W. S. How:

Fig. 55.


Fig. 56.

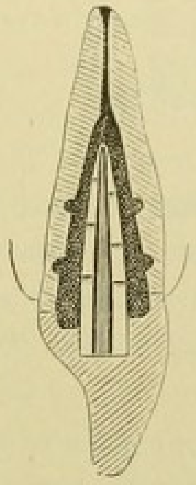
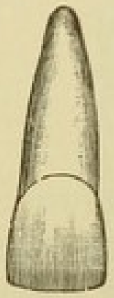

Fig. 57.


Fig. 58.


"Fig. 55 shows a superior right central root, an end appearance of the same, and a Logan crown, front view. Fig. 56 exhibits, at a right angle to the plane of the first figure, the same

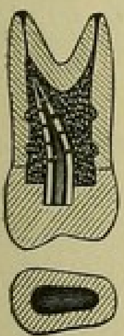
Fig. 59.


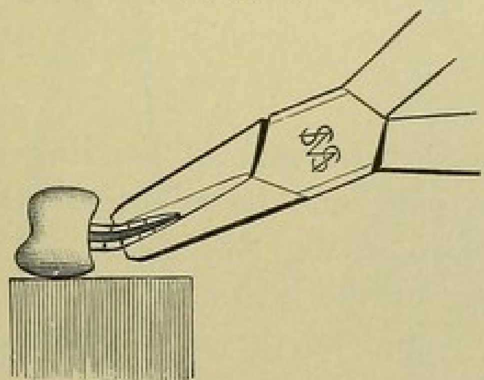
Fig. 60.


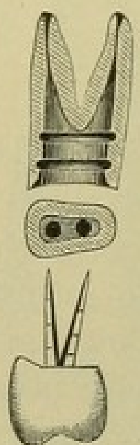
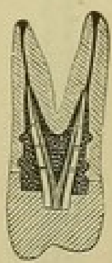
Fig. 61.


Fig. 62.


root, its end, and the Logan crown, side view. In both figures the root-canal is supposed to have been first drilled to a gauged depth with an engine twist-drill, No. 154, and then enlarged by means of a fissure-bur, No. 70, to the tapering form shown; the walls being subsequently grooved with an oval bur, No. 90. The enlarged section, Fig. 57, shows the crown adjusted on the root by means of cement or gutta-percha, which surrounds the post and fills all the spaces in the root and crown. Fig. 58 shows the

FIG. 63.

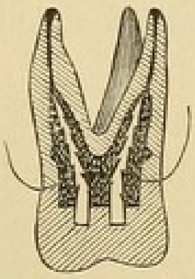


FIG. 64.

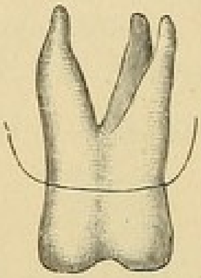


FIG. 65.

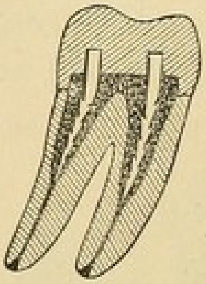
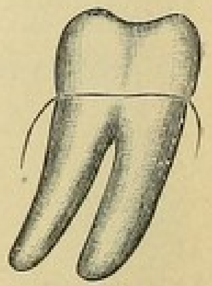


FIG. 66.



completed crown. Fig. 59 exhibits a bifurcated bicuspid root, its end appearance, and a Logan crown adjusted to the root. Fig.

FIG. 67.

FIG. 68.

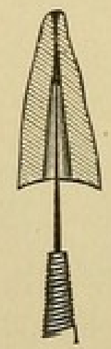


FIG. 69.

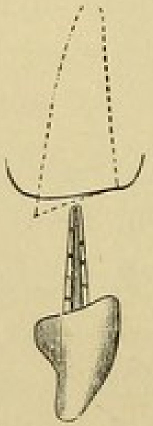


FIG. 70.

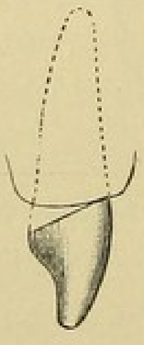


FIG. 71.

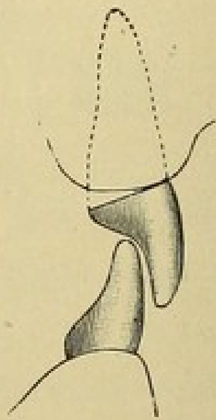
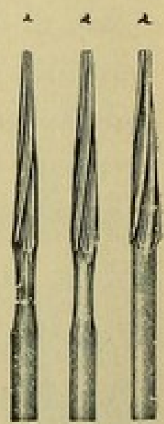


FIG. 72.



60 illustrates the best manner of bending the post. Fig. 61 shows a split post, and its adaptation to a bifurcated bicuspid root is seen in Fig. 62. Figs. 63 and 64 exhibit the mode of mounting the Logan crown on a superior molar root, and Figs. 65 and 66 the same crown in its relations to an inferior molar root.

"The preceding figures clearly present to the mind's eye of the expert dentist the essential features of the Logan crown and the method of mounting it.

"The details are as follows: The root should first be measured through its canal from the cervical opening to the apical foramen. This may be accurately done with a gauge adjustable on a delicate canal-explorer (Fig. 67). The same device serves to measure the distance from the apex to which the canal should then be filled (Fig. 68). It also gauges the depth to which the drill may be carried. The proper degree of enlargement from the bottom of the drilled hole will, of course, depend on the observed size and character of the root. For preparing the roots, the Ottolengui root-reamers (Fig. 72) and facers (Fig. 73) are very desirable instruments. The reamers are made in three sizes to correspond with the Logan pins. With a root-reamer of the appropriate size, the root-canal is enlarged to fit the pin along its whole length, and so hold the crown firmly *independently* of the cement. With a root-facer a labial slope is given to the root-end, so that the crown neck shall fit under the edge of the gum. Figs. 74 to 78 show the method and its result; the cross-section shows how the cement incases the pin. The suitable preparation of the bifurcated roots

FIG. 73.

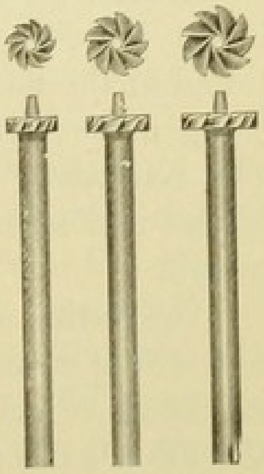


FIG. 74.

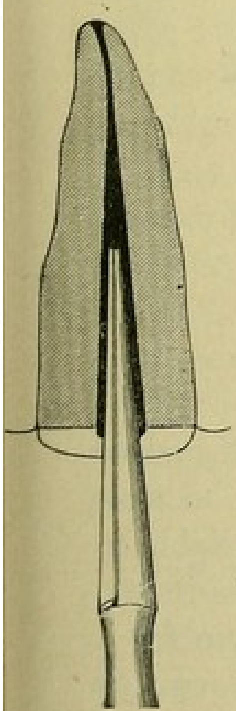


FIG. 75.

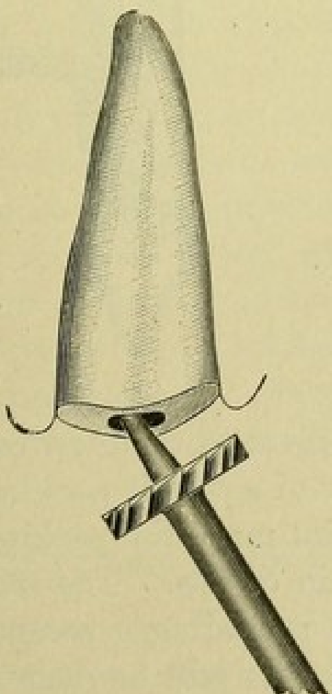


FIG. 76.

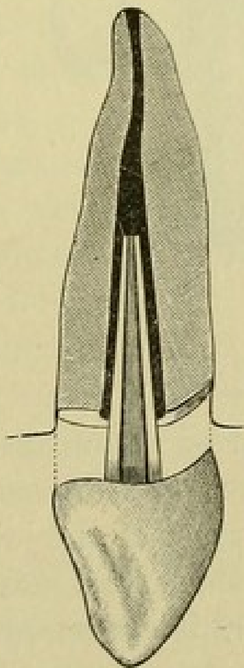


FIG. 77.

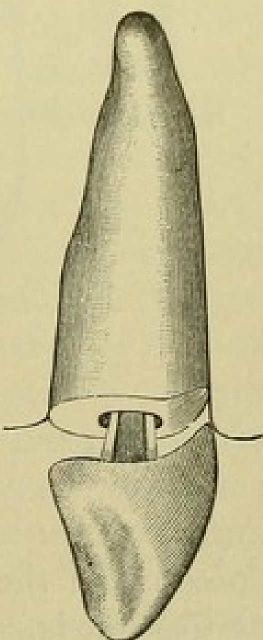
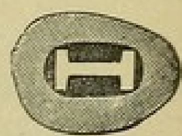


FIG. 78.



of some bicuspids and of all the molars is a matter involving difficulties of an unusual character and requiring good judgment.

The feasibility of splitting the post of a Logan crown to adapt it to the bifurcated root of a bicuspid is shown by Figs. 61 and 62. This example directs attention to the peculiar shape of the post, in which there is effected such a distribution of the metal that its greatest strength is in the line of the greatest stress that will in use be brought to bear on the crown, while the least metal is found at the point of the least strain; the applied part of the post being in outline nearly correspondent to that of the root itself. The root-canal is likewise conformably enlarged to receive the largest and stiffest post which the size and shape of the root will permit.

"The fitting of a Logan crown to a root may be done with a wet stump-wheel in the engine hand-piece. A safe-side crown corundum-wheel (Fig. 79) can be used in the same manner. It also affords the greatest facility for the slight touches required to abrade the thin cervical borders of the crown, which may by this means be done without encroachment on the post.

Fig. 79.

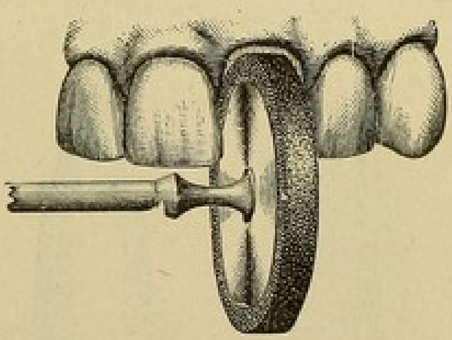
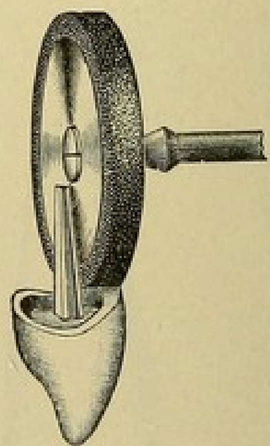


Fig. 80.



"By the old method of adapting pivot-teeth to roots, the close fitting of the crown precluded the use of a plastic packing, because its thinness over the surface of the joint made the packing liable to break loose under the shock and strain of use. The recess in the Logan crown obviates this defect by providing a receptacle for a considerable interior body of cement that will be deep enough to be self-sustaining internally, and yet allow the peripheral portions of the root and crown to approach each other so closely that, though only a film of packing remain, it will still be strong enough to insure the persistent tightness of the joint. This annular boss, if formed of amalgam, also adds strength in some cases to the mount.

"When enough of the natural crown remains, it is well to leave standing some of the palatal portion, and cut the root under the gum-margin at only the labial part, as shown by Fig. 69. The safe-side crown wheel is especially useful in such cases (Fig. 80). Thus the labial joining of the root and crown will be concealed, and the other parts of the joint will be accessible for finishing and keeping clean (Fig. 70). The Logan crown may be ground until a large part shall have been removed for adaptation to the occluding tooth or teeth without seriously impairing its strength (Fig. 71). This crown also in such cases maintains the translucency which is one of its peculiar excellences, owing to its solid porcelain body, and the absence of a metallic backing or an interior largely filled with cement or amalgam.

"The distal buccal root of the natural superior molar is nearly always too small to receive a post of any useful diameter, and therefore the Logan superior molar crown has but two posts, which like those of the inferior molar crown are square, and thus may be easily barbed, as may also the ribbed posts of the crowns for the anterior tooth-roots. These posts are large enough in all the Logan crowns to answer in any given case, and can of course be easily reduced to suit thin or short roots.

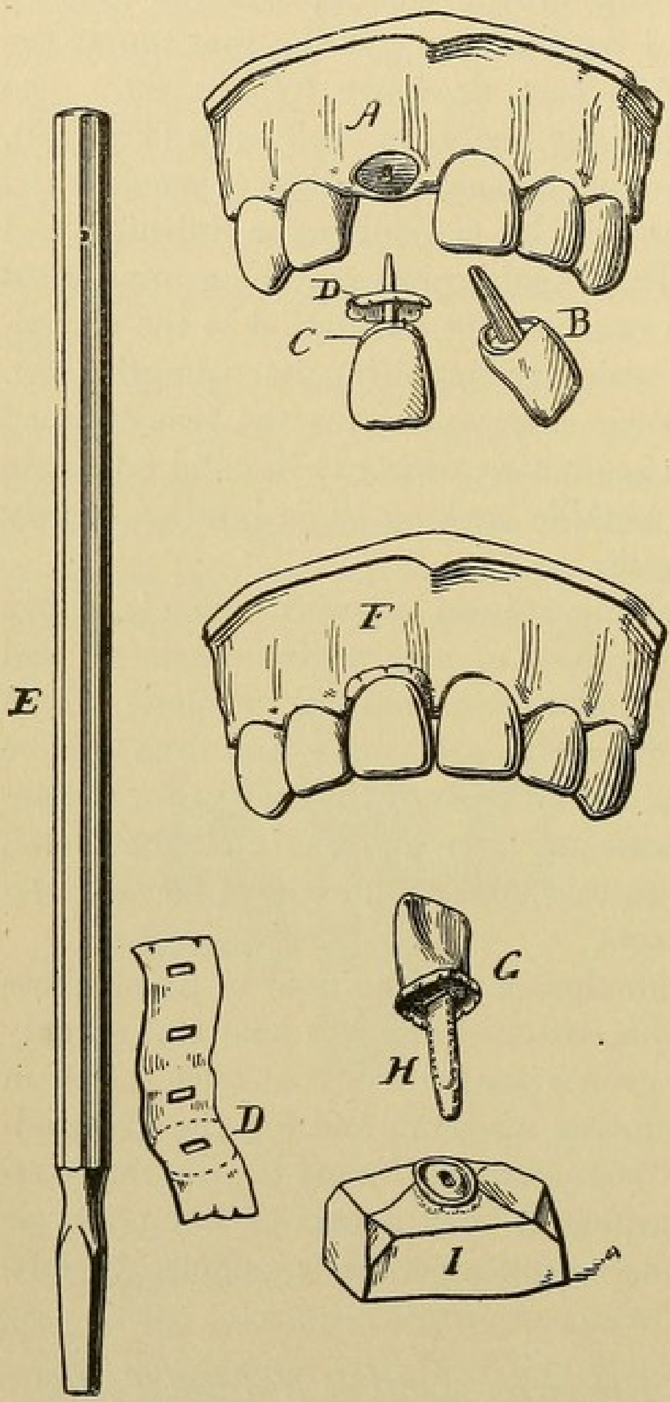
"Any of the cements or amalgams may be used in fixing these crowns, but good gutta-percha, softened at a low heat and quickly wrapped around the heated crown-post, which is at once seated in the root, forms the best mounting medium, and has the great advantage of permitting a readjustment, or, if need be, the ready removal of the crown by grasping it with a pair of hot pliers or forceps, and holding it until the gutta-percha is sufficiently softened."

Method of Fitting Logan Crown by Model of Natural Tooth.

First prepare the face of the root to be crowned as desired, (A, Fig. 81), and having selected a suitable crown, B, bend the pin, if necessary, so as to make a proper alignment.

Next place a piece of paraffin 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. 81.



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 end 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.

REMARKS ON THE USE OF PORCELAIN CROWNS AND CROWNS WITHOUT COLLARS.

Porcelain 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. Then, again, if porcelain crowns are attached with amalgam, the discoloration of the line of union with the root, if subsequently exposed, is disfiguring. These facts, and the lack of strength incident to some forms of construction, are the principal objections urged against porcelain crowns as ordinarily inserted.

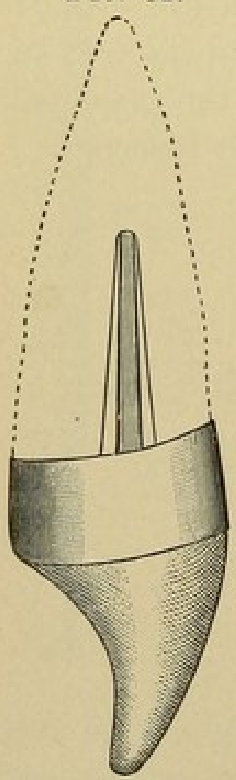
CHAPTER II.

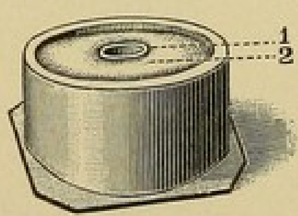
PORCELAIN CROWN WITH GOLD COLLAR ATTACHMENT.

A GOLD collar, either seamless or soldered, can be used advantageously in combination with many of the porcelain crowns.

The root having been properly prepared, a collar is adjusted and adapted to it the same as for a gold collar crown. (See page 70.) The porcelain crown, the base of which should be fully as large as the end of the root, is then ground even with the cervical walls, and fitted into the collar, which should be trimmed and burnished to the form of the crown. Dr. Townsend's fusible metal die, used in the following manner, facilitates the application of a collar to a Logan crown (Fig. 82). Enlarge the root-canal to receive the Logan pin. Grind a Logan crown to fit, and articulate it. Construct a band of No. 30 gold (or of No. 32 crown-metal) wide enough to project beyond the end of the root say $\frac{3}{32}$ of an inch. Cut a wooden peg about an inch long and taper one end of it to the general size and shape of the pin in the Logan crown. Place the band on the root, insert the peg in the canal, and fill up the band with Melotte's moldine or plaster, pressing it closely about the peg. Remove all together, and hold the die over the flame of an alcohol lamp to melt the fusible metal. When melted, place the socket side of the band or collar and wooden plug that enters the root-canal downward on the surface of the metal; cool and remove the moldine or plaster, and plug. This gives a tight grasp on the lower end of the band and does not allow it to change shape. While fitting the crown into it, place the crown in the band, allowing the pin to

FIG. 82.





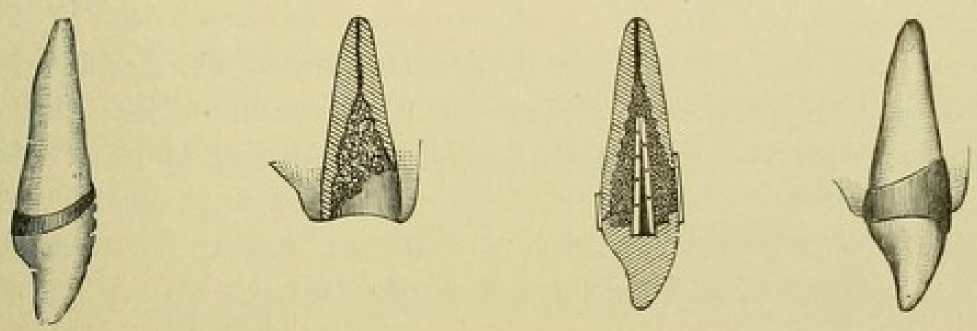
1. Socket. 2. Fusible Metal.

enter the socket. Drive down with a mallet till the porcelain comes in contact with the metal. In this way you stretch the gold around the porcelain; now burnish down tightly. If this work is carefully done, the articulation should be the same as before the band was put on. Melt fusible metal to relieve the collar and crown. This method of setting a porcelain crown makes a strong operation.

Enough of the collar should be trimmed away at the labial portion to prevent too conspicuous exposure of the gold (Fig. 83).

This collar combination is available in very difficult cases, as, for instance, when a root is decayed upon one side far beneath the gum, as seen in Fig. 84.

Fig. 83. Fig. 84. Fig. 85. Fig. 86.



Such an operation, when completed, would appear in vertical section like Fig. 85, and a view in perspective would resemble Fig. 86. The collar is also very useful wherever the root and crown are not made flush and smooth at every point, as, if practicable, they should always be.

METHOD OF MOUNTING A LOGAN CROWN WITH A BAND AND CAP.

Prepare the root in the usual way for banding. (See Fig. 87, front view, and Fig. 88, side view.)

Grind the abutting surface of the crown to fit the root under the free margin of the gum, along the labial face *only*. (See Figs. 87, 88, *a* to *b*.)

Cut the crown away slightly at the lingual surface, so as to leave a space between it and the end of the root. (See Fig. 89, *c*.)

Make a band wide enough only to give a good hold on the root, but not to extend beyond the margin of the gum to fit the root, and trim off even with the end of it. (See Fig. 89, *d.*) After fitting the band properly, remove it and solder a piece of pure gold plate, say about No. 34, on the outer end. (See Fig. 89, *e.*) This can be done quickly by placing the plate in the hand and pressing the band onto it with the thumb for a fit, then soldering in the flame of a Bunsen burner. Punch a small hole through the plate to take the pin in the crown, and replace in position on the root after trimming off the exposed edges. Now take a piece of thin pure gold, say No. 34 or 36, with ears as shown in Fig. 90, *f*, punch a hole through it, slide it over the pin of the Logan crown, and burnish tightly to the base of the crown. (See Fig. 90.) Next warm the pin and place a sufficient quantity of Parr's fluxed

Fig. 87.

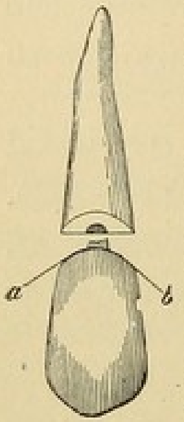


Fig. 88.

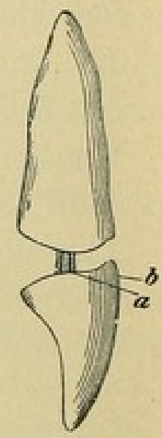


Fig. 89.

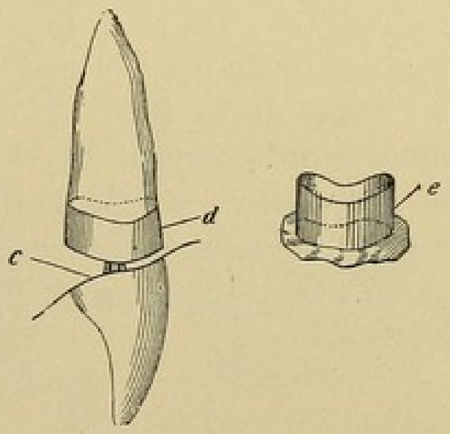
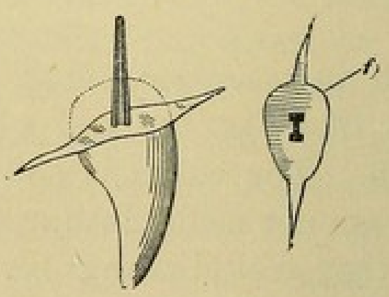


Fig. 90.



wax around it as shown by dotted lines, Fig. 90. Replace the Logan crown on the root (with the cap in position), force home until the labial edges of root and crown meet, obtain the proper alignment, and cool and harden the wax by using a napkin with ice-water. Then remove the crown and cap together, held in proper relative position by the wax. (See Fig. 91.) Trim off the surplus wax and invest. (See Fig. 92.) Remove all the wax possible between the crown and the band, and flow 20-carat gold solder into the space. The wax which will necessarily remain, being fluxed, will carry the solder into every crevice and give the crown great strength. Finish the band and the soldered edges, and the result will be a strong and perfectly aligned crown.[1]

Should an unusual alignment of the porcelain crown with the root be required and the position of the pin interfere with securing it, vary the process as follows: When the piece of thin gold has

FIG. 91.

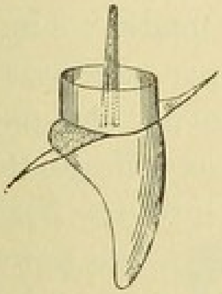
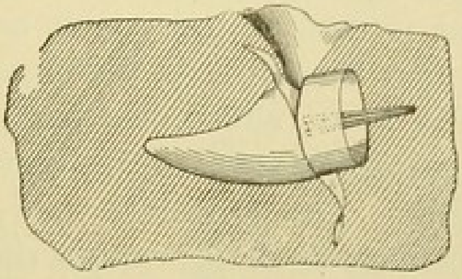


FIG. 92.



been fitted to the base of the crown as shown in Fig. 90, cut off the pin close to the surface of the gold and cement the gold to the stump of the pin with wax. Fit the cut-off pin in the root-canal and to the cap, cement pin and cap together, remove and solder. Next place a proper quantity of wax on the surface of the cap, insert in the mouth and adjust the crown with the gold on its base

FIG. 93.

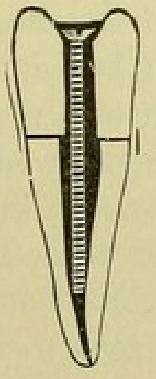


FIG. 94.

in position against the wax to the surface of the cap. Then remove cap and crown, invest, and solder the same as previously described and illustrated in Fig. 92.

Dr. E. C. Kirk, of Philadelphia, uses for bicuspids and molars a Foster crown in combination with a collar (Fig. 93). A collar

[1] A method quite similar to that just shown, but omitting the band, was described by Dr. Gordon White in the *Dental Cosmos* for January, 1893.

is made, and, on being fitted to the root, is cut narrow on the buccal side, and left wide on the palatal, so that it shall extend nearly to the cusp of the crown when finished (Fig. 94). (The seamless gold collars are well suited for this style of crown.)

The crown selected should have a somewhat greater circumference at the base than the collar, so that when ground down somewhat conically on its lingual and approximal surfaces it can be tightly adjusted to the collar. If a crown smaller than the collar is used, a tight joint cannot be made. The screw is fitted so that it shall hold the crown in proper relations with the root. The screw and crown are then removed, the parts dried, and the root-canal filled with a slow-setting oxyphosphate cement, mixed thin. The crown is then pressed into its position, the surplus cement flowing through the opening in the porcelain and filling up any interstices around or between the band, the root, and the crown. The screw is then driven into position, and when the cement is set perfectly hard the head of the screw or the nut on it is notched to form a retaining-pit, and the countersink of the crown filled with gold.

Dr. C. S. W. Baldwin caps the root and attaches a Logan crown in the following manner:

First, the root is shaped, the outer margin beveled about the thickness of the gold used, to give a proper form for close adaptation of a cap. Then an impression is taken and a die made in the gold seamless cap method (see Chapter VII). To strike up the cap, place No. 32 gauge gold plate on a cushion of lead, holding the die firmly on the gold where you wish to produce the cap, and strike until the required depth is secured before removing it. This drives the gold and die into the lead, forming a female die and a perfect-fitting cap at once, in less time than is occupied in describing the process. Trim the edges to fit the festoon of the gum, and drill a hole from the inner side for the pin, leaving the raggedness made by drilling to catch in the cement. Place the cap on the root and fit the porcelain crown accurately to it in the desired occlusion and position. A Logan crown can, with little grinding, be made to do good service (Fig. 95). A crown having the H-shaped pin, but square on the edge, like some of the early patterns of Logan or Bonwill crowns, would reduce the time of setting and give best results. Having polished the edges of the cap, the crown is adjusted as follows: Place oxyphosphate cement in the countersunk portion of the porcelain, and with the gold ferrule or cap in place, properly adjust the crown. When the oxyphosphate is hard, remove the crown and cap and solder the pin to the inside of the cap, with a very small amount of soft solder,—tin and lead,—using muriate of zinc as a flux, a few blasts of the blow-pipe being all that is required. Fill the root-canal and the inside of the cap with oxyphosphate and press the crown to place (Fig. 96).

Fig. 95.

Fig. 96.

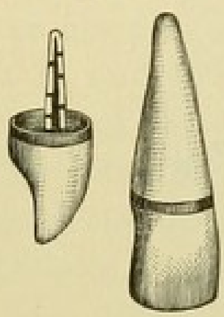


Fig. 97.

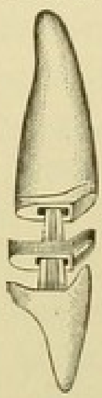


Fig. 98.

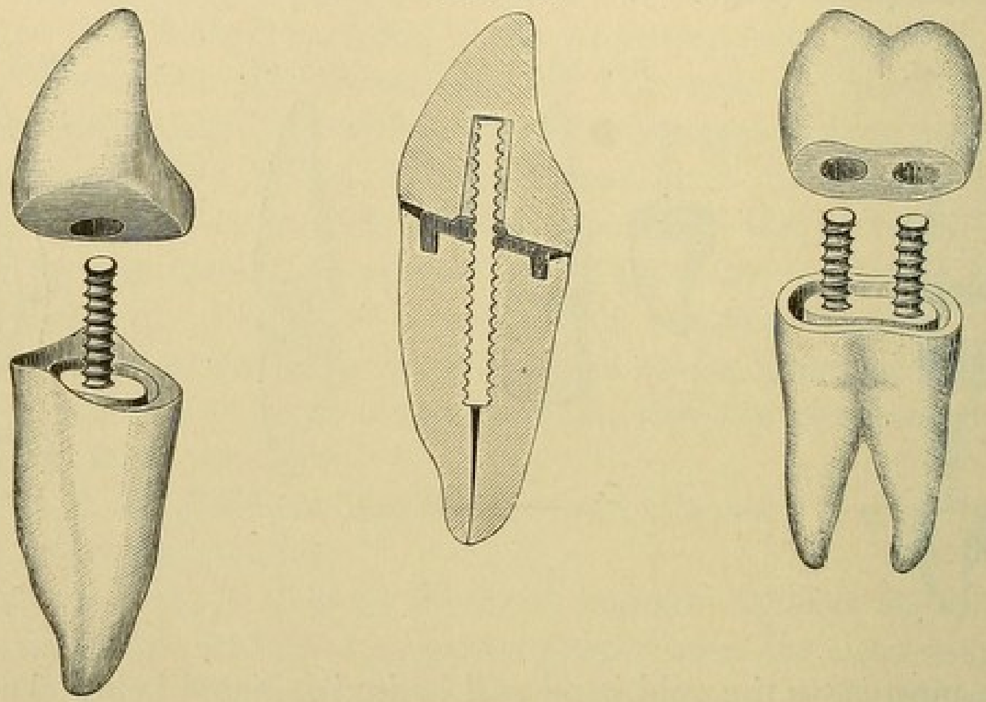
In most cases the gold band will be invisible and below the free margin of the gum. Cases may occur where the anterior teeth are prominent, and it will be necessary to cut away the top of the cap in front, allowing the porcelain to come directly in contact with the root, the band going deeper than in ordinary cases, which prevents the appearance of gold (Fig. 97).

Dr. Bonwill's plan is to cap the tooth with a platinum or gold cap having a slot, into which the pin passes as it is slipped on the root (Fig. 98). The crown is then fastened on the post and cap with amalgam.

Dr. S. S. Stowell suggests the following method of applying porcelain crowns, with or without a countersunk base in which a post can be cemented, forming what he calls the "Simplicity Crown":

The end of the root is prepared in the usual manner and slightly countersunk. The porcelain crown (an ordinary pivot, an English tube tooth, or a Howland-Perry crown) is then fitted in position, and the glazed surface of the base and cavity removed to secure better adhesion of the cement. A How screw-post, preferably of iridio-platinum, is inserted in the root in alignment with the cavity in the crown. After the screw-post is set, a groove is cut on the end of the root, around the post, with small-sized engine-burs. This groove is filled with copper amalgam, the

Fig. 99.



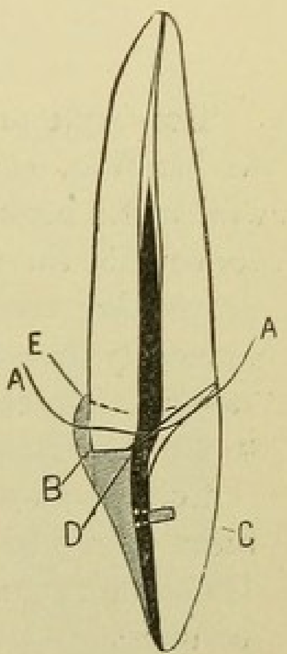
crown placed on the root, and the excess of amalgam pressed out. The crown is then removed, filled with oxyphosphate cement, and pressed back in place. The excess of cement exudes on all sides, and carries with it any excess of the amalgam. The crown is held in position until the cement sets. Fig. 99 shows an incisor and a bicuspid made by this plan, when ready for adjustment; also a sectional view of the completed incisor.

CHAPTER III.

PORCELAIN CROWNS WITH RUBBER OR VULCANITE ATTACHMENT.

FIG. 100 illustrates the formation of such a crown. The root, when prepared, extends at the palatal side a little below the line of the gum (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 is 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. 100.



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 with the post, and fit the tin to the end of the root. Fit a suitable two-pin rubber 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, in its place, melt fusible metal 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.

THE GOLD SYSTEM.

CHAPTER IV.

GOLD COLLAR CROWNS.

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, thus permanently preserving them. 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.[4] [5]

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 perfect construction and adaptation of 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.

[5] Article on Writings of M. Mouton, 1746, by Dr. William H. Trueman, *International Dental Journal*, October, 1897.

Many devices and methods in use facilitate this operation, but its skillful 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. 101.

FIG. 102.

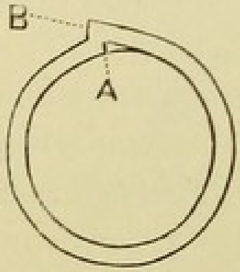
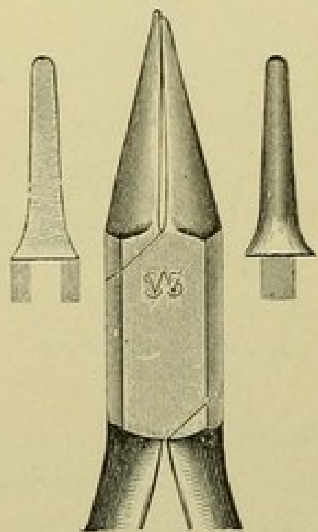


FIG. 103.



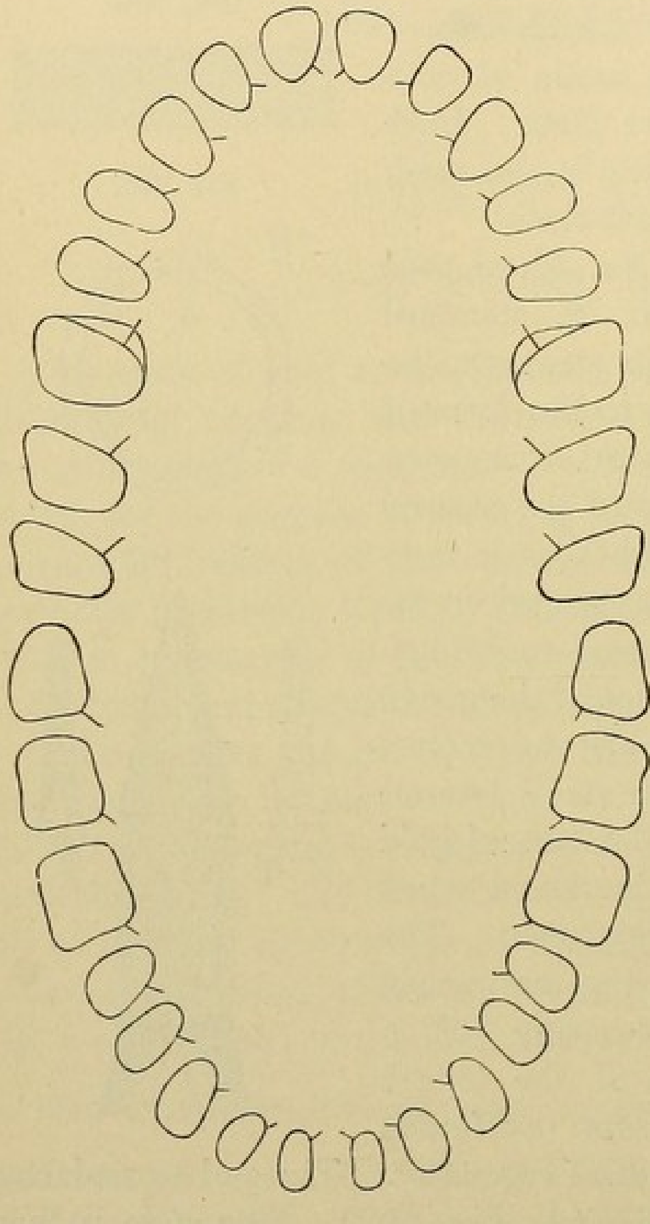
The collar is preferably made of coin gold, or 22- to 23-carat gold plate. Pure gold plate lined with platinum is also used, and platinum[1] plate in special cases.

Gold plate of No. 28 to No. 30, or gold and platinum about 30, U. S. standard gauge, 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 only effect restoration of the natural crown or to additionally give support to bridge-work, should govern the choice of the gauge of plate to be used. Cuspids and molars require a heavier plate than small laterals or lower centrals, and in all forms of gold caps the gauge should be increased when they are to support bridge-work. The natural crown or root having previously been properly prepared (see page 35), 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. 101). The end to underlap at joint is beveled with a file (A, Fig. 102). The strip is then bent with suitable pliers (Fig. 103) to the average form (Fig. 104), any special deviation from such average being noted (Fig. 105),

[1] The use of platinum plate, 32 to 34 gauge, is 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. 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.

and to the size of the cervical periphery of the root of the tooth to be crowned. 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 joint is made at this mark by placing there the least possible quantity of solder, or, better, fluxed solder filings, and holding the collar with a clamp in the flame of an alcohol lamp or a blue (Bunsen) gas flame. Another method is to grasp the seam of the collar at the cervical side with a clamp (see Fig. 150) or with common tweezers held by pliers, or, better still, by a small hand-vise (Fig. 106), and unite the extreme outer end of the seam by an atom of solder or fluxed solder filings with a blow-pipe. The points of the clamp or tweezers prevent the solder from flowing along the joint. The cervical side of the

Fig. 104.



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.

collar is thus left open, which admits of the collar being slightly contracted, if desired, and accurately burnished to the root. The solder can then be flowed across the collar and the joint closed. The collar is then slipped on the point of a small anvil, and the joint tapped and trimmed level.

A method by measurement is as follows: The root is encircled with a strip of thin sheet copper, previously annealed, one-sixteenth of an inch or less in width, and the copper fitted to the cervix. 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, being soft and flexible, can be most accurately fitted to the root without inconvenience to the patient, and when removed shows the exact length and shape to cut the gold or platinum for the collar.

Fig. 105.

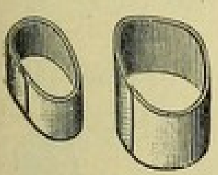
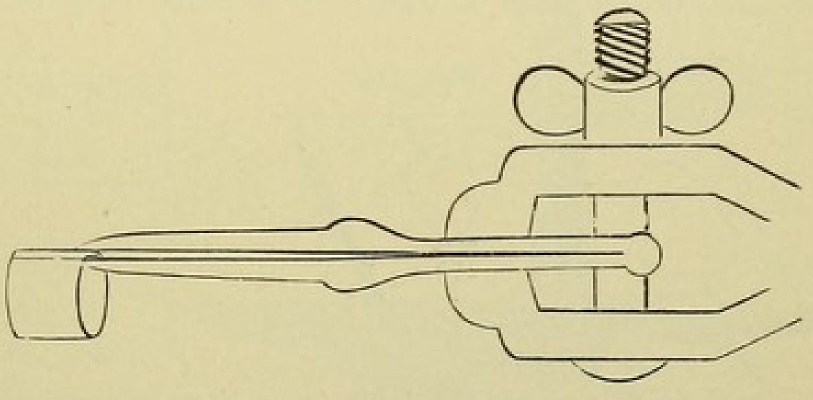


Fig. 106.



Upon a strip of the metal to form the collar, from one-quarter to one-half inch in width, is laid the copper pattern, and the exact length required for the collar is marked on the metal, which is then cut a trifle longer than the mark indicates (less than one-sixteenth of an inch), to allow for an over-lap 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 adjusted. 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 gauge, by twisting the ends together with pliers. Slip the loop over the tooth or root, press the wire down under the gum-margin, and twist the ends with the pliers until the loop fits tightly at every point (Figs. 107 and 108). Slip off the loop, cut it in the center and extend the ends lengthwise in opposite directions, as shown in Fig. 109. Then lay it on the surface of the plate of

Fig. 107.

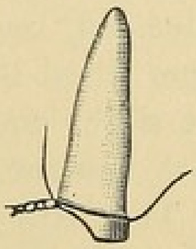


Fig. 108.

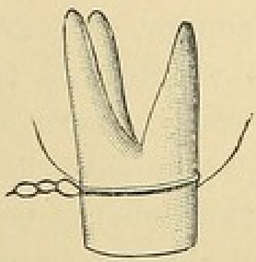
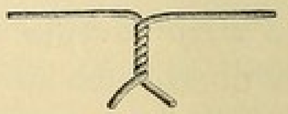


Fig. 109.



which the collar is to be constructed, and mark the length. Cut the metal beyond this mark sufficiently to allow for an over-lap; bevel and lap the ends to the mark and solder them.

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 re-

Fig. 110.

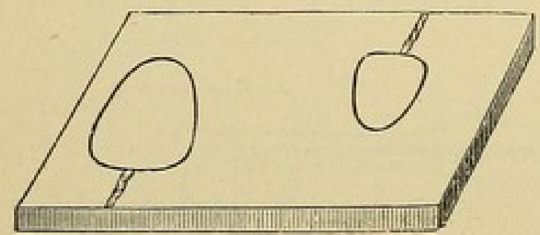
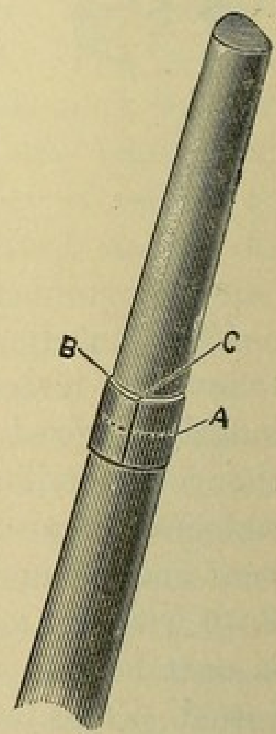


Fig. 111.



moved, 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. 110). The wire ring is removed from the tin, slipped on a mandrel[1] 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. 111). The distance from the end of the mandrel to the wire is then measured and marked on a strip of paper, and 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 por-

[1] A description of mandrels will be found in the chapter on the "Mandrel System of Bridge-Work."

tion (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. The wire method of measurement will be found preferable for roots for collar crowns with porcelain fronts.

Fitting of collar to root or tooth. When the collar has been formed, it is adjusted on the root and pressed or, by the aid of a piece of wood, one end of which is placed across the outer edges of the collar, tapped, up to the margin of the gum. A line parallel with the margin is marked with a sharp-pointed instrument on the

FIG. 112.

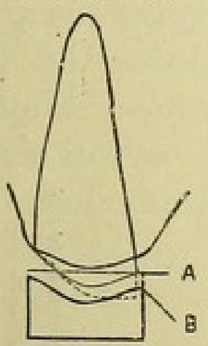


FIG. 113.

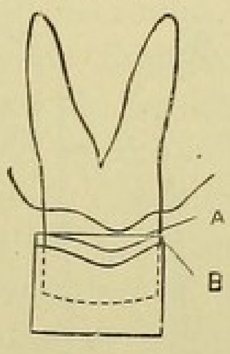
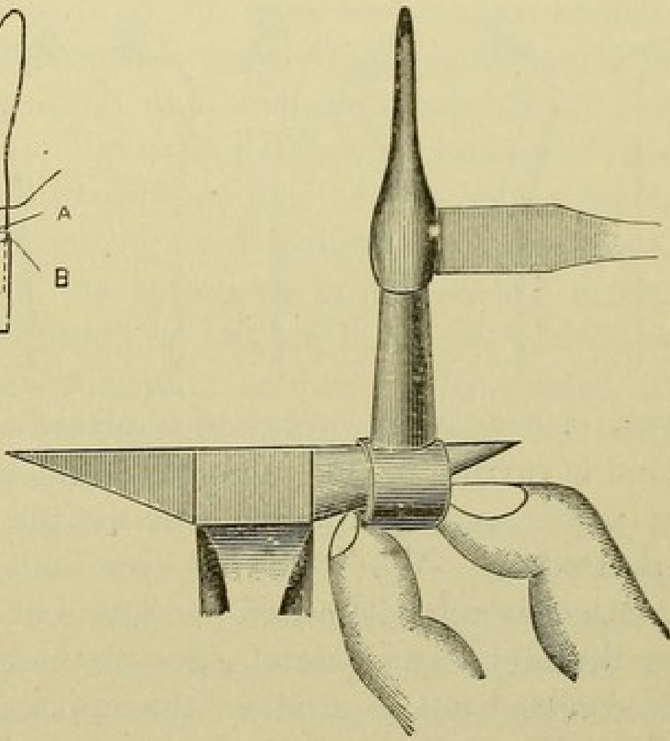


FIG. 114.

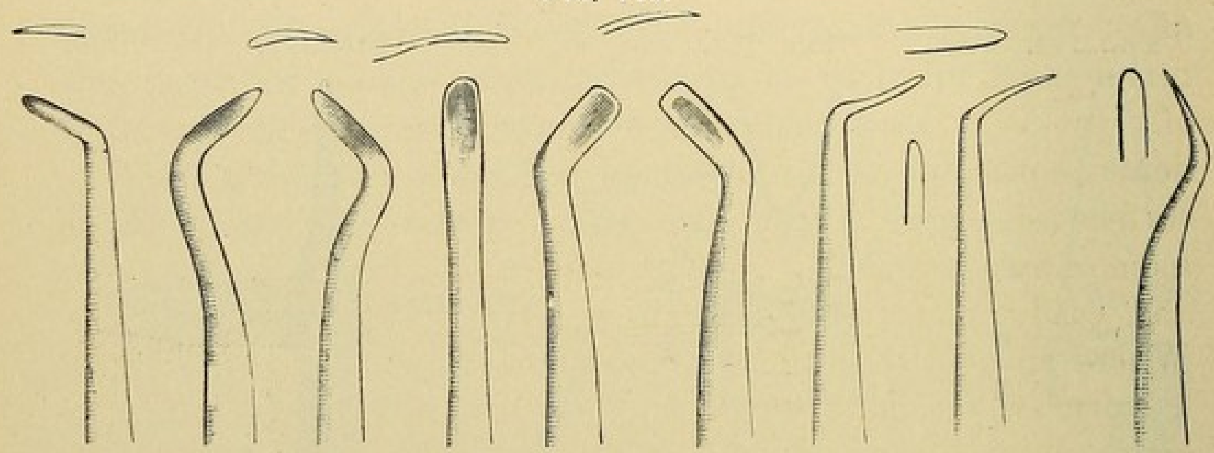


collar (A, Figs. 112 and 113), which is then removed, trimmed to this mark, readjusted, and again marked (B), and the process continued until the collar fits proportionately under the margin of the gum.

If, on adjusting, a collar is found a trifle too small, it is easily enlarged by tapping the gold with a riveting hammer on an anvil (Fig. 114), the edge-end of the collar marked B, Fig. 102. By this means the surplus gold at this point can be thrown into the collar and its circumference proportionately enlarged without altering its gauge. If, on the contrary, the collar should prove to be too large 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. 115.) Fine serrated foot-shaped gold-foil condensers can be advantageously used to flatten a stiff or angular point of a collar.

The application of a local anesthetic, such as cocain, will lessen the pain attending the operation. 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.

FIG. 115.



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 will effect rapid diffusion of the cocain (cataphoresis), 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.

COLLAR CROWNS HYGIENICALLY CONSIDERED.

The principal argument against ferruled or collared 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 unskillfully adjusted or cemented ferrule or collar which would by its presence hold a position analogous to a calcareous deposit, but no such comparison can be fairly made with 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 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 or iridium, or one of gold and platinum crown-metal, presenting the platinum surface, is suggested in preference to gold, as these metals 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 be extended well under the gum-margin, or the edge of the collar kept considerably above it. Where pyorrhea alveolaris is present, a collar of fine gold, properly fitted and extended well up over the exposed section of the surface of the root, has often a tendency to retard the disease, as calcareous deposits do not adhere to the smooth surface of the gold so readily as to the dentin.

CHAPTER V.

GOLD COLLAR CROWNS WITH PORCELAIN FRONTS.

INCISORS AND CUSPIDS.

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 at present 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. In making an incisor or cuspid crown of this style, the collar, having been formed, is trimmed even with the surface of the end of the root. With the collar in position on the root, a corundum-wheel is passed over the labial edge, along the margin of the gum, to level the gold with the root and render it invisible when the crown is finished. The side of the wheel should revolve toward the root, its motion even being reversed for that purpose when necessary, the idea being to turn the feather-edge of the metal of the collar over the end of the root. The work will then present the appearance shown in Fig. 116.

The cap is made by placing the outer edge of the collar against the surface of a piece of very thin platinum plate or heavy foil, adapting the platinum to the edge of the collar and then uniting the platinum to the collar with solder in a Bunsen flame (Fig. 117). The quantity of solder used must be very small, barely sufficient to unite the parts, and it should be placed on the platinum outside of the collar. Used in that manner it will not flow over the inside of the collar and interfere with the fit of the cap. The process is facilitated by first merely attaching the platinum, with the solder, to the edge of the collar, then readapting, and finishing the soldering. The platinum is next trimmed to the collar, and the cap adjusted on the root. The labial section of the surface of the cap is then burnished to the end of the root (A, Fig. 116). The root-canal having been slightly enlarged, a pin of round iridio-platinum wire, No. 16 or 17, U. S. standard gauge,—filed a little smaller for laterals or other roots which require it,—is slightly tapered at the point, fitted to an aperture made in the cap, and to the canal (B). The pin is then cut off even with the cap, removed, and temporarily laid aside.

FIG. 116.

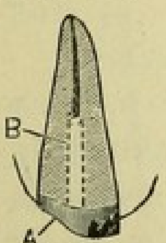


FIG. 117.

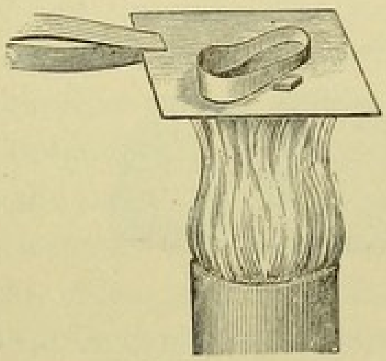


FIG. 118.

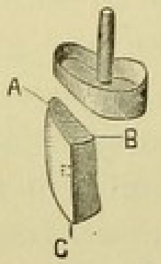
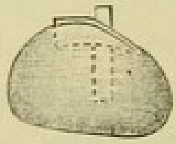


FIG. 119.



A hollow wire, the open space in the center of which is very 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.

To accurately fit a post in a root-canal which for some reason has been reamed considerably, use a piece of platinum wire of a gauge which will fit the end of the canal. Twist a narrow strip of platinum foil on the post from the point downward, and fit post and platinum to the canal. Remove post and platinum foil together and solder them with a pellet or two of gold foil by holding in a Bunsen flame.

A plain-plate cross-pin tooth, suitable in form and color, is ground and fitted in position on the cap. The labio-cervical edge of the porcelain (A, Fig. 118) should be flush with the edge of the collar, and meet the margin of the gum. It should be cut out at the base (B) so as to form a slight space just over the end of the pin. The tooth is then backed with very thin pure gold, gold lined with platinum, or pure platinum foil. Platinum gives a faint blue shade, and gold, or gold lined with platinum, if the gold side is toward the porcelain, a slight yellow shade. The backing should extend as far as possible under and between the tooth and the cap, as the solder will flow in and fill the space, thus giving strength and continuity of structure. This result can also be effected by first simply backing the porcelain with gold or platinum and then shaping a piece of very thin platinum *foil* to the base, extending from A to B, heating the porcelain, veneering with a mere film of resin and wax, and by pressure with a

FIG. 120.

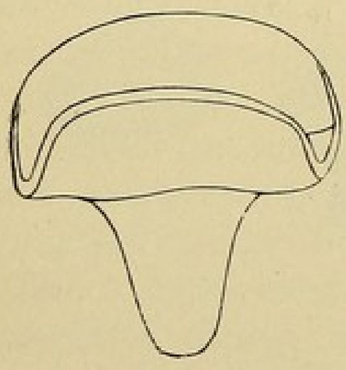


FIG. 121.

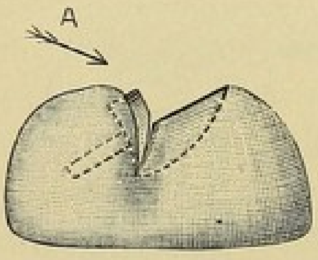
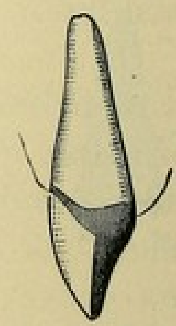


FIG. 122.



napkin or cotton causing the foil to adhere to the surface of the porcelain. The backing, if bent over the incisive edge (C) at an obtuse angle to the line of the back of the tooth, will protect the porcelain in occlusion. A narrow strip of fine gold placed transversely across at that point previous to investing, and united in the soldering of the backing, will answer the same purpose. If the platinum backing used is of the nature of foil, it is advisable to rivet over it on the back of the tooth a piece of gold plate smaller in size, and in which a number of perforations have been made with a punch forceps. This will insure against melting the platinum foil off the porcelain with the gold solder, which may occur if a pointed flame is used. The solder will flow through the perforations and unite the gold with the platinum under it.

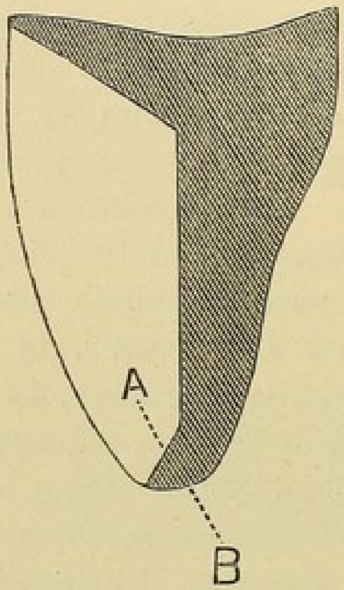
The tooth, when backed, is secured in position on the cap with a compound of wax and resin, and the whole adjusted in the mouth, then removed, and the pin, which has been laid aside, warmed and placed in position by passing the end from the inside of the cap through the hole into the wax attaching the porcelain crown. Another adjustment in the mouth is then made to determine the exact line for the pin, and the case is ready for investment.

After the fitting of the pin to the root and root-canal, as was described when the cap was formed, some prefer to solder it to the cap, for which purpose it should be adjusted in position and cemented with wax, then removed, invested, and soldered (Fig. 119). At this stage of the work, if desired, an impression can be taken in a small impression cup (Fig. 120) with either plaster or modelling composition. The cap should be removed in position in the impression. An articulation of the lower teeth should also be obtained. When the model is made, the pin is cut off even with the cap, and the porcelain tooth fitted as already described.

Calcined marble-dust and plaster, in the proportion of two parts of marble-dust to one of plaster, to which is added a pinch of sulfate of potassium to quicken the setting, makes what is considered to be the most suitable investing material for crown-work. The metallic section of the crown, when invested, should be left exposed at the sides, about as illustrated in Fig. 121, but the porcelain should be carefully covered. Pour boiling water on the investment when desirous of removing the wax before heating, but never attempt to remove it with an instrument. Many simply allow the wax to burn out. This is always done when fluxed wax is used. The investment should be first heated over a Bunsen burner, and then removed to a charcoal soldering-block. Gold solder cut in small pieces is then placed in and over the aperture between the porcelain front and the cap. By uniformly heating the entire investment, especially underneath and in the direction A, with a large flame from a gas blow-pipe, the solder is melted and flowed between the porcelain and cap. More solder should be added, and melted in this manner until the space between cap and porcelain is filled in and continuity of structure assured; but if an excess is used, it is apt to bulge or flow out over the collar. After letting the body of the investment slightly cool, additional solder is then placed on the backing and cap, and with a small pointed flame melted and flowed over these parts. Only sufficient gold should be used to insure restoration of contour. When soldered, after having been placed in acid and thoroughly divested of borax, the crown is ready for the finishing and polishing process. Fig. 122 represents the completed crown.

When it is desirable to protect the incisive edge of the porcelain against fracture in use and at the same time have the gold invisible, the porcelain should be ground in the manner illustrated

FIG. 123.



at A, Fig. 123. The gold in the final finishing should be brought on a straight line to the edge of the porcelain as shown at B. This will protect the edge of the porcelain in use, and render the gold invisible when viewed from the front.

BICUSPIDS AND MOLARS.

Bicuspids crowned by this method will have greater strength if a portion of the palatal section of the natural crown is reserved (Fig. 23), and the band or collar made deep enough to 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. 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. The front and cap are then removed, invested, and soldered, after which they are adjusted in the mouth, and the occluding edge of the porcelain is ground clear of the antagonizing teeth (A, Fig. 124). With a die of suitable size representing the occluding surface of a bicuspid, as illustrated in Fig. 125, a piece of pure gold plate (about No. 30 gauge) is swaged (Fig. 126) and the cusps filled in with 18-carat solder or gold plate.[1] The cap is then trimmed (Fig. 127), ground, and fitted to the occluding edge of the porcelain front (Fig. 128) 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 side of the crown, which is invested (Fig. 129). The long ends of the two side-pieces of gold plate are designed to retain them in position, as the investing material should be removed from

FIG. 124.

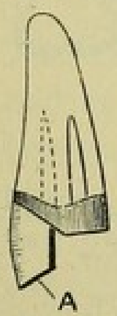


FIG. 125.

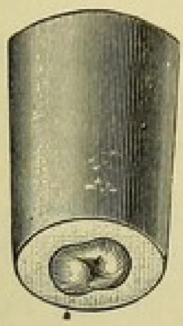


FIG. 126.

FIG. 127.

FIG. 128.

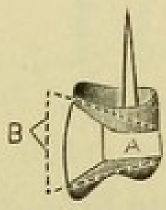
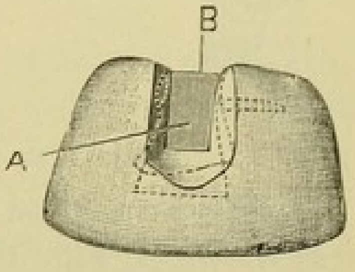


FIG. 129.



the portion inclosing the sides of the crown (A). Mica—isinglass—is recommended for this purpose, and is preferable to metal. In the process of soldering, the solder is placed in the aperture at B, and the flame of the blow-pipe 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. 130 represents the finished crown.

[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.

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. 131). The porcelain front should be backed so that the solder can be flowed over its occluding edge.

FIG. 130.

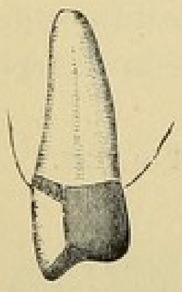


FIG. 131.

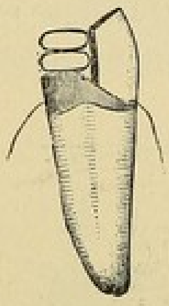


FIG. 132.

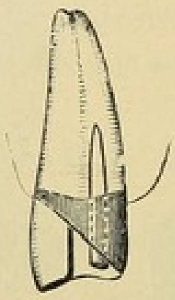
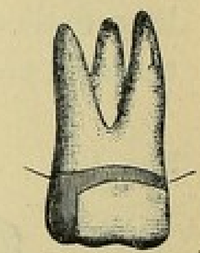


FIG. 133.



Another method is to extend the palatal part of the collar down as shown in Fig. 132, 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 the collar 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 in the soldering as to the amount of solder required to form the grinding-surface. In this and in the method just previously described, the porcelain front can be soldered and the palatal cusp formed in the one investment.

The method of construction of molar crowns with porcelain fronts is similar to that for bicuspids (Fig. 133).

Dr. Stowell's Method.—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 ordinary countersunk tooth, but in most cases the Logan crown, having a strong

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

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. 134). The tooth is then invested (Fig. 135) and pure gold fused on to the platinum pin, and while in a fluid state it is with a wax spatula 'spatted' down flat (Fig. 136).

FIG. 134.

FIG. 135.

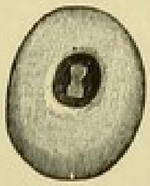


FIG. 136.

FIG. 137.

FIG. 138.

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. 137). The tooth is then secured in place on the cap with wax cement (Fig. 138), 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. 139) caused by the grinding of the bevel on the crown. The

FIG. 139.

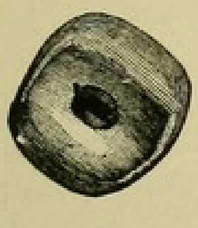


FIG. 140.

FIG. 141.

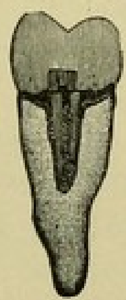
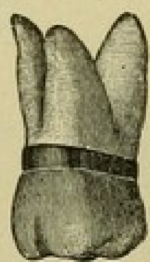


FIG. 142.

FIG. 143.

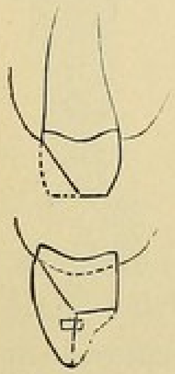


clipping of platinum serves as a lead for the solder, which follows it down into the countersunk cap, around the ends of the dowels, and finally attaches itself to the pure gold already attached to the stump of the platinum pin. Fig. 140 represents the completed crown. A sectional view of a like crown (Fig. 141) also shows the organization in detail. A porcelain crown can be used to represent any of the teeth in the same manner. (See Figs. 142 and 143.)"

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.

Fig. 144.



Crowning in Cases of Abrasion.—In a case of extensive abrasion of the incisive 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. 144 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 so inserted between the line of the pulp-chamber and the palatal wall.

CHAPTER VI.

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

The root and crown having been properly prepared, the collar is formed and adjusted as described at page 71, 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. A close knuckling can be insured by seizing the collar and the approximal tooth in the manner shown in Fig. 145. The collar is removed, filled with plaster, and adjusted in position. Fig. 146 represents a typical case.

Fig. 145.

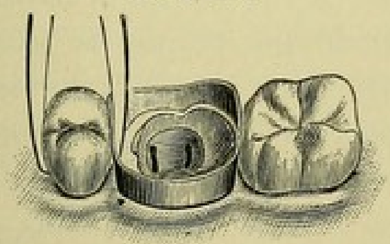
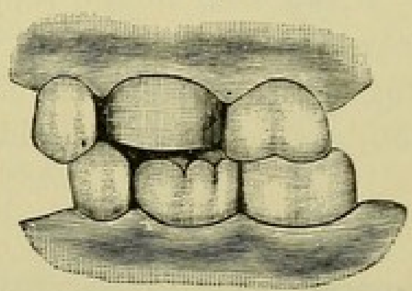


Fig. 146.



The antagonizing teeth, having been covered with a piece of tin foil, are then occluded until the plaster sets. The collar is then removed. The surface of the plaster inside the collar will give the impression of the natural root or crown, and the outside that of the antagonizing teeth. The latter furnishes an outline to form the grinding-surface of the crown.

The plaster 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.

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. 147, 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. 148) 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. A little of the surface of the plaster in the collar may have to be removed, if, on trial in the mouth, the cap is found a little flush. The crown, with the plaster still inside the collar, is fixed in a soldering-clamp constructed in one of the forms shown in Figs. 149, 150, and 151, which holds the parts together and permits the

Fig. 147.

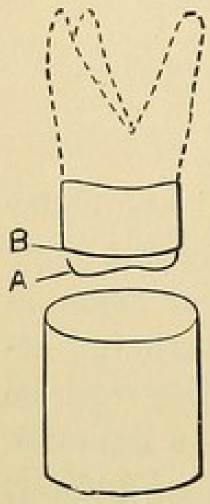
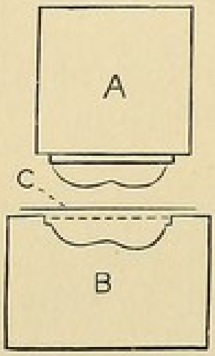
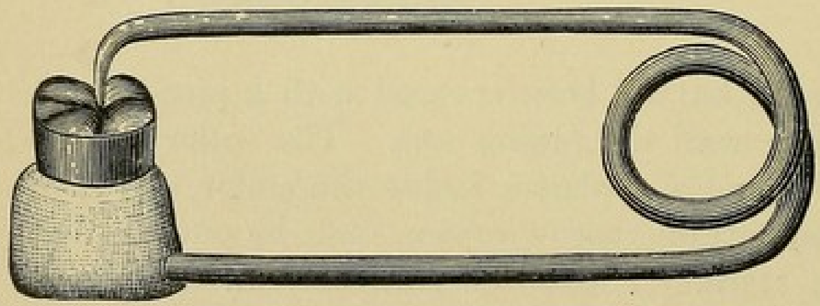


Fig. 148.



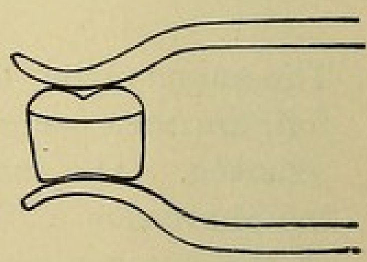
A, Fusible die.
B, Counter-die.
C, Plate to form the cap.

Fig. 149.



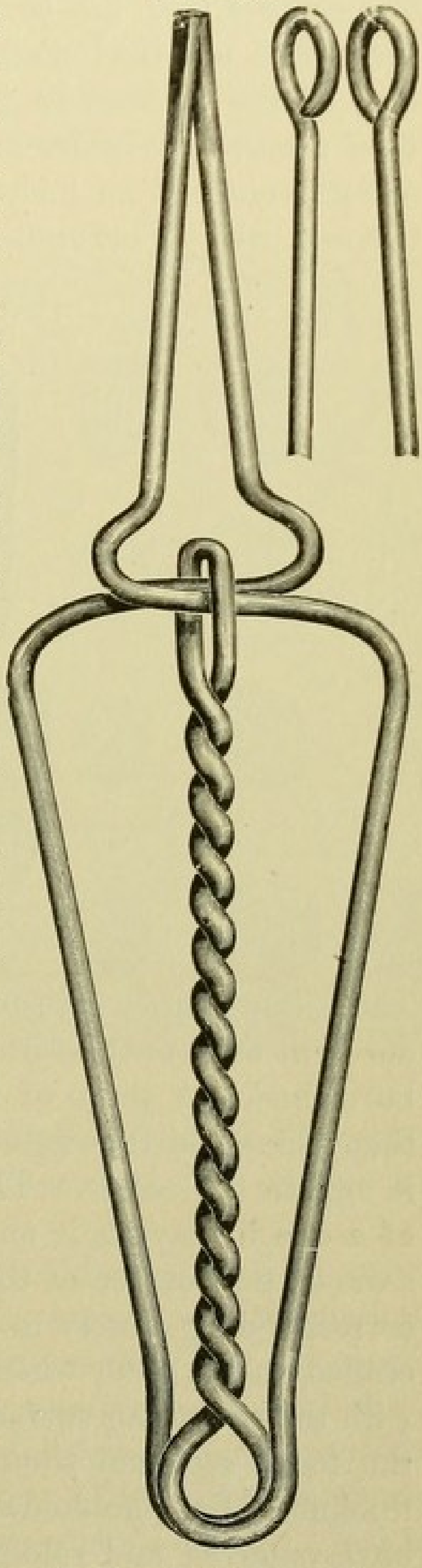
The frame of this clamp is formed of iron wire, and the support for the crown of plaster, asbestos, and marble-dust.

Fig. 150.



flame to reach all points. With the clamp Fig. 149, 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-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 the contour requires, as an excess necessitates additional labor in finishing.

Fig. 151.



Another method, if the crown is not to be contoured with the aid of the solder, is, when the cap is struck up, to 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 blow-pipe is then thrown upon it in such a way as to 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.

Still another method 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, is to adjust the collar in the mouth, and, with a small piece of wax or impression-compound pressed upon it, to take an impression and "bite," in which the collar will 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, which was first made known by Dr. N. W. Kingsley, 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.

In utilizing a tooth as an abutment in bridge-work when all or nearly all of the occluding surface of the natural crown is present, a practical method of construction is to mark the outline of the natural crown 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. 152.

Fig. 152.

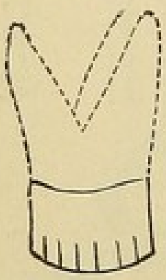


Fig. 153.

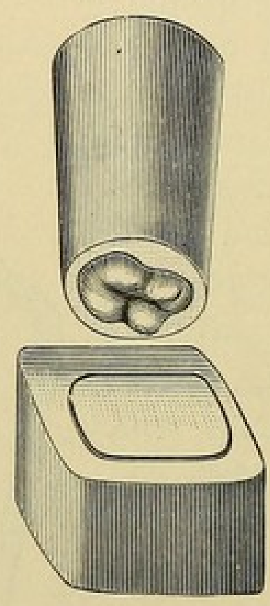
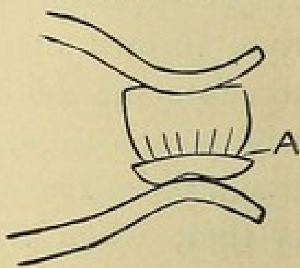
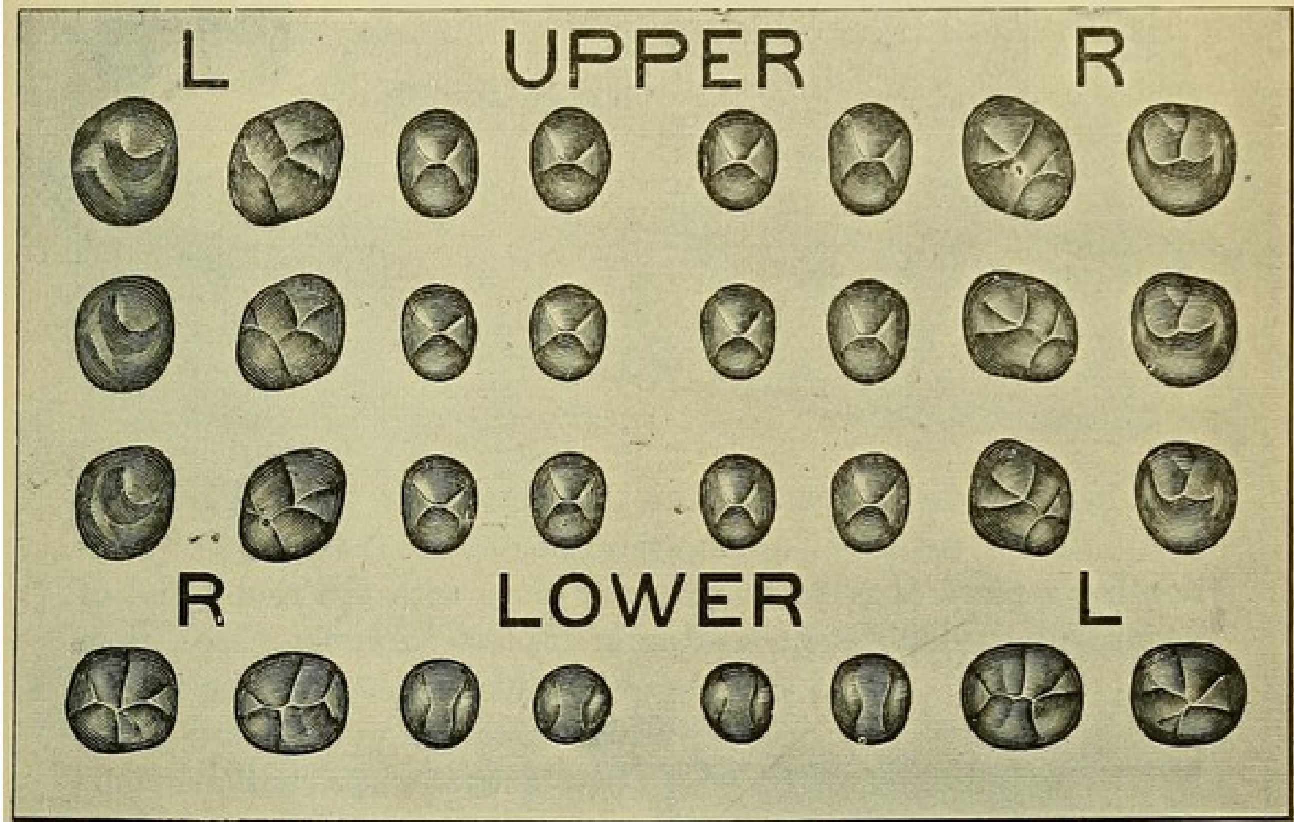


Fig. 154.



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. 34 gauge, 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 of a cap by laying it on a block of lead and hammering into it a die of the surface of the tooth to be crowned (Fig. 153), or one corresponding closely to it. 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 should always 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. 154, 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 crown to the collar, with the smallest possible quantity of solder,

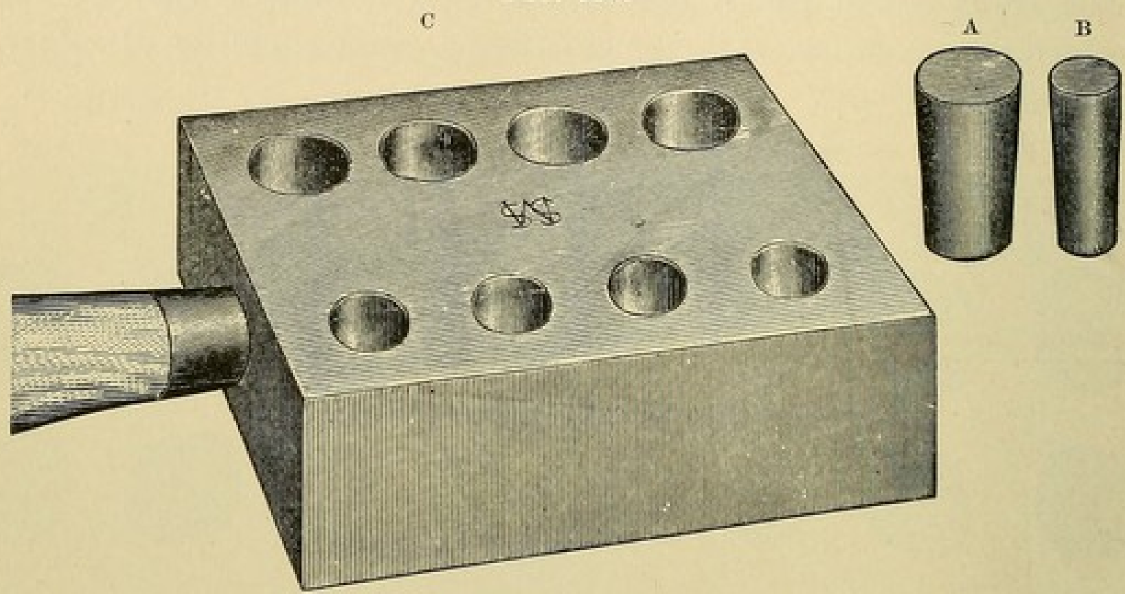
Fig. 155.



then readjusting collar and cap on the tooth, adapting their edges together with a foot-shaped foil condenser, and then completing the soldering.

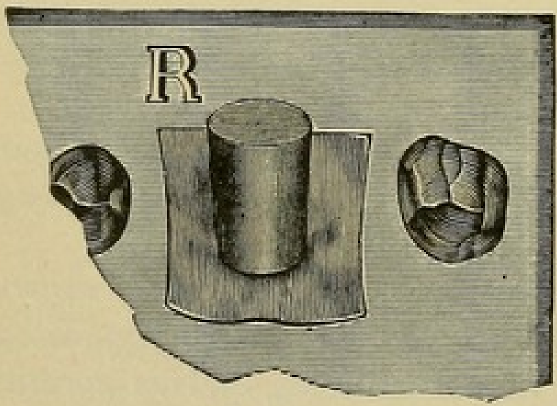
The methods described insure a perfect occlusion of the crown with the antagonizing teeth. In the absence of antagonizing teeth, or when the general form of the grinding-surface permits it, the cap can be struck up with a die similar to the one shown in Fig. 153 that approximates in size and form what is required. The cusps are then filled in, 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 soldered. 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, the cap and collar must be joined with solder either on the inside or outside.

Fig. 156.



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, then reversing the cap, resting it on a flat surface, and creasing between the cusps with a burnisher.

Fig. 157.

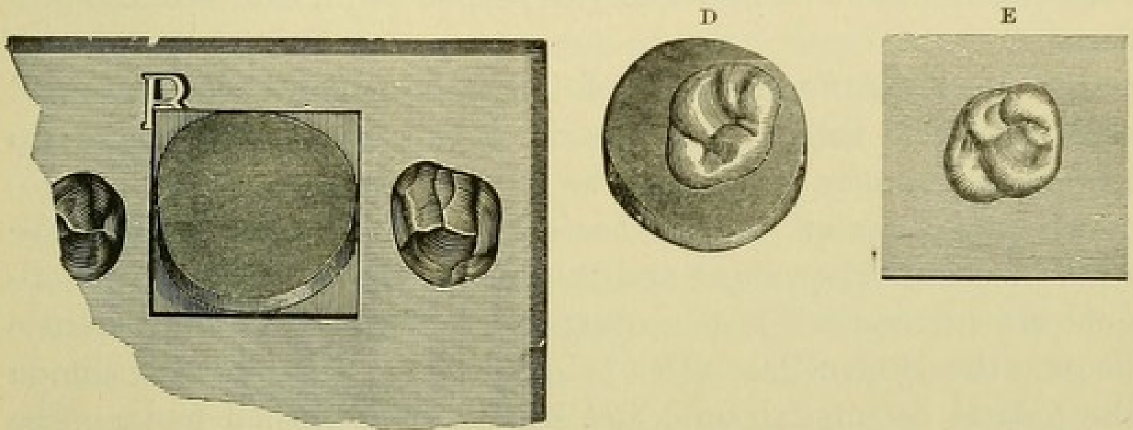


Metallic caps, or forms of the occluding surfaces of teeth for use in constructing crowns, are quickly made with the die-plate shown in Fig. 155,[1] "in which are four groups of intaglio dies representing the peculiar cusps of the bicuspids and molars. The hubs A, B (Fig. 156) are of the sizes shown, and are made of an alloy composed of tin one part, lead four parts, melted together. The mold C should be warmed,

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

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. 157 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 plate into the die, and at the same time spread the hub metal from the die center to its circumference, in such a manner

Fig. 158.



that the plate will be perfectly struck up with the least possible risk of being cracked. The flattened hub is seen in Fig. 158, 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. 155) 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 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

[1] Dr. Patrick's crown-work methods and the principles upon which they are based are set forth in a paper published in the *Dental Cosmos* for October, 1888, page 706.

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.

A method of making a gold crown by stamping it out of one piece of gold plate is, make or select a metallic die for the crown to be formed; then place a piece of pure gold plate, about No. 31 gauge, on the flat surface of a block of lead, and gradually stamp the die downward into the gold to about half the depth of the intended crown. The gold is then removed, and each side of the unswaged portion slit and adapted to the form of the die, the full length of the crown, which is then adjusted in the mouth, the edges of the gold trimmed to the proper form, and the slits soldered.

Dr. M. Rynear's crown is of the same general character and construction as the one just described, except that a seamless cap is used to form the crown, instead of a flat piece of plate.

All-Gold Crowns for the Incisors and Cuspids.—When the teeth are abraded or short and the incisive edges flat, 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 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 incisive edge trimmed even. A flat, thick piece of gold plate or clasp-material is soldered across the incisive edge to form and inclose that portion of the crown.

Fig. 159.

When the crown required is of the normal form, the collar when properly fitted should be removed at the palatal section, as shown in Fig. 159. The edge of the gold is then chamfered, and bent and burnished over the incisive 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. Fluxed solder filings can be melted in the interior of the incisive edge to increase its thickness.

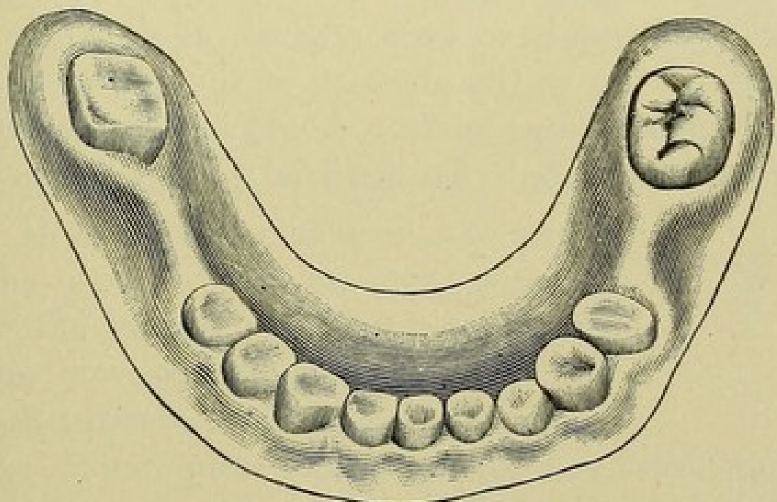
Another method is to select a porcelain tooth of the desired form and of the size of the gold crown, and use it as a model to cast an intaglio die. The die is made by placing moldine in a pill box, smoothing off the surface, and imbedding half of the porcelain tooth with the palatal or pin side down. Next wind some paper around the box, slightly warm the porcelain tooth, and pour in fusible metal. On this intaglio die shape a piece of gold plate, 30 to 32 gauge, to the form of the labial surface of the crown. Remove and bend the metal round to the form of the sides and palatal section of the tooth, trim the meeting edges, and solder. (Fig. 160.)[1]

Fig. 160.

A fusible metal die of the prepared form of the natural tooth is a material aid in the construction of this style 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 Chapter V), using a gold front instead of the porcelain. This can be made 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 at the same time.

Fig. 161.



To correct the accidental presence of solder on the inside of a crown, which interferes with its adjustment, make a thin paste of

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

rouge and oil. To determine exactly at what point the gold strikes, 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, 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, when the interfering point will be marked on the natural tooth, which can then be trimmed instead of the gold to permit proper adjustment.

Fig. 162.

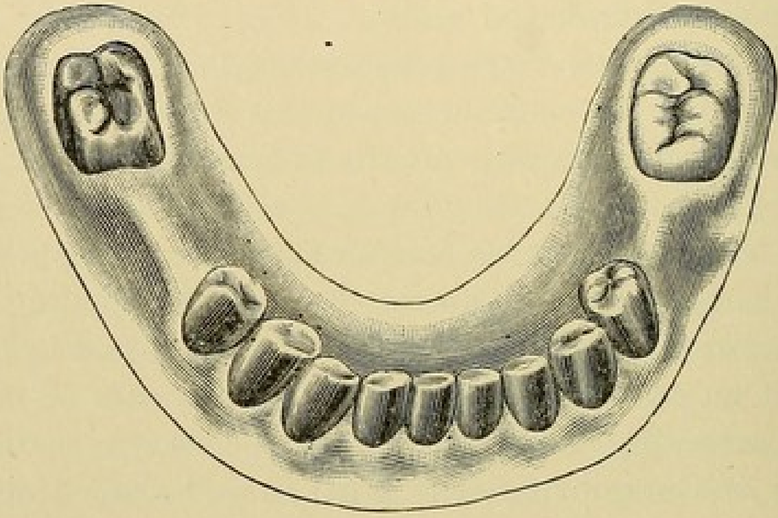


Fig. 161 represents a case of abrasion of the lower teeth, to which all-gold crowns have been applied, as shown in Fig. 162. In such cases, owing to the attrition of the occluding teeth, the cap forming the occluding surface should be constructed of heavy gold and platinum plate. An artificial plate replaces the upper teeth.

CHAPTER VII.

THE GOLD SEAMLESS CAP-CROWN.

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

INCISORS, CUSPIDS, AND BICUSPIDS, 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. 163). A die of the end of the root is then 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 some plaster of Paris with a little sulfate of potassium, mixed to the consistence of a paste, 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. 164). 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 tied around the wood or tube, and a die cast with the fusible metal. The cooling is hastened by im-

Fig. 163.

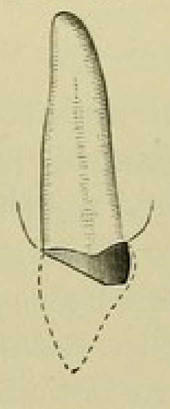
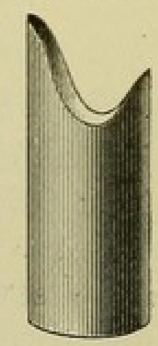


Fig. 164.



[1] See article on "Molds and Dies," which describes how to make a tube without soldering.

mersion 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. 165). A counter-die is then made by punching a hole in the surface of a block of pure lead, and with a few blows of a hammer driving the die into it.

A cap of pure gold, or preferably of platinum, can be formed by placing a piece of the plate, No. 30 gauge, of suitable size upon

Fig. 165.

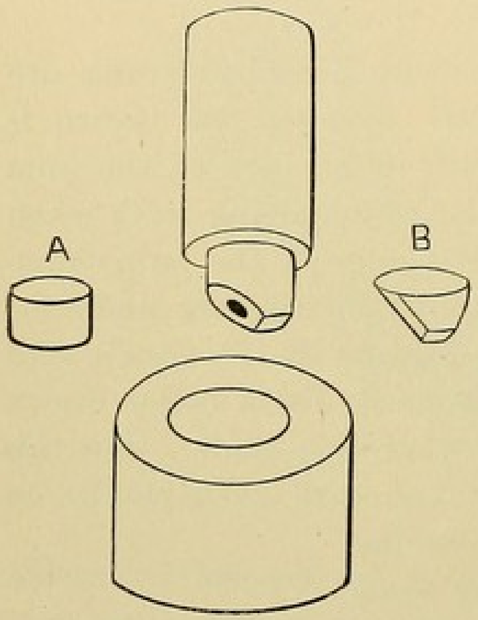


Fig. 166.

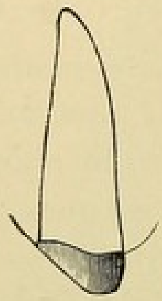


Fig. 168.

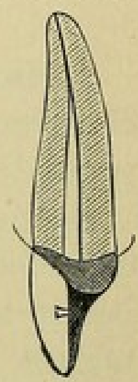
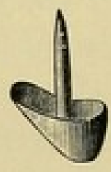


Fig. 167.



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 a quarter-inch in depth (A, Fig. 165). The gold should be withdrawn from under the punch and annealed several times during the process. Caps can also be made with a stamping-press. (See page 101.)

The cap is then annealed and swaged on the die to the form of the end of the root (B, Fig. 165). 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. 166). An iridio-platinum pin is then fitted in the root-canal and soldered to the cap (Fig. 167), or afterward adjusted as in the construction of the gold collar crown with porcelain front (page 75), with which operation the remainder of the process of construction is identical. Fig. 168 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 gold of the cap, where it encircles the root at the cervico-labial edge, is entirely removed, the crown is still held securely.

In a paper on the subject of preserving and utilizing this part of the tooth, Dr. W. F. Litch, of Philadelphia, describes a crowning operation,[1] in which he constructed the cap of platinum by slitting a piece of the plate in a number of places, adapting it to the end of the root, and then soldering the whole together.

This operation is not, however, so easily or so satisfactorily performed as the method above described. In some respects pure platinum is preferable to gold in capping roots, as it is less likely to be affected by the secretions of the mouth.

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 should be removed at least the thickness of the plate to be used. An impression of the restored tooth is then taken in plaster or gutta-percha in a tube, as explained on page 93, and a die 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

[1] *Dental Cosmos*, vol. xxv, No. 9, page 449.

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 69, 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. 169).

FIG. 169.

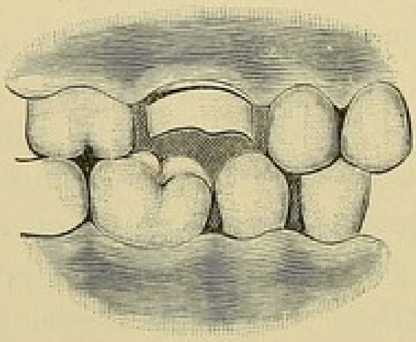
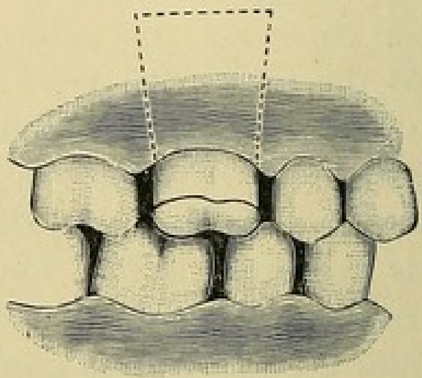


FIG. 170.



Another method is to fit a copper collar accurately to the root, removing it in the impression. In such a case plaster ought to be used. When the model is made the collar, on being cut and removed, will present the exact form of the neck.

From a "bite" taken in wax a plaster articulation is then made to the model. 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 plaster are then trimmed to the form of the crown, and the whole carved in detail (Fig. 170). As the crown will always stamp larger in circumference than the die, in proportion to the thickness of the gold used, an allowance must be made by trimming off a proportionate amount of the grinding-surface. 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. 170, and trimmed in the form shown by the cast A, Fig. 171. From this model the die is made in a tube with moldine and fusible metal as described at page 84. 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. 171) is made by punching a hole in a block of lead and hammering the die into it. The crown, which is usually formed of pure gold, or gold slightly alloyed, or gold lined with very thin platinum from No. 30 to No. 32 gauge, is then made by first stamping a piece of plate (see page

FIG. 171.

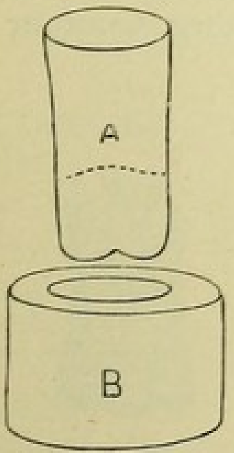


FIG. 172.

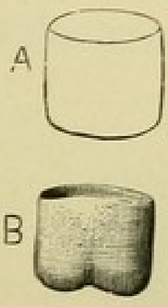


FIG. 173.

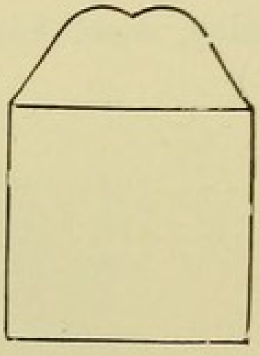
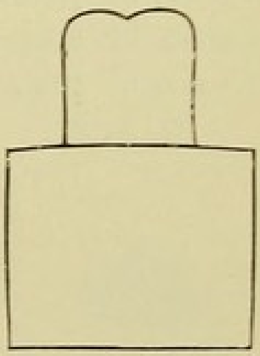


FIG. 174.

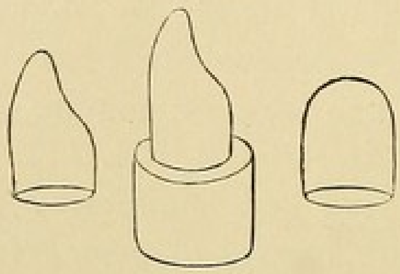


99) in the form of a cap of gold (A, Fig. 172). The cap is then placed on the cast, and with the aid of the counter-die (B, Fig. 171) swaged to the form of the crown B, Fig. 172. A piece of kid-leather or rubber dam should be used to cover and protect the gold from the lead, and to facilitate its removal from the counter-die. An allowance for the thickness of the leather must be first made, by driving it, 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.

Dr. C. B. Parker's method of stamping the piece of gold plate is to form two dies of the required crown,—the first with a cone-shaped neck up to the grinding-surface (Fig. 173), and the second straight on the sides (Fig. 174). The gold is stamped up on the first die, giving the grinding-surface, but leaving the sides flaring, and then on the second to straighten the sides.

Cuspid crowns from which a portion of the gold on the labial aspect is to be removed, or which are to be used entire as a support for bridge-work, can usually be advantageously formed with

FIG. 175.



a seamless cap (Fig. 175). The necks of these crowns can be contracted in fitting in a contracting plate, or slit, lapped, and soldered, should the case so require. (For details of process of adjustment and insertion, see "Adjustment of Seamless Contour Crowns," page 102.)

CHAPTER VIII.

GOLD SEAMLESS CONTOUR CROWNS.[1]

The artistic requirement in all-gold crown-work is, that it shall reproduce the anatomical contour of the natural teeth. This is usually accomplished by melting solder on the collar and then trimming it to the form of the crown. A preferable method is to shape the metal forming the sides of the crown by swaging. This is easily done in a crown formed in sections, but a special process is required in the construction of seamless crowns.

A contour crown can be made by placing a seamless cap on a sectional die or mandrel of the shape of the tooth, first swaging

Fig. 176.

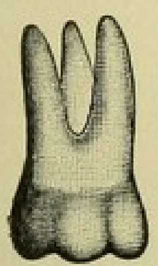


Fig. 177.

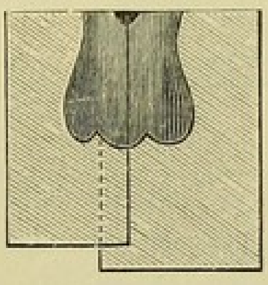
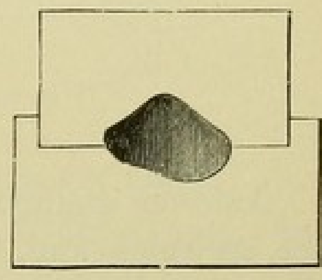


Fig. 178.



the grinding-surface on the mandrel and then stamping downward on the straight sides of the crown with a cap fitted to the shank part of the mandrel. But such a process, like many others, is too complicated to be of any use to the dental practitioner. The sectional mold method here presented is simple, practical, and general in its application.

To describe and illustrate the process, we will take one of the most difficult crowns to construct,—a superior molar (Fig. 176). A natural tooth, or one made of plaster, is used as a model. From this a sectional mold is made, as illustrated in Figs. 177 and 178,

[1] Gold crowns of this form are now made and sold as the "Evans Gold Crowns." The Evans Gold Non-fusible Crown is lined with platinum on the interior of the occluding surface and part of the sides, to prevent melting the gold in soldering.

in Babbitt's metal, zinc, or fusible alloy. Into the mold a cap of gold (Fig. 179) 23 to 24 carats fine, No. 28 to 30 gauge, 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 it into a mass of cotton, and then swaged more in detail to the form, and with a wood point or a burnisher revolved by the dental engine burnished in every part of the mold (Fig. 180). To facilitate the process, the mold should be frequently opened, and the gold annealed. Fig. 181 represents the completed crown. These results can be secured by other styles of molds. Fig. 180 illustrates one, but the principle is the same.

Fig. 179.

Fig. 180.

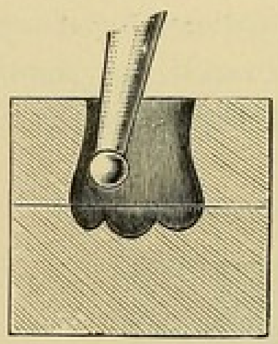


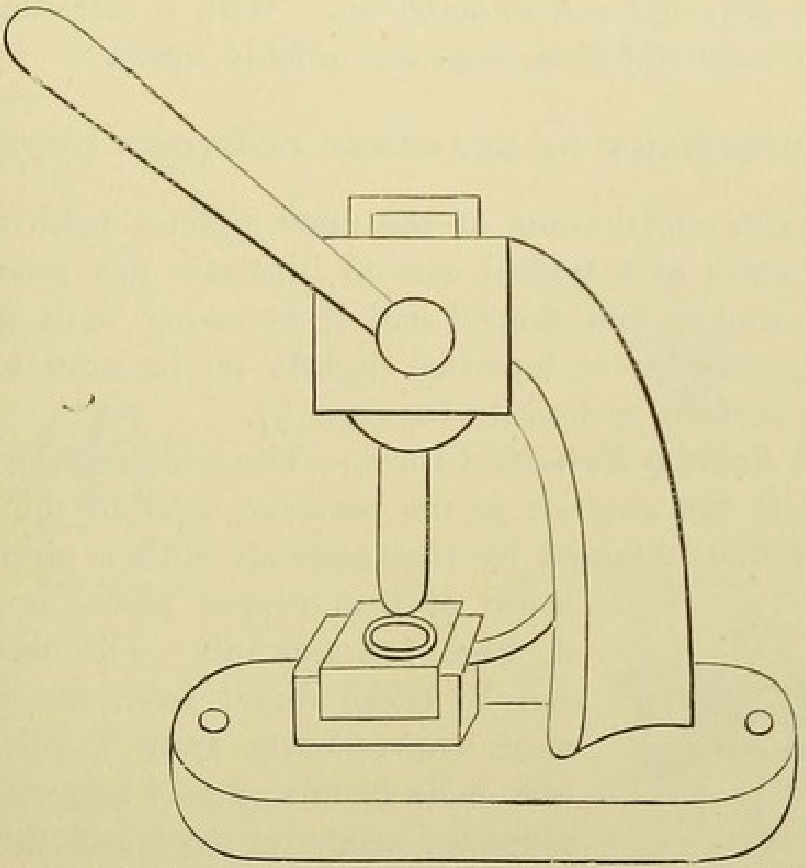
Fig. 181.

Another method is to form a fusible-metal die of the tooth to be crowned, and, after having stamped the grinding-surface of the crown, to reverse and swage the sides close to the die; the crown is then relieved of the core (die) by heating to the melting point of the fusible metal and pouring it out.

For practical use, a variety of molds is required, made from natural teeth of different sizes and average forms to serve in corresponding cases. The crowns can be contracted at the neck more than their size and contour call for, so that the gold will act as a tight-fitting band which will expand to the form of the root as the crown is pressed up in the process of adjustment.

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 machine (Fig. 182), 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 gauged to the holes; at each punch a small portion of the gold is turned

Fig. 182.



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

over, thus preventing its lapping or creasing (Fig. 183). Repeated annealing of the metal is very necessary in this process.

Fig. 183.

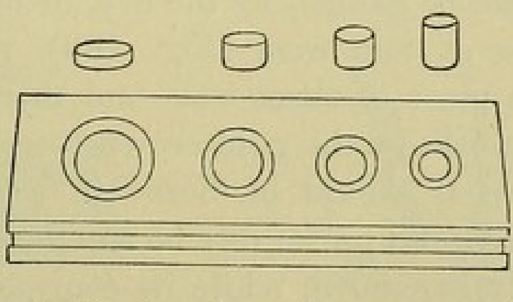
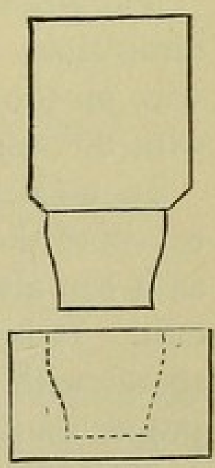


Fig. 184.



Methods of Contouring Crowns constructed in Sections.—In constructing a crown in sections, the collar can be first formed on a mandrel, then placed in a mold, and burnished to the shape of the sides. The process of its adjustment to the neck of the root is then continued in the usual manner.

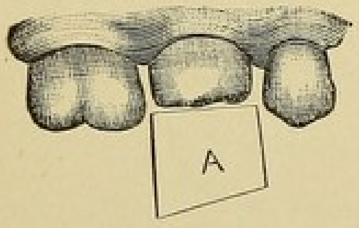
Another method is to stamp or burnish up the collar on a die representing the upper sections of a tooth, designated as the middle and cervical third (Fig. 184). After contouring the collar, the cap is adjusted and soldered on. With a metallic stamping plate (see page 87) these caps are quickly made.

ADJUSTMENT OF SEAMLESS CONTOUR CROWNS.

A superior molar—one of the most difficult teeth to operate on—will serve as a typical case to illustrate this process. 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 37.

How to Select a Suitable Crown.—The width of the crown required from the anterior to the posterior sides of the occluding surface is first obtained by measurement with a piece of cardboard or thin copper plate, as shown at A, Figs. 185 and 189. The measurement can be taken direct from the mouth, or more conveniently from a small plaster cast made from a correct impression of the *prepared crown or root* and the two approximal teeth. With this measurement as a guide, the proper-sized occluding surface is readily found by comparison with the dimensions of the various crowns as shown on the printed chart of the crowns (C, Figs. 186 and 187).

FIG. 185.



The size of the neck can be gauged by the eye, or by taking the dimensions with a piece of fine wire (Fig. 190), pressing the wire on the surface of a piece of sheet wax, and then comparing with the impression the necks of the gold crowns.

In making a selection, it should be borne in mind that the cervix of the gold crown should preferably be smaller than larger, as it can always be easily expanded, while its contraction is difficult. It is not essential that the curve of the collar shall correspond with that of the tooth, as the gold will readily take the proper shape as the crown is adjusted.

Method of Adjusting the Crown.—1. Anneal the crown selected, and slip it over the end of the natural crown or root and gently press or work it upward—the gold of the collar will expand to the form of the root in the operation—until the edge meets the margin of the gum (A, Fig. 188).

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

FIG. 186.

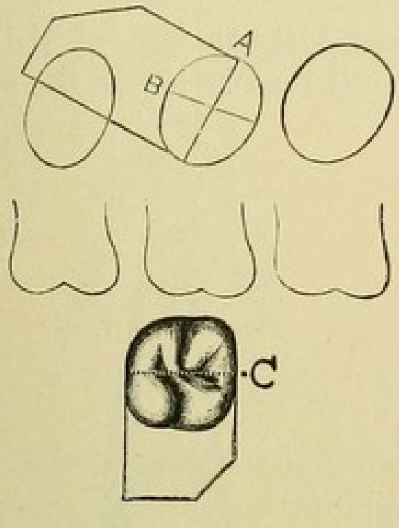


FIG. 187.

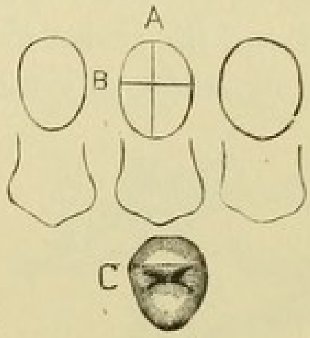
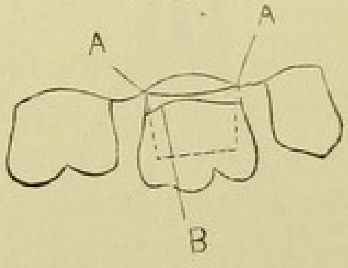


FIG. 188.



3. Remove and trim to this line (A, Fig. 191). If necessary, repeat the marking and trimming until the edge meets the gum evenly.

4. 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. 189.

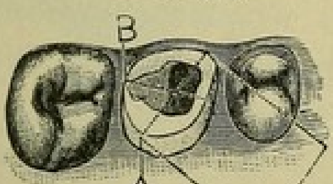


FIG. 190.

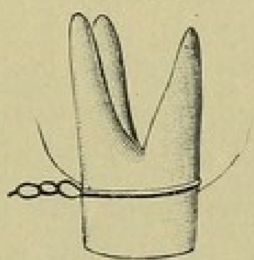
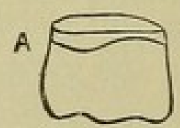


FIG. 191.



To Expand 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. 192), 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.

To Alter a Side.—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,

FIG. 192.

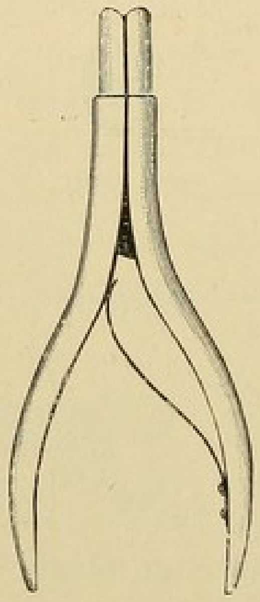
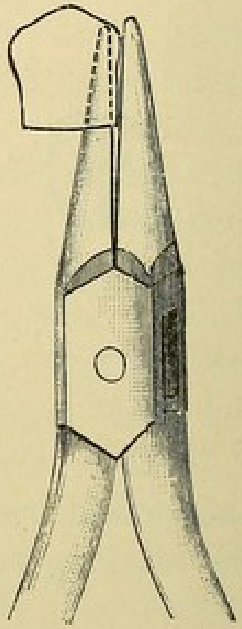


FIG. 193.



then steadying the crown with the fingers, as shown in Fig. 194, 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 being placed against the bulge on the outside (Fig. 193). This is necessary when the *contour* or *the side* of a crown *presses on an adjoining tooth*, and the crown is thus prevented from coming in 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.

To Alter 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. 194.

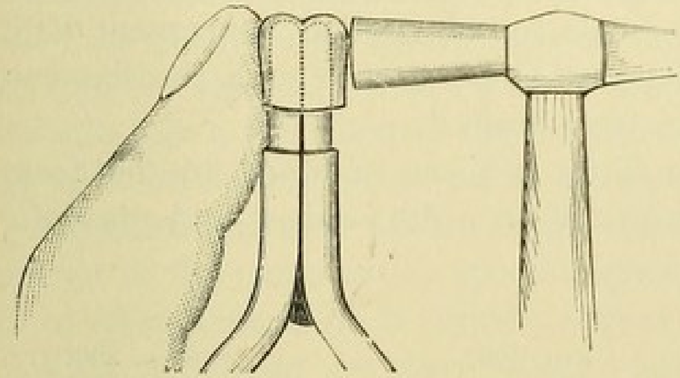
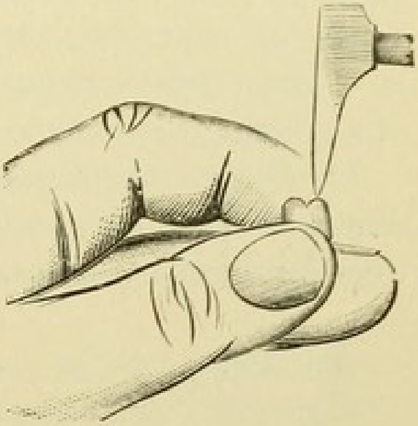


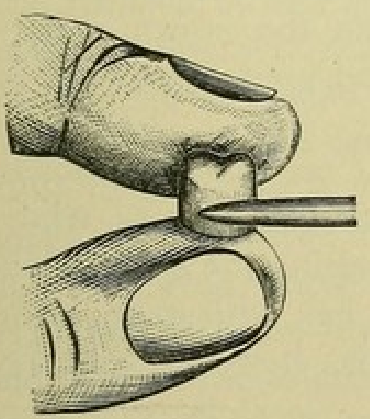
Fig. 195.



To Alter 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. 195. The closing of the antagonizing teeth upon the crown by the patient with force will aid or complete the operation of articulating.

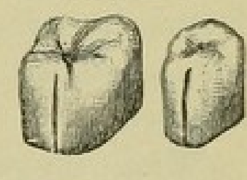
To Contract the Neck.—Slightly bend in the edge of the gold at the neck with narrow-beaked pliers, and holding the crown evenly and firmly between the fingers, as shown in Fig. 196, burnish the sides and neck section inward around the entire circumference of the crown.

Fig. 196.



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. 197, bevel off the edge to lap under, contract the crown, readjust to the tooth, remove, place the smallest quantity of dampened flux solder filings in the seam *on the inside of the crown only*, and solder by holding in an alcohol flame. Then proceed with the further adjustment of the crown.

Fig. 197.



The outside 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 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.

To Deepen the Cusps.—Trim a piece of wood to the form shown in Fig. 198, rest the neck on a flat surface and press the wood between the cusps.

FIG. 198.

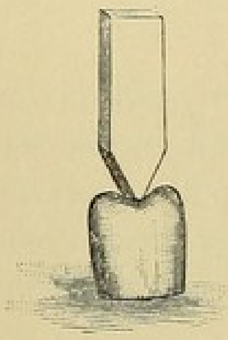


FIG. 199.

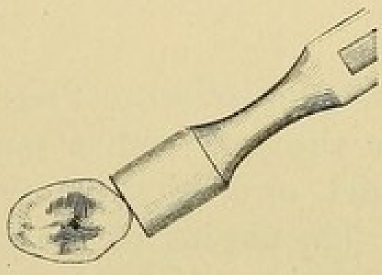
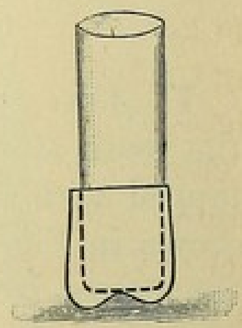


FIG. 200.



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. 199.

To remove the indentation between the cusps and thus flatten the whole grinding-surface, introduce inside the crown a flat-ended piece of wood the size of the crown and press downward as shown in Fig. 200.

Strengthening Seamless Gold Contour Crowns.—Additional strength and stiffness can be given to seamless gold crowns, when desired, in several ways. The liability of melting the gold which forms the side of the crown in the operation has, with some, been the principal objection to their use. This, however, can be avoided.

When the crown has been properly adjusted, dampen the inner surface with a piece of 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 open end of the crown, invert, and shake well. A portion of the solder filings will adhere evenly all over the wet surface. The surplus is allowed to drop out by removing the finger. Then *gradually* and *uniformly* heat the crown by holding it with tweezers in an *alcohol flame* until the solder fuses, when it will flow evenly over the surface of the gold without materially altering the general form. 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, which will occur at a red heat.

An extra quantity of the solder filings can be placed in the interior of the cusps with a spoon-shaped excavator to additionally fill or strengthen them if found necessary.

When a *Bunsen gas flame* is used instead of an alcohol flame, the gold must not be brought above a *dull red heat*. The grinding-surface and sides of the crown might be first coated with whiting as a safeguard. This is easily done by dipping the crown into a cream-like mixture of whiting just before inserting it in the flame. The moisture in the whiting should be first slowly evaporated by heating up gradually. Great care must be exercised in the use of a gas flame to avoid melting the crown. The crown should be watched, and instantly removed as soon as the solder fuses and flows.[1]

If too much solder has been applied at any point, it can be trimmed and smoothed with corundum melted on to an old engine bur-point. Always boil the crown in acid to remove the flux. The removal of flux from the inner surface of the crown is absolutely necessary if you intend to use it in bridge-work, as solder will have to be melted on the outside.

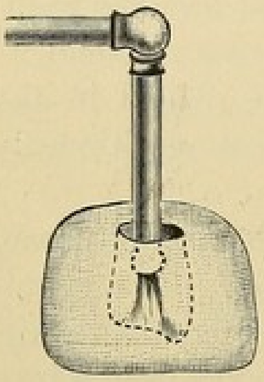
To repair a hole melted in any kind of a gold crown, place a piece of soft wax in the aperture, on the outside of the crown, adapt on the inside close against the gold a piece of platinum foil, somewhat larger than the aperture, so that it will adhere to the wax. Fill the interior of the crown with investing material, and flow a little solder over the surface of the platinum, and gold on the outside of the crown.

Gold seamless crowns can also be strengthened or filled with

[1] 18-carat gold plate can be melted in the "Evans Crowns" as safely as solder if heated up slowly.

solder, or even 18- or 20-carat gold plate, by investing the outside surface in plaster and marble-dust (Fig. 201), and then with a small flame of the carbo-oxyhydrogen blow-pipe, not over one-half inch in length, introduced inside of the crown, melt and flow the solder or gold plate over any portion or even all of the surface of the gold. The crown, if formed of gold even with a thin lining of platinum, can be soldered by either method with little danger of being melted.

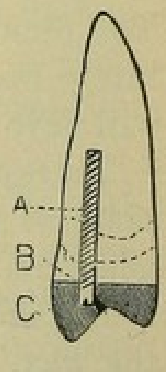
FIG. 201.



Another method to thicken the grinding-surface is: Scratch the inside surface of the gold cusp and pack evenly against it freshly annealed pellets of gold with a sharp plugger. The gold will adhere, and when burnished with a revolving agate point will form *solid gold cusps*. If desired, the gold foil can be even fused in the cusps, after being packed, by heating up slowly in a Bunsen flame, or a particle of solder filings can be melted over it.

Supporting the Crown.—In crowning teeth with living pulps there is sufficient of the natural crown present to afford a secure foundation and attachment for the artificial crown, as is also the case with many teeth that are pulpless; but in badly broken-down crowns, or where only the root is present, a metallic pin or post should be inserted in the root, and the part built down with amalgam to a form which will afford secure support and attachment to the artificial crown, and facilitate its adjustment. (See "Special Preparation of Badly Decayed Teeth or Roots," page 38.)

FIG. 202.



In many cases the required support for the crown can be secured by means of a screw (Fig. 202). A How screw or post of silver wire is inserted in the root-canal A (see page 47). Amalgam is then packed in the lower section of the artificial crown, C, to the line B, and into the amalgam the screw is pressed. Amalgam which has been put in a piece of chamois and the mercury pressed out with a pair of pliers until it is in the condition termed "dry" will adhere to the gold without affecting it. The amalgam is first placed in the crown slightly in excess of the amount required, and the crown adjusted, removed, and the surplus scraped out.

This process is continued until the screw or the crown section of the natural tooth forms an indentation in the amalgam, which it will fit when the crown is cemented on. (For process of cementation, see article on "Insertion and Cementation.")

These crowns can be inserted in an easy and inexpensive manner by filling in the lower section of the crown with amalgam instead of gold, and allowing the head of the screw or the natural crown to indent the amalgam as above described, 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 apt to wear through in places and expose the amalgam.

Fig. 203.

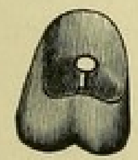


Fig. 204.

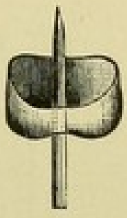
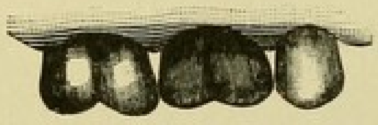


Fig. 205.



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. 203. 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. If the pin is tapered and fitted tightly to the hole (Fig. 204), the soldering can be accomplished without investing, by holding the crown and pin with solder in position in an alcohol flame.

To Alter a Gold Crown to the Exact Form of any Corresponding Natural One.—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 article on "Molds and Dies"), 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 and is qualified to meet all requirements.

Fig. 205 represents the typical molar crown cemented in position.

The advantages of seamless contour crowns are, that they represent perfectly the tooth in its anatomical contour, present a uniform surface of pure gold, which preserves its color without tarnishing, and are quickly and easily adjusted.

CHAPTER IX.

SPECIAL FORMS OF GOLD CROWNS WITH PORCELAIN FRONTS.

PORCELAIN AND GOLD CROWN WITHOUT A COLLAR, AND PARTIAL COLLAR CROWNS.

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. 206). The root-canal is then uniformly enlarged a reasonable distance up, with a drill which will closely fit the opening. Into the canal, gauging its full diameter, is fitted a piece

Fig. 206.

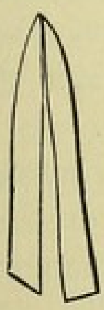


Fig. 207.

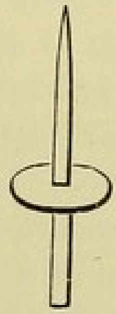


Fig. 208.

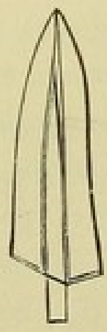


Fig. 209.

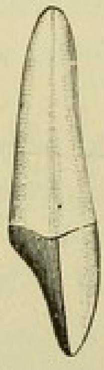
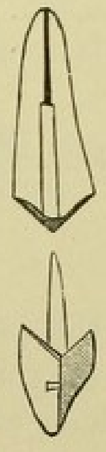


Fig. 210.

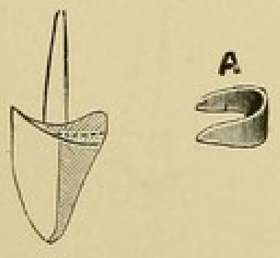


of iridio-platinum wire, tapered off to a point, so that by introducing it far up the canal greater strength can be obtained, and the root rendered less liable to longitudinal fracture from pressure in a forward direction. A piece of platinum plate, a trifle larger than the end of the root, of about No. 30 U. S. standard gauge, with a hole punched in its center, is then slipped on the post, which it must fit tightly (Fig. 207).

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 the flame of an alcohol lamp. Barely enough 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. 208). Sometimes around the palatal portion of the root the platinum may be slightly burnished over the edge. 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 85. 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 or oxyphosphate cement (Fig. 209).

Dr. F. T. Van Woert, of Brooklyn, N. Y., in constructing crowns without collars, shapes the end of the root, and adapts the cap as shown in Fig. 210. The slant given to the palatal side aids the root to resist force in a forward direction.

Fig. 211.



Partial Collar Crowns.—The advantages of a collar can in a great measure be given this form of crown by the addition of a metal flange, encircling the palatal section of the root, as shown in Fig. 211. 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, 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 gauge to the shape shown in Fig. 212; for instance, for an incisor. Bend the metal to the form illustrated in Fig. 213. 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. 214). 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. 215), and remove the surplus plate and projecting ends and the labial section of the collar (Fig. 216). The cap is then ready to have the post fitted and soldered to it in position (Fig. 217).

Fig. 212.

Fig. 213.

Fig. 214.

Fig. 215.

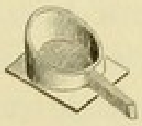


Fig. 216.

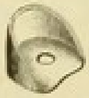


Fig. 217.

Post and Disk Method.—Ready-made posts corresponding in size to the Ottolengui reamers, Fig. 72, with disks of platinum, can be used to facilitate the construction of crowns of this style.

The posts are illustrated in Fig. 220. A disk of platinum with a perforated depression in which a little gold has been melted is shown in Figs. 221 and 222.

The method is as follows:

Shape the surface of the end of the root as shown laterally in Fig. 218.

Trim the approximal and palatal sides of the end of the root as illustrated in Fig. 219, but leave the labial side A, intact.

Fig. 218.

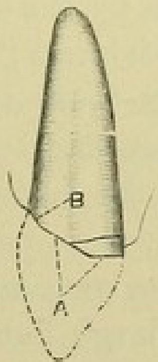
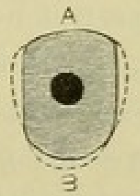


Fig. 219.



Enlarge and ream the root-canal with Ottolengui root-canal reamers, shown in Fig. 72, to the proper depth, first using the smallest size, and if necessary the larger sizes afterward.

Select a post (Fig. 220) 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 the slightest 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 moving the position of the pliers. Screw the post into the hole in the depression of the platinum disk, shown in Fig. 221 and in section in Fig. 222, 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. 223, 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.

Fig. 220.

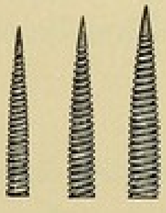
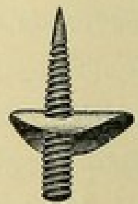


Fig. 221.

Fig. 222.

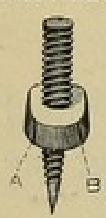
Fig. 223.



The orifice of the canal of the root 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.

Fig. 224.



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 outline the form of the end of the root on the platinum. Remove and slit the platinum at two points between the palatal and approximal sides to the outline of the end of the root as shown in Fig. 224, at A and B, and bend the platinum over with the pliers to embrace the approximal sides of the root.

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

MOUNTING 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 against the root, and cover it. (See Fig. 225.) The projecting end of the post should also be removed by first notching with a disk, leaving it a little flush at the

Fig. 225.

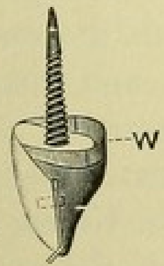


Fig. 226.

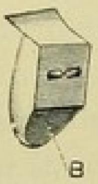
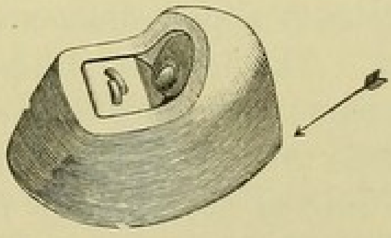


Fig. 227.



palatal side. The porcelain front, which should be a cross-pin plate tooth, is ground and closely fitted to the surface of the root or metal, as may be, at the cervico-labial section under the edge of the gum, but a properly shaped space opening toward the palatal side is left between it and the surface of the cap. To so shape the porcelain simplifies the fitting of the cervical section. The space between the cap and the porcelain is also easier filled in the soldering. To the porcelain front at the part B, Fig. 226, a piece of very thin platinum foil is shaped, the porcelain heated, the part veneered with a mere film of resin and wax, and by pressure with napkin or cotton the platinum foil is attached thereto. The rest of the porcelain is then backed with thin platinum plate (about No. 34 gauge). The platinum is left slightly extending over the incisive edge, and the porcelain front is waxed in position on the cap.

Fig. 225 shows the crown waxed up ready for investment. Wax in full quantity must be extended over the collar to its edge, in the seams, and between the porcelain and the cap at every point solder is to flow (the writer uses Parr's fluxed wax). Fig. 227 shows the invested crown with the wax removed. In trimming the investment the material must not be removed from over the collar lower than the line of the surface of the cap, nor in such a manner that the platinum turn-over edges are exposed to the direct force of the flame. Even though the collar is not exposed, the solder will flow over the outer surface of the platinum just where it is wanted and where wax has been applied, and all the parts will become united. The investment must be slightly raised at one end and heated up under its base with the full flame of a gas blow-pipe thrown in the direction indicated by the arrow in Fig. 227. Heat thus applied will cause the solder to flow downward by gravitation and fill the interstices in all parts of the investment as though it were an ingot. The best way is to apply solder a little at a time until the deep parts are filled. The flame is withdrawn for an instant, and with a small pointed flame and more solder the backing contoured. As platinum forms the cap and backing, the soldering can be conducted without fear of accidentally fusing those parts. Unless the soldering is conducted as described, the two seams of the cap should be previously soldered.

THE PARR CROWN.

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 with a band which half encircles the inner cap, and tapers off from the palatal to the labial section, as illustrated in Fig. 230. 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. 228). A hole is made in the cap, and a post fitted in the canal. A piece of gold plate, fully the size of the cap on the root, is adjusted on the post above the cap by making a hole in the gold in which the post will fit tightly. The gold plate is then adapted to the cap on the root,

Fig. 228.

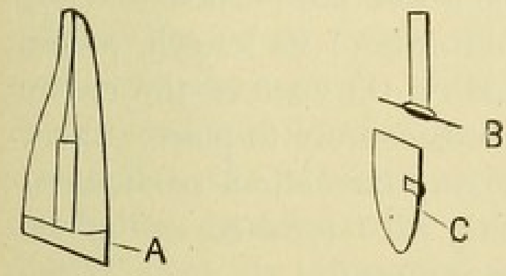
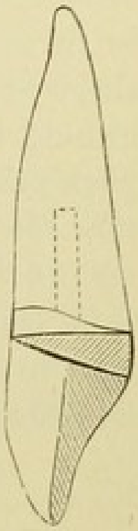


Fig. 229.

Fig. 230.



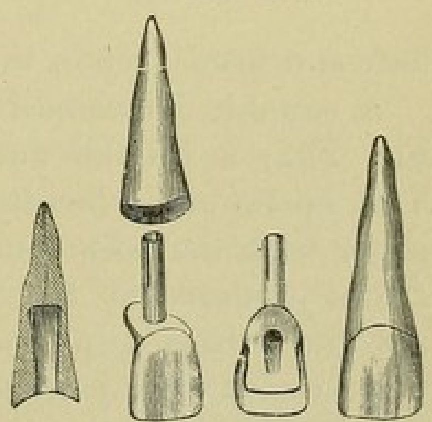
and burnished, without a collar, around the post, forming an outside cap; the pin and the outer cap are then removed and soldered together and adjusted on the inner cap, and the edge of the outer cap trimmed even with it (B). The porcelain tooth to form the crown, C, is fitted and attached to the outer cap, which, when finished, is cemented in position as shown in Fig. 229.

THE LEECH CROWN.

Dr. Leech's crown is thus described by Dr. J. E. Dexter:[1]

"A method devised by Dr. H. K. Leech, of Philadelphia, shown in Fig. 231, and described in the *Dental Cosmos* for April, 1879, is as follows: The root is drilled out to a depth of about three-eighths of an inch in diameter of about No. 16, standard (American) wire gauge, the bottom of the hole being flared or enlarged, and the canal above filled with gutta-percha. A gold tube is made to fit the hole accurately and project sufficiently for convenience of handling, and is soldered through a hole in a gold base struck to the root, projecting through the plate some distance. A plate tooth is fitted to the root and plate and soldered to the latter,

Fig. 231.



[1] *Dental Cosmos*, May, 1883.

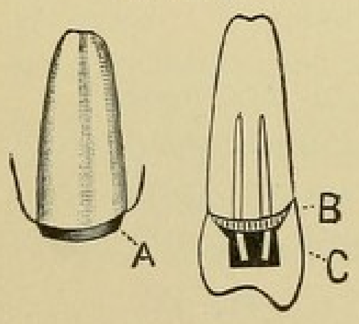
gold being flowed onto the plate and backing and around the projecting tube to form the palatal contour, and the tube cut off flush with the latter. We now have a plate tooth, gold backed, with a tube-pivot, the orifice of which opens on the palatal aspect of our tooth. The root-end of the tube is now slit perpendicularly in three or four places, for about two-thirds of its length, a thin sheet of warmed gutta-percha is placed on the base of the crown around the tube, and the whole is pushed securely to place. Now pack gold or tin into the tube, *condensing the bottom portions so that the slit end will spread and tightly fill the flared end of the hole in the root,* and the operation is complete."

A collar crown fastened with a tube-pivot as described can be used to advantage in detachable bridge-work, as the tube if filled with tin foil will admit of the crown being easily detached.

THE PERRY CROWN.

Dr. Safford G. Perry, of New York, employs a porcelain crown in combination with a capped root. A bicuspid will be taken as a typical case to illustrate Dr. Perry's method. The end of the root, by trimming the edge, is given the tapering form shown at A, Fig. 232. The collar (B) is made very narrow. A cap made of platinum soldered with pure gold is fitted on the collar, and a post or posts fitted in the root and through the cap. Enough of the post is allowed to extend beyond the cap to attach and firmly retain the porcelain crown (C).

Fig. 232.



A suitable Howland-Perry porcelain (see page 49) crown (C, Fig. 232) is ground and fitted in proper position on the cap. This operation is facilitated by perforating a disk of marking-paper with the posts and adjusting it on the cap. Then, as the crown is placed on the cap and pressed against it, points which prevent perfect adjustment are marked on the porcelain. By this means a close joint is easily secured. The edge of the porcelain should be fitted under the free margin of the gum, especially at the cervico-palatal part. The porcelain crown is next set over the projecting pins, and cemented to the cap with oxyphosphate.

The advantage of this method is, that the root being slightly tapered, the collar can be made to fit absolutely, while the excess of oxyphosphate is gotten rid of through the vent-holes, instead of being squeezed out around the edge of the collar. The edge of the collar being made to a knife-edge, can be properly burnished before the crown is placed, so that it will not irritate the gum or make a shelf. The crown covers the cap, and can usually be ground and fitted so as to entirely hide any exposed portion of the collar, the junction of which with the cap should be trimmed and then rounded with a burnisher, to give a form which will better meet the interior of the porcelain cap or crown. The porcelain can be replaced at any time in case of fracture without disturbing the cap on the root. Easy repair, simplicity of construction, and artistic result, are the special features of this crown.

CHAPTER X.

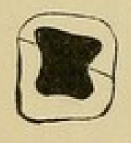
CROWNING FRACTURED TEETH AND ROOTS—CROWNING MOLAR ROOTS DECAYED APART AT BIFURCATION—CROWNING IN CASES OF IRREGULARITY.

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 previous health of the parts, and the length of time that has elapsed since the occurrence of the injury.

LONGITUDINAL FRACTURE OF THE CROWN AND ROOT.

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 peroxid of hydrogen. 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. 233).

FIG. 233.



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. Aromatic sulfuric acid followed by the peroxid can be recommended for the final injections. The upper parts of the root-canals are then filled with gutta-percha, or, preferably, with oxychlorid of zinc, and the main body of the cavity and the slots with a hard, quick-setting amalgam. A collar crown should always be used in these cases. If the form to be used has a post, a short, small tube of gold or platinum should be set in the amalgam in proper position to receive it. 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.

FRACTURE OF THE CROWN WITH SLANTING FRACTURE OF THE ROOT.

Fractures of this kind are common, especially 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.

In such cases the fracture seldom extends beyond the edge of the alveolar process. The fractured part having been carefully

Fig. 234.

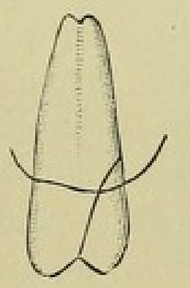
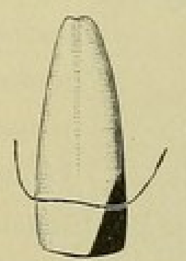


Fig. 235.



removed, a dovetail slot is made in the crown or root, in which gutta-percha is inserted for a day and the membrane of 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. 234 and 235).

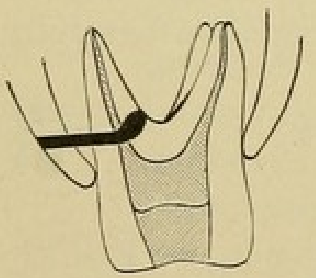
The tooth or root is then crowned, the mode of operation being the same as in any other case.

PERFORATION OF A SIDE-WALL OF A ROOT-CANAL OR OF THE DENTIN AT THE BIFURCATION OF THE ROOTS.

Extensive perforation by decay in these locations 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 peroxid of hydrogen. Dry the canal thoroughly. Bathe the edges of the perforation with chloroform. 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. Oxychlorid of zinc 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. 236). Carbolic acid may be used as described at page 32, to obtund the tissue. The necessary perforation through the alveolar process should be small in diameter, and be made with a drill. Injections 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.

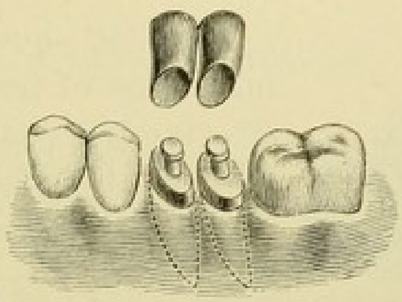
FIG. 236.



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,

Fig. 237.



and then soldering the sides of the cap together (Fig. 237). Where one root is missing, the other can be crowned singly.

DR. FARRAR'S CANTILEVER CROWN.

Figs. 238 and 239 represent Dr. J. N. Farrar's cantilever crowns. He describes them as follows: Fig. 238 illustrates a sectional view of three teeth, and an amputated first bicuspid root preserved by a screw, showing the application of the cantilever crown T P, set upon the decayed second bicuspid and made

Fig. 238.

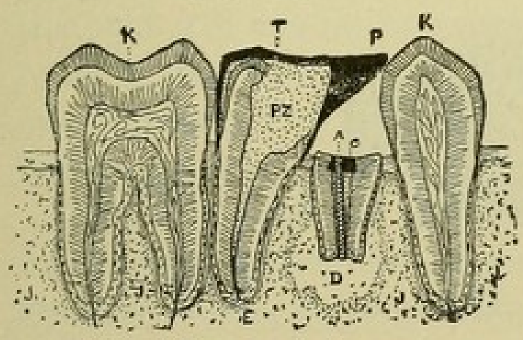
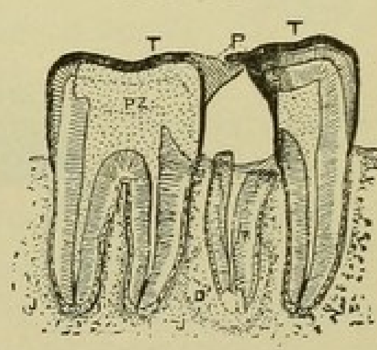


Fig. 239.



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 masticating surfaces and prevent tilting forward of the second bicuspid. The abscessed root here shown was extracted.[1] Fig. 239 illustrates the appearance of two molars, the posterior half of one of which is destroyed, showing also the ap-

[1] *Dental Cosmos*, vol. xxvi, No. 3.

plication 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.

METHODS OF CROWNING IN CASES OF IRREGULARITY.

Fig. 240.

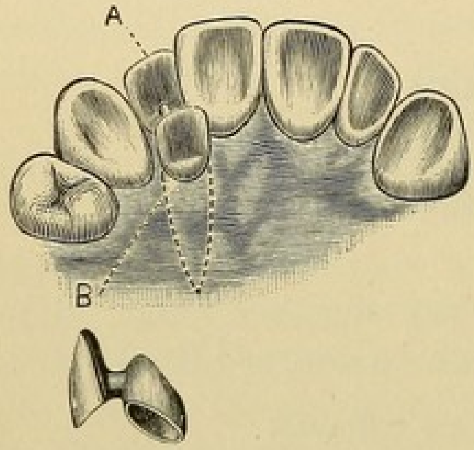
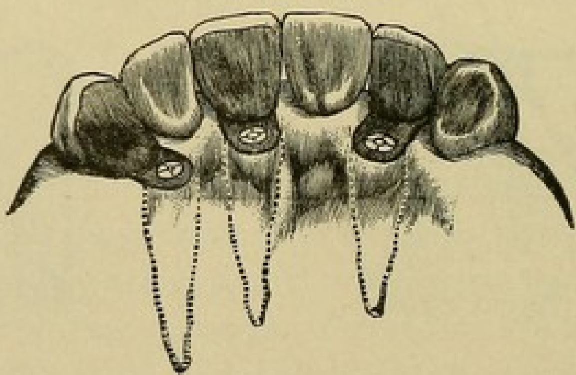


Fig. 240 shows a method of treating a case of irregularity without destroying the vitality of the pulp. The tooth at B, which stood inside the line of the lower teeth when the mouth was closed, was trimmed, shaped, and capped. To this cap was attached the tooth at A, with an oval-shaped piece of gold that cleared the lower teeth in occlusion. The cap was then cemented to the natural crown.

Fig. 241 represents a case of irregularity treated by Dr. Bonwill, who says in his description of it,—

"This shows a case of irregularity which was beyond correction, on account of the poor character of the teeth, their position in the palatal arch, and the age of the patient. In such cases I

Fig. 241.



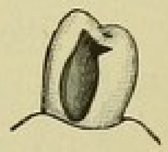
do not hesitate to cut off the crown, destroy the pulp, and insert an artificial crown. The crown is brought in the circle and connected with the root by a strip of heavy gold plate. The plate is attached to the root with a post or a screw with a nut."

CHAPTER XI.

PARTIAL CROWNS.

All-Gold.—Partial crowns of gold for the protection of plastic fillings in large cavities and for the restoration of contour are often desirable when, for any reason, a solid metallic filling cannot well be inserted. 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. Where decay extends close to the margin of the gum, if the tooth is trimmed away so that the gold will extend just under its free edge, a recurrence of decay at that point will be avoided. The bicuspid shown in Fig. 242 will serve as a typical case to illustrate the constructive details.

FIG. 242.



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 gutta-percha or moldine; or the shape of the natural tooth may be restored with wax or gutta-percha and the mold made directly from it in plaster. The die and counter-die having been formed (see article on "Molds and Dies"), a piece of pure gold, No. 28 to 30 standard gauge, 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. 243) 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. 244), but the brace should not touch the bottom of the cavity.

Fig. 243.

Fig. 244.

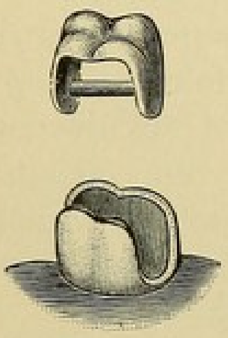
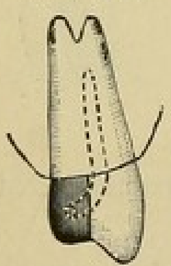


Fig. 245.



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. 245).

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

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.

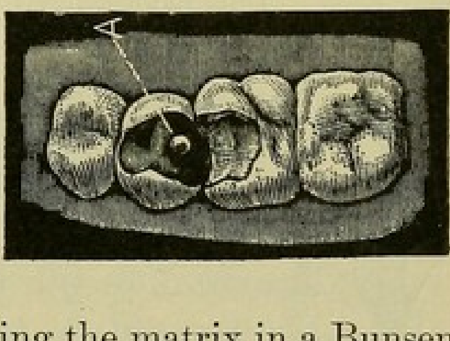
The cement should be first inserted in the cavity, and then a small quantity placed around the pins of the cap, which should be immediately adjusted accurately in position. When gutta-percha is used, it is heated and applied in the same manner to cavity and cap. The cap is then heated, pressed into position, 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.

Solid Gold Inlays.—The walls of at least the aperture of the cavity are trimmed straight. No. 60 platinum foil is adapted to the interior of the cavity and just over its edges by the aid of burnishers and cotton twisted on the end of an instrument, assisted by frequent annealing of the platinum. The matrix thus formed is then filled with wax, chilled, and removed from the cavity and invested, after which fine gold or 22-carat solder is melted into it. The removal of the matrix from the cavity can be facilitated by the insertion in the wax of a pin or a short piece of wax, which is grasped with tweezers. The plug of gold thus formed is properly trimmed and polished, and cemented in the cavity of the tooth. When completed, it has the appearance of a gold filling. If necessary, the cavity must be previously partly filled with oxyphosphate or amalgam or shaped with it, to give a better form to permit the removal of the shell of platinum foil. Plugs so made can occasionally be utilized as an anchorage for bridge-work.

Gold Inlays with Extensive Restoration of Contour.—Dr. W. V-B. Ames's method 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 gauge 24-carat 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. To fill this gold matrix 22-carat solder is used. For instance, in a case such as is illustrated in Fig. 246, a little of the solder is first melted in the most depressed or anchorage cavity of the occluding surface, by holding the matrix in a Bunsen flame. The matrix is again fitted to the cavity and the operation of fitting and soldering continued until the required contour is obtained. To facilitate the contouring it is well to tack at the proper point a small globule of high-grade solder as shown at A. To and around this globule pack crystal gold or foil to the line or bulge of the required contour, and flow solder in the interstices,

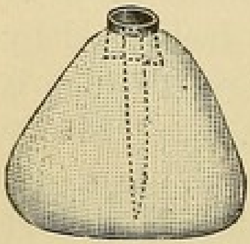
Fig. 246.



shaping the rest of the inlay at the same time. If considered necessary, the matrix may be invested for this final soldering.

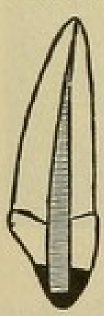
Solid Gold Tips for Abraded Pulpless Front Teeth in preference to fillings are constructed in the following manner: An opening is made through the occluding surface of the crown into the root-canal. A flat post, wide enough to fit closely in the pulp-chamber across its greatest diameter, thus tending to prevent any rotary motion of the gold tip, is then formed. A very thin piece of pure gold plate, say No. 30 U. S. gauge, 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 gold again burnished to the edges of the tooth and trimmed closely. 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 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. 247).

FIG. 247.



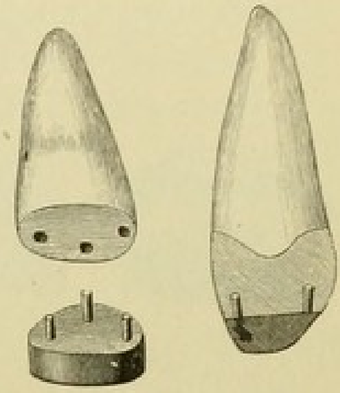
The investment is next heated, and 20-carat gold solder melted into the matrix formed by the foil over the cap. The surplus gold is then trimmed to the edge of the abraded surface of the tooth and to the desired form for the tip, and polished. The trimming or polishing of that portion of the tip at or 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 oxyphosphate. Fig. 248 gives a sectional view of a central incisor tipped in this manner.

FIG. 248.



For Gold Tips in Cases of Living Pulps, 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. 249. Three pins are generally placed in upper incisors and two in lower incisors. 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 and trimmed. A final investment is then made and the required form of the incisive edge added with solder.

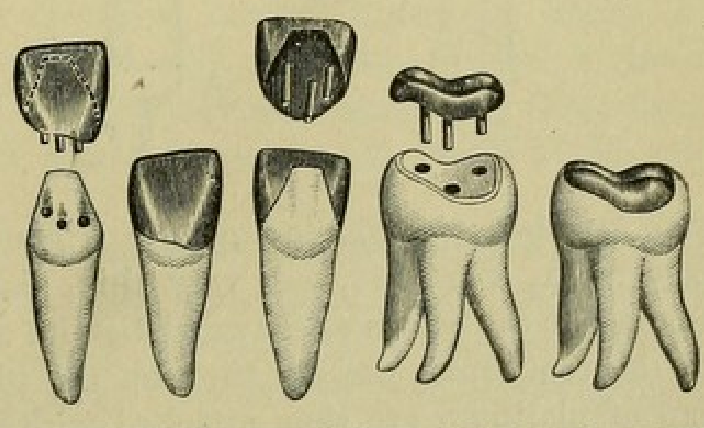
FIG. 249.



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 as previously described. If three pins are used, it is very seldom necessary for stability to extend the plate beyond the incisive surface, over the palatal side of the tooth.

The partial restoration in gold of a crown having a vital pulp by the methods explained is illustrated in detail by Fig. 250,[1] which illustrates the partial restoration of a central incisor and molar with vital pulps. The gold for the incisor, it will be seen, is adapted to the palatal surface and supported by three pins.

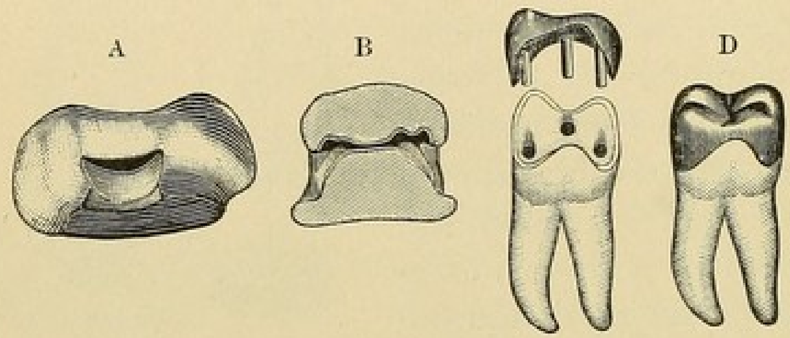
FIG. 250.



[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

Fig. 251 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 with boiling water through the open end, and the matrix was heated and properly filled with gold solder through the same opening. Another method is to strike up a grinding-surface of pure gold of about No. 34 gauge, adjust on the cap with wax, fit in the mouth to determine occlusion, remove, invest, and fill the cavity through the opening with solder.

Fig. 251.



Porcelain and Gold.—The partial restoration with porcelain and gold of an incisor crown such as is shown in Fig. 252 can be accomplished as here described: The edges of the crown to form the joining with the porcelain are trimmed straight and level, and

Fig. 252.

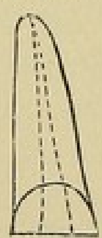
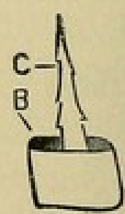


Fig. 253.

Fig. 254.



then polished. A shallow groove is generally formed to advantage at A, Fig. 253. A very thin piece of platinum is then adapted to the crown as shown at B, Fig. 254. 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. 253. 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. 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. 255.

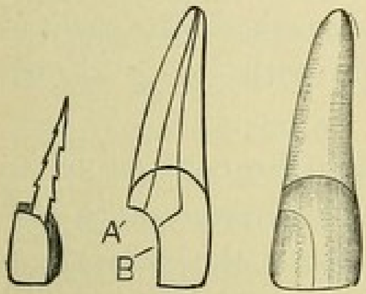


Fig. 256.

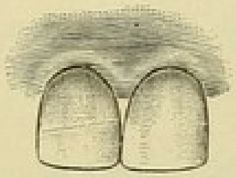


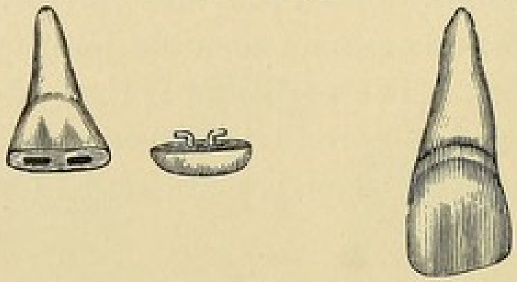
Fig. 257.

In a case such as is represented in Fig. 255 the cap is shaped to the surface of the dentin and enamel at A, and over its palatal edge, and the backing on the porcelain is extended out over the palatal edges of the enamel at B. The two sections of the platinum are united in the soldering.

Fig. 256 illustrates a fractured central incisor in which the pulp was not exposed, restored with porcelain by Dr. J. Bond Littig. The cap to the fractured part was fastened by three small pins as shown in Fig. 257, which illustrates the details of the construction.

"Where the piece broken off is so narrow that the porcelain tooth cannot be ground to fit in the ordinary way, without cutting out the pins," Dr. Littig describes his method as follows: "First cut a groove in the end of the broken tooth, making slight undercuts. The pins of a suitable porcelain tooth are bent outward, and the ends flattened. The porcelain is then ground away from both ends, until it is made as narrow as the natural tooth is thick or nearly so. The piece is fitted to the end of the tooth by placing the pins in the groove. If the joint is not good, grind away from either tooth or porcelain until it is perfect. Then set the piece with zinc phosphate, and after it has become hard, grind

Fig. 258.



the tip to shape in the mouth, and polish with moosehide disk and pumice-stone. Fig. 258 illustrates the second method; the ground porcelain tip, prepared crown, and restored tooth being shown separately."[1]

Figs. 259 and 260 illustrate a case in which the contour of an incisor tooth was restored by Dr. W. F. Litch's pin-and-plate process. Fig. 259 shows the palatal aspect of the tooth, in which the openings for two retaining pins were drilled, the openings being made quite small. In Fig. 260 is seen the porcelain tip attached to the plate and ready for mounting. The two retaining-pins will be observed soldered to the plate. In this case the cervical margin of the natural tooth was made level to afford a secure resting-place for the porcelain tip.

Fig. 259.

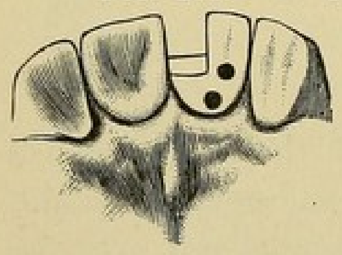


Fig. 260.

[1] The partial restoration of teeth with porcelain is explained in the chapter on "Porcelain Dental Art."

CHAPTER XII.

FINISHING AND POLISHING—PROCESS OF CEMENTATION.

FINISHING AND POLISHING CROWN-WORK.

The finishing 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, is 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. 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 gold should first be properly shaped, which includes trimming the collar off to a fine 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 incisive 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.

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 presented and the artificial crown.

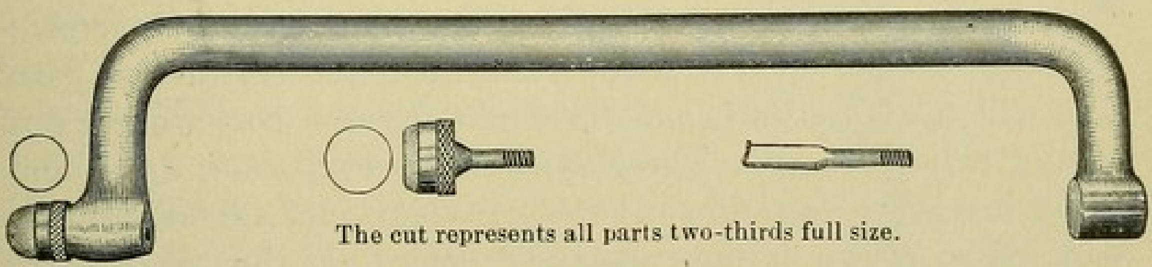
OXYPHOSPHATE OF ZINC.

As a cement for this purpose, the plastic oxyphosphate of zinc is generally preferred, and it 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 oxid of zinc should have been calcined at a high heat, and then ground to a very fine 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 oxyphosphate of zinc 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 oxyphosphate of zinc 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. For all styles of crowns with collars, and for bridge-work depending on crowns of similar construction, the cement should be mixed thin; but for crowns without a ferrule or collar it can be moderately thick. For mixing the cement, a piece of plate-glass about five inches long and three 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; the consistence should be that of thick cream. 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. In this respect the side of a square bottle filled with ice-water and well corked is preferable to a slab.

The parts to be crowned should be previously syringed with water and peroxid of hydrogen 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. 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. Each cap or crown, which should have been thoroughly 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 many cases it is best to quickly remove the napkin and close

Fig. 261.



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, or a crown-driver[1] (Fig. 261), can be used. With bicuspids or molar crowns and in bridge-work, however, it is better in most cases to occlude the teeth, and keep them in position under a steady pressure until

[1] This instrument can be used to fit a tight collar or crown. It also has a pull-off attachment which is handy in removing crowns.

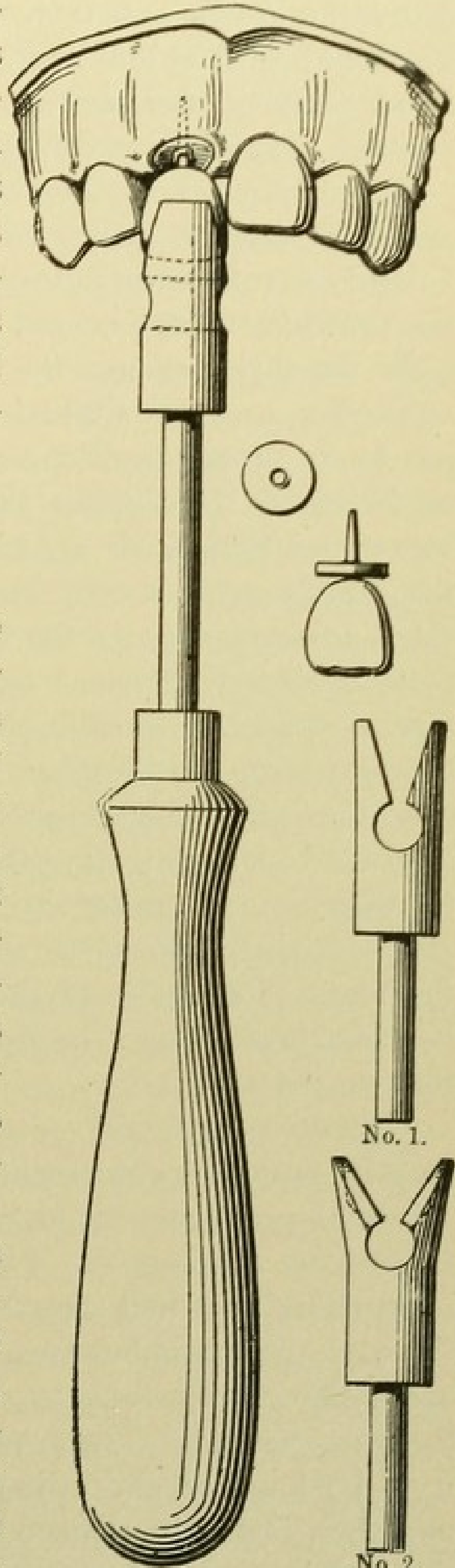
the cement sets. Under these circumstances the saliva can reach only the surplus portion of the cement, and cannot interfere with that under the cap or crown. One or two thicknesses of tin foil, placed over the crown as the teeth are occluded, will slightly favor the length.

When the cement has set perfectly hard, 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.

Previous to insertion the posts of crowns should be slightly barbed. By encasing 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 crown to a point that will heat the post, and then painting the post with a thin coat of chloro-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 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, easily detachable. A film of gutta-percha placed in the grinding-surface 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.

FIG. 262.



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, but 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, it lacks rigidity, so that its sphere of application is limited, and there are besides the well-known difficulties which attend its manipulation.

Crowns without Collars.—When gutta-percha is used, 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. Let the gutta-percha cool slightly, remove the crown and trim the surplus from the edges; wipe out the 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.

A crown-setter, as illustrated in Fig. 262, heats the crown and assists 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 applied to the setter forces 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. Sometimes it may be desirable to fasten the post with oxyphosphate and join the end of the root and artificial crown with gutta-percha. In such a case the crown should be heated and the gutta-percha, rolled down very thin, placed on the edges to be united in the form of a perforated disk. The crown is then pressed to position in the oxyphosphate placed in the root. The order of the use of these materials should be reversed where it may be desirable at some future time to easily remove the crown.

Collar Crowns with or without Posts.—The crown is heated, freshly prepared chloro-gutta-percha is painted all over the inside of the cap and over any post present in successive layers as the chloroform evaporates. The quantity of gutta-percha at first applied should be a little less than will be required to properly cement the cap. The whole crown is next heated to a point sufficient to cause the gutta-percha to adhere to the metal, but not to burn the gutta-percha. The crown is allowed to cool enough to permit it to be handled and adjusted in position on the tooth or root, and then instantly removed before the gutta-percha cools. The saliva present on the teeth prevents the adhesion of the gutta-percha to the tooth-structure. The inside of the cap is next washed out with water, followed with alcohol, and dried with a hot-air syringe. The gutta-percha on the inside of the cap will show an impression of the natural tooth or root. Points showing a deficiency of gutta-percha are to be filled up with more of the solution in chloroform, or it may be well to use a little of the solid gutta-percha for the purpose. The crown is again heated, adjusted in the mouth, and removed, this being repeated until the cap shows a perfect distribution of the gutta-percha. Any surplus extending from the edges of the cap should be removed.

For the permanent insertion the gutta-percha is dried in the same manner as before. The tooth or root is protected with napkins and also dried, and then varnished with an exceedingly thin solution of solidified Canada balsam dissolved in chloroform. The crown is next heated and placed on the tooth or root and held in position, either with an instrument or by occlusion of the teeth, until the gutta-percha cools. There is usually very little, if any, surplus to remove. If, on close examination, it should be found that the crown has failed by any means to exactly assume its proper position, a heated crown-setter or the copper bulb of a root-canal drier may be applied, and the crown heated to as much as the patient can bear, which will soften the attachment to allow the crown to be pressed to place.

As to the amount of heat that can be tolerated by the patient in the use of gutta-percha, your gauge will be: Any heated crown or bridge that can be held by the fingers of the operator can always be inserted without special discomfort to the patient.

Bridge-Work.—The method of cementing on a single crown just described can also be well applied to some small cases of bridge-work, such as a single cap with an extension bridge of one or two teeth, or a bridge with two caps, especially if all or nearly all of the natural crowns of the abutment teeth are present.

Large Pieces of Bridge-Work, more especially where the caps cover teeth with considerable of the crowns absent, can be cemented with gutta-percha more conveniently by the following method: Select a preparation of gutta-percha which softens at a low heat. Place it on a piece of soapstone or on a large granite-ware spoon. Heat up until the gutta-percha becomes so plastic that it can be worked with a spatula. Heat the bridge-work and caps. Coat the inside of the caps with chloro-gutta-percha, and when the chloroform has evaporated place the gutta-percha you have heated with the spatula around in the caps somewhat as you would oxyphosphate cement. Have water boiling in a cup and immerse the bridge in the water, letting it remain for about one-half minute. Remove with tweezers, dry the exterior with a napkin, and immediately adjust in the mouth in position, and then quickly remove it. On removal, the gutta-percha in the caps should be dried as described in the use of chloro-gutta-percha, and more gutta-percha added where required.

The boiling and insertion are repeated until a proper quantity of gutta-percha is placed in each cap. The gutta-percha is then again dried, and the caps heated in a flame to a point which will assure the adhesion of the gutta-percha to their inner surfaces. The natural crowns or roots are then varnished with the solution of chloroform and Canada balsam as before described, and when the bridge is at a heat possible to handle, it is permanently placed in position in the mouth and cooled with ice-water from a syringe. Should the bridge be found to have failed to assume its proper position, a heated crown-setter, or the copper bulb of a root-canal drier from which the point has been removed, can be applied rapidly from one crown to another until a heat as great as the patient can bear is reached, when the caps can be pressed to place.

Another method of heating gold crowns in the mouth is to apply a gas jet about one-eighth of an inch in size to the gold caps. This is done by passing the gas through a small brass tube, like the nozzle of a syringe, connected with a rubber tube.

Gutta-percha and Oxyphosphate Combined.—In case of collar crowns, envelop the post with gutta-percha by the use of heat and chloro-gutta-percha as described. After adjusting in the mouth remove and fill the cap with oxyphosphate cement, at the same time placing a little cement on the post, and bring the crown to place on the root. In setting gold crowns by this method, apply the gutta-percha in the manner described for gutta-percha alone, but in a slightly less quantity than is required, then place the oxyphosphate in the cap or caps and adjust in position in the mouth.

Crowns and bridges mounted in this manner present no special difficulties in removal when desired; for, when the heat applied is sufficient to soften the gutta-percha thoroughly, the oxyphosphate will usually loosen sufficiently to permit removal.

AMALGAM.

Amalgam is used to some extent to support and retain porcelain crowns. Its use in connection with the Gates-Bonwill crown is given on page 48. Where it is desirable to use amalgam, Dr. Kirk gives copper amalgam the preference to other kinds 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 pulp-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 (occluding) surface a suitable point mounted in the Bonwill mechanical 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 surfaces of contact 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 mechanical mallet blow.

PART III.

BRIDGE-WORK.

BRIDGE-WORK.

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 antique origin, having been practiced long before plates came into use.

FIG. 263.

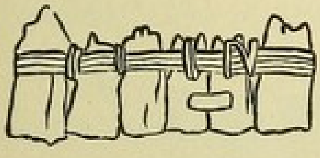
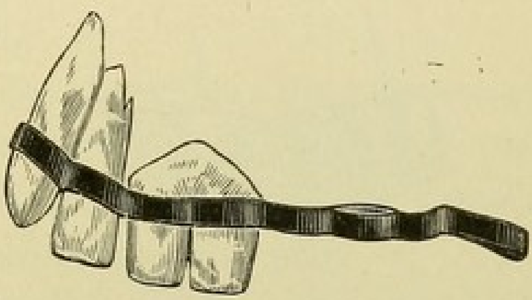
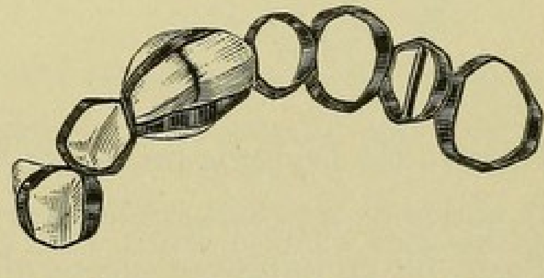


FIG. 264.



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. 263, 264, and 265 illustrate the antique methods.[1] Fig. 263 is an illustration of a specimen of ancient Phœnician dentistry. Fig. 264 is that of one in the Etruscan age, dating about five hundred years B.C. Fig. 265 gives a view of the same denture inverted.

FIG. 265.



[1] See *Independent Practitioner*, vols. vi and vii, "Evidences of Prehistoric Dentistry," by J. G. Van Marter, D.D S., Rome, Italy. Figs. 263, 264, 265, 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.

Dental literature presents bridging operations as described by J. B. Gariot in 1805, C. F. Delabarre in 1820, Dr. S. S. Fitch in 1829, William Imrie in 1834, J. Paterson Clark in 1836, and Dr. W. H. Dwinelle in 1856. Figs. 266 and 267 are copies of illustrations in Dr. Fitch's work, published in New York in 1829, and Fig. 268 one from a translation of F. Maury's work in 1843.

Fig. 266.

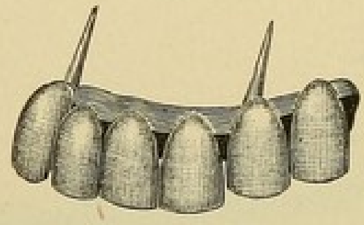


Fig. 268.

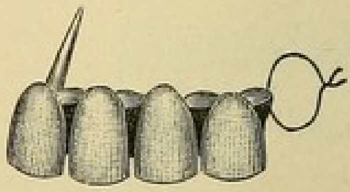


Fig. 267.

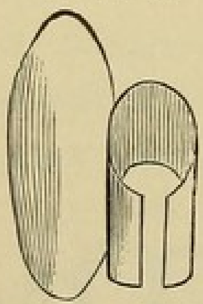
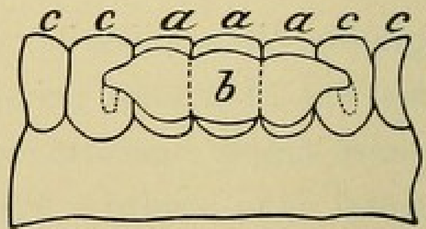


Fig. 269.



In 1871 the bridging 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. 269). The system was also practiced in operations by the late Dr. M. H. Webb, and is described in his "Notes on Operative Dentistry."

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.

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.

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 fourteen 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 any one who is experienced in dental practice; and unless the anatomical conditions are most favorable, the usefulness and durability of such work is decidedly 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.

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.

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. 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.

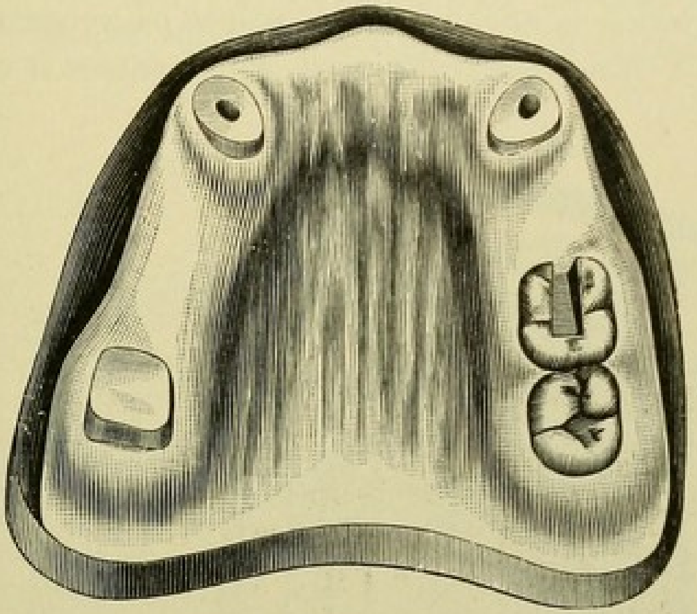
One molar or bicuspid on one side, and a bicuspid or molar on the other, with one or two roots in an intermediate position, will support a bridge between them.

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.

Fig. 270.



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 case represented in Fig. 270 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 87), the two cuspid roots capped for collar crowns with porcelain fronts (see page 79), and the left first molar, which will afford anchorage to a bar on that side of the bridge (Fig. 271). A slot, dovetail in form, is usually cut well into the body, but not to an extent that will endanger the pulp of the last-named crown (Fig. 272). If the tooth is not decayed, it can be first opened up with a rubber and corundum disk. The shaping of the slot is best accomplished with fissure-burs. With the crowns and caps in position, an impression and articulation of the case are then taken with plaster[1] slightly colored with carmine, to which is added a little sulfate of potassium, less than the proportion of salt generally used, which causes it to set quickly.

Fig. 271.

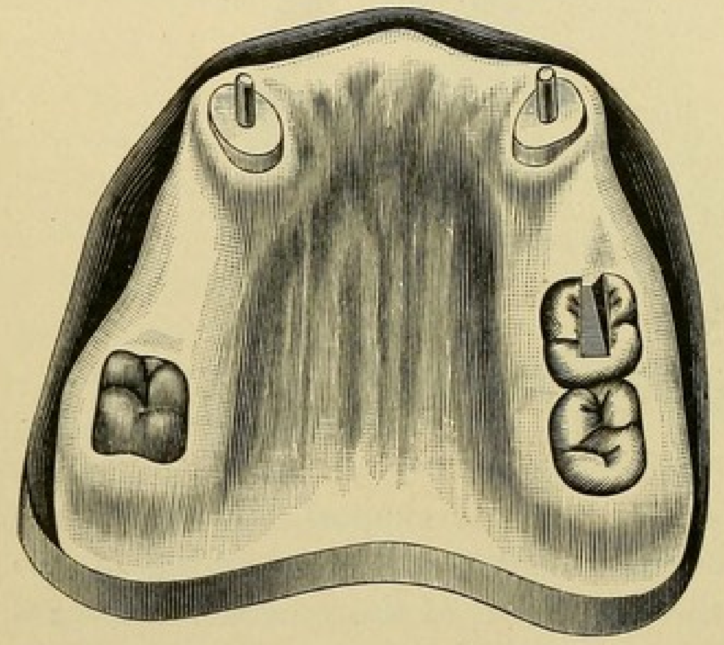
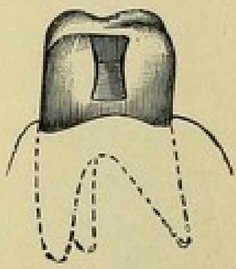


Fig. 272.

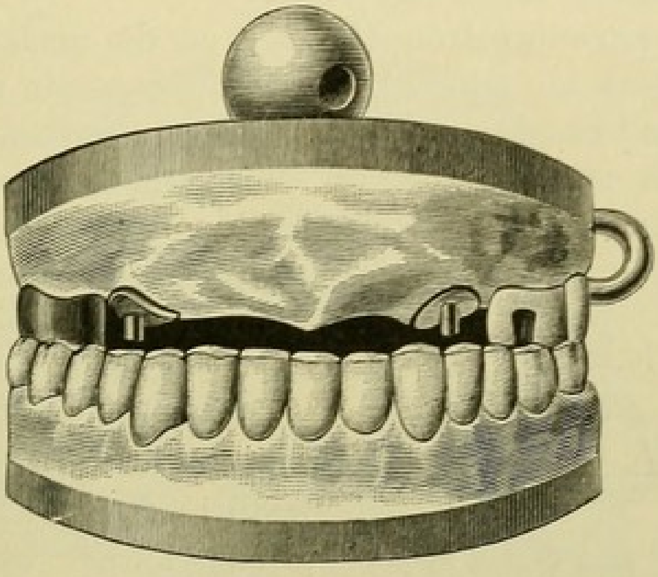


The plaster is mixed moderately thick, and with the aid of a spoon or rolled in a mass in the fingers, which should be wet to prevent adhesion of the plaster, is placed around in the mouth on the crowns, caps, and parts to be included in the bridge, and the antagonizing teeth occluded tightly and so 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

[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.

a model is run, composed of equal parts of calcined marble-dust and plaster, to which a little sulfate of potassium is added. When the model has 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 and articulation of the case will be found, with the crowns and caps in exact position as in the mouth (Fig. 273).

Fig. 273.

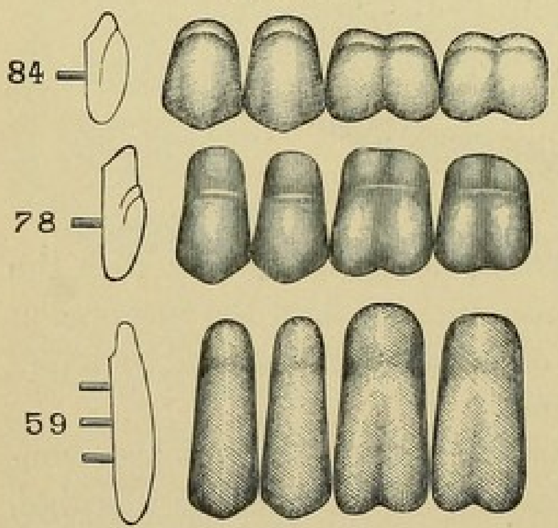


Another method is to first take the articulation in wax with the caps and crowns in position in the mouth, and then the impression in an impression-tray with plaster, and make a model and articulation from them in the usual manner.

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 blow-pipe, 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 position, 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.

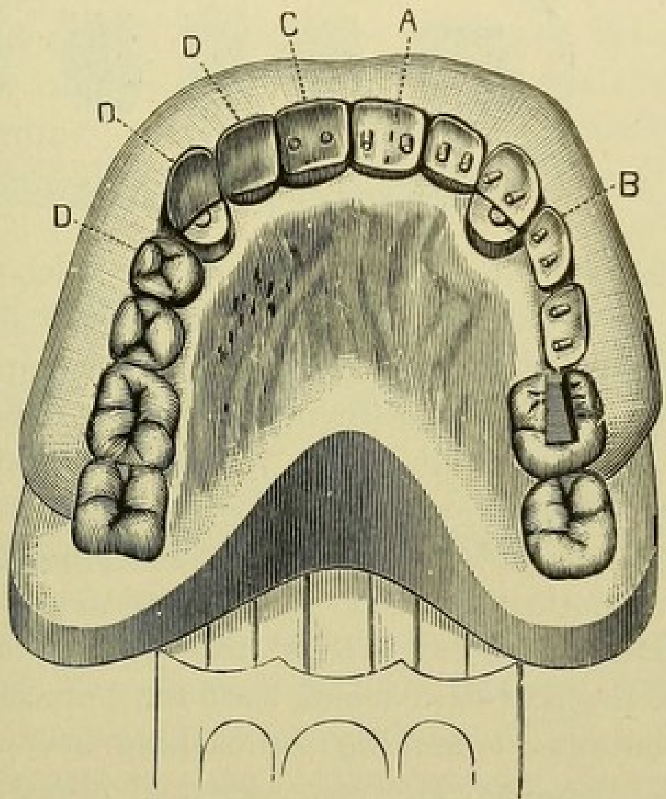
The pins protruding from the caps on the model are next cut off short. Teeth are selected,—ordinary cross-pin plate teeth for the incisors and cuspids, and partial teeth, representing the front section of the tooth and styled porcelain facings, which were specially designed for crown- and bridge-work, for the bicuspids and molars (Fig. 274). 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. The wax is then removed, exposing the palatal portion, and permitting the forms

Fig. 274.



and position of the teeth to be studied (Fig. 275). 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. 275). This is to form the self-cleansing spaces. The incisors are then backed, using either thin platinum or pure gold (C). The backings are allowed to extend just over the incisive edge as a protection to it, and, if preferred, down on the curve of the self-cleansing space. A more desirable result is

Fig. 275.



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.

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, which is apt to occur if 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. 276), 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 88), and the concave portion filled by melting in scraps of 20-carat gold plate or 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

FIG. 276.

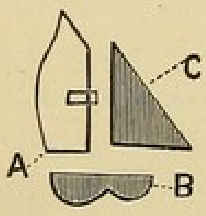
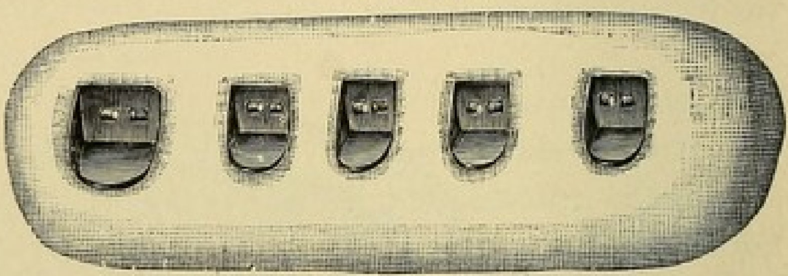
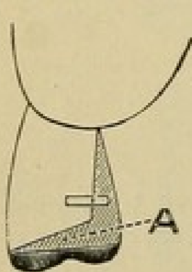


FIG. 277.



with the articulation of the lower teeth, and the space filled in with wax. This metallic occluding surface is to protect the porcelain. Triangular pieces of very thin gold plate, platinum, or No. 60 gold foil, or mica (C), cut and fitted 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, leaving the back open, presenting the form of a pocket (Fig. 277).[1]

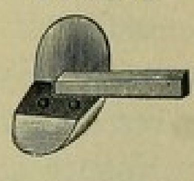
FIG. 278.



Another method of constructing bicuspid and molar dummies is to fit the cap to the labial 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. 278.

The bar intended to be anchored in the slot cut in the molar on the left side is made of iridio-platinum wire, about No. 15 U. S. standard gauge, with the end shaped as shown in Fig. 279, and fastened with wax to the tooth and cap, and adjusted in the mouth to obtain accuracy of position before soldering.

FIG. 279.



The advisability of constructing bridge-work with what are termed self-cleansing spaces is not favorably

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

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 accurately. 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, and the conformation will also exclude particles of food and present a much

FIG. 280.

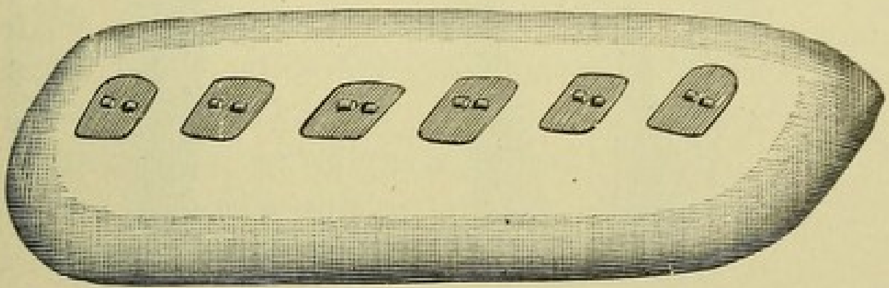
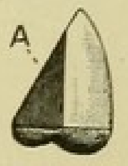


FIG. 281.



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. 278.[1]

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.*

All the porcelain teeth or fronts can be invested at the same time, including the incisors and porcelain fronts to the cuspid crowns, as shown in Fig. 280. In the soldering, if the backing is done with platinum, and the occluding surface 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 (see page 79) may

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

be melted into the pockets formed by the cap and side pieces to fill out to the line at A, Fig. 281, and flowed over the backings of the incisors and cuspid fronts in sufficient quantity to shape them as shown at B, Fig. 282. When the backing and occluding surfaces are made of 18 or 20-carat gold plate, 18 or 20-carat solder and small pieces or filings of gold plate should be used instead. After the soldering and removal of the borax with acid, the metal of each tooth is then, when it is easily done, very carefully trimmed and shaped with corundum-wheels and points.

FIG. 282.

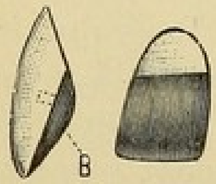
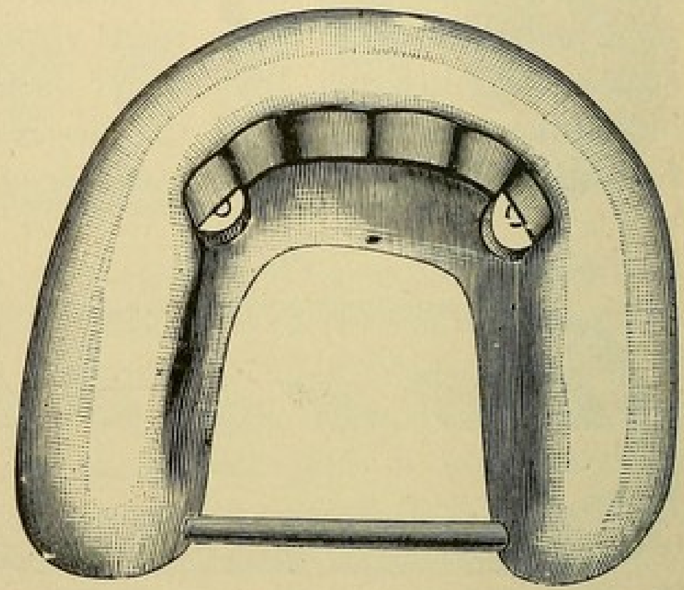
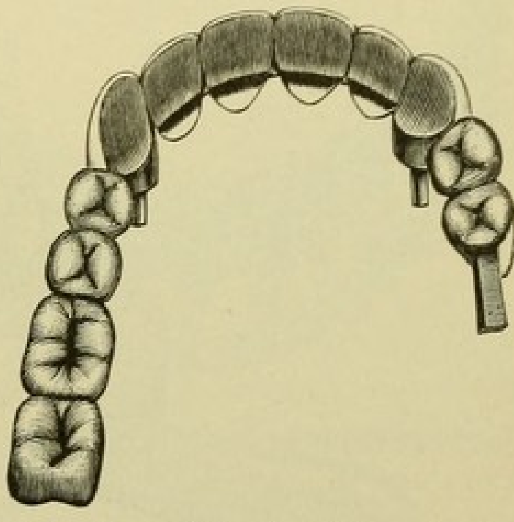


FIG. 283.



The teeth are next placed in their relative positions on the model as shown at D, D, D, Fig. 275, and attached to one another with wax in exactly the 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 process of soldering, which might readily occur from contraction in so large an investment, an iron wire or a narrow horse-shoe shaped strip of sheet iron should be placed in the investment so as to encircle the teeth and crowns about one-fourth of an inch from their exterior surface (Fig. 283). In any spacings between the backings pieces of gold or platinum plate or wire, about one-eighth of an inch long, are placed lengthwise, 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 blow-pipe on a piece of charcoal with a concave depression (see chapter on Soldering). 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 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. 284). If the constructive details have been properly performed as described, a finished piece of bridge-work is the result.

Fig. 284.

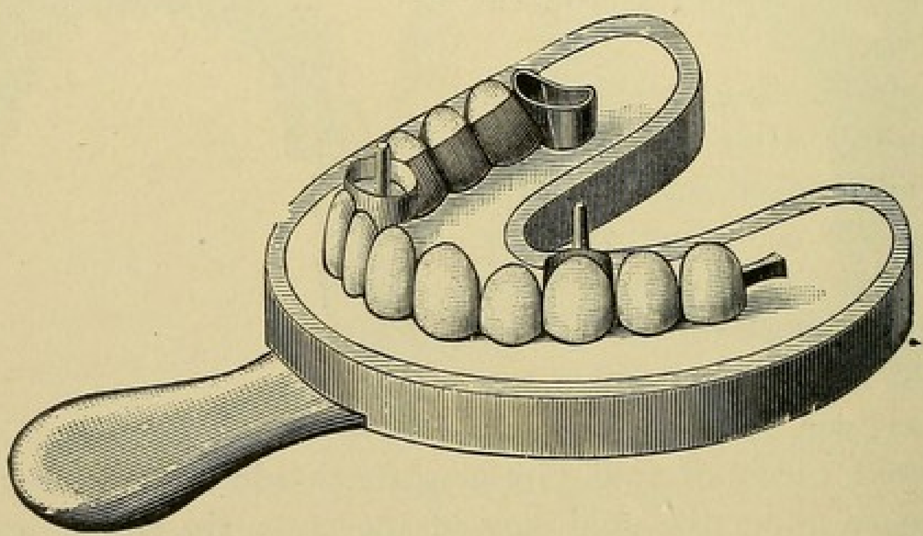


In constructing bridge-work many prefer, after the porcelain fronts are backed and the caps forming the occluding surfaces of the bicuspids and molars are properly adjusted on the model, to invest and do the entire soldering at once. When this plan is followed, pieces of gold wire or plate should be laid lengthwise in the slots under the gold caps of the porcelain fronts, 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, and the finishing of the bridge is not so easily done.

In large pieces of work warping may be avoided, whichever method of soldering is adopted, by first removing, in proper position, the "dummies," and soldering those of each span together. The spans are then replaced in the matrix and soldered to the abutments.

Another method much practiced 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. 285. 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 exposed and soldered together. To enable 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.

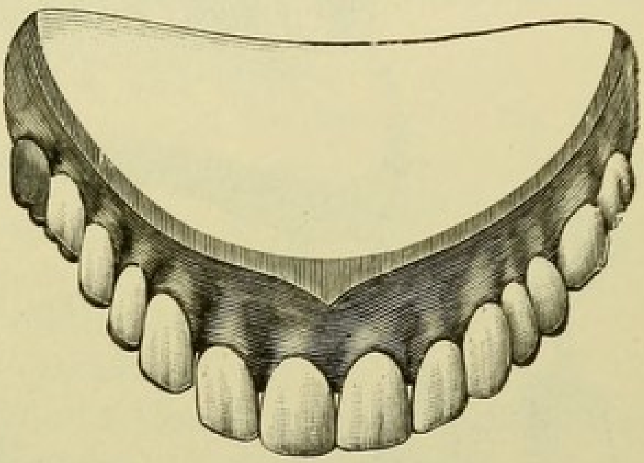
FIG. 285.



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. Only sufficient investing material to cover the points of the teeth and crowns (Fig. 285) should be used as just described in construction of a bridge in sections, more investment material being added after removal, and the sections soldered together.

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. 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 cement or gutta-percha. The end of the bar is anchored in the slot by either a gold or an amalgam filling (see chapter on Bar Bridges). Fig. 286 represents the bridge in position.

Fig. 286.



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, are adjusted and cemented with resin and wax 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 with a serrated surface. The 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 process of soldering. Figs. 287, 288, represent cases of bridge-work constructed in this manner.

Fig. 287.

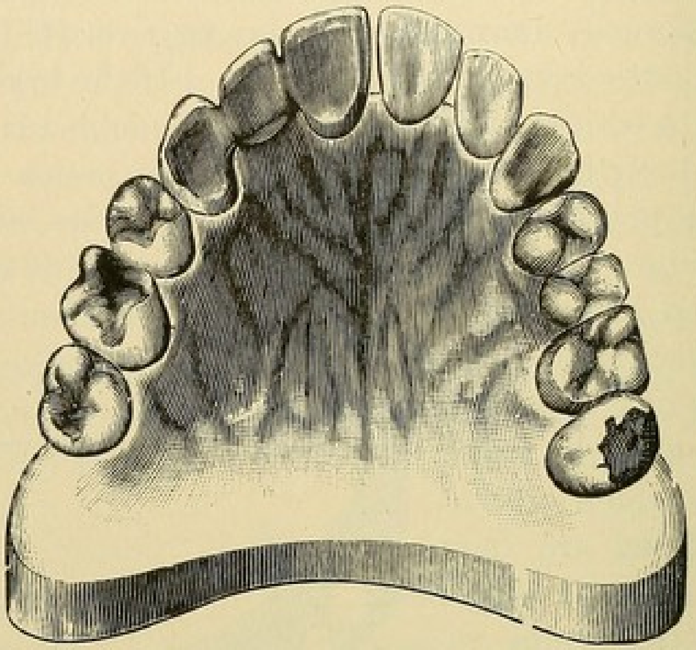
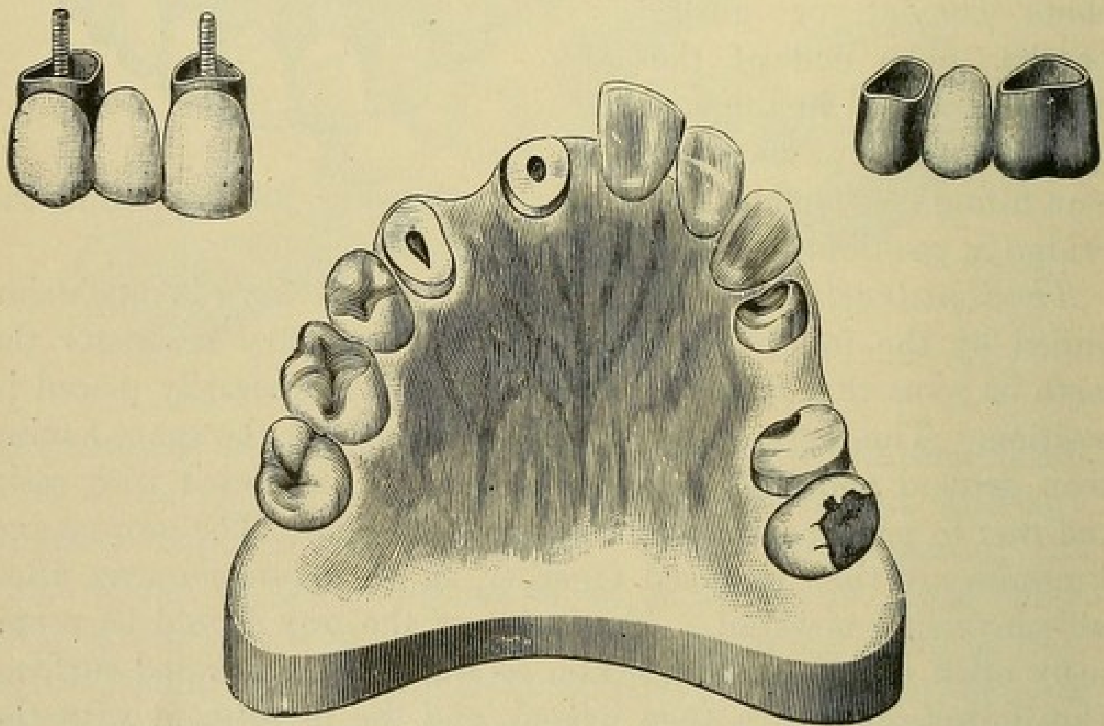


Fig. 288.



In a 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 from the mouth, then invest and solder together.

CHAPTER II.

SPECIAL PROCESSES AND APPLIANCES IN BRIDGE-WORK.

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.

FIG. 289.

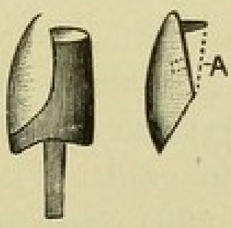
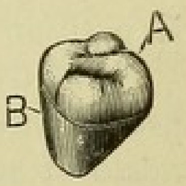


FIG. 290.



Another method is to attach with wax transversely across the backing in proper position a strip of gold plate as shown in Fig. 289, and then flow in gold to the 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 incisive edge of the porcelain to retain it in position in the investment.

Solid Porcelain Dummies with Gold Base.—In some cases of bridge-work on the lower jaw, protection of the incising 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 the 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 gauge, 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. 291, and punch a hole, A, in one of the corners. Slip this over the left-hand pin A, Fig. 292, 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 on the gold enough to expose the porcelain as shown in Fig.

FIG. 291.

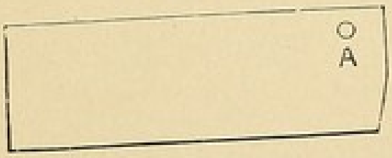
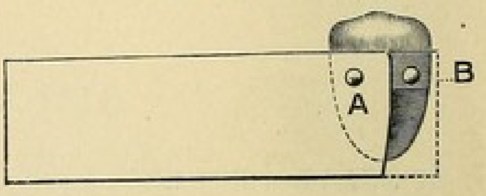


FIG. 292.



293. 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. 293, which can be placed in position and attached with solder.

FIG. 293.

Solid Gold Crowns.—In a close articulation, 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. 290) representing the grinding-surface (see page 86), 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, or, if pure gold and platinum has been used in the sections of the crown, with 18- or 20-carat plate.

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

A bar bridge can be made with these seamless crowns by passing an iridio-platinum wire through the crowns before filling in (Fig. 294).

A Solid Gold Crown for a Pulpless Molar, supporting the end of a bar as shown in Fig. 295, is constructed as follows: The natural crown is ground down, banded, capped, and pivoted as in Fig. 296. The gold or platinum forming the top of the cap on the root is made perfectly flat and left projecting a little at the

Fig. 294.

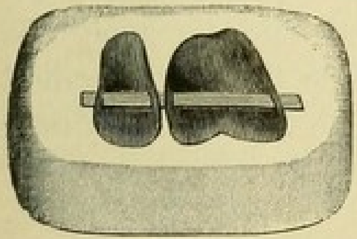


Fig. 295.

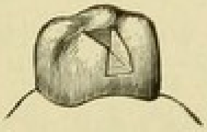
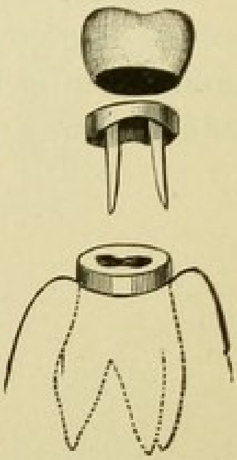
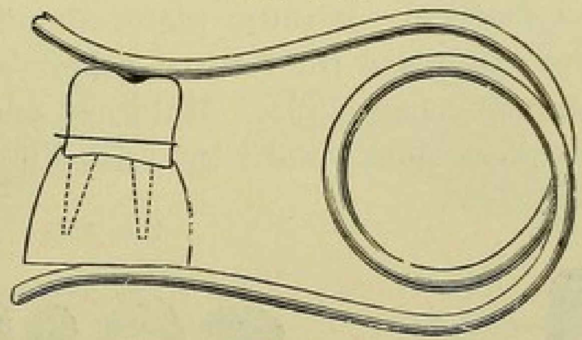


Fig. 296.



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 bur is to rest in. A shell of thin platinum of the size and shape of the anchorage cavity is then inserted in the slot and cemented with wax on the inside of the crown. The crown is

Fig. 297.

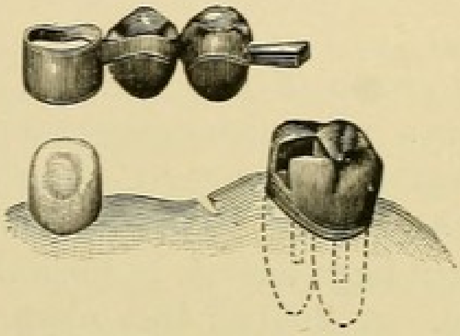


then invested and filled with 18-carat gold solder, which should be cut into small pieces, and be placed successively in the crown and melted by maintaining a uniform heat with the large flame of a blow-pipe. The base of the crown is next ground level and accurately fitted to the cap and articulated to the antagonizing teeth. It is then clamped in position to the cap, the pivots of which are protected with investing material (Fig. 297), and soldered, making a perfect joint. This is an easy method of constructing an otherwise difficult form of crown.

Fig. 298 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. They are formed as follows: Take a gold seamless contour crown of suitable size, with a thick grinding-surface, or one which has been reinforced with solder or gold plate and with the flux removed, and 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

FIG. 298.



of the portion of the gum the dummy is to rest on, and scrape a little from the surface of the model to cause pressure and insure closeness of fit. Melt a small quantity of solder with flux to a ball form. Fit a piece of platinum plate, about No. 32 gauge, over the aperture, and place the ball of solder on the platinum within the gold cap (see Fig. 299). Hold cap and platinum in a Bunsen flame, and heat slowly until the solder melts and appears

FIG. 299.

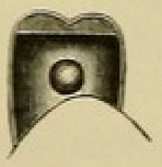
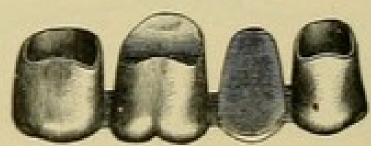


FIG. 300.



under the edge of the cap; then instantly remove from the frame, 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. Fig. 300 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.

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. 301, 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. The aperture is then closed with platinum as shown in Fig. 299.

Fig. 301.

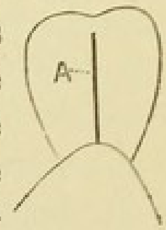


Fig. 302.

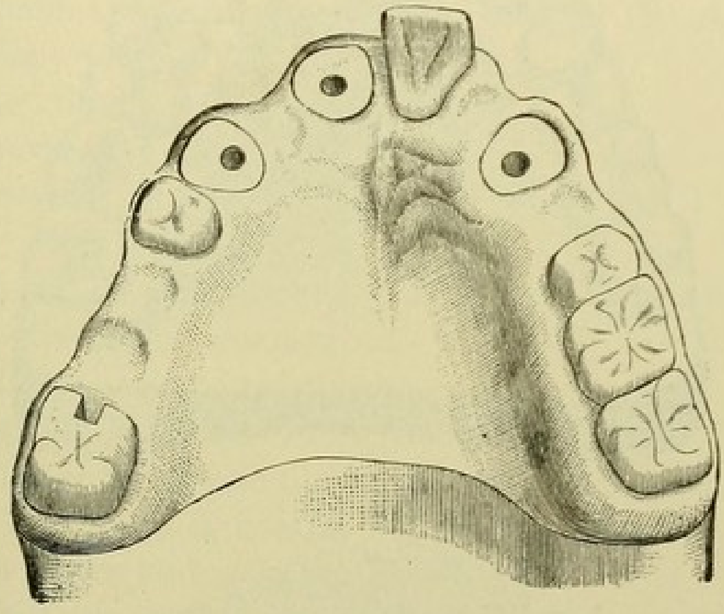


Fig. 303.

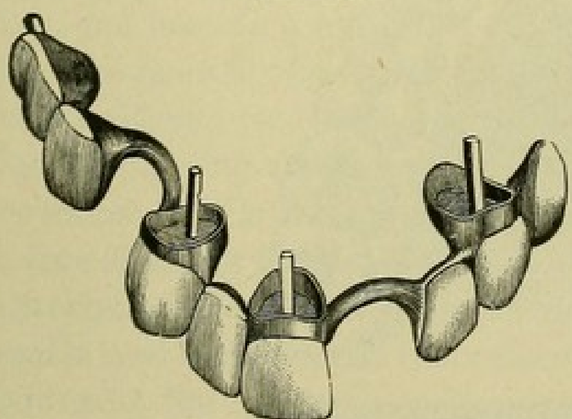
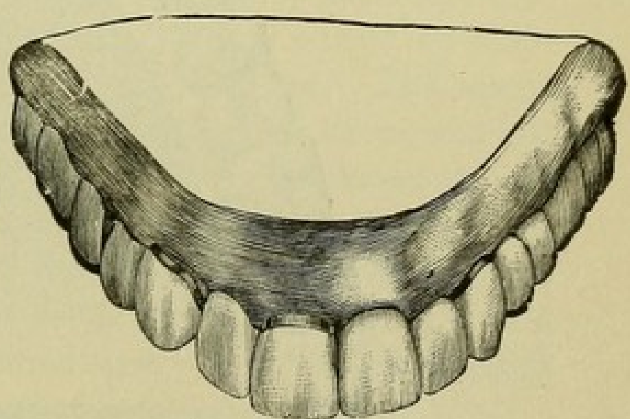


Fig. 304.



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 oval-shaped gold or iridio-platinum wire around the intervening teeth, close to but not touching them, and pressing slightly into the

Fig. 305.

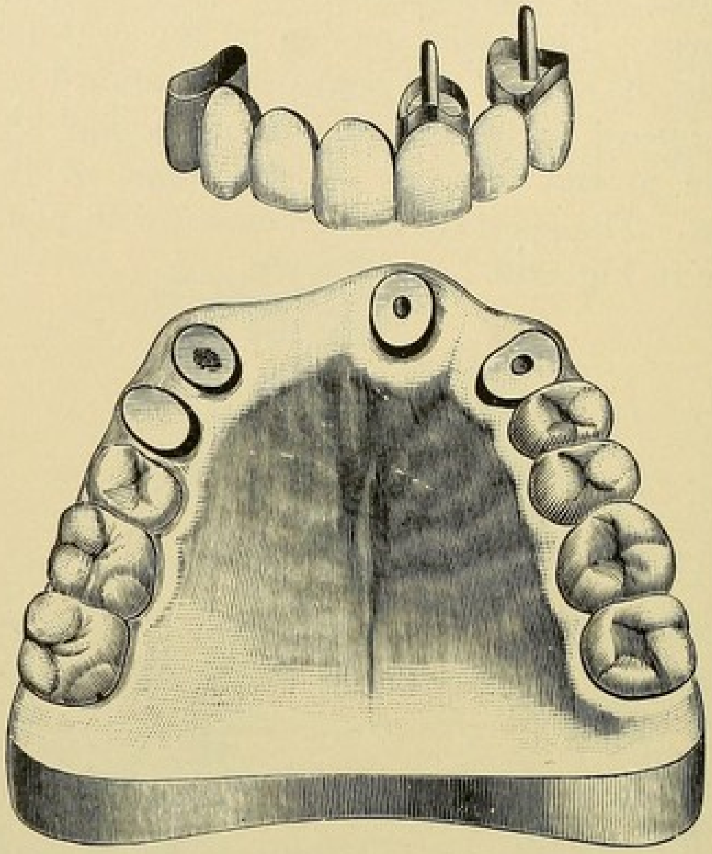
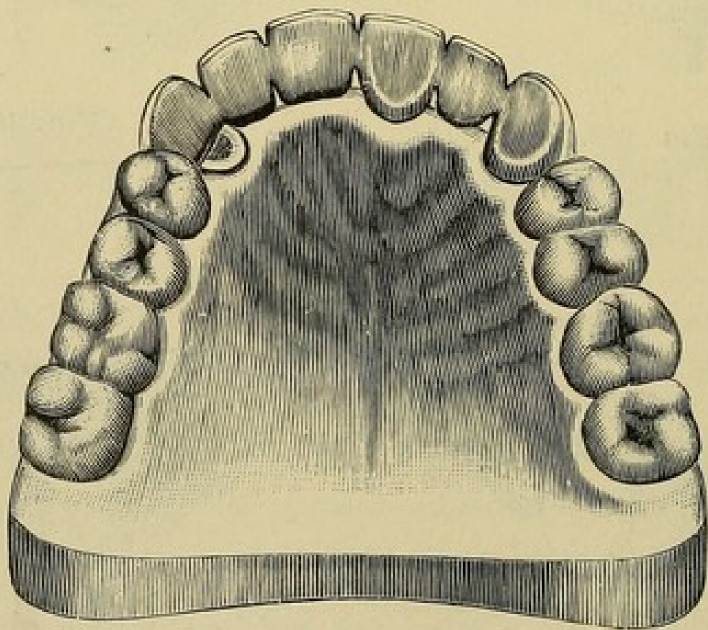


Fig. 306.



gum so as not to present too pronounced an interference to the tongue. (See Figs. 302, 303, and 304.)

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. 305 and 306 represent a case in which the root of the cuspid on the right side has been so treated and utilized.

Shell Anchorage or Crown.—A shell crown or anchorage for a cuspid to support bridge-work 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 the sides. 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 below the incisive edge. Remove a portion of the gold from the incisive labial section, and slit the palatal surface on both sides of its center, as represented in Figs. 307 and 308. 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. 307.

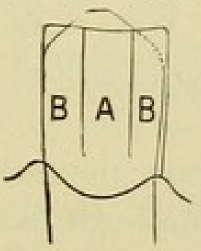
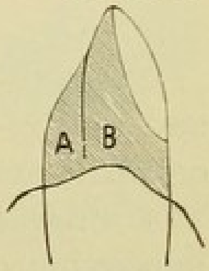


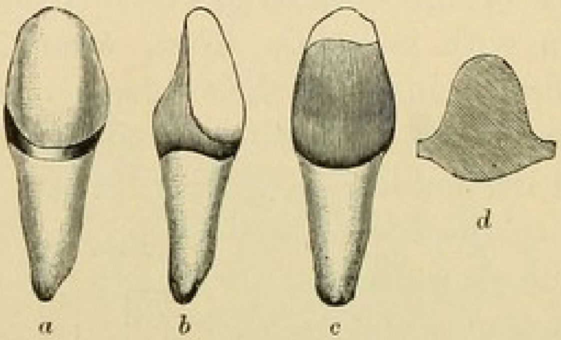
Fig. 308.



The collar has now assumed the form of a gold crown having an open face and seams. The seams are next united by placing, melting, and 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. 309. In the vacancy between the collar and tooth at the palatal side, fit and burnish a piece of pure gold or thin platinum, 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. 309, 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,

Fig. 309.



and remove the surplus gold of the collar extending above the crown; *b* and *c* show the finished shell crown.

A Seamless Shell Anchorage is formed as follows: From an impression of a natural crown taken in plaster, gutta-percha, 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 stamped from a seamless cap of

Fig. 310.

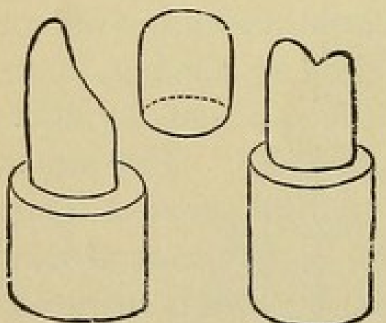
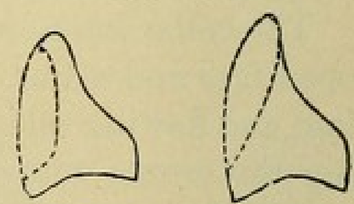


Fig. 311.



gold (Fig. 310). 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. 311. A shell for a cuspid can be made from a gold collar as well as a cap. The shell formed in either manner is then filled with investing material, and strengthened by flowing 20-carat solder over the surface.

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

Fig. 312 shows the forms usually given shell crowns for bicuspids. When the gold is removed at the labio-cervical part, the crown should be additionally secured by a pin introduced and soldered at the point A.

Fig. 312.

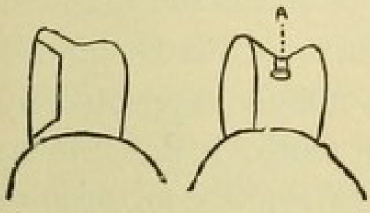


Fig. 313.

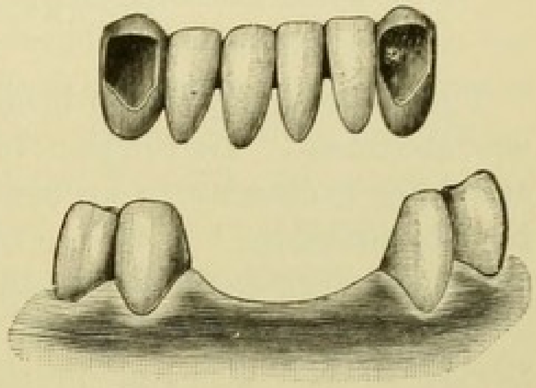


Fig. 313 illustrates a bridge in which the lower incisors are supported by shell crowns on the cuspids.

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.*

Fig. 314.

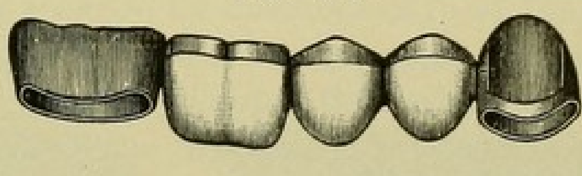


Fig. 314 represents the restoration of the inferior bicuspids and molar on the right side, by a bridge with a shell crown on the cuspid and an all-gold crown on the second molar as abutments.

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.

CHAPTER III.

EXTENSION BRIDGES.

This term is applied to bridges which are chiefly supported by one abutment. In relation to the anterior teeth, it consists in 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

Fig. 315.

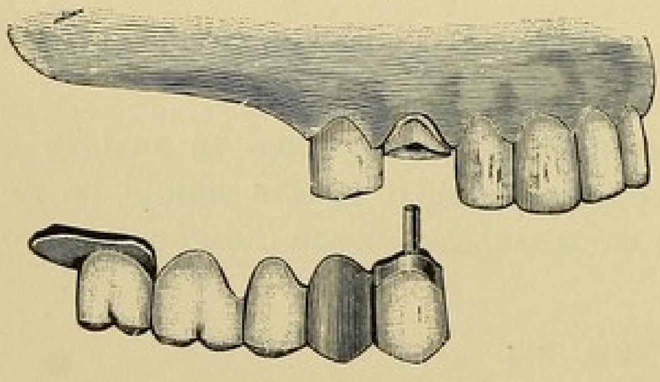


Fig. 317.

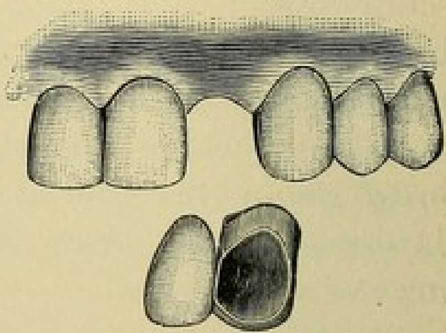


Fig. 316.

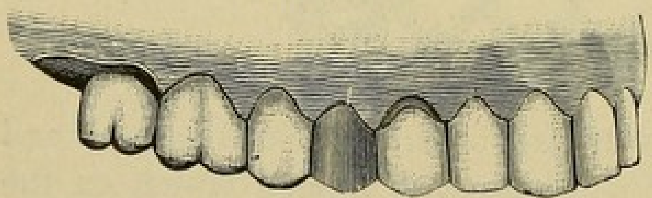
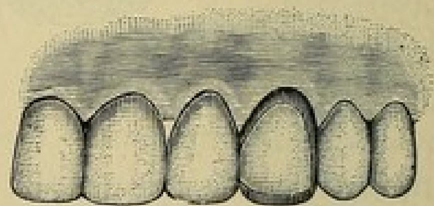


Fig. 318.



to it as one abutment, with a saddle for the other. A saddle is an oval-shaped piece of gold, of the form of the gum and a little larger than the base of the tooth, placed under the posterior tooth of the bridge.

Figs. 315 and 316 represent an extension bridge. A crown on the cuspid, an all-gold crown on the bicuspid, and a saddle, are the abutments. In constructing this bridge, the teeth forming the abutments were first crowned. 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 154. 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 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 gauge 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. 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, in some cases the constant springing motion of the extension bridge will 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, instead of excising the natural crown and mounting an artificial crown on the root for the purpose (Figs. 317, 318).

Figs. 319 and 320, 321 and 322, represent small extension bridges of frequent construction, the former to repair losses in 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 that 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 occluding surface is then added in the usual manner. When the finished crown is

Fig. 319.

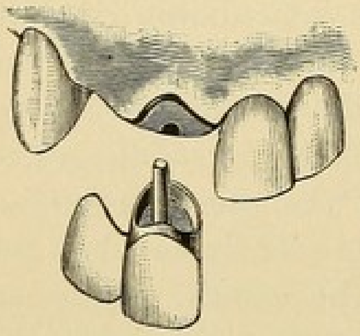


Fig. 321.

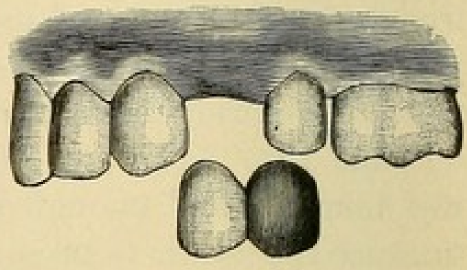


Fig. 320.

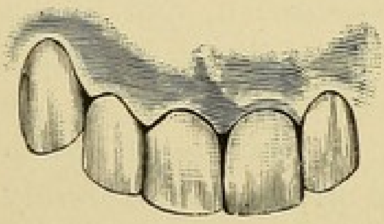
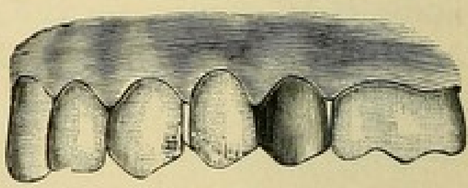


Fig 322.



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. 323, is brought close against the neck of the natural tooth. This method of forming a gold crown may be advantageously practiced in these cases of bridge-work.

Fig. 324 shows a pin shell crown which can be made to support a porcelain front representing a cuspid or bicuspid. By forming

Fig. 323.

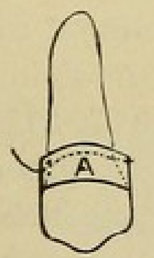


Fig. 324.

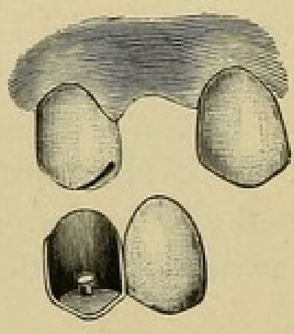
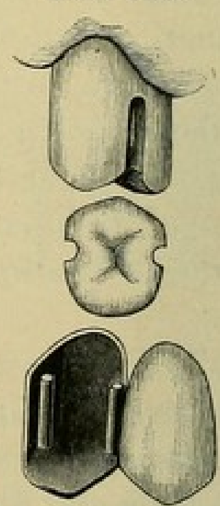


Fig. 325.



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, great security of attachment is obtained with a partial cap, and without the least exposure of gold (see Fig. 325). In a favorable case a cuspid cap may be formed on this plan to support a lateral. A third pin may be necessary at the palatal side of the cuspid.

The same result can be obtained, but in a more laborious way, by first forming the grooves in the sides of the natural tooth, then making a collar of pure gold, about No. 33 gauge, and burnishing it well into the grooves, and removing and flowing 20-carat gold plate over the outer surface of the collar. The grinding-surface is next added. The gold is then removed from the labial surface of the cap sufficiently to expose the natural tooth.

FIG. 326.

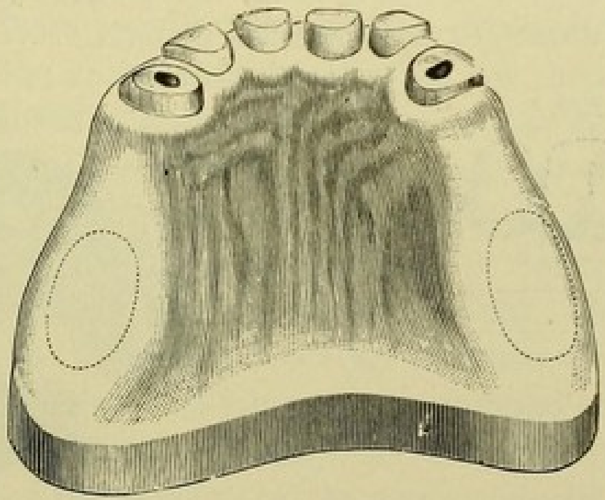


FIG. 327.

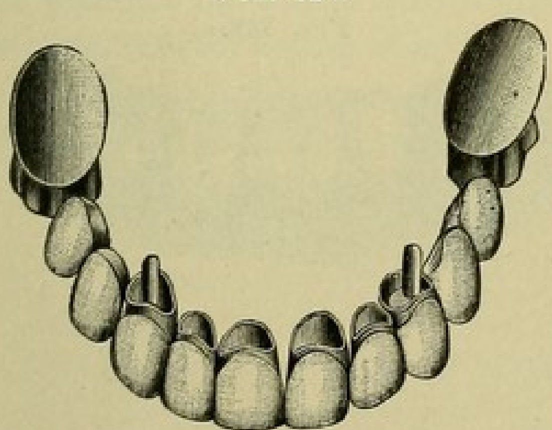
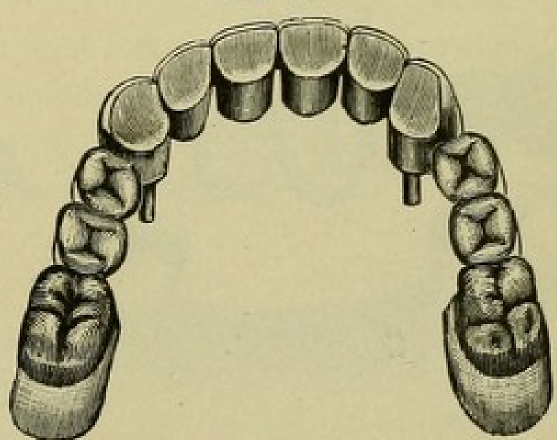


FIG. 328.



In most cases where shell crowns are used on the upper jaw, the gold forming the posterior side of the cap can be brought round slightly on the labial surface of the tooth without being observable when viewed from the front; but it must be cut short at the anterior side and not 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 enough to avoid exposure in speaking.

Figs. 326, 327, and 328 represent an extension bridge. The anterior abutment consists of the six front teeth, which were all 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 on each side, resting on a plate or saddle extending from the cuspids back beyond the bridge teeth or dummies, is suggested instead.

Fig. 329.

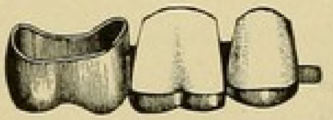


Fig. 330.

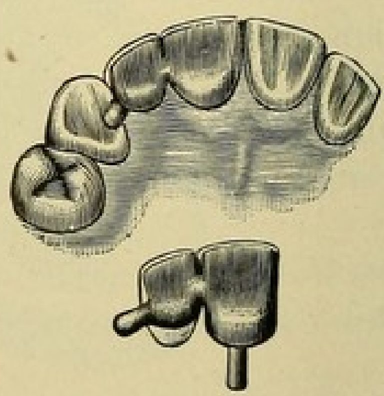


Fig. 331.

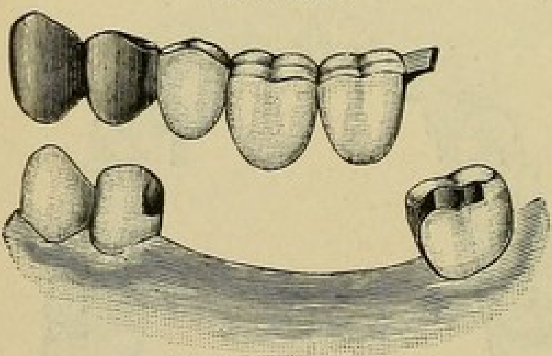
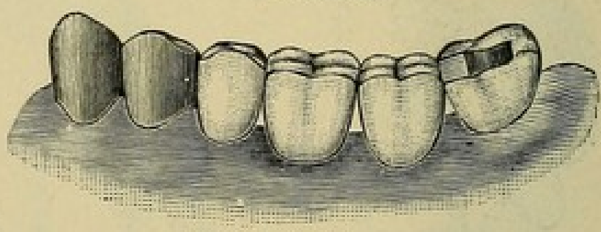


Fig. 332.



A Spur Support consists of a flange formed at the end of an extension bridge, affording support by resting on the palatal wall of either an incisor or a cuspid, or in the sulcus between the cusps of a bicuspid or molar, as shown in Fig. 329. Fig. 330 illustrates a case with a spur resting against a cuspid. In the case represented in Figs. 331 and 332 the spur rests in an indentation in an amalgam filling in the molar. This form is termed a cantilever bridge.

A spur is best formed as follows: When the dummies are mounted on the model ready for investment, adapt on that portion 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 only cover the portion of the spur to be soldered.

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 teeth should be made unusually narrow from labial to palatal side, to offer less occluding surface to those antagonizing.

CHAPTER IV.

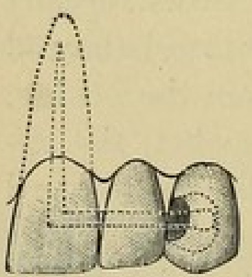
BAR BRIDGES.

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 faults of 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. 333.

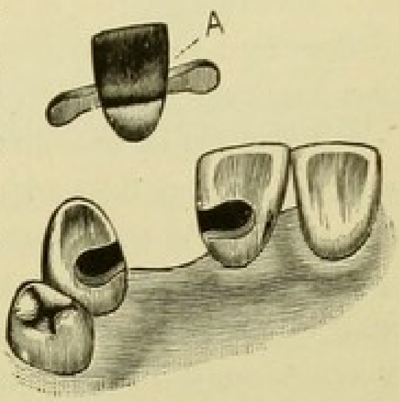


In a pulpless tooth the bar should be bent and inserted into the root-canal, as shown in Fig. 333.

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. 334), 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.

Fig. 334.



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.

The bar is best constructed of platinum or iridio-platinum wire, Nos. 14 to 16 gauge. The platinum is more easily manipulated, but affords less rigidity, which should be considered where there is a close occlusion. 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. 334. 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 suited 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 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.

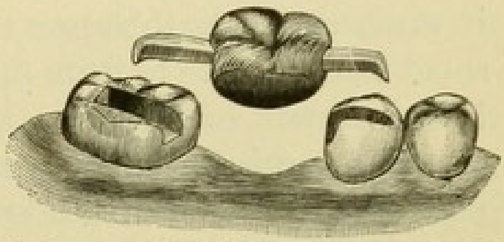
When the anchorage tooth is pulpless, the end of the bar which extends into the canal should be cemented first. Frequently, when bicuspids and molars containing large cavities of decay are used for anchorages, it is advantageous to first insert the anchorage fillings, and then drill out sufficiently 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 expedient 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.

In Bicuspid 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. 335. 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. 335.

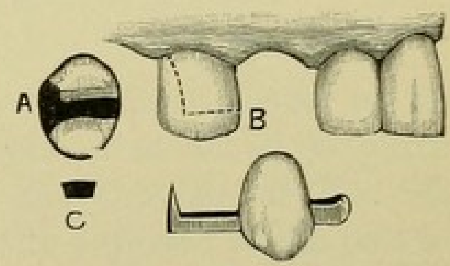


The principles involved and the method described for shaping and securing the ends of bars apply equally well to cases where one end of the bridge is supported by a bar and the other by an artificial crown, as has been previously illustrated.

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. 336, 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 posterior approximal 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 anterior 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. 336.



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 deeper position in the jaw than at the time it was inserted, though this was only to the extent of the absorption of gum-tissue under the bridge. 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.

Cast Inlays or Fillings, as described on page 127, can be used in some instances to support the end of a bar. In such a case, a short piece of wire to form the bar is inserted in position in the wax in the matrix of platinum before it is removed from the cavity, and soldered in it. The wire permits the inlay to be removed in position at the end of the bridge. The attachment of the bridge is then made to the bar or inlay.

The practical application of bar bridge-work is limited. It frequently affords advantages for artificial restoration, in many cases where a single tooth has been lost, not presented by other methods. Its practical success depends chiefly upon the character of its supports and the skillfulness with which it is anchored.

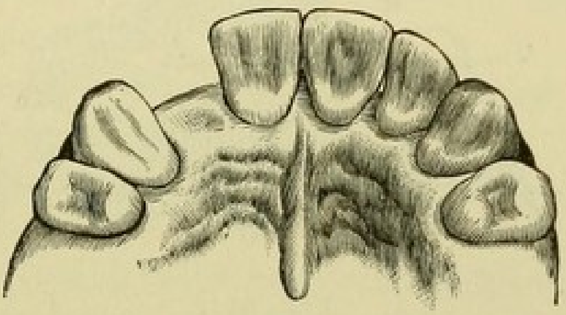
CHAPTER V.

PARTIAL CAP AND PIN BRIDGE.

THIS style of bridge is used only in case of loss of a single front tooth.

Fig. 337 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.

FIG. 337.



To Make a Pin and Plate Bridge.[1]—1. Take in plaster an accurate impression. From this obtain a plaster model of the parts.

2. Make from pure gold, rolled to the thinness of No. 26, standard gauge, 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 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. 338.

[1] Dr. W. F. Litch, *Dental Cosmos*, vol. xxviii, No. 3.

4. For the purpose of 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. 340, at C, D. Sometimes, owing to a close occlusion or to

Fig. 338.

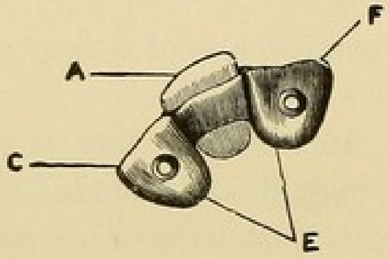


Fig. 339.

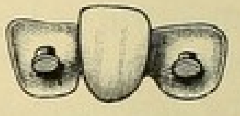


Fig. 340.

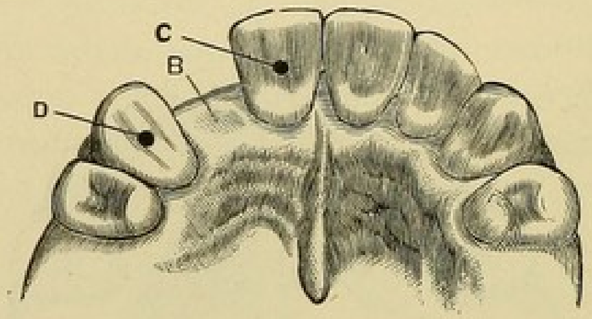
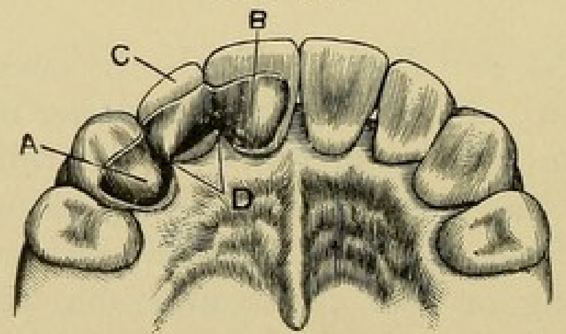


Fig. 341.



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, standard gauge, with a shank of No. 18, standard gauge. 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. 338 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. 339 represents the appliance completed with the pins in position.

Fig. 340 represents the natural teeth and interspace B, with openings for retaining-pins, C, D.

Fig. 341 represents the appearance presented when the bridge is cemented in position.

The bridge is attached by cementing in position with oxy-phosphate.

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 re-cementation. Practical experience by the author in the use of this form of attachment shows that two pins in one, if not in each, of the plates are necessary. The exception is a pulpless tooth, which admits of considerable lengthening of a single pin.

CHAPTER VI.

REMOVABLE AND REPLACEABLE PORCELAIN FRONTS.

In those forms of crown- and bridge-work in which porcelain fronts are used there is some liability of fracturing the fronts, either in the soldering processes connected with the construction, or subsequently, after the insertion of the piece in the mouth, by the patient in mastication. 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.

A modification of Dr. I. F. Wardwell's method, which is simple in construction and application in comparison with most forms in use, is as follows: A thick, narrow piece of 18-carat gold plate, at least No. 18 standard gauge, is soldered to the tooth, and its two sides undercut with a very thin separating file (Figs. 342, 343). 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 the bar, this forms a substantial backing or socket (Fig. 344), in which, when the bar is anchored, the porcelain tooth can be fastened with a little oxyphosphate cement or gutta-percha (Fig. 345).[1]

FIG. 342.

FIG. 343.

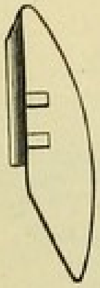


FIG. 344.

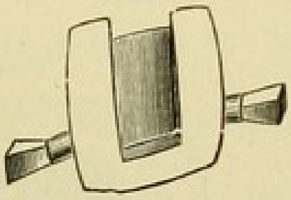
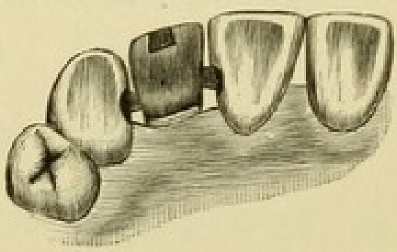


FIG. 345.



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. 346), 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.

FIG. 346.

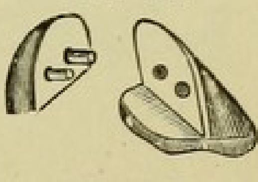
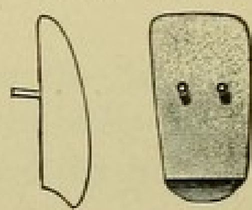


FIG. 347.



Dr. C. L. Alexander's method is to use teeth having long pins, as in Fig. 347. The facings are fitted in proper position and cemented with hard wax. The wax around the pins is then heated with the points 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 backings

[1] 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 ot the porcelain front in case of fracture by the patient.

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."

and little ferrules of pure gold placed around the pin-holes (Fig. 348). Hard wax is next applied on the 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. 349 shows an invested case ready for the soldering process, which

Fig. 348.

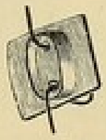
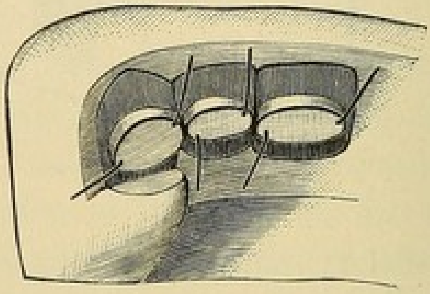
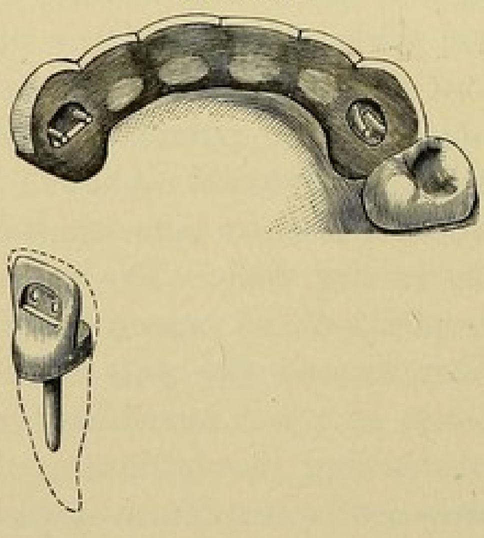


Fig. 349.



will unite the ferrules to the backings, 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

Fig. 350.



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. 350 shows a central crown ready to receive the porcelain front, and a piece of bridge-work with the cuspid ferrule chambers as yet unfilled.

CHAPTER VII.

GENERAL APPLICATION OF CROWN- AND BRIDGE-WORK.

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. 351, 352 illustrate a method of replacing a superior central or lateral. The central or lateral is formed with a base of gold or platinum

Fig. 351.

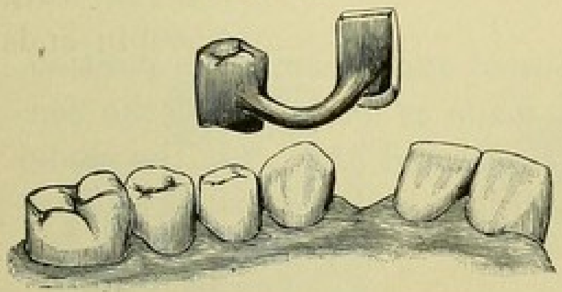
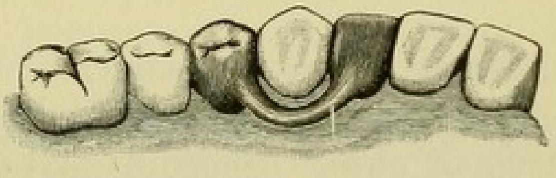


Fig. 352.



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 is suggested in such cases.

Figs. 353, 354 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 groove, and wax 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.

Figs. 355 and 356 illustrate a method of construction which will avoid the exposure of gold, and also the presence of a bar against the membrane of the gum. A shell crown is constructed as described on page 174, Fig. 325, for the bicuspid. The crown is

FIG. 353.

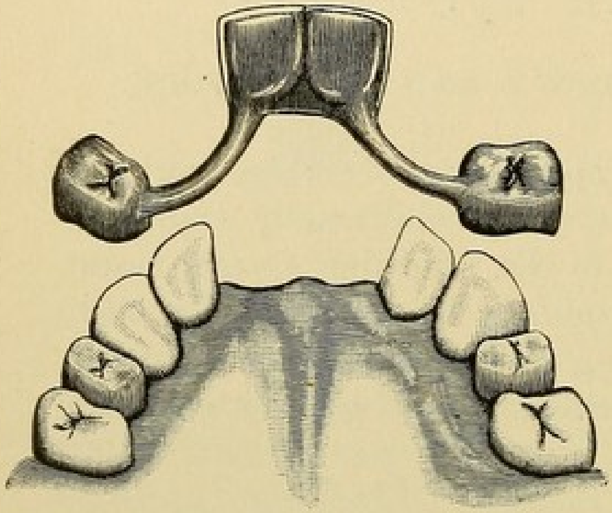
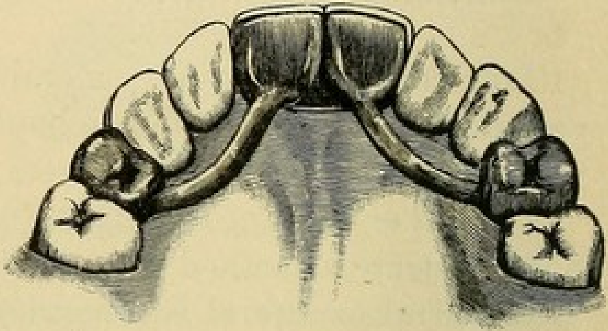


FIG. 354.



placed on the tooth, the lateral adjusted and cemented in position, an impression taken, and a model made as described in the construction of case illustrated by Figs. 351 and 352. On the model having the crown and lateral in position, a flat bar is formed be-

FIG. 355.

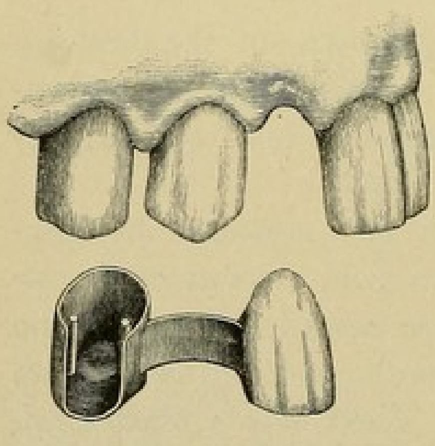


FIG. 356.

tween the cuspid and lateral across the palatal section of the cuspid to connect and support the lateral. This bar is made by first fitting across the palatal side of the cuspid, a piece of thin platinum plate 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 investment 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. 357 shows the form of bridge-work suitable for 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 sufficient 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. 317, 319, 321, 324, 330, 334, 336, and 345.

Fig. 358 explains and illustrates a method of restoring an incisor and supporting the adjoining loosened teeth with successive cemented connecting collars of gold in cases of pyorrhea alve-

Fig. 357.

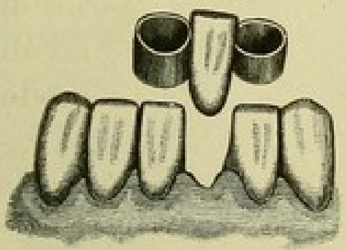


Fig. 358.

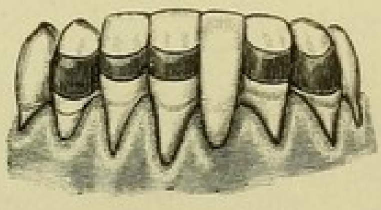
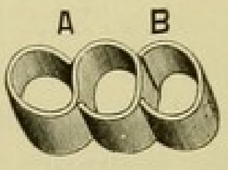


Fig. 359.



olaris. When the natural teeth are all present, but very loose from this disease, connecting the teeth together with a succession of bands steadies each tooth in its socket and consequently permits of much more effectual treatment. 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 33 gauge, by bending and fitting the strips to the forms of any two teeth in the shape shown in Fig. 359, A. This leaves but one thickness of the plate between the teeth. An additional loop can then be added as shown at B, for one adjoining tooth. All the soldering can be done quickly with the Bunsen burner without investing.

Centrals, Laterals, or Cuspids Combined.—Two laterals supported by two central crowns are illustrated in Figs. 360, 361. 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.

Fig. 360.

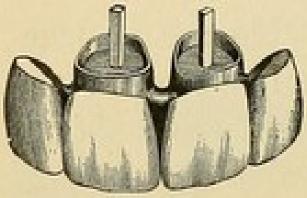
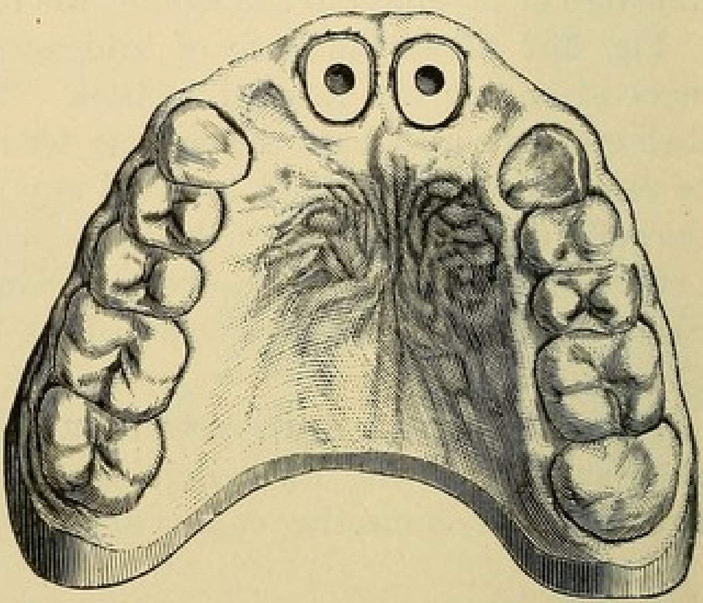


Fig. 361.



Figs. 362, 363, 364, and 365 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. 366, 367, and 368 illustrate a case with shell crowns for supports. In its construction the best method of procedure 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 bands of these shell caps should be beveled and burnished close to the teeth. If properly done they will 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. Other cases of this character are illustrated in Figs. 288 and 305.

Cuspid, Bicuspids, and Molars Combined.—Figs. 369 and 370 show bridge-work supported by cuspid and molar cap or crown. If the cuspid contains a living pulp the natural crown should be preserved, and an all-gold or shell crown should be used in preference to the form illustrated. Figs. 314 and 315 illustrate other cases.

Fig. 362.

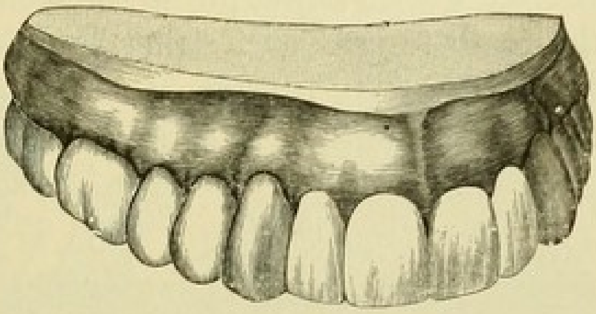


Fig. 363.

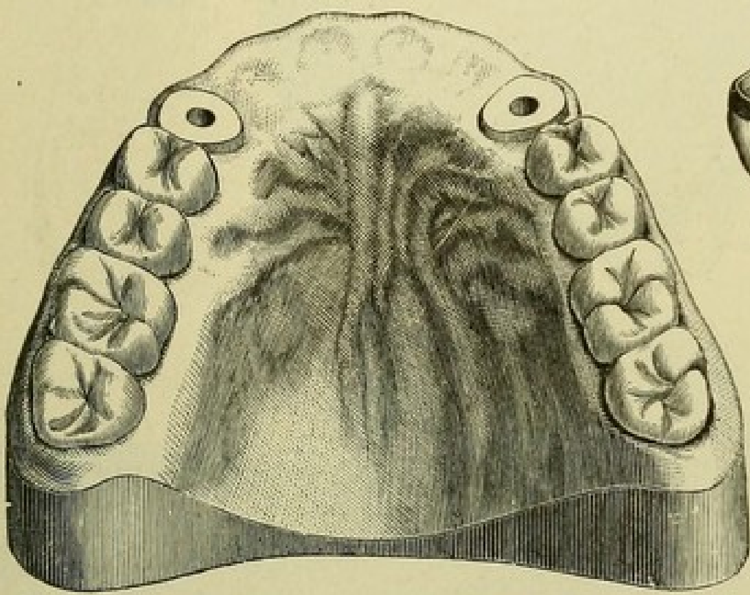


Fig. 364.

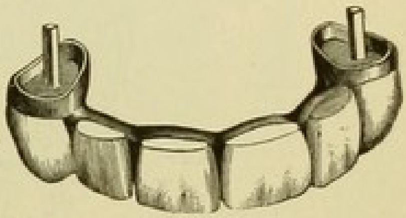
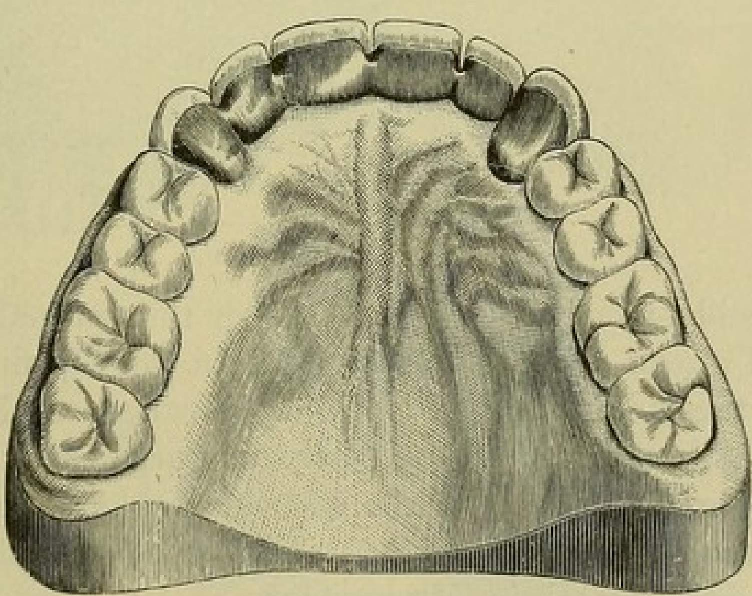


Fig. 365.



Bicuspids and Molars Combined.—Fig. 371 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. The molar is covered entirely with a cap, the bicuspid only on the occluding surface,

Fig. 366.

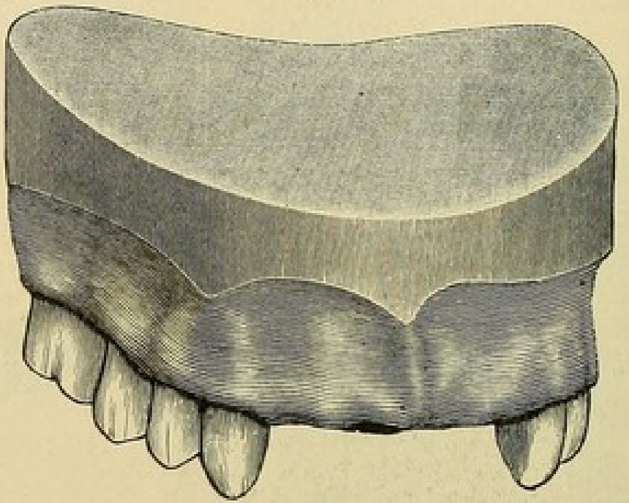


Fig. 367.

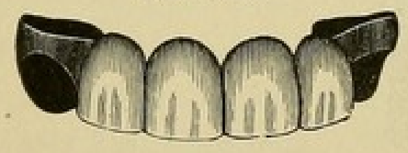
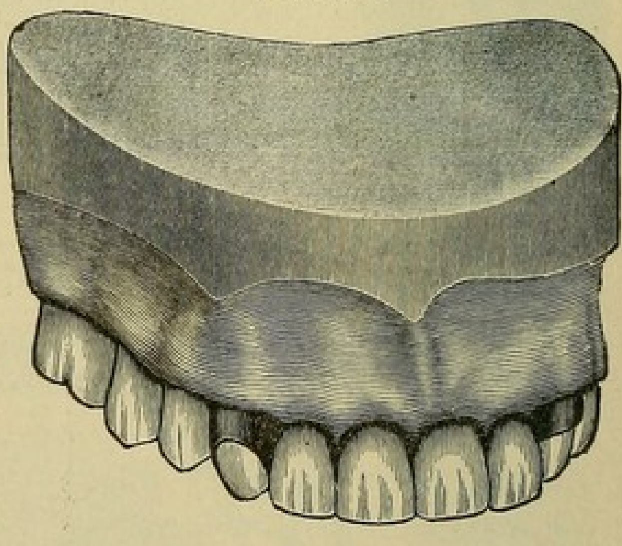


Fig. 368.



with the gold extending only 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 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. 369.

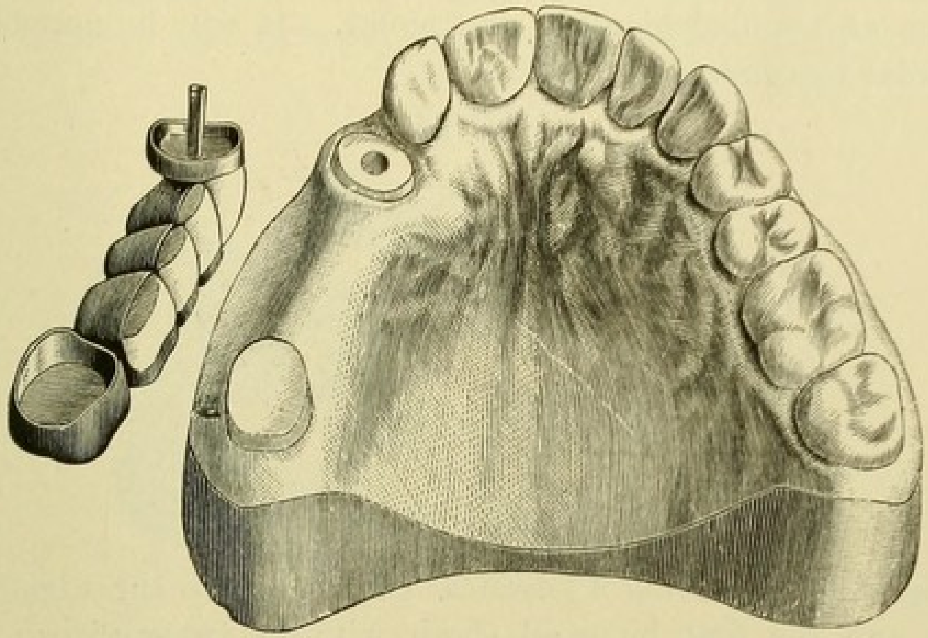


FIG. 370.

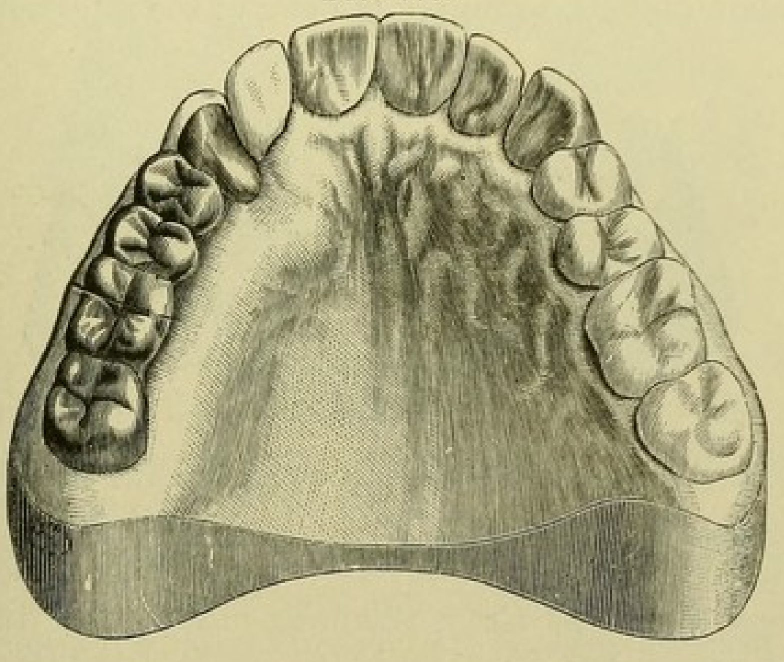


FIG. 371.

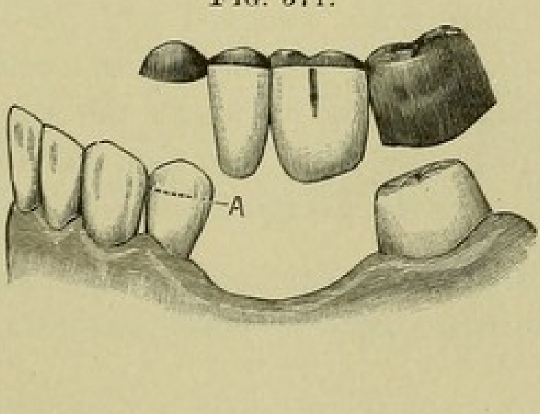
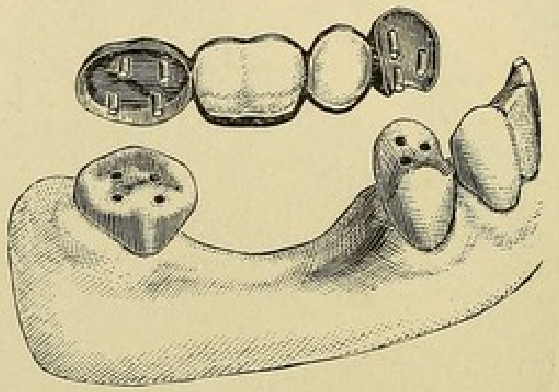


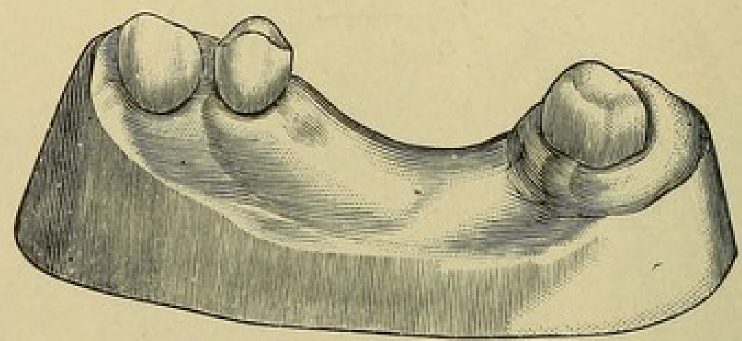
Fig. 372 illustrates a case of bridge-work supported by cast fillings on an abraded bicuspid and molar. It will be noticed that the molar tips forward considerably.

FIG. 372.



"Fig. 373 represents a practical case in which the upper third molar and the first bicuspid (both without antagonizing teeth) were utilized for the attachment of a bridge made of gold crowns with porcelain facings, to supply the loss of the intervening teeth.[1]

FIG. 373.



"Fig. 374 represents the case as prepared for the bridge. A, the inner cusp of the bicuspid cut down to allow the placing of 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 also being considerably retrenched; D, the crown-plate of a partial cap, made of pure gold, soldered with 20-carat gold, and 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. 375 represents the bridge anchored in position with oxyphosphate cement.

[1] Dr. W. F. Litch.

"In the above case it will be observed that there is a considerable space between the bicuspid and cuspid. This made it readily

Fig. 374.

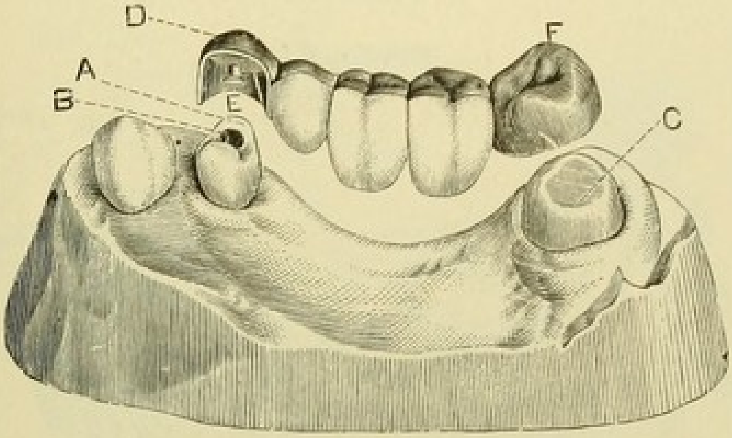
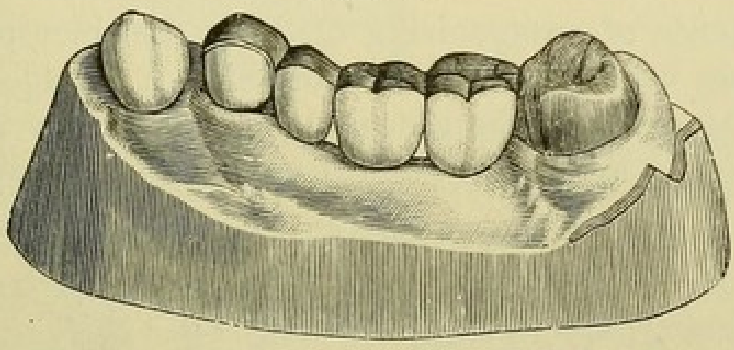


Fig. 375.



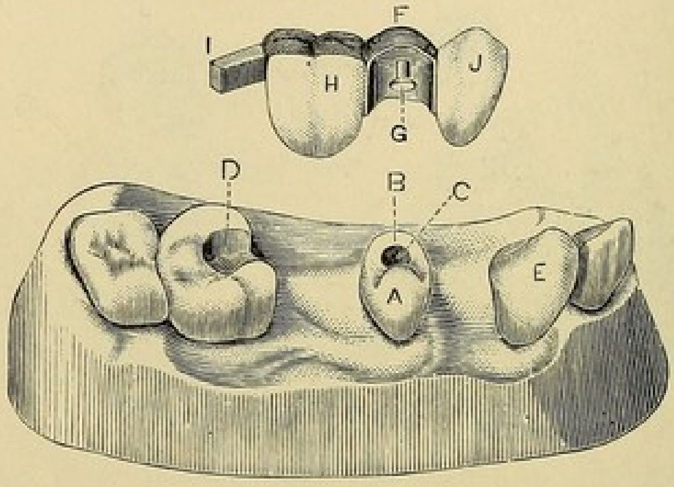
practicable to give so considerable a thickness to the mesial wall of the partial cap as to hold it securely against the side of the tooth. Had the space been less, contact with the cuspid would have afforded the desired security.

"Fig. 376 represents another case in which a bridge was attached 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 facing; G, the retaining-pin; H, a molar crown of gold, with porcelain front; I, a platinum bar attached to the crown (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. 377 shows the bridge anchored in position.

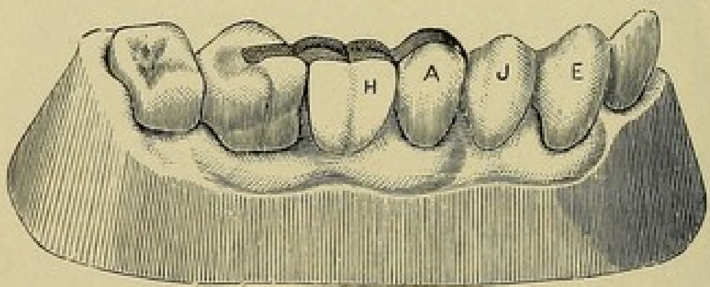
"This case, after two years of wear, was still in perfect condition and doing good service. As it was possible to keep the gold attachments, backings, etc., out of sight, the appearance presented is very natural.

Fig. 376.



"The absence of antagonizing teeth for the bicuspids in each of these cases was a favorable condition, as a considerable thickness could be given to the crown-plate without any interference with occlusion. When the conditions are not so favorable, cut-

Fig. 377.



ting down the inner cusp to the required extent and sinking the opening for the retaining-pin to the necessary depths are processes certainly to be, as a rule, preferred to the entire removal of the crown for the purpose of ferruling the root for the mounting of a crown of gold and porcelain,—a procedure, however, not by any means to be indiscriminately denounced, for in many cases it is in the highest degree advisable.

"There is this fact to be considered in regard to the use of the partial caps here figured,—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 of a well-fitting bridge, the wearer is much more likely to consent to whatever measures are necessary to give it security and permanence."

FIG. 378.

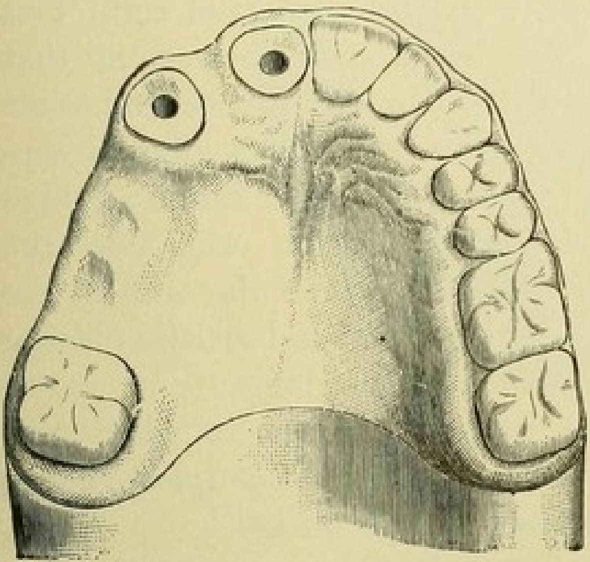
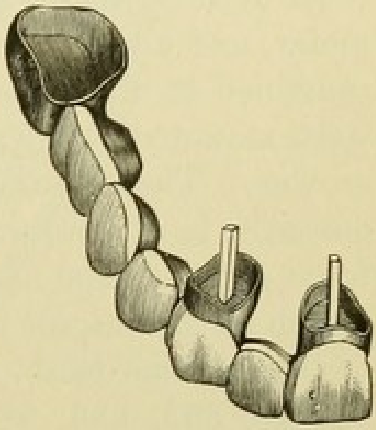
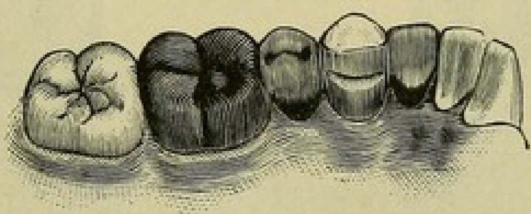


FIG. 379.



Incisors, Cuspids, Bicuspids, and Molars combined.—Figs. 378 and 379 represent a piece of bridge-work extending from a 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, construct the front section, consisting of the central, lateral, and cuspid; next form the molar cap. Fit the molar cap and 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 gold cap. In a bridge of this character, if the natural cuspid is intact, a shell crown may be used. Fig. 380 gives the palatal view of a

FIG. 380.



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. 303 illustrates bridge-work similar in principle.

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. 381, 382, 383, and 384 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-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 skillful and artistic placing of the artificial teeth, which are prominent and long.

Figs. 385, 386, 387, and 388 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. 389 and 390, 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 of extensive permanently cemented bridge-work, such as is illustrated in this and the case illustrated in Fig. 386, is questionable. The 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

Fig. 381.

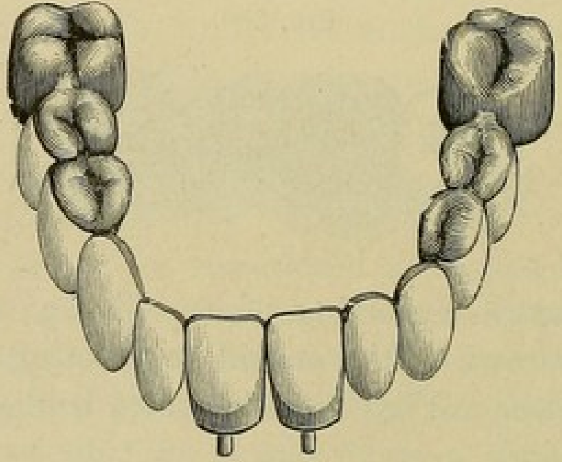


Fig. 382.

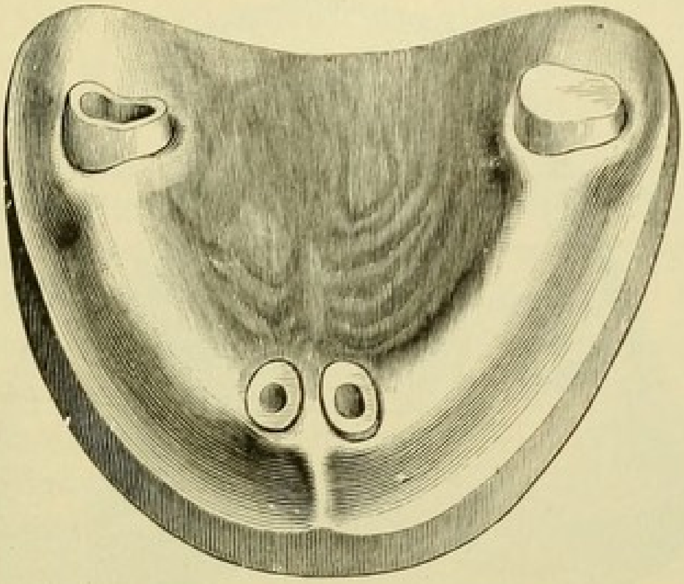


Fig. 383.

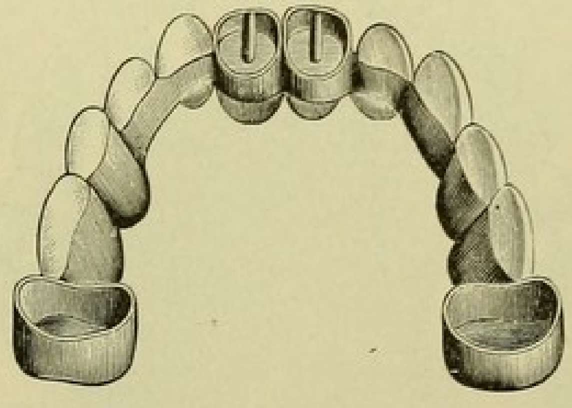


Fig. 384.

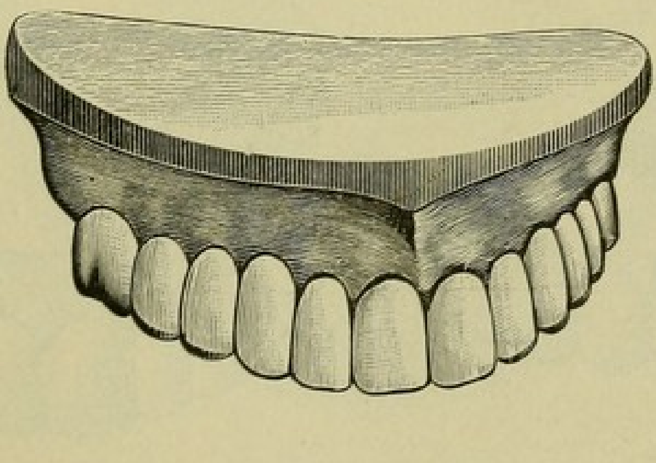


Fig. 385.

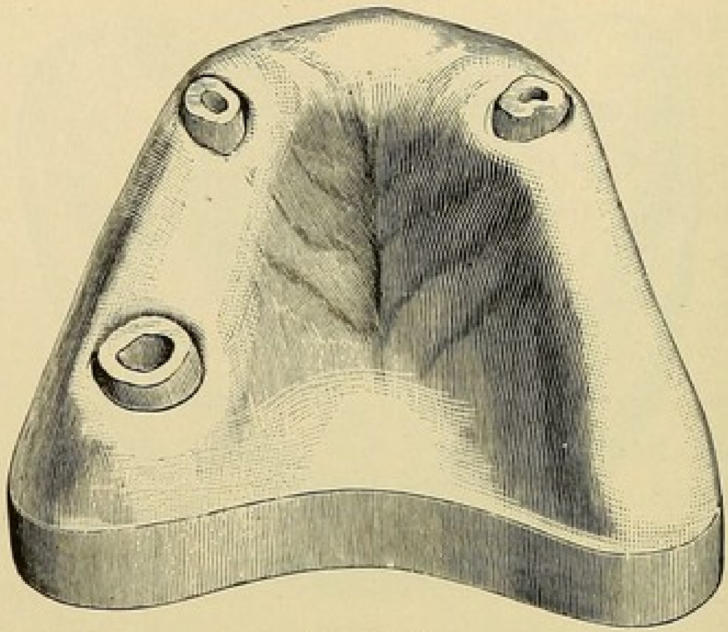


Fig. 386.

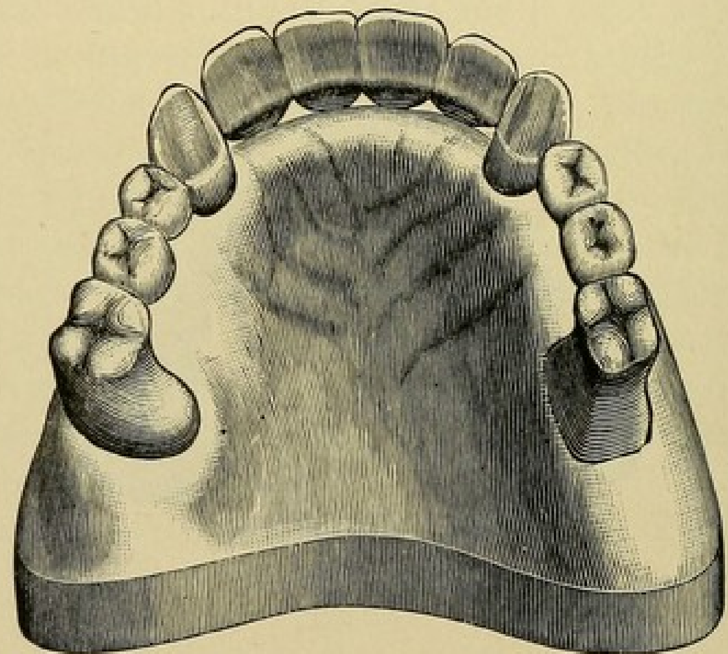


Fig. 387.

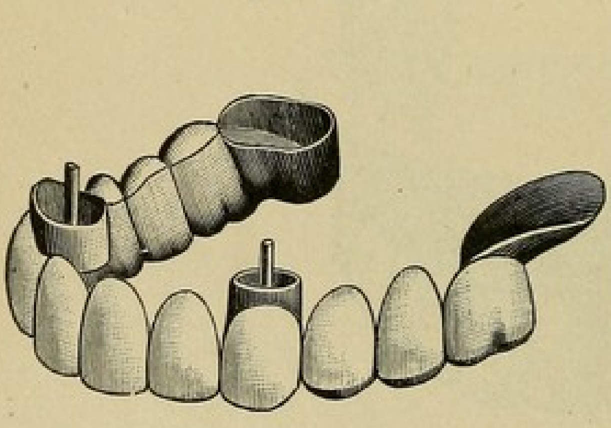
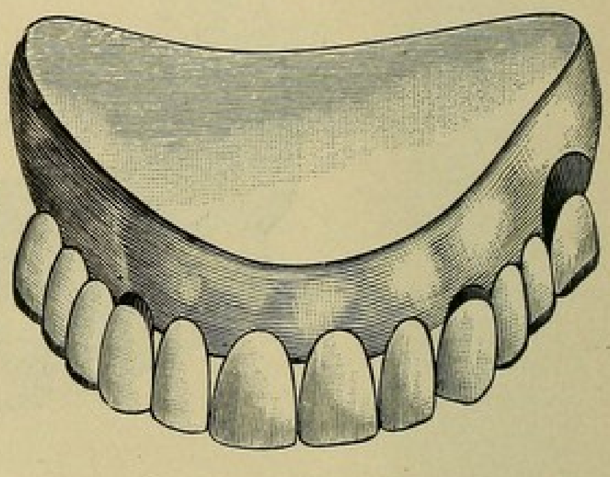


Fig. 388.



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 abutments. 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 an expedient not to be indorsed, as the patient in a short time will again have to resort to a plate and again experience the initiatory unpleasantness attending its insertion.

In the bridge-work illustrated in Figs. 391, 392, and 393, crowns on a second bicuspid, a pulpless molar, and the roots of a cuspid and lateral constitute the abutments.

FIG. 389.

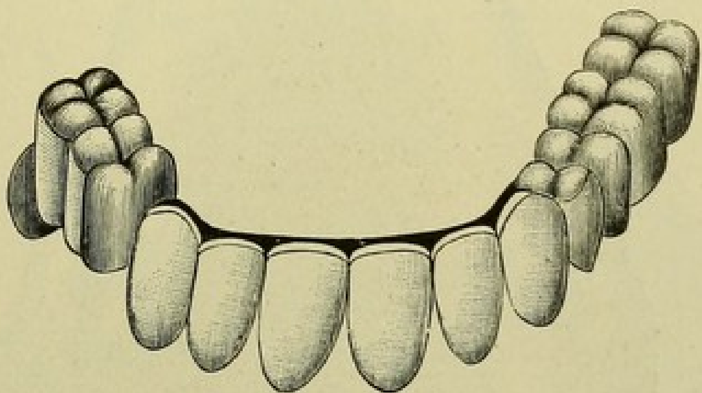


FIG. 390.

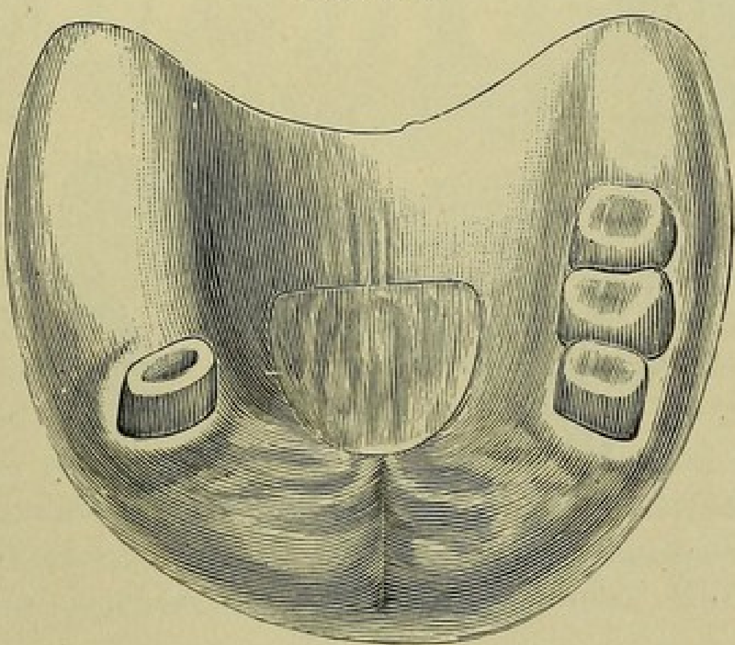


FIG. 391.

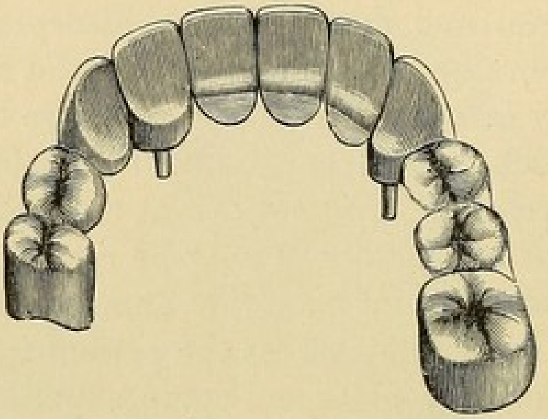


FIG. 392.

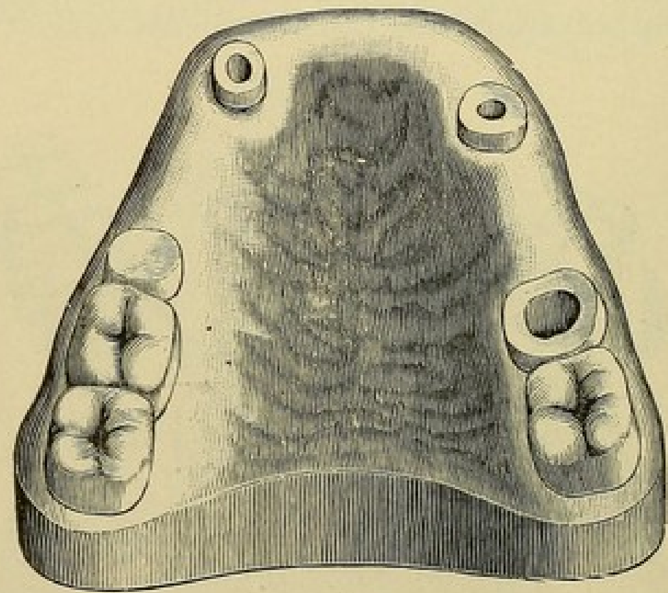


FIG. 393.

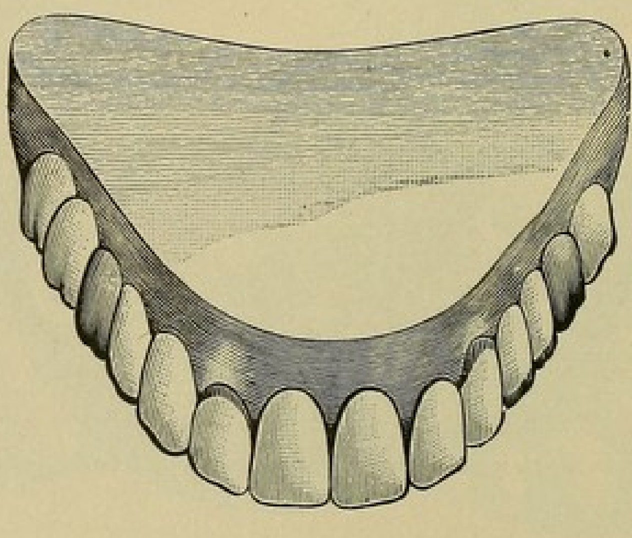


FIG. 394.

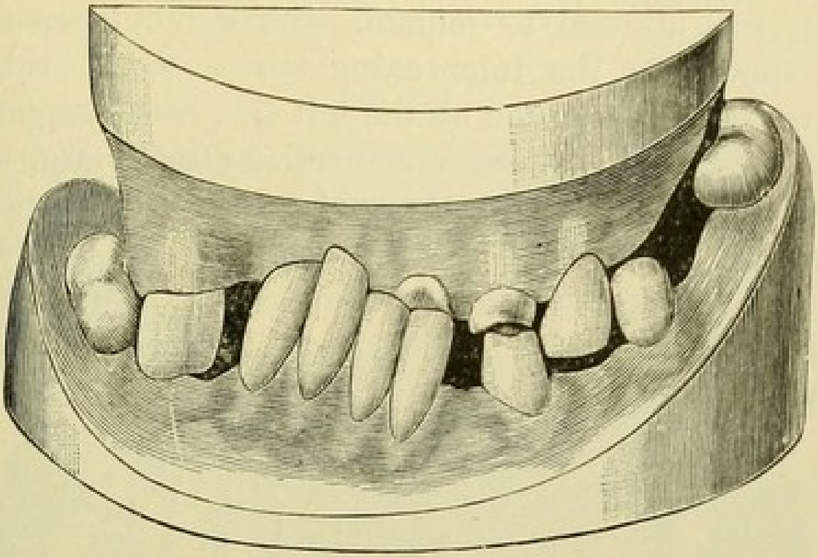
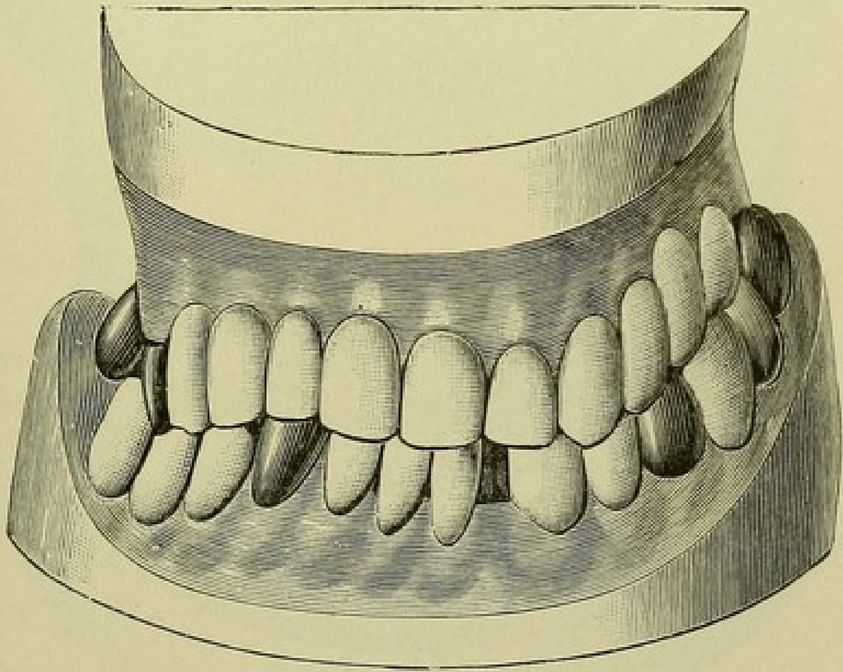


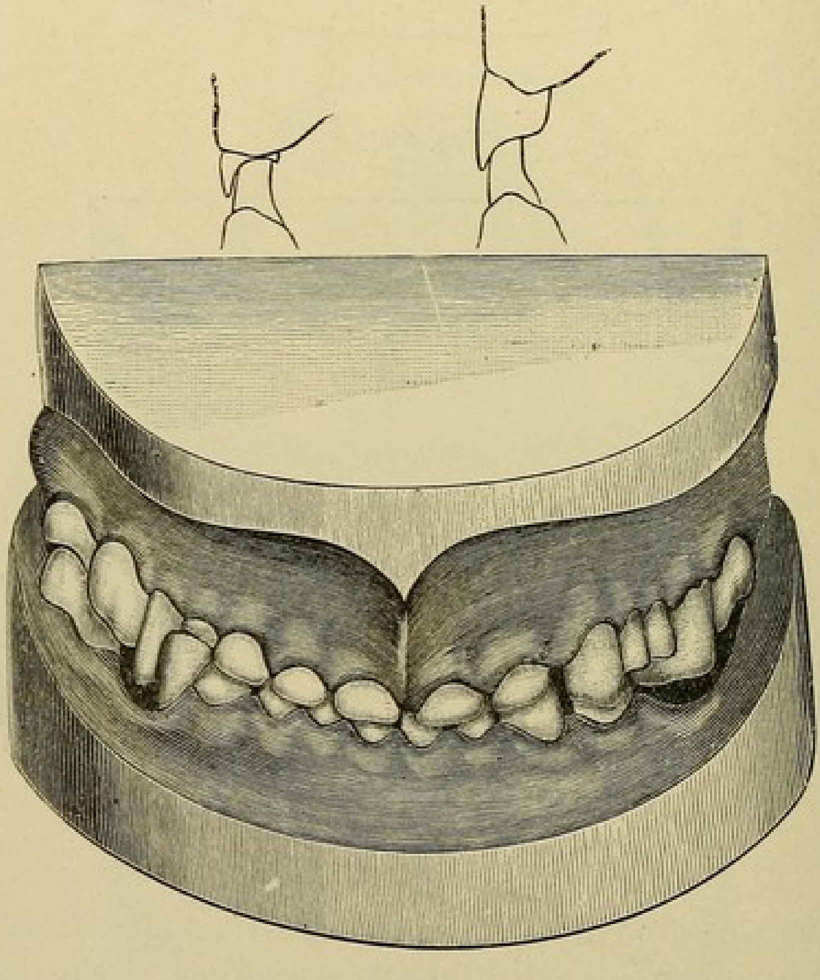
FIG. 395.



Figs. 394 and 395 illustrate an extensive case of artificial replacement by crowning and bridging operations. Fig. 394 represents the case as presented for treatment. The few remaining superior and inferior natural teeth had no corresponding antagonists, 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 shortened 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 artificial 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 incisive edges of the incisors trimmed even.

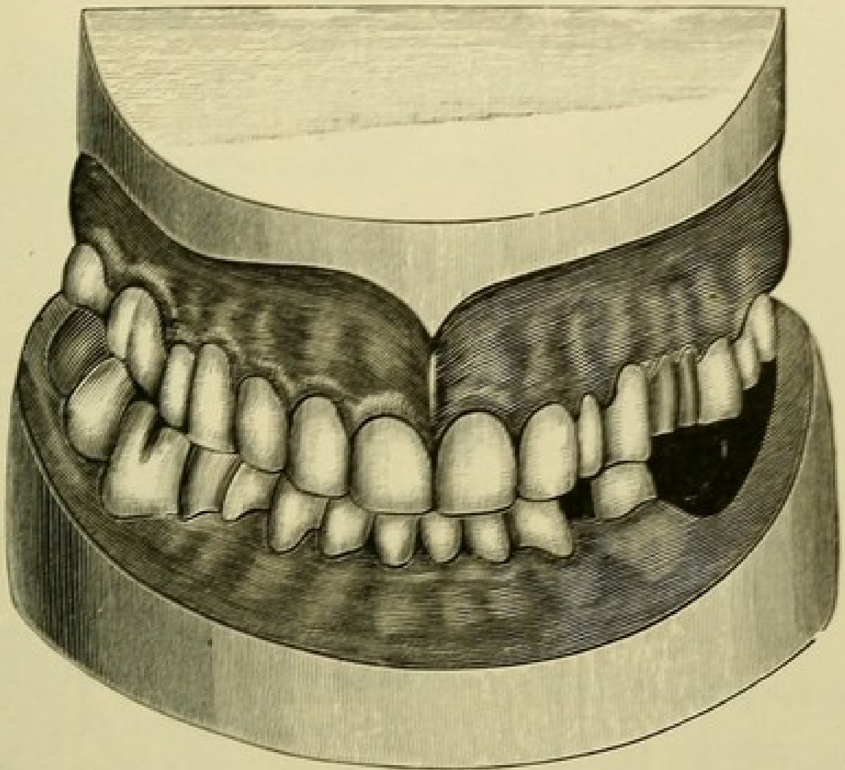
Fig. 395 illustrates the finished case, and shows the complete artificial restoration of the parts.

Fig. 396.



Figs. 396 and 397 represent a case in which crown- and bridge-work has been extensively applied. The occluding surfaces of the teeth were affected with abrasion. Gold crowns with porcelain fronts which presented laterally the form illustrated in Fig. 396 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 inferior left side, were artificially restored with bridge-work.

FIG. 397.



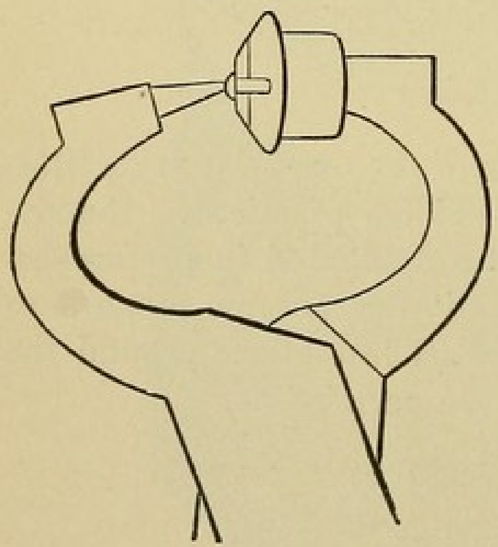
Permanently cemented bridge-work of the extensive style illustrated in some of these cases is now seldom practiced. Removable forms affording alveolar support are adopted in preference. Where the abutments are numerous and offer suitable supports to permit the bridge-work to be constructed in sections around the arch, permanently cemented bridges are permissible.

CHAPTER VIII.

REPAIR OF CROWN- OR BRIDGE-WORK.

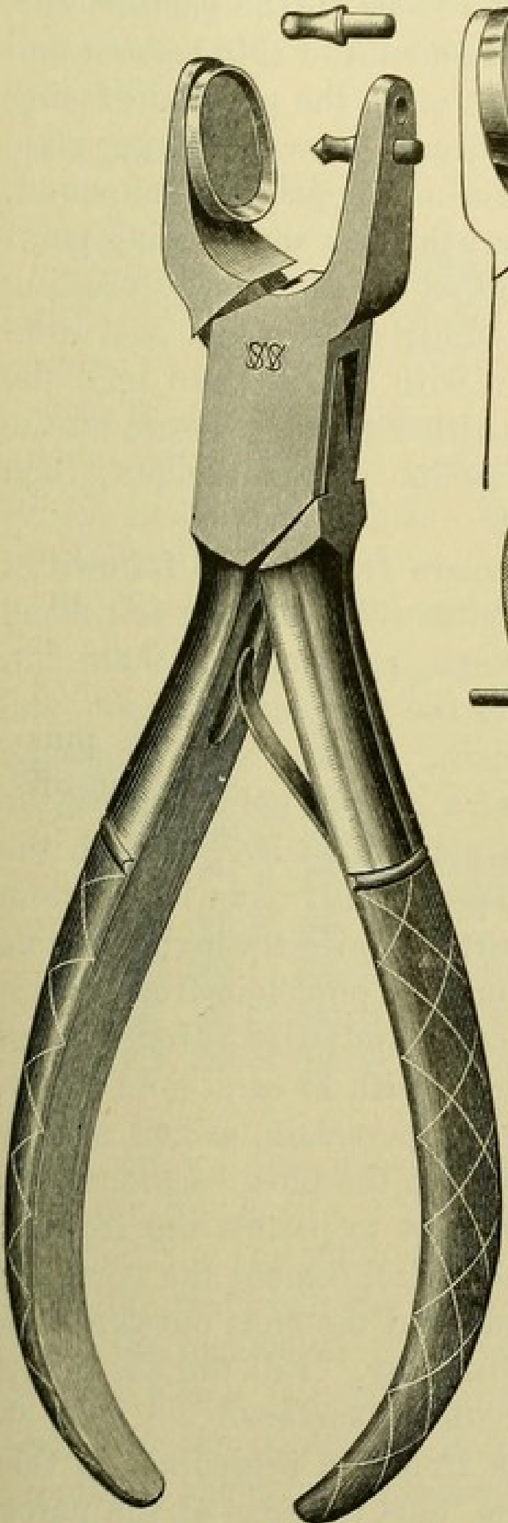
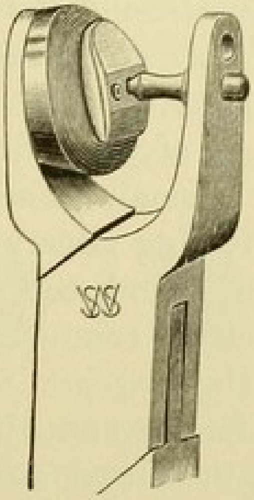
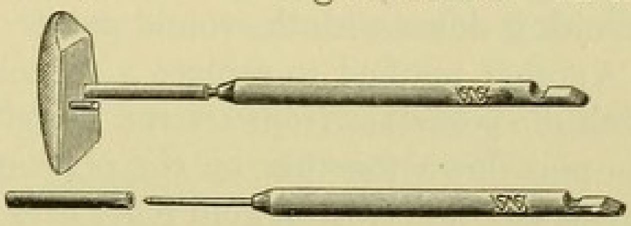
The fracture of a porcelain front to a permanently attached bridge is an annoying incident for both patient and dentist. It is usually attributable to failure to properly protect the incisive edge or occluding surface of the porcelain with metal, a precaution rendered necessary by the rigid character of the resistance offered the antagonizing teeth through the abutments. 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 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 porcelain 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 its ends to the ends of the pins with pure gold. The wire is then cut in the center, and the

Fig. 398.



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. 398). 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.

Fig. 399.

Dr. F. M. Shriver's method of fastening the pins in the backing 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 in place on a tooth pin in Fig. 399, countersink the end of the pin; with the cone bur—for right angle—countersink the holes on the palatine surface of the backing. Prepare a small amount 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 modelling compound, place in the cup on the riveting pliers; then set the riveting point (see Fig. 399) in the countersunk end of the pin, gently pressing the facing into the modelling 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.

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 sufficient 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.[1]

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

[1] Dr. W. W. Williamson's method.

backing on the bridge to receive them and prevent 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. 400, 401, 402, and 403 illustrate this method.

FIG. 400.

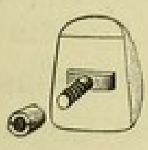


FIG. 401.

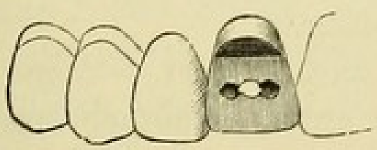


FIG. 402.

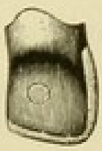
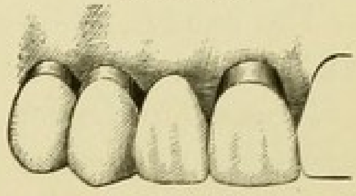


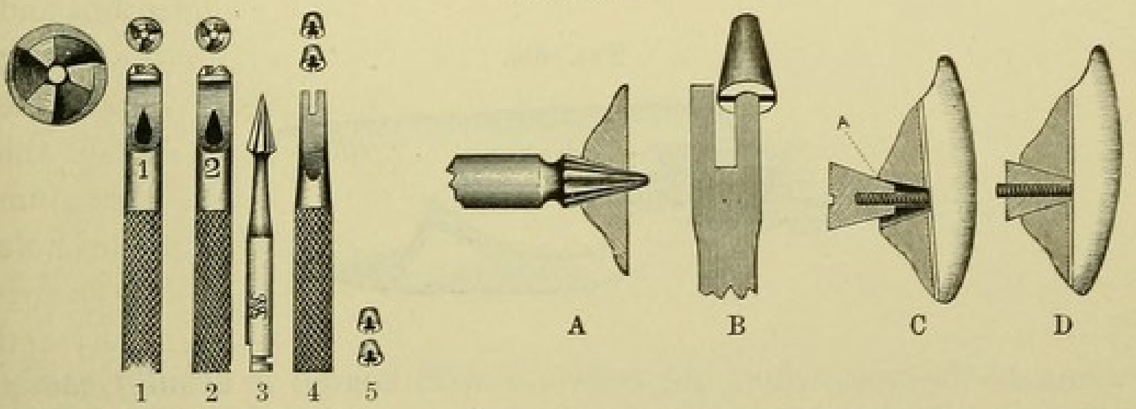
FIG. 403.



Dr. E. A. Bryant describes a method[1] of repairing bridge-work by the aid of a set of tools, now made and 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:

FIG. 404.



Each pin of the selected tooth-facing is to be screw-threaded with die No. 1, Fig. 404, first oiling the pin and finishing it with die No. 2. The pin-holes in the bridge backing are countersunk from the rear with the right-angle engine reamer No. 3 (see A). With the nut-driver No. 4, 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.

[1] *Dental Cosmos*, June, 1894, page 370.

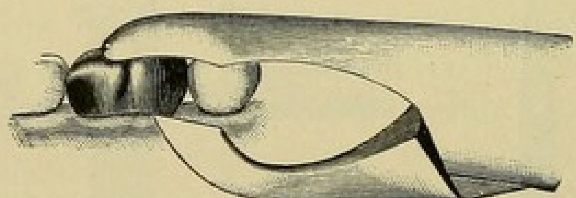
Bridge-work can be made with replaceable porcelain fronts which can be easily substituted in case of fracture. A description of their application will be found at page 187.

If the character of the breakage is such as will not permit its repair in the mouth, the bridge must be removed for the purpose and then reinserted. Under such circumstances the advantages of bridge-work in a detachable form are most evident.

The results following the repair of single crowns in the mouth will seldom repay the labor attending it.

Removal of Cemented Crowns and Bridges.—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 process of cementation on page 137, the detach-

Fig. 405.



ment of the post when the crown is well heated is usually easily effected. 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-cutter, an instrument made for the purpose, will facilitate this part of the operation (see Fig. 405). With care and patience in the operation, the crowns will not usually be injured beyond repair.

When gutta-percha is the cement that has been used, a hot instrument or crown-setter (see Fig. 262) can be placed against the metallic part of the crown, or the crown seized with the beaks of heated forceps, the gutta-percha thereby softened, and the crown removed.

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 fixing 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 IX.

THE HYGIENIC CONDITION OF THE MOUTH AS AFFECTED BY BRIDGE-WORK.

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.

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 properly 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.

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 brush and a dentifrice are necessary. Floss silk can be passed through apertures around the necks of crowns, in places out of reach of the brush, and drawn along the gum under the bridge by the aid of a slightly curved blunt-pointed needle, 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 X.

REMOVABLE AND DETACHABLE 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 argued 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.

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. Much that is here stated concerning removable bridge-work might be applied to the detachable form. The necessity for using the latter in preference to the former is limited to a very small sphere, owing to the fact being demonstrated that gutta-percha, alone or combined with oxyphosphate, can be used practically as a cement in most cases, thus permitting the removal of a bridge without much difficulty.

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 gauge 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 anterior approximal side usually restores its perpendicularity sufficiently, as does the cutting away of the posterior 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 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. 406) 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. 407) 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

Fig. 406.

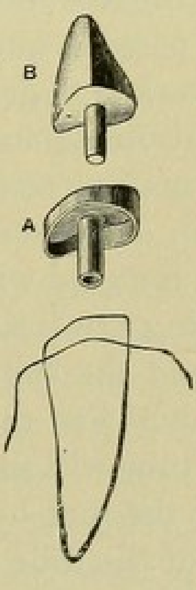
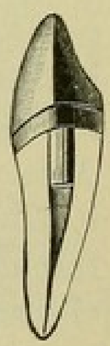


Fig. 407.



and the cap section of platinum, No. 32 gauge (A, Fig. 408). A substantial piece of gold and platinum wire, from No. 16 to No. 18 gauge (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. 409). 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. 408). The tube for this post is formed by once encircling the post with a piece of iridio-platinum plate, No. 34 gauge, the edge of which is beveled and cut to meet the plate even and close (C). The post is then

Fig. 408.

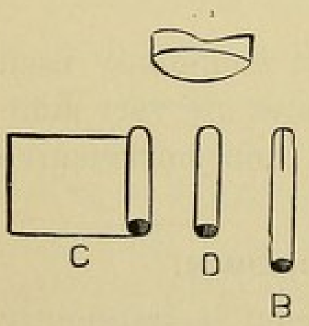


Fig. 409.

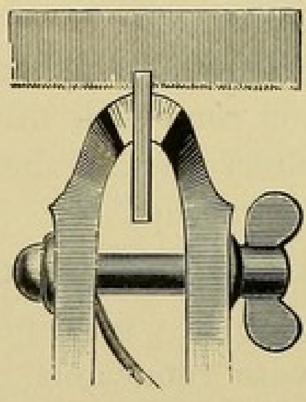
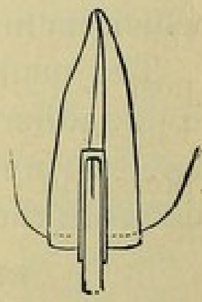


Fig. 410.



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 on 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 gauged in a gauge-plate. With a drill just the size of the tube the root-canal is enlarged so that the tube will fit tightly (Fig. 410). This plan prevents weakening of the root by too great enlargement of the canal. 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 a piece of platinum about No. 34 gauge. 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 post, having been cemented with wax, are removed and soldered together. As the point of the post may have to be 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. 407 represents the finished crown. The incisive edge of the porcelain does not necessarily require to be protected with metal as in fixed bridge-work.

A square tapering post, either solid or split in some cases, is preferred to the form above described, especially in a root of a cuspid. When a 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. 411). To receive the tube and post, the canal should be carefully deeply opened and then shaped with a reamer, such as is illustrated at Fig. 72.

FIG. 411.

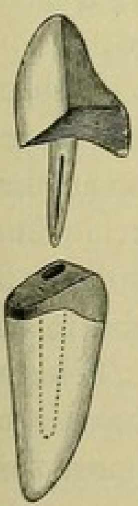


FIG. 412.

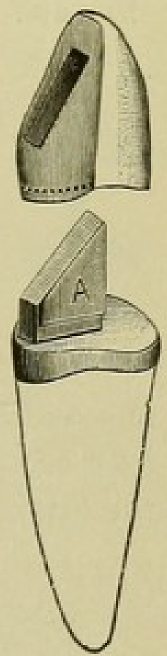
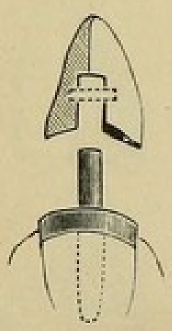


Fig. 412 illustrates a removable cuspid crown which can be used in removable bridge-work. It is constructed as follows: The end of the root is first capped, and a post attached fitting the root-canal. A porcelain cross-pin tooth, the pins of which are set well apart, is then ground and adjusted in position, cemented with wax to the cap, and both removed. Enough plaster to form a matrix is placed on the labial aspect of the porcelain and collar to hold them in relative position when the wax is removed. A flat post is then formed on the root-cap, extending from the palatal edge forward between the pins of the tooth, the porcelain of which, between the pins, should be slightly cut out to receive it. To this is soldered the piece A, which is to act as a spring. The post is formed of gold plate No. 18 gauge, and the spring of clasp or spring gold No. 26. The post is soldered to the cap from the opposite side to the spring by investing without the tooth. The tooth is then lined with very thin platinum, and with the aid of the matrix is adjusted in position on the cap, and a thin piece of platinum plate is slit at the edges and adapted over the post, cap, and edge of the collar, with its inner edge meeting the backing of the tooth. The platinum plate is then cemented with wax to the backing on the tooth, removed with it from the cap and post, and invested, the slot for the post being carefully filled with the investing material. Twenty-carat gold solder is then flowed over the plate and backing so as to consolidate the parts in one piece.

This crown when finished will fit on to the cap and post, the spring of which can be bent to securely retain it. The line of the post on the cap as it fits in the slot in the crown should be such as will favor the insertion and removal of the bridge.

In the form shown in Fig. 413, which is a sectional view, a square or round iridio-platinum wire is used as a post on the cap instead of the form above described.

Fig. 413.



The post having been soldered to the cap, a thin piece of platinum is first perforated and fitted over the top of the cap, next a tube of platinum over the post and between the pins of the porcelain. The porcelain front is then lined with platinum foil, and cemented with wax to the tube and the platinum at the base, and removed and soldered together. Where one end of a bridge is securely attached to a first molar having a long crown, the form of crown here described is ample support for the other end on a cuspid.

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 Partial Cap and Collar.—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 have to be first trimmed as nearly as possible straight or 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

Fig. 414.

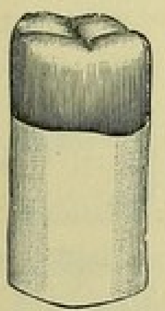


Fig. 415.

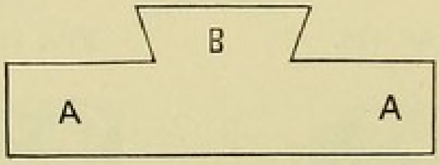
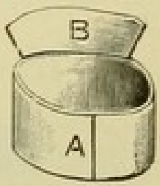


Fig. 416.



the crown, with a shank as seen in Fig. 414. When the natural tooth is not crowned with gold, a die of the tooth is made in a manner similar to that described on page 96, and in chapter on "Molds and Dies." The crown is then encircled with a strip of pure gold about No. 30 gauge, one part of which will extend above the rest in the form shown in Fig. 415.

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. 416). The collar is readjusted on the crown, and the part at B, Figs. 416 and 418, 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 (Fig. 417), is next adjusted in the position shown at the lines C, Fig. 417, then removed and the seam, which had best be located at the point C, Figs. 417 and 418, 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 the collar 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 will prevent the solder flowing there.

The collar section of the removable cap is then trimmed smooth. The cap section at B can be adjusted and soldered to the collar now, or preferably after the cap has been united to the bridge, and its relative position on the gold crown accurately determined. Fig. 419 shows the gold crown and the finished removable partial gold cap over it.

FIG. 417.

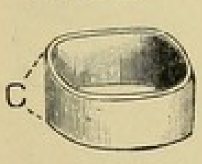


FIG. 418.

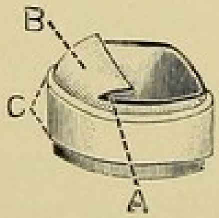


FIG. 419.

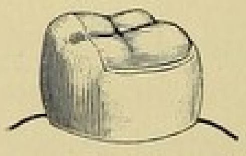
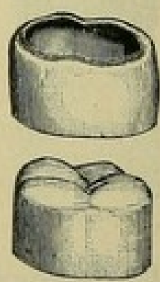


FIG. 420.



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.

Flanged Collar Attachment.—Fig. 420 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.

This form of collar may also be made entirely of clasp gold, No. 28 gauge for molars, and of No. 29 to 30 gauge 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. 421 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.

Fig. 421.

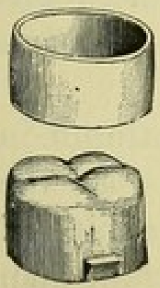


Fig. 422.

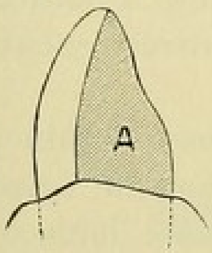


Fig. 423.

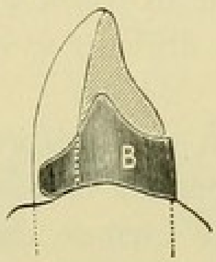
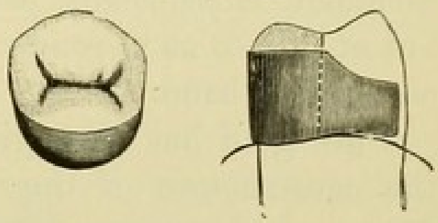


Fig. 424.



Removable Partial Cap and Clasp Attachment.—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 gauge, is adapted to the palatal surface and partly over on the approximal side, in the form shown at A, Fig. 422. In some cases it may be extended to the incisive edge. A gold clasp of at least No. 24 gauge is fitted over the gold partial cap in the position shown in Fig. 423, 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 the bridge denture, which should be done by soldering the clasp portion only at the point B, Fig. 423. This method allows the soft gold of the cap portion to be again adapted to suit any position the clasp may assume in the final adjustment of the denture in the mouth. The bridge and clasp should then be invested again, and solder flowed over and between the cap and clasp.

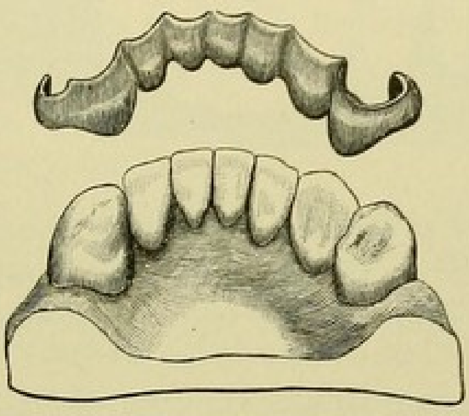
A Bicuspid or Molar Partial Cap and Clasp Attachment.—Fig. 424 illustrates the form the attachment just described usually assumes in cases of bicuspids and molars. The dotted line marks the boundary of the partial pure gold cap. The construction follows similar lines to those laid down in the case of 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.

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 former 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 to avoid 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 two hundred degrees (see chapter on "Molds and Dies"). The cast must correctly represent the lingual or palatal surfaces of the teeth. Upon this cast a strip of pure gold, No. 30 gauge, 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 attachment to be connected. Wax is placed on the surface of the gold, and the gold is removed and invested. The wax is next removed, and a piece, or pieces, of gold clasp plate, a trifle narrower than the strip of pure gold, is bent and shaped to fit over its surface. 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

Fig. 425.

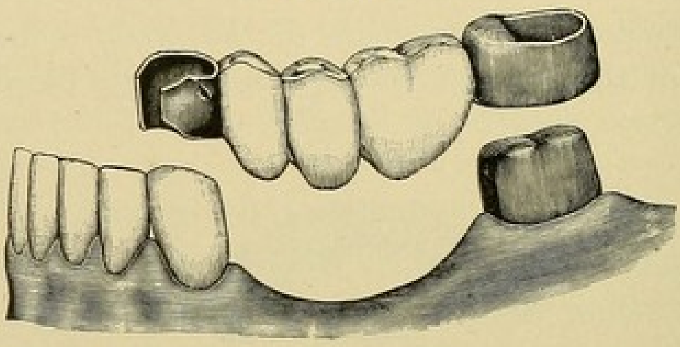


with wax or ligatured on the teeth, the attachments placed in position, and the bar and attachments removed in their relative positions in a plaster impression. On the model made from this impression they will be found the same as in the mouth. The construction of the bridge can then be continued. Fig. 425 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 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. Methods for connecting sections of a bridge are illustrated in Figs. 303, 351, 353, 430, 434, 447, 482, 590, and 594.

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.

FIG. 426.



A case frequently presented, involving the loss of a portion of the lower teeth, as shown in Fig. 426, 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 is first filled with fusible metal, and the remainder of the impression with pure plaster, as described in chapter on "Molds and Dies."

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. 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, plates 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 222.

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.

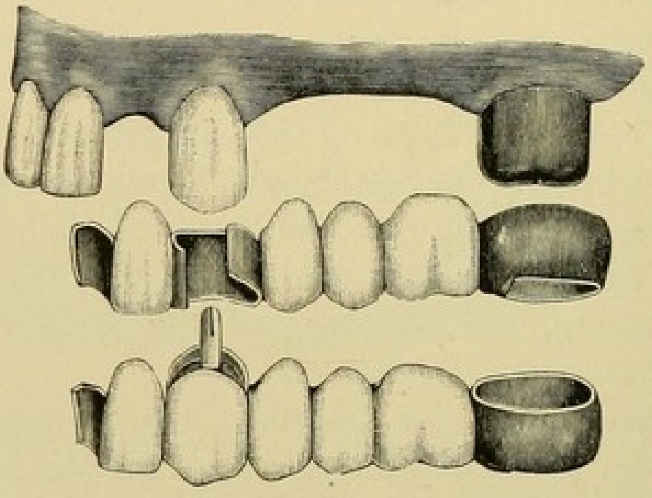
The procedure in the case described can be varied by making the entire model of fusible metal, or by placing a little wax in the interior of the grinding-surface of the gold crown, making a plaster model, removing the gold crown and filling it with fusible metal, making the attachment and replacing the gold crown on the model. The cuspid attachment can be formed on a fusible metal cast of the tooth.

The methods of construction as above given may be still further varied by first forming the gold crown and attachments to it and 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 investing material, and the cavity in the investment is then to be filled with more investment material.

Removable bridge-work is best constructed with the bases of the dummy teeth pressing firmly on the tissue of the gum. If the collar of the molar attachment should prove difficult to remove 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. 427 are illustrated the two forms of removable bridge-work that could be constructed for the same case. In the one a clasp attachment is placed on the natural cuspid, in the other the natural crown is excised and a removable cuspid crown con-

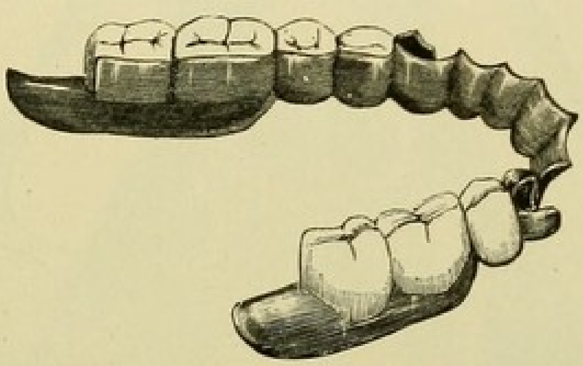
Fig. 427.



structed. In the construction of either style, a gold crown is made for the molar, with a removable gold partial cap and collar attachment. A removable partial cap and clasp attachment is made for the cuspid, or, if the natural crown is excised, a removable cuspid crown, and the cap and tube section cemented in position on the root. The crown or crowns and attachments are adjusted in position in the mouth. If the cuspid attachment is used, and it seems liable to become misplaced, it can be ligatured to the natural crown. An impression and bite are then taken in plaster, and when removed from the mouth the crowns and attachments are to be replaced in position in the 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 is adapted 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 investing 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.

The denture illustrated in Fig. 428, a case of Dr. A. S. Richmond's, was made to restore a loss of teeth which is frequently

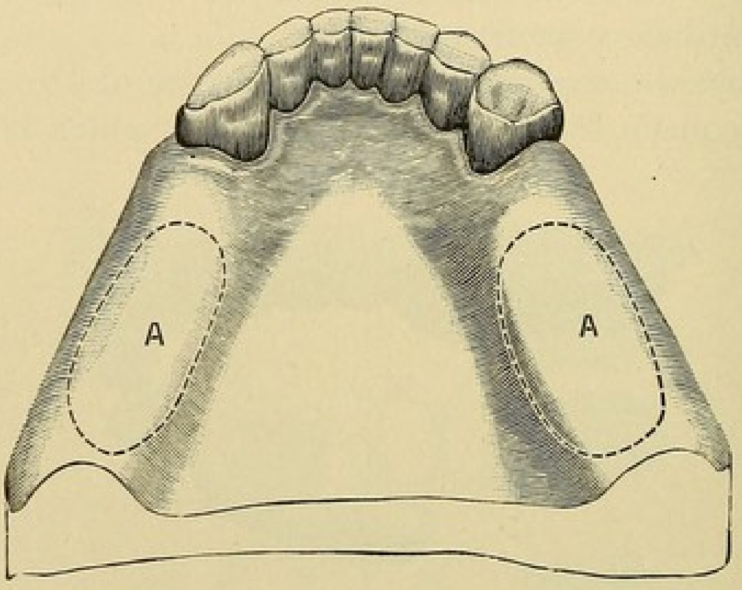
Fig. 428.



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 those ordinarily practiced. In brief, the constructive details are: A connecting bar is formed as described on page 224. In the case in hand, when the pure gold to form the connecting bar is adapted to the cast, it is extended around and over the cuspid and bicuspid. Gold clasps are then adapted over the pure gold on these teeth, and attached with solder. The bar and clasp attachments are inserted in the mouth, and an impression taken in plaster. Two pieces of sheet lead about No. 26 gauge 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 173.) 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. 429, and two gold 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.

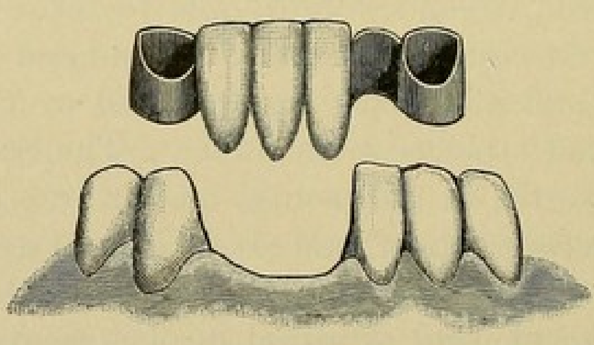
Removable bridge-work offers peculiar advantages for artificial replacement of lower incisors in cases similar to that illustrated in Fig. 430. A portion of the contour of the approximal sides of the right cuspid is removed. Shell caps for the right and left cuspids are then formed of crown gold, reaching nearly to the margin

Fig. 429.



of the gum. The caps are encircled with a narrow strip of stiff gold plate or clasp metal, about No. 35 gauge, which is soldered to the caps as described on page 224 in the construction of molar

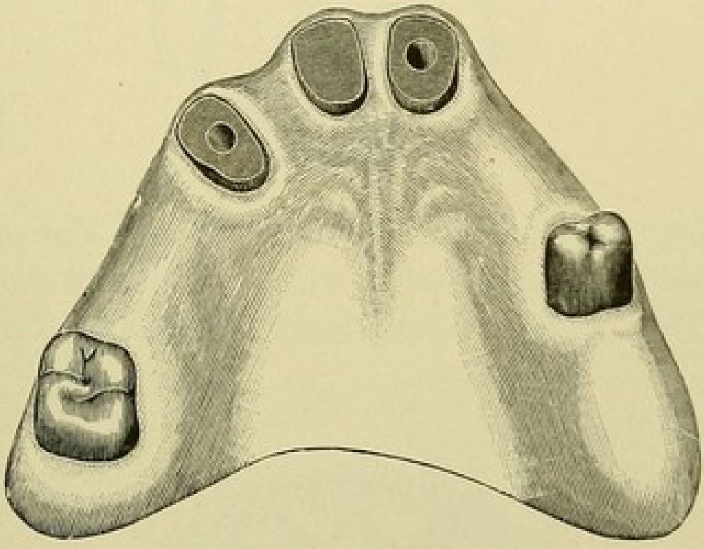
Fig. 430.



partial caps, or are stiffened by flowing a film of coin gold or solder over their surface. 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 half each plaster and 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 extending from the lingual-approximal side of the gold cap on the left cuspid around to the mesial side of the lateral is formed of a strip of pure gold, 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 pyorrhea alveolaris and those remaining are affected by the same trouble.

Fig. 431.



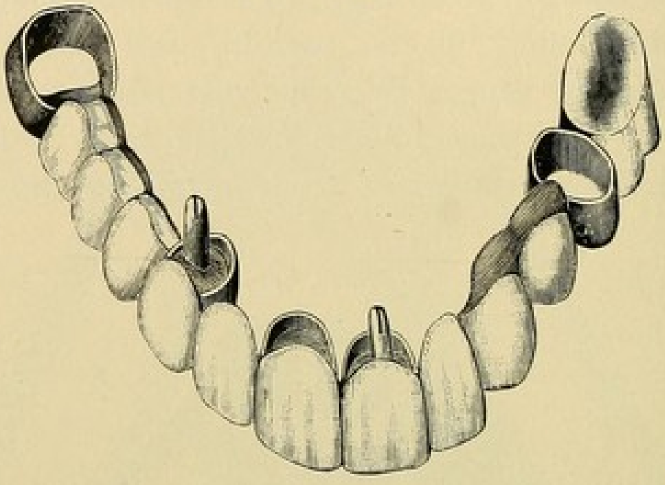
The natural teeth, if loose, are in a measure steadied and supported by the appliance. In some cases, especially if the teeth tip, one or both of the attachments on the cuspids can be made of thick clasp metal in the form of a clasp attachment, as described on page 224.

In the case represented in Fig. 431, gold crowns with removable partial cap and collar attachments are made for the molar and bicuspid, and removable crowns with flanges of the metal on the palatal sides for the centrals and cuspid. The right central is capped and the crown fitted over it without a post, as the posts in the other two crowns afford ample security.

After the crowns are made, the root-caps are cemented on each root. The central crowns are cemented together with wax, adjusted in position, covered with a small quantity of investing material, removed, more investing material added, and the crowns soldered together.

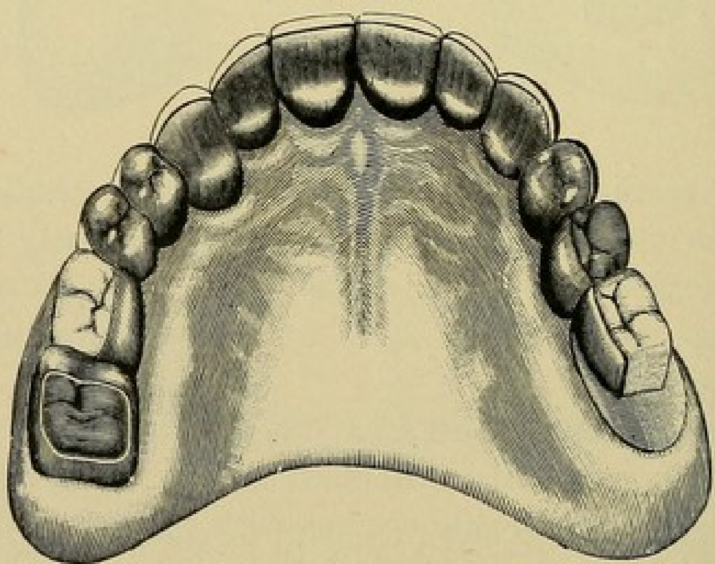
The centrals and the cuspid are then adjusted in the mouth, a lateral is backed, fitted, and waxed between them in position,

FIG. 432.



the whole removed in investing 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

FIG. 433.



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 impression of the part while the portion of the bridge already constructed is in position, removing bridge and impression together as described on page 228, and making a model. A piece of pure gold 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. 432 shows the bridge completed, and Fig. 433 the piece in position.

CHAPTER XI.

REMOVABLE PLATE BRIDGE-WORK.

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.

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. The attachments are adjusted in the mouth and the plate fitted in position between the attachments, and then the plate is removed. A plaster impression is next taken, and the attachments removed in position in the impression. The gold plate is turned upside down and placed on the surface of the plaster impression between the attachments, an atom of sticky wax being applied at a point or two if necessary to retain it in position. A model is run in the impression, composed of marble-dust, sand, or finely shredded asbestos, and plaster, of each one part. When the plaster impression is removed from the model, the plate will be found imbedded in place between the attachments. The attachments are then securely soldered to the plate. If necessary, before soldering, a little more investing material may be added to protect the attachments. A plate made after this method, when fitted with the attachments in the mouth, will press on the membranes of the alveolar ridge sufficient to displace them to fully the thickness of the plate.

Another method to obtain a similar result is: Strike up on the die a plate of sheet lead from No. 22 to 32 gauge, according to the hardness of the tissues and the pressure desired. Fit and place the lead plate in the plaster impression, and after the model is made, remove the lead and substitute the gold plate for it on the model, and then solder the attachments. By this latter method you can regulate the pressure of the gold plate equally over the membranes to any desired degree.

FIG. 434.

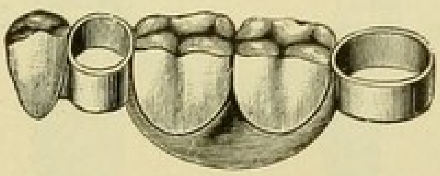
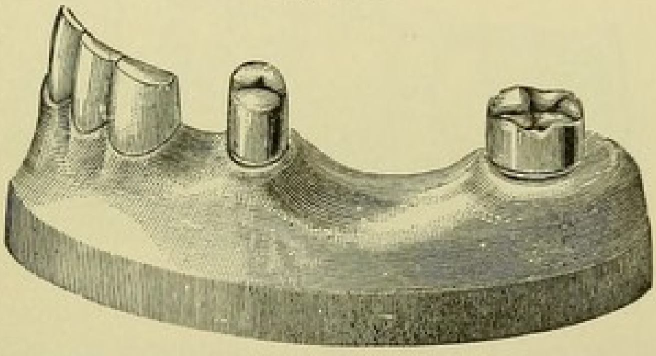


FIG. 435.



Pressure of the plate on the tissues in small cases of 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. The plate and attachments are next fitted in the mouth, an articulating impression taken, and articulating models made. 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 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.

In the artificial replacement of the lower teeth in a case such as is illustrated in Figs. 434, 435, a plate bridge possesses many advantages. In the construction of such a denture, the teeth are first properly shaped. Gold crowns (Fig. 437), 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.

Fig. 436.

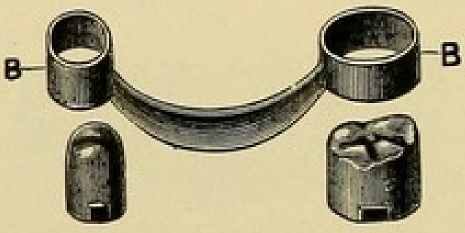
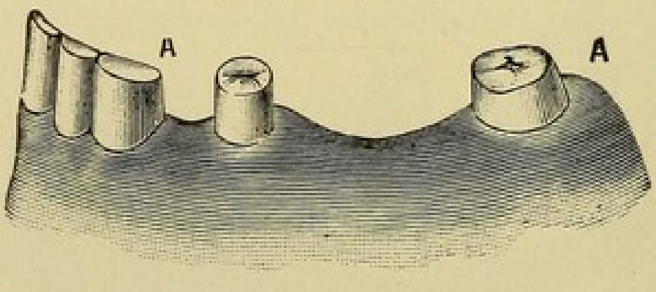


Fig. 437.

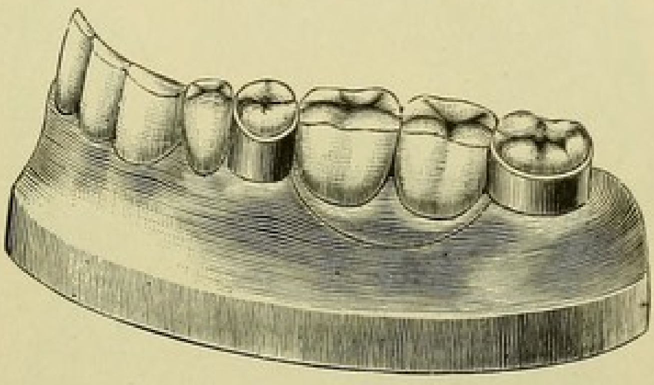


On the crowns, at the buccal sides, a narrow shoulder (A) is constructed to sustain the collars and bridge in position. In some cases this shoulder is placed on the approximal side to better advantage. Collars B, B, Fig. 436, reaching from the cervical to the occluding edge, are fitted to these crowns.

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 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 upper 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 the method previously described.

The attachment of the artificial teeth to a plate of this kind can be of either gold or rubber. Whichever is adopted, the first bicuspid is best supported by being soldered to the collar. If iridio-platinum is used in the construction instead of gold plate, and the soldering done with pure gold, 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. 438 shows the denture in position.

Fig. 438.



Figs. 439 and 440 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 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 the gum margin marked with a sharp instrument on the buccal surfaces of the gold crowns. At the lines marked shoulders are next soldered such as are described at A, Fig. 437. The plate and all the caps are then adjusted in the mouth. The plate is pressed firmly against the tissues, the double caps on the cuspids attached with cement, or plaster instead can be placed over them and the adjacent surface of the plate, and plate and cuspid double caps removed and soldered together. 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

Fig. 439.

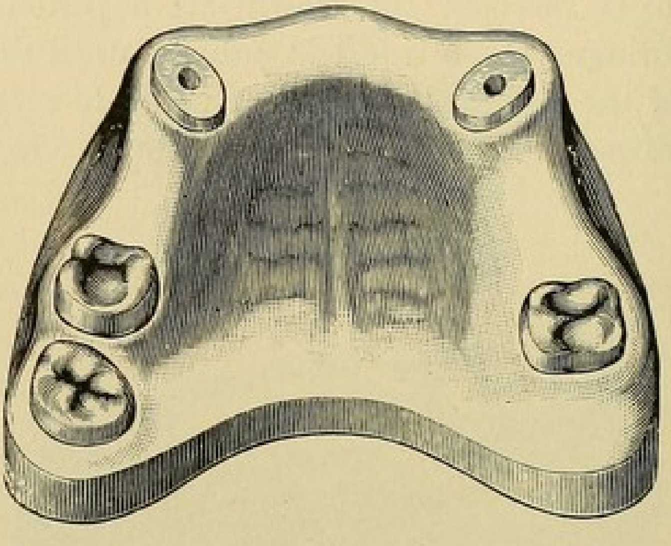
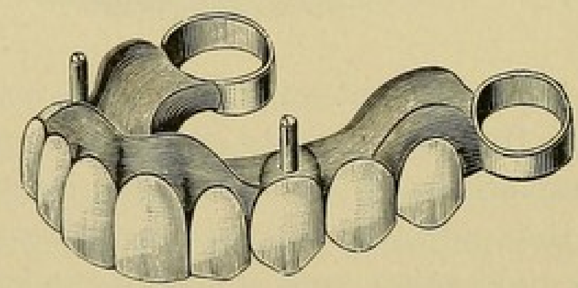


Fig. 440.



hard palate. A shallow groove can be made around the palatal surfaces of the teeth, and 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. 441 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 ex-

Fig. 441.

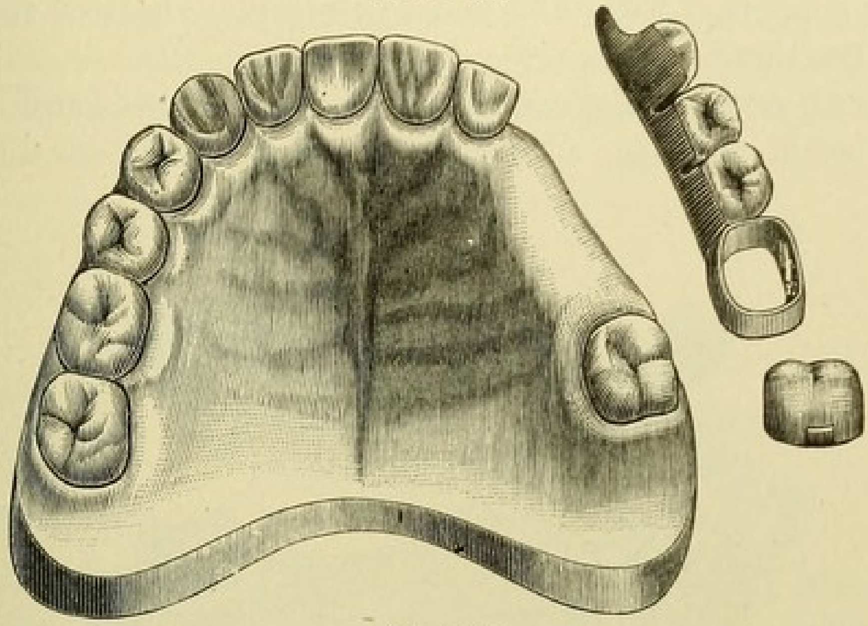


Fig. 442.

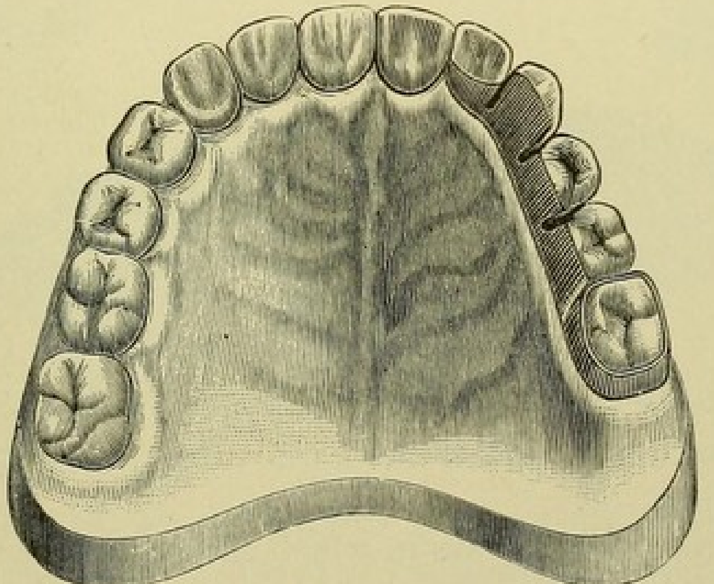
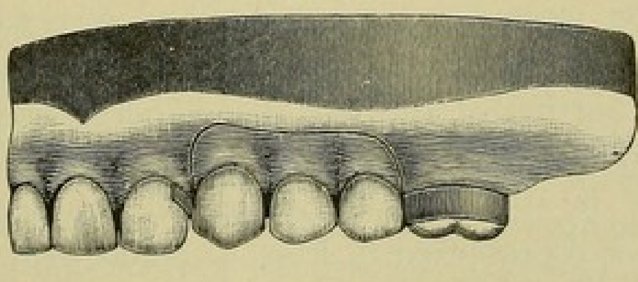


Fig. 443.



tend across the palate. The lateral was hardly strong enough to support a permanent bridge. The molar was capped, and a removable appliance constructed with a band which slipped over the cap and rested on a shoulder on the mesial side to form the posterior abutment. The lateral was notched and clasped for the anterior support. Figs. 442 and 443 are two views of the appliance in position.[1]

Fig. 444 represents a case in which the bicuspids and a molar are replaced, and also a central, on an extension of the plate,

FIG. 444.

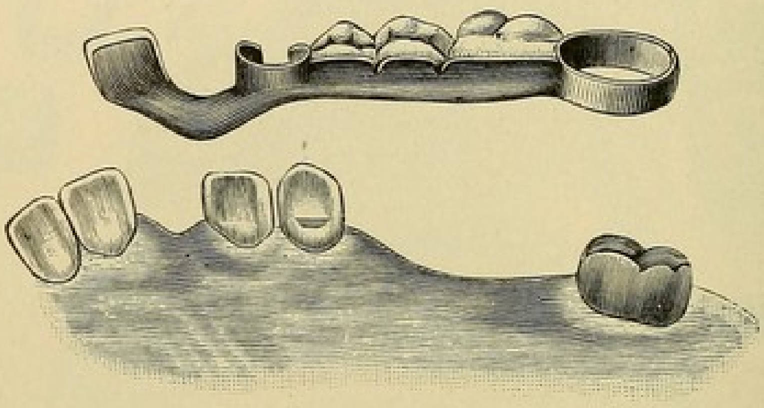
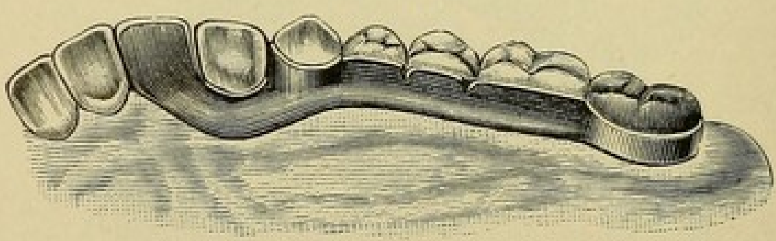


FIG. 445.



the cuspid being partly encircled by a clasp with a shoulder resting on the palatal section of the tooth. Fig. 445 shows the denture in position.

Fig. 446 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 cavity was filled with gold, and the gingival border, by treatment, brought nearly to its normal position on the tooth. A plate bridge, such as is represented in Figs. 447 and 448, was then constructed. Clasps, with flanges resting on little shoulders formed

[1] This denture at the time of writing has been worn thirteen years.

at A, A, Fig. 446, support and retain it. A flange such as was 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

Fig. 446.

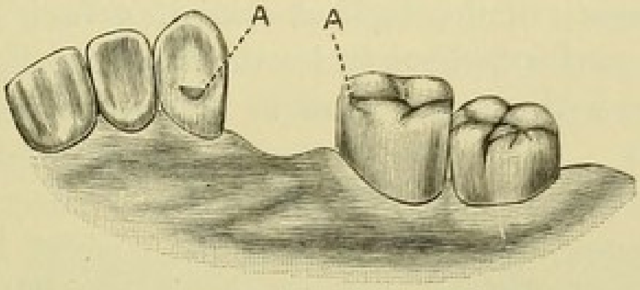


Fig. 447.

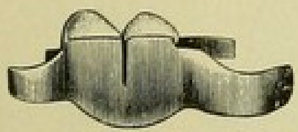


Fig. 448.

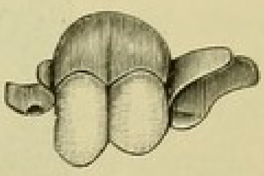
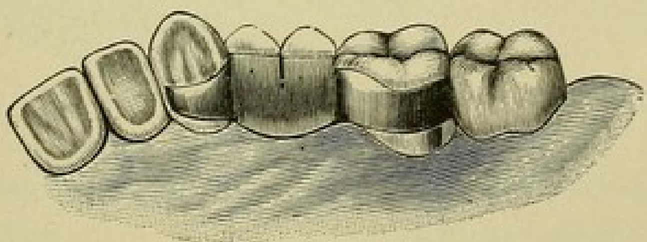


Fig. 449.



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. 449 shows the denture finished and in position. If the teeth are dense in structure, an attachment of metal held in proper position against the lower portion of a crown will be worn a long while before it causes injury to the parts. Filling, or crowning, if necessary, can be resorted to subsequently.

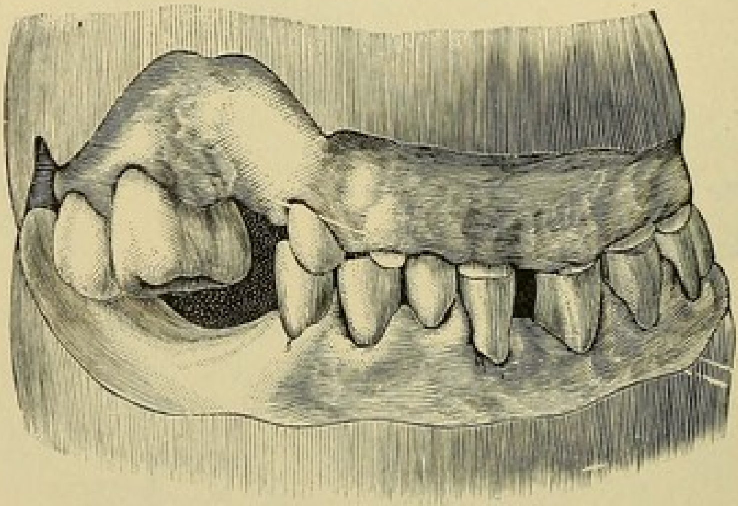
By a correct application of the methods just explained and illustrated, a piece of removable bridge-work of this style can be devised for many cases.

Dr. J. L. Davenport describes the methods he adopted in the application of plate bridges to the following case:

"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

Fig. 450.



crowns, while the lower ones suffered but little loss, as will be seen by reference to Fig. 450.

"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 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.

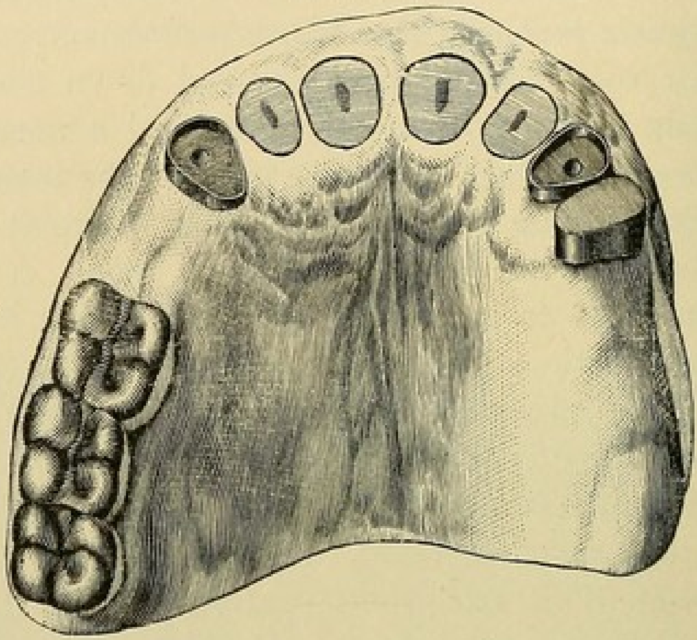
"Fig. 451 shows the upper jaw ready for the plate.

"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.

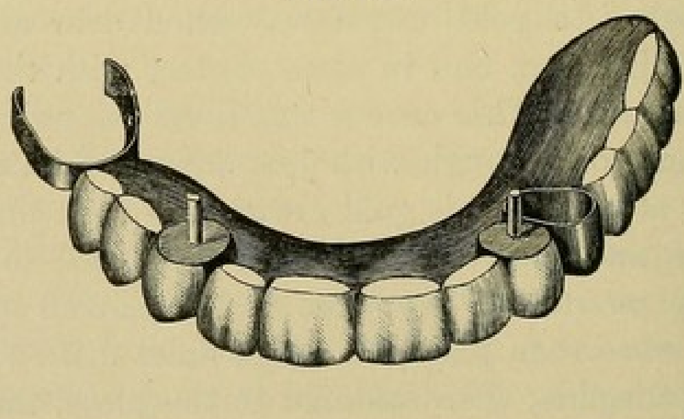
"The plate was then provided with a gold bar about one-eighth of an inch wide, occluding perfectly with the lower teeth, and plain teeth soldered in place, hiding the bar, and just meeting the gum in front of the incisor roots. The plate rested squarely against the capped cuspids, each of which showed a narrow band of gold when the plate was in position. As finally completed (see Fig. 452), this was the most perfectly fitting piece I ever

FIG. 451.



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. 452.

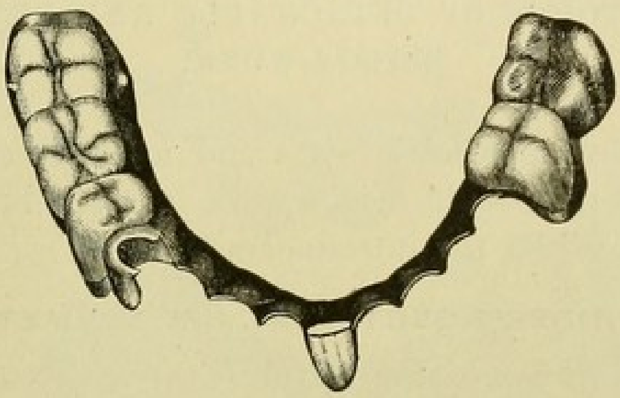


been, though it had no support on the left side back of the first bicuspid.

"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

Fig. 453.



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 crown and occluding with the molar on the upper plate (see

Fig. 454.

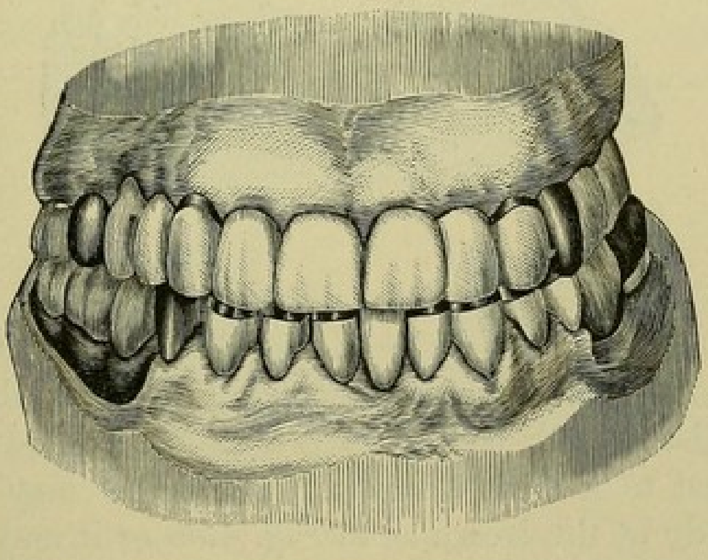


Fig. 453). This not only prevented the plate from being bitten down unpleasantly on the gums during mastication, but enabled me to use a shorter molar upon the upper than I otherwise could have done, and allowed better the antero-posterior and lateral movements of the jaws.

"Fig. 454 shows the case as completed."

CHAPTER XII.

SPECIAL FORMS OF DETACHABLE AND REMOVABLE BRIDGE-WORK.

A description of special forms and methods of constructing detachable and removable bridge-work is given in the following pages, as practiced by the introducers.

DR. WINDER'S SECTIONAL CROWN METHOD.

This method presents the novel feature of constructing the crowns and forming the abutments in sections, the bridge being attached to the detachable section.

Fig. 455.

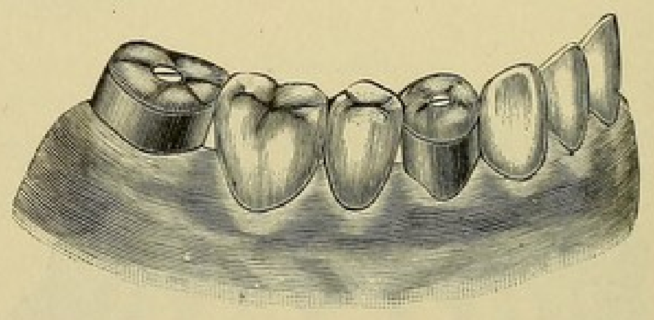
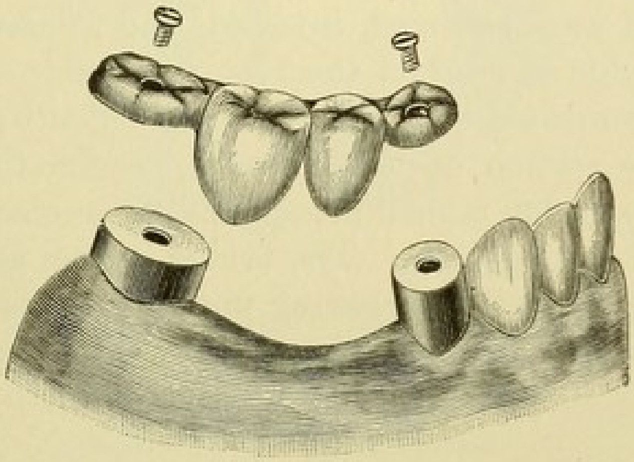


Fig. 455 illustrates a case of bridge-work made in this manner. The collar section of the artificial crown is capped and cemented on the natural crown or root, the gold forming the occluding portion of the crown, when the bridge is adjusted in position, being secured to it with a screw. The screw may be made to enter the body of the crown as in Fig. 456, or it may be soldered to the cap on the collar, passing through the occluding section of the crown, and being secured by nuts on the screws (Fig. 457).

In constructing a bridge of this style, the crowns forming the abutments having first been made, are removed from the mouth in a plaster impression and articulation, from which a model is made, showing the crowns in position. Each section of the bridge between the crowns is then constructed, and the crowns adjusted in the mouth. The bridges are next inserted in position, and cemented with resin and wax to the detachable sections of the crowns. The whole is then removed in investing material, in an impression-cup, or by placing the investing material in position on the bridge. After being removed from the mouth

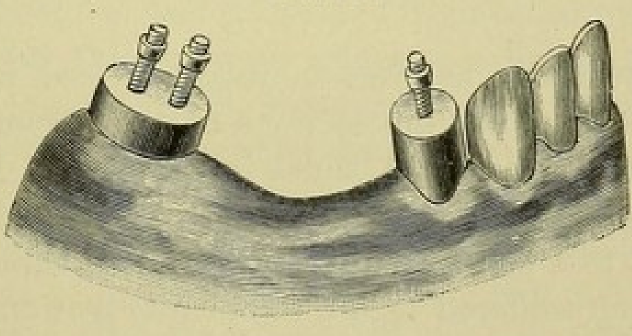
FIG. 456.



more investing material is added and the bridge and crown sections soldered together. Only the detachable sections of the crowns should be in the investment at the time of soldering.

The incisive edges can be protected and the occluding surfaces of the porcelain capped with gold as in permanently attached

FIG. 457.



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 occluding surfaces of bicuspids or molars forming the bridge are to be capped with gold, the collar sections alone are first made and removed in the impression. The caps for the crowns and the bridge teeth are then formed of one continuous piece of gold plate. This is made by laying the strip of gold on a piece of lead and stamping along its length with suitable dies representing the occluding surfaces of the different teeth. The gold is then properly fitted to the collar sections on the model, conforming to the occlusion of the antagonizing teeth.[1] The cusps are filled with solder, and the porcelain fronts, backed with platinum plate, are fitted in position to the gold forming the caps and the backings, cemented with wax, removed, invested, and soldered to the caps. 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 approximating the section fastened to the bridge 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 or nuts. The gutta-percha prevents the secretions invading the interstices between the sections of the crown.

FIG. 458.

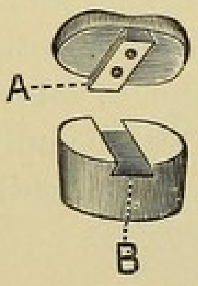


FIG. 459.

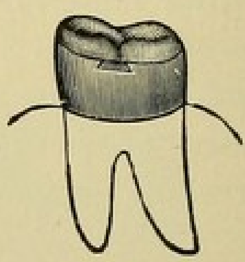


Fig. 458 illustrates another method, devised by Dr. W. R. Spencer, of constructing the sections of the crowns in this style of bridge-work. The part A slides in the groove B. The dovetail flange A is made of a thick piece of plate, fitted to the groove B, and riveted to a piece of platinum adapted transversely across the cap and then soldered to the removable section of the crown. Fig. 459 shows the section of the crown in position.

Fig. 460 illustrates a bridge made by Dr. C. L. Alexander, in which dovetail slides are placed on the sides of the crowns.

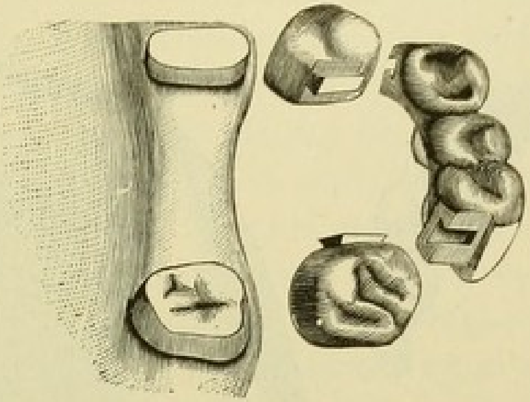
In either of these forms gutta-percha can be used to securely attach the bridge so that it shall be detachable only by the dentist.

---

[1] In the Hollingsworth System will be found another method of constructing the grinding-surfaces of a number of crowns and dummies of one piece of plate.

An advantage possessed by these styles of bridge-work is the facility they afford for the ready utilization of irregular teeth as

FIG. 460.



abutments, no matter how much they converge or diverge, or lean in and out of the line of the arch.

DR. LITCH'S METHOD.

Dr. 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. 461, 462, and 463 illustrate a bridge similar to the one illustrated in Fig. 284 (page 159) 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. 464) made of gold, No. 16 U. S. standard gauge, 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 U. S. standard gauge, 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 position on this cap, backed, attached with resin and wax, and removed with the cap. The cap is next invested in plaster to the 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), No.

16 U. S. standard gauge, 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

FIG. 461.

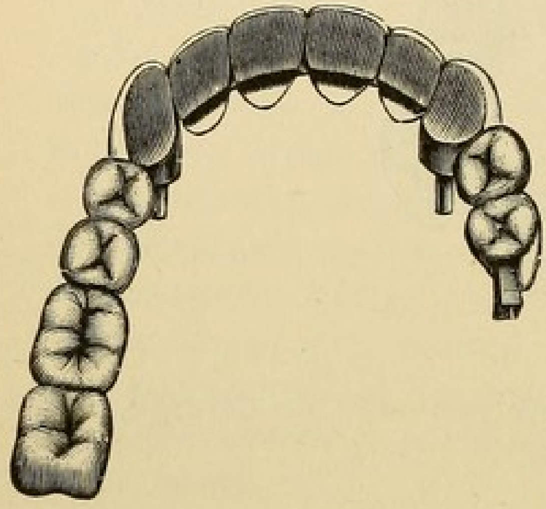


FIG. 462.

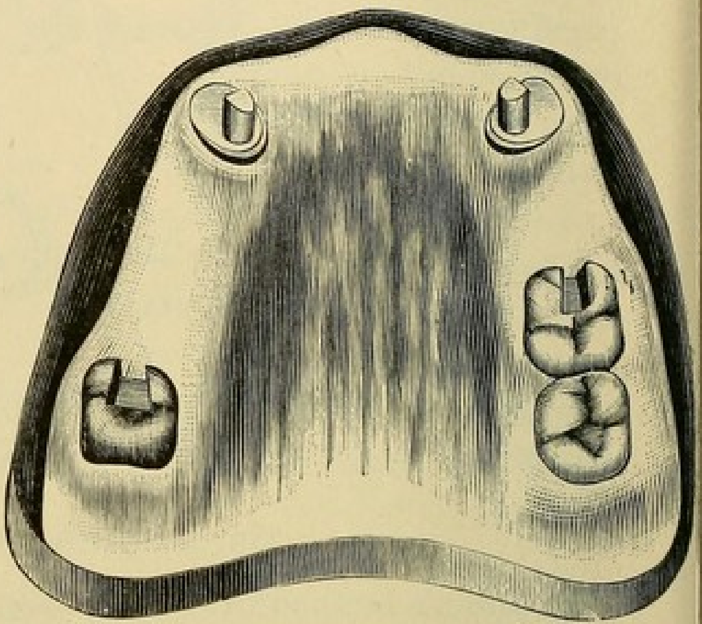


FIG. 463.

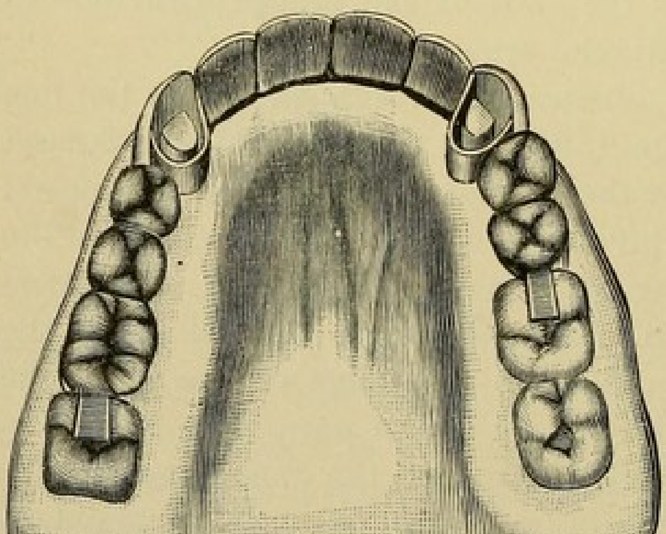
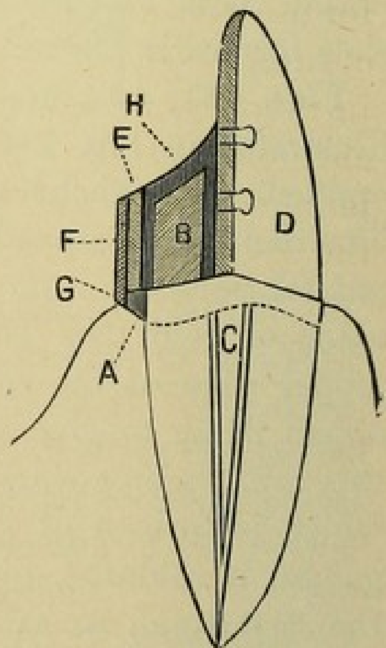


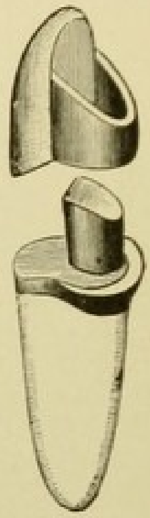
FIG. 464.



when completed. On the outside of this half-ring is fitted and soldered a thin strip of gold (F) of No. 28 U. S. standard gauge, 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. 465). To this ring the bridge is soldered the same as to a crown. 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. 464) can be protected by a metallic filling.

Fig. 465.



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.

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 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. R. W. STARR'S METHODS.

Dr. R. Walter Starr gives the following descriptions of his methods in detachable bridge-work:

"The case of Mr. W. presented difficulties of an unusual character, as may be seen by inspecting the illustration (Fig. 466), which renders detailed description unnecessary.

"It will be observed that the molars and the left second bicuspid overhang to a degree that would make the taking of an accurate impression by ordinary methods well-nigh impossible. After a careful study of the case, it was decided that two separate pieces of detachable bridge-work should be attempted, and, as an essential preliminary step, the overhanging sides of the molars and bicuspids were ground with engine corundum-wheels and points

FIG. 466.

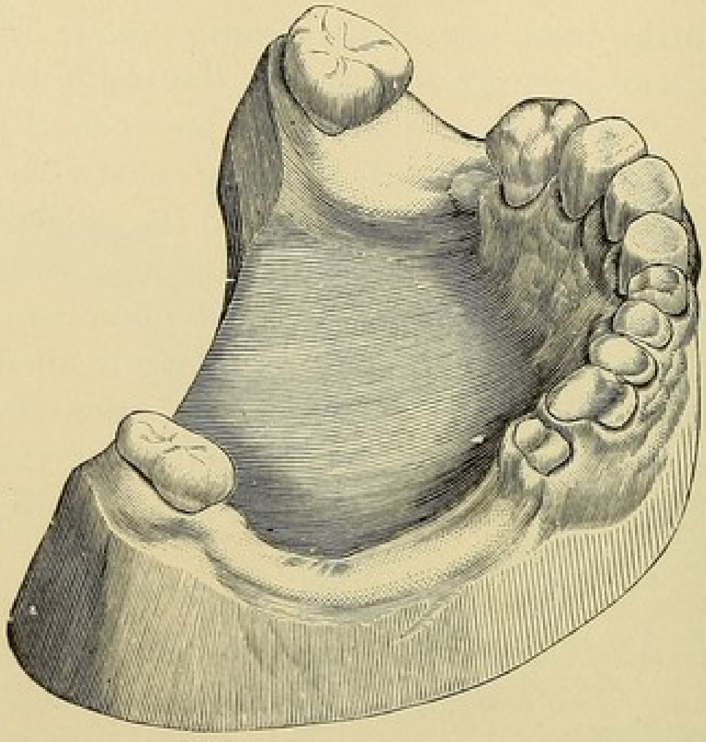
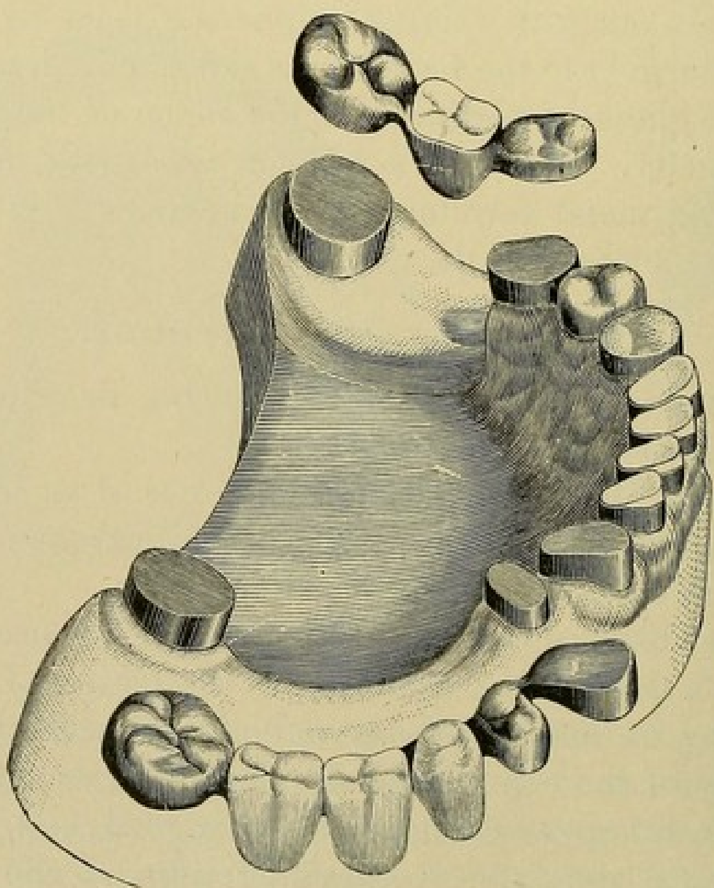
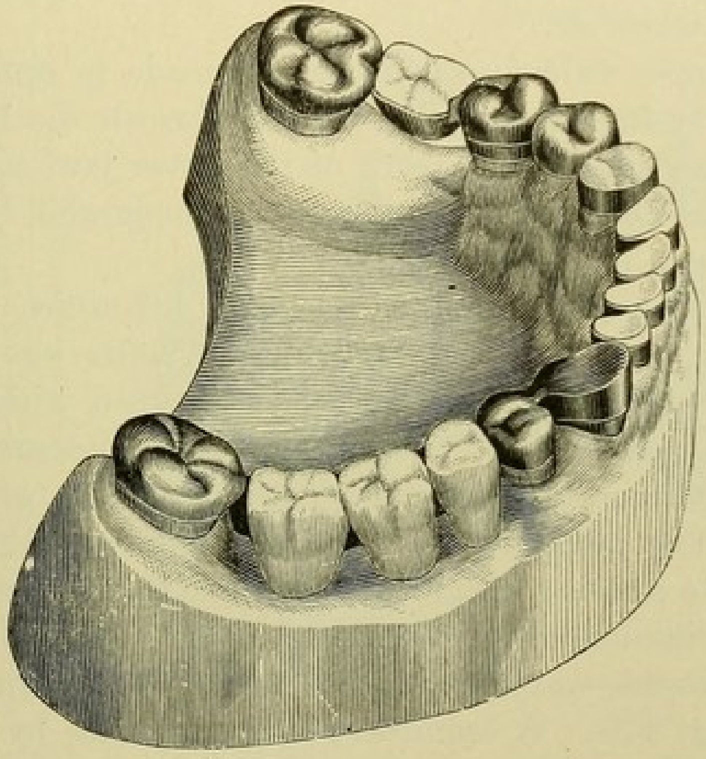


FIG. 467.



until those sides were made much less inclined, when plaster impressions were taken, first of one half, and then of the other half, of the jaw. Gold cap-crowns were closely fitted over the molars, left second bicuspid, right first bicuspid, and cuspid stump. Gold crowns were made to telescope over all the caps, which were then, by means of oxyphosphate cement, fixed firmly on the teeth. Suitable plate teeth were selected, fitted, backed, and hard-waxed in place between the telescoping crowns. After hardening the

FIG. 468.



wax with cold water from a tooth-syringe, the pieces were carefully removed, invested, and soldered. The two completed bridges were easily replaced on or removed from the supporting capped teeth, and their appearance when detached is correctly shown by the illustration, Fig. 467, which also shows the capped teeth and stumps. The figure likewise shows the results of the novel method employed in crowning the incisors. Gold collars were fitted tight on the necks of the incisor stumps, and the porcelain caps adjusted in the collars, and set in the oxyphosphate cement which had been packed into the collars; thus at the same time fastening the collars on the stumps and the caps in the collars, as shown completed in Figs. 467 and 468.

"Fig. 468 illustrates the finished crowns and bridges, which latter were secured in position by placing a small piece of gutta-percha in each of the telescoping cap-crowns, which were then warmed and carefully pressed in place,—the gutta-percha filling only the spaces between the flat tops of the caps of the natural teeth and cusped caps of the bridges.

"Whenever, for repair or for any other purpose, it shall become desirable to remove one of the bridges, that may readily be done by applying a hot instrument or hot air to the caps to soften the gutta-percha sufficiently to permit the telescoping bridge to be taken off.

"A full upper vulcanite denture was made to replace the old one, which, by improper occlusion, had thrown the full force of mastication on the anterior teeth of the lower jaw, and produced the destructive action that resulted in the deplorable loss of tooth-substance shown in Fig. 466."[1]

The next case also presented unusual difficulties. "The forward overhang of the inferior right second molar was so excessive that an impression could hardly be taken, until with corundum-wheels and points the sides of the tooth had been made parallel, or rather slightly tapering to form a truncated cone, with the neck as a base. The molar was alive and sound, but the crown was gone from the pulpless cuspid, which I suitably shaped by means of my root-trimmers (Fig. 469).

"An impression was then taken, the cast from which is illustrated by Fig. 470. A seamless gold collar was, by means of a slightly tapering mandrel, made to exactly fit the tapered natural molar, the lower edge of the collar cut to conform to the gingival margin; a cap piece of gold plate soldered to the top edge of the collar, and a hole drilled through the center of the completed cap (A). Care was taken to so fit and proportion the cap that it would require finally pretty hard driving to send it home on the tooth; but first there was fitted to the cap a telescoping seamless collar, on which was soldered a gold plate, with cusps, to form a molar crown as shown. The molar was then thoroughly dried, slightly painted with Agate cement, and the cap, A, driven hard down with a flat pine stick held upon it and struck with a mallet; the

[1] *Dental Cosmos*, vol. xxviii, No. 1, page 17.

hole in the cap enabling me to see when the cap was quite down. The cuspid was then likewise fitted with a seamless gold collar, the top edge of which was given a roof-shape, as seen above the root in Fig. 470. A piece of gold received a corresponding roof-shape, had a short section of gold tubing soldered into it, and was trimmed to the outline of the collar, beside which, B, its form is seen, and to which it was subsequently soldered, after suitable investment to keep the parts in proper place. The root-canal had been previously prepared to receive the tube, which, with its

FIG. 469.

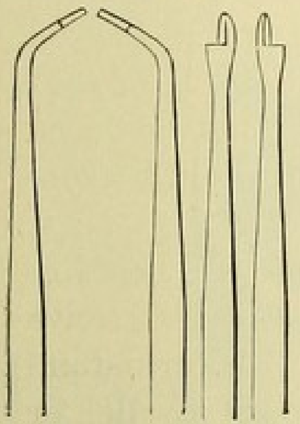
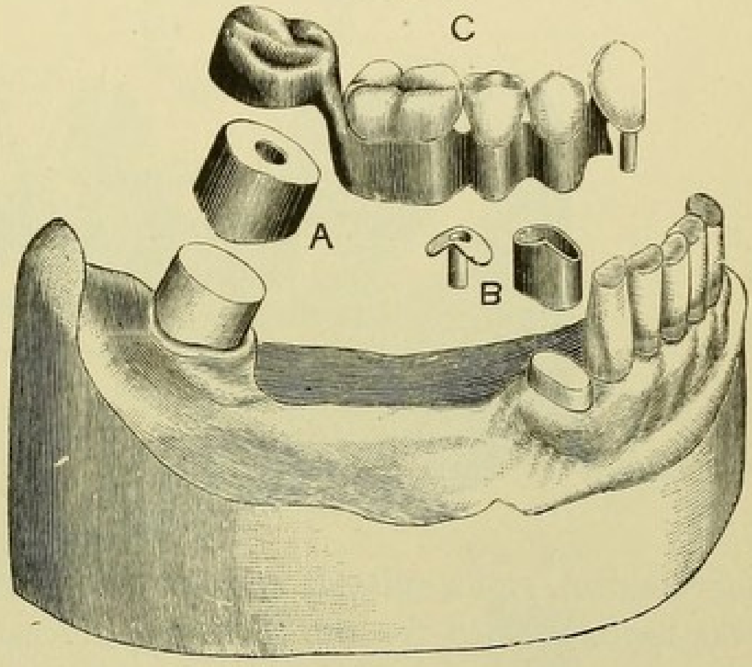


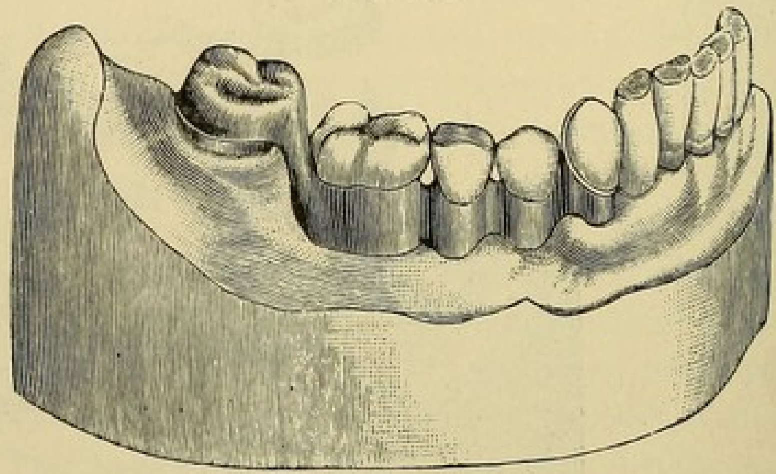
FIG. 470.



roofed cap, was with stick and mallet driven hard down over the root. A piece of gold wire exactly fitting the tube had a roof-shaped piece of properly perforated gold plate slipped over it into position on the root; became fixed in such relation by a drop of melted hard wax; was removed, invested, soldered, and finished in such shape that, excepting the hollowness, it looked like the tube and cap B.

"The relations of the occluding teeth had, of course, been determined by an articulating model, and by means of it a series of seamless gold collars and cusp-crowns were adjusted on a thin platinum plate fitted on the cast between the cuspid and second molar, and the collars soldered to the plate after investment. The truss thus formed received an appropriate finish by the rounding and smoothing of its basal borders. A plain plate cuspid was backed with gold plate and fitted on the roof-plate, to which, after determining its proper occlusion, it was secured by hard wax; removed, invested, and soldered. It was then put into the tube on the root; the telescoping cap put over the molar; the truss put in position in the mouth, and the whole covered with plaster and marble-dust, contained in a suitable sectional impression-tray, which enabled me to hold the mass steadily in place until the mixture was sufficiently hard to bring away cap and truss and roof-plate all in proper position. A second mixture of plaster and

FIG. 471.



marble-dust, and a suitable trimming of the first mixture after all was hard, sufficed for the soldering process that resulted in the denture which, when finished, appeared as shown detached at C, Fig. 470, and mounted on the cast in Fig. 471. It went firmly to place in the mouth, and yet was removable in the possible event of accident to the denture, or for readjustment of the cusp-crowns, which latter could easily be done by warming the piece sufficiently to soften the gutta-percha, replacing the denture on its anchorages, and directing the proper closure of the occluding teeth."

DR. PARR'S METHODS.

Detachable.—Fig. 472 illustrates a method 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. 473. The bridge is supported by two shoulders on the abutment crowns, which slide into grooves in the dummies (Fig. 474). These supporting shoulders and slots are made by shaping two pieces of platinum plate to the form shown in Fig. 475, 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. 472.

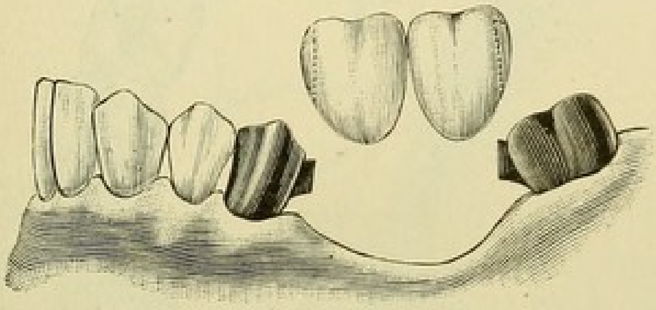


FIG. 473.

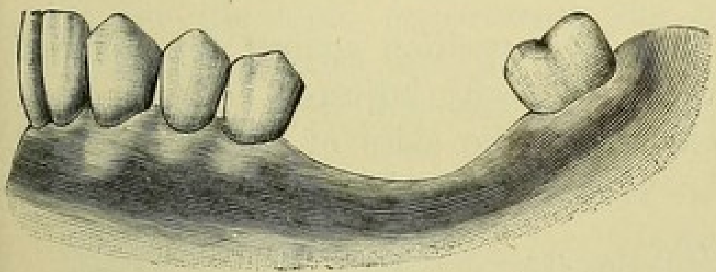


FIG. 474.

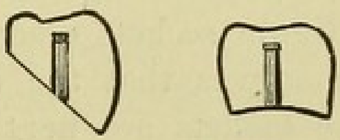


FIG. 475.

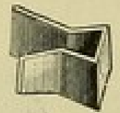


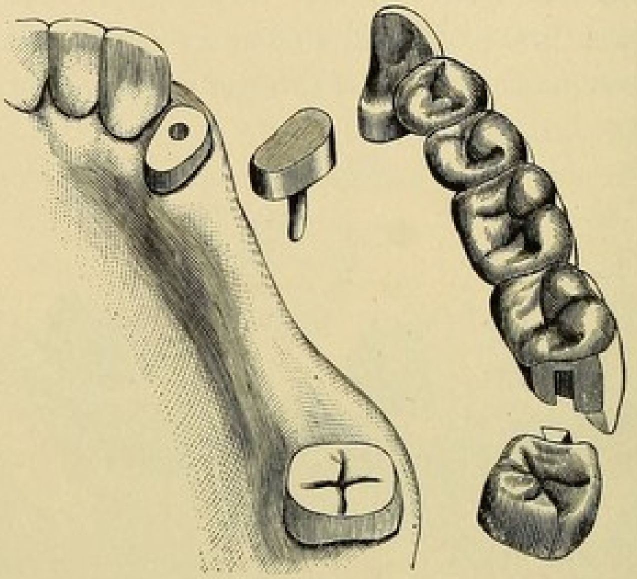
Fig. 476 shows a bridge constructed with the attachment described at one end and a double cap attachment at the other.[1]

Removable Bridge.—In this style the crowns forming the abutments are permanently cemented in position, each section of the bridge between them being removable. The case illustrated in Fig. 477 will serve as a type to give the constructive details. The cuspid and molar crowns are first formed in the usual manner. A model from an impression is then made, on which the crowns will appear in the same position as in the mouth. A gold and platinum bar (A, Fig. 478) is then formed between the cuspid and molar. The end for the cuspid is rounded, and that

[1] Case of Dr. C. L. Alexander, described page 27, *Dental Cosmos*, vol. xxxiii.

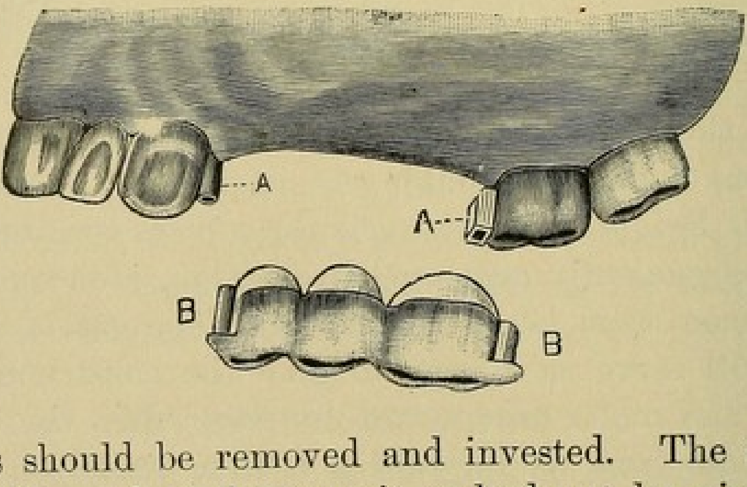
for the molar flattened. This last may be done by hammering the wire flat or by soldering a piece of clasp plate transversely to it. The two ends of the bar are then fitted in sockets of platinum (B, B). The ends of the bar should be bent and the

FIG. 476.



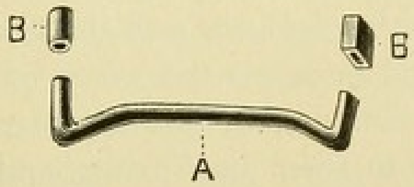
platinum sockets placed in such a position against the sides of the crowns that the bar can be easily adjusted and removed. The sockets are next soldered to the sides of the cuspid and molar crowns (A, A, Fig. 477), for which purpose the sockets

FIG. 477.



and crowns should be removed and invested. The sockets are held in position when the wax is melted out by pieces of iron wire, one end of which, covered with a portion of the investing material, is inserted in the socket, the other end being imbedded in the investment. If preferred, the slot on the side of the molar crown can be made with a piece of platinum adapted over the flat piece of gold forming the end of the bar, and then soldering the platinum to the side of the crown, the platinum being stiffened by flowing the solder over it. At this point the crowns and bar may be adjusted in the mouth, as well as on the model, to insure accuracy. A piece of thin platinum or gold is then perforated and slipped over the ends of the bar, which is placed in position on the crowns, and the platinum or gold

FIG. 478.



adapted to the form of the attachments, and to the immediately adjacent surfaces of the crowns. These shell forms are made to assure to the ends of the bridge a perfect fit by giving them the shape of the crowns and the attachments on the crowns. To this bar the teeth constituting the bridge are fitted in their respective positions and soldered. Bending either end of the bar slightly (B, B, Fig. 477), or sawing a slit in the cuspid end

FIG. 479.

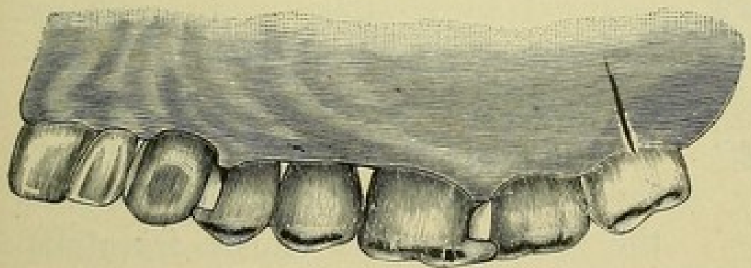
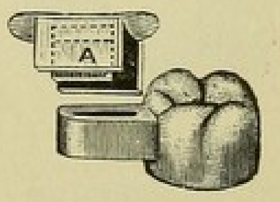


FIG. 480.



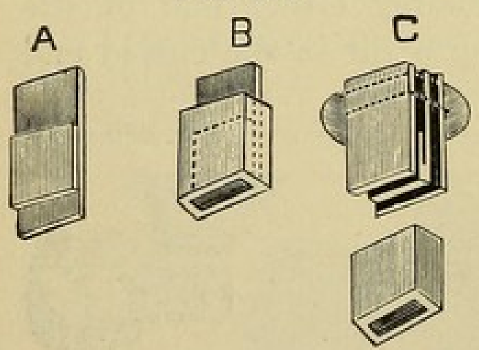
of it (Fig. 409), affords the means of holding the bridge firmly in position, although it may be removed and reinserted at the option of its wearer. Fig. 479 shows the inserted bridge.

Fig. 480 shows another method of forming a socket attachment. In the figure, the socket section of the attachment is seen projecting from the side of the molar crown. The other section consists of a cap having a spring flange. The flange enters the socket, which the cap incloses on the top and at the sides. The spring is made by bending open a little the part of the flange marked A.

This form of attachment is constructed as follows: To make *the spring flange*, two pieces of clasp or spring gold plate about No. 23 U. S. standard gauge, one of them one-half and the other one-fourth of an inch long and from one-eighth to one-quarter of an inch wide, the exact dimensions being governed by the case in hand, are laid together, so that one end of the short piece is nearer one end of the larger piece than the other. The edge of the short piece nearest the end of the longer one is then soldered to it with a hard-flowing solder, the two being held during the operation in a blue gas flame with tweezers, and the end is trimmed square. A little whiting placed between the other edges will prevent the solder from flowing between or joining the pieces there. The short piece of plate is to form the spring, and is left unconnected at one end for that purpose (A, Fig. 481).

To Form the Socket.—The spring flange is first enveloped once around with a thin piece of platinum, a little deeper than the socket is required. The platinum is then enveloped with one thickness of coin gold plate, No. 32 U. S. standard gauge, about the depth the socket is to be, leaving a ledge of the platinum projecting. The platinum and gold are next removed and soldered, by holding them in a flame and using very little solder, of a hard-flowing variety, which is placed upon the ledge. The sides and ends of the sockets are then filed level and the socket given a square form (B).

Fig. 481.



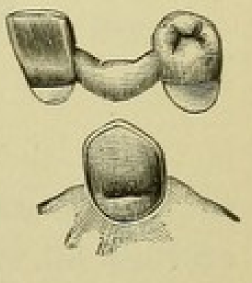
To Form the Cap.—The spring flange having been inserted in the socket, two pieces of the spring gold plate of the same length as the socket are adjusted along its sides, the pieces being cut a little wider than the depth of the socket, so that when adjusted they shall project slightly above it. A piece of thin platinum plate is then adapted to the end of the flange, to the socket, and to the pieces of spring plate, first being perforated to allow the projecting ends of the latter to pass through it. The spring plates and the flange plate are then cemented to the platinum plate with wax, removed from the socket, invested, and soldered (C).

The sockets must be so placed on the crowns that the springs at the ends of the bridge shall enter them on parallel lines. Their proper relative positions to secure this movement are readily determined by attaching the tops of the spring flanges (either temporarily or permanently) to the ends of a piece of wire of the length of the space to be bridged, which will permit the necessary adjustment. The sockets are then soldered onto the crowns.

When the bridge teeth or dummies adjoining the sockets have been fitted in position, they are withdrawn with the caps and spring flanges, and soldered to the bar, in the manner described at page 258. The gold caps forming the occluding surfaces of the bridge tooth can usually be fitted over the cap. When the socket is attached lengthwise from labial to palatal side to a gold crown as at A, Fig. 477, the spring metal plate of the flange is best placed on the side toward the crown.

In a bridge of this style of the anterior teeth only,—where the abutments form the extremities of the piece,—the ends should be attached to the mesial sides of the crowns forming the supports; but when it also carries teeth posterior to the abutment, and the sections of the bridge are united together, the attachment should be made on the distal side, the bar supporting the anterior teeth resting in a slot formed on the palatal side of the abutment (Fig. 482). A shell crown on a cuspid can be utilized as a support for this form of attachment.

Fig. 482.



The attachment described can also be used in combination with removable plate bridges.

Fig. 483 shows the cast of a lower jaw in which only the left second molar, left cuspid, and right first bicuspid remained. The molar and bicuspid were fitted with gold cap-crowns, and spring socket attachments (Dr. Parr's form) were soldered in proper positions on the crowns, as illustrated. The completed denture in position supported by the attachments is seen in Fig. 484. The under side is shown in Fig. 485.

Fig. 486 represents the articulated cast of a case in which a similar form of attachment and a clasp were used. This is illustrated in Fig. 487, which needs no description.

Fig. 483.

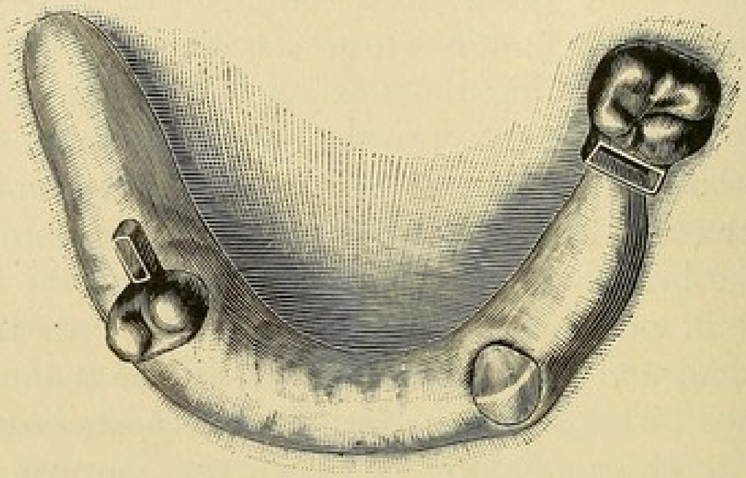


Fig. 484.

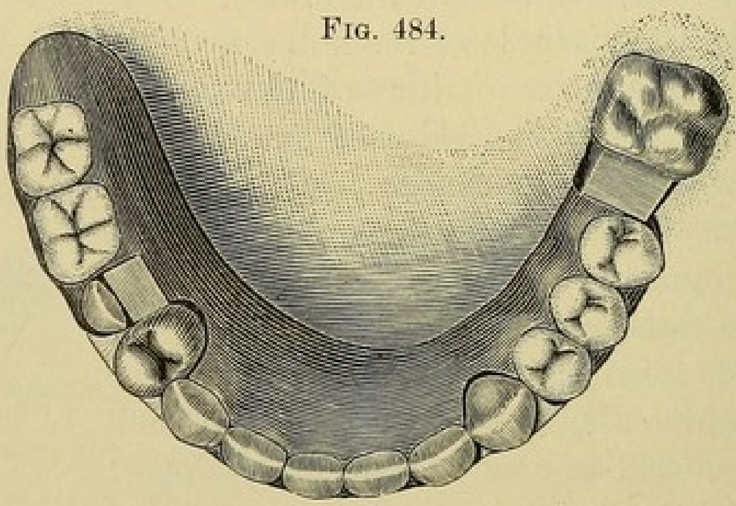


Fig. 485.

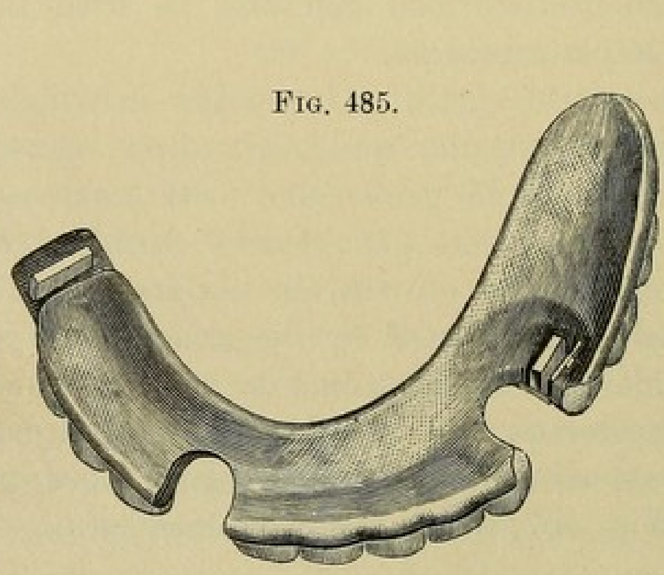


Fig. 488 shows the denture in place. It was constructed of vulcanite, and made for and placed in the mouth of a patient

FIG. 486.

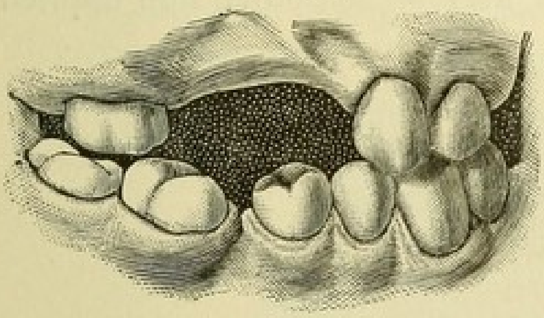


FIG. 487.

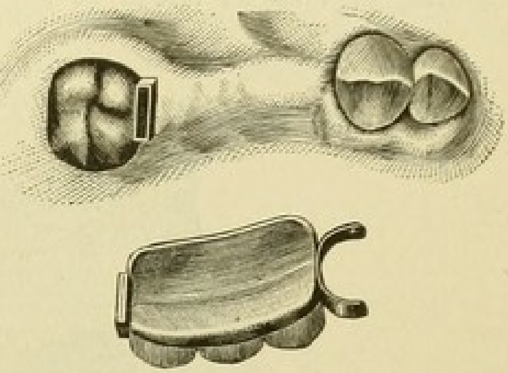
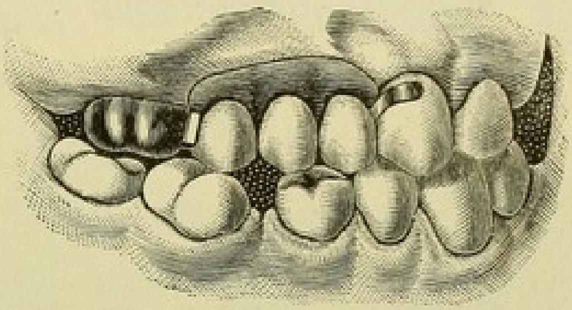


FIG. 488.



exhibited at a clinic of the Odontological Society of Pennsylvania, at Philadelphia, in December, 1888.[1]

DR. WATERS'S METHODS.[2]

Dr. T. S. Waters explains the advantages of his removable plate bridge-work as follows: "In the system I present the denture is retained securely and steadily in the mouth, yet is readily removed and replaced at pleasure by the wearer. The pressure and strain are distributed properly over all the structures and tissues available for the purpose, and the roots and crowns to which the denture is attached are so prepared that there is no place for the lodgment and retention of food, and when the denture is removed, both it and the mouth can be thoroughly cleansed. Should the roots or other tissues be attacked by disease, thus requiring treatment, or should repairs to the mechanism become necessary, the movable bridge-work offers facilities for those purposes not to be found in permanent dentures."

[1] *Dental Cosmos*, March, 1889.

[2] *International Dental Journal*, April, 1889, page 197.

Dr. Waters thus describes the formation, combination, and application of his devices to cases of removable plate bridge-work:

"My devices are three in number, each of which may be used alone, or two of them or all three may be combined and applied

Fig. 489.

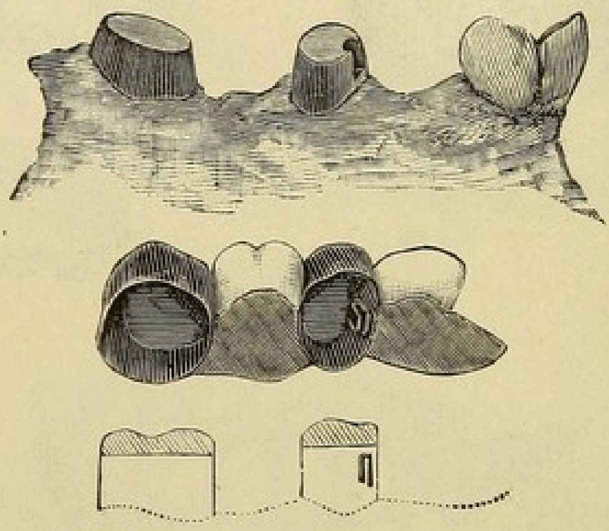


Fig. 490.

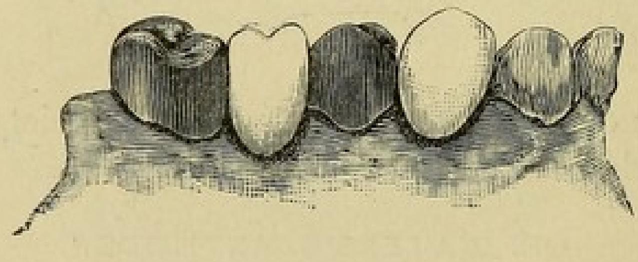
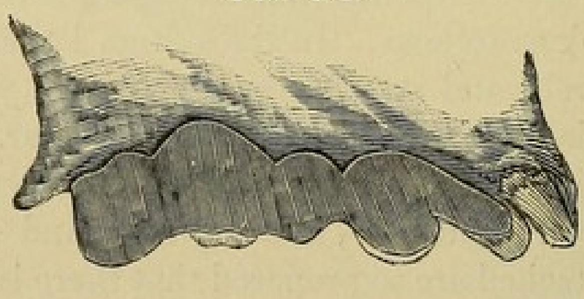


Fig. 491.



in the same case, as the position, character, and relation of the teeth and roots remaining in the mouth may seem to indicate.

"The first is a gold crown fitted to and sliding on a cap attached permanently to the root or natural crown. This cap is made high and has on one side a longitudinal groove. The gold crown has soldered on the inside a spring catch, which works in the groove on the cap, and holds the crown firmly in its place. The character of the device is seen in application to the case represented in

Fig. 489. Fig. 490 shows the denture in position. Fig. 491 gives the lingual aspect. It will be readily seen that under proper circumstances two or more roots or teeth may be fitted with this device, the gold crown may be soldered to and made a part of the denture, making the whole a piece of bridge-work capable of being removed, cleaned, and replaced at will. The spring catch regulates the firmness of retention.[1]

Fig. 492.

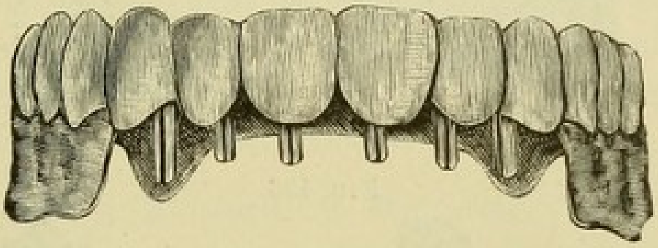


Fig. 493.

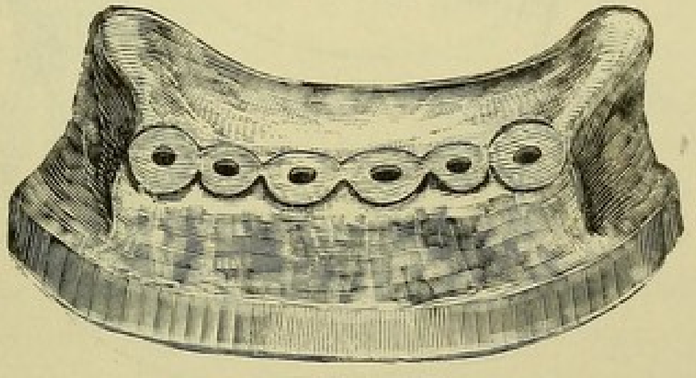
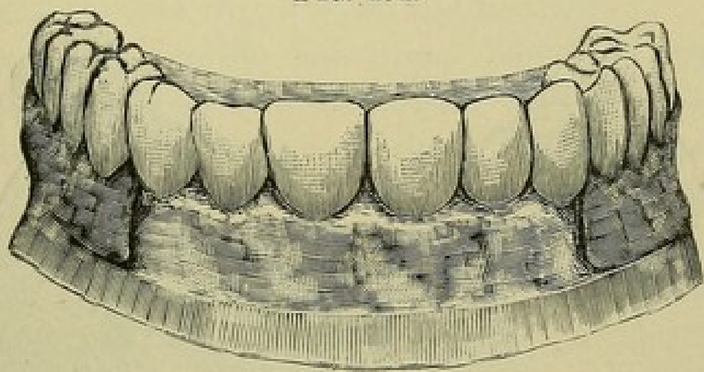


Fig. 494.



"The next device is the box cap and split post; the box cap being fitted permanently to the root, and the split post being soldered to the plate bearing the teeth. The box cap is the usual cap, with a box or tube soldered to it and extending into the root, the cap end of the tube being open. The split post is so

[1] Dr. Waters has patented this invention and donated it to the profession.

secured to the denture as to slide snugly into this tube, the firmness of retention being regulated by pressing the split slightly open when necessary. This device, like the first, may, under

Fig. 495.

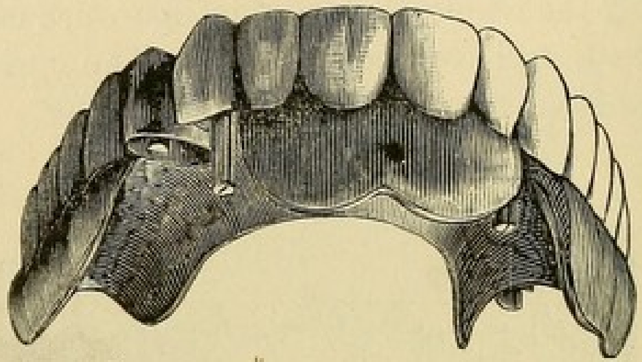


Fig. 496.

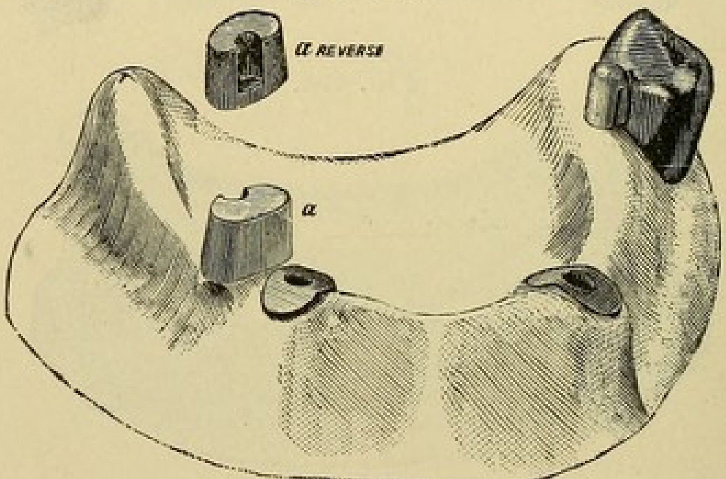
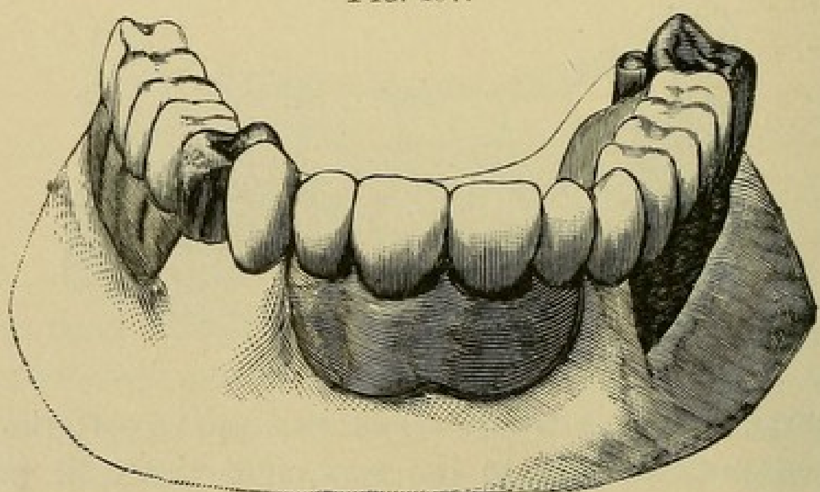


Fig. 497.



proper circumstances, be used by itself in any case, as shown in application in Figs. 492, 493, and 494, in which the whole denture is supported by box caps and split posts adjusted to the roots of the six anterior teeth.

"The third device consists in soldering to the side of the gold crown covering the natural tooth a split pin or post, which is inserted into the open tube attached to the denture.

"As before remarked, these devices may be used singly or in combination in any one case. In one of the dentures illustrated the box cap and split post alone are used; in another, the cap, gold crown, and spring catch are used; in the case illustrated in Figs. 495, 496, and 497 the three are applied, in which the entire denture is attached to and retained by two cuspids, a bicuspid, and a molar. In all this, great care must of course be taken in the preparation of the roots and natural crowns, to protect them against the action of destructive agents."

DR. BONWILL'S METHOD.[1]

The special feature of this method is, the advocacy of connecting the clasp attachment 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. 498 is a cast for the first upper bicuspid, right 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. 499. The second bicuspid had also a large amalgam filling, around which the clasp was placed, so that it would not show from the mouth. Fig. 499 shows the plate with a tube-tooth or porcelain crown thereon, with pin 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. 498.

Fig. 500 is a skeleton plate with the attachments without the tooth made for the case—left side, lower jaw—shown in Fig. 502.

[1] *International Dental Journal*, vol. xiv, page 94.

e and *e*, Fig. 500, 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. 502, 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. 501 shows the finished case with the artificial crown cemented over the pins or vulcanized on.

Fig. 498.

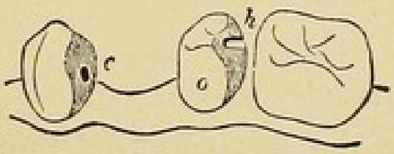


Fig. 499.

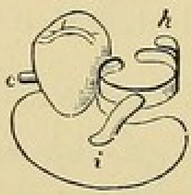


Fig. 500.

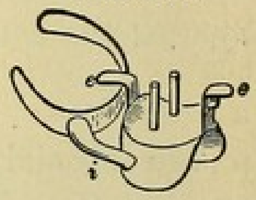


Fig. 501.

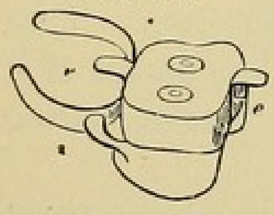


Fig. 502.

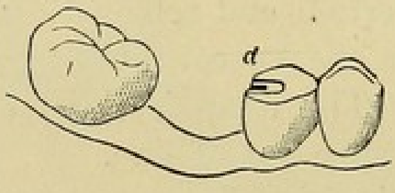


Fig. 503.

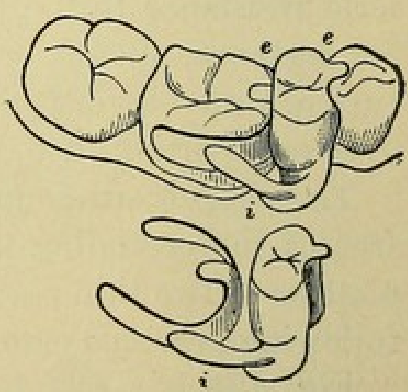


Fig. 503 shows the replacement of a second bicuspid, right side, lower jaw. The bar *i* is soldered to the plate and clasp on the buccal side of the first molar. The artificial tooth is made entirely of gold, and the flange resting on the first bicuspid is soldered directly to it. The anterior surface of the gold tooth is made concave to fit the distal surface of the first bicuspid, and so prevent lateral movement.

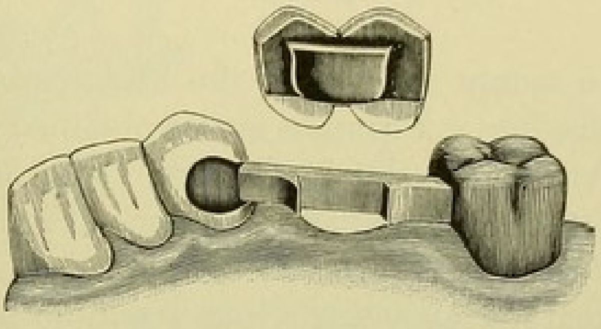
In this case a gold crown is used as the artificial tooth, as it facilitates the soldering, adds to the strength, is easy to repair, and is not seen. The rear flange, which rests on the molar, might have been soldered to the gold tooth also, and less strain would thus come on the clasp.

CHAPTER XIII.

REMOVABLE BAR-BRIDGES.

In removable bar bridge-work the bar is permanently attached to the abutments, and spans the space between them independent of the bridge. The bridge portion proper of the denture, consisting of the artificial teeth (dummies), is formed with a slot, or a countersunk base, into which the bar slides as the bridge is placed in position.

Fig. 504.



In the case represented in Fig. 504, one end of the bar is attached to the gold molar crown and the other end anchored in the cuspid with a gold filling. The bridge section fits over the bar as illustrated. The process of construction as given by Dr. J. G. Morey is as follows:

The molar is capped with gold. A flat bar of iridio-platinum, about No. 12 gauge and one-eighth of an inch wide,—the width being regulated by the needs of the case in hand,—is fitted to the space. One end of the bar is fitted in the anchorage cavity in the cuspid, and the other end to the gold molar crown. A slot is then cut in the bar, beveled slightly toward the gum (Fig. 504).

A piece of gold clasp plate, about No. 28 gauge, the width of the slot, is cut and shaped in the form of a clamp to fit over both sides of the bar in the slot. The end of the bar is then soldered to the gold crown. The bar must be placed far enough toward the palatal side to leave space for the artificial teeth. Porcelain teeth are next fitted in place, backed with thin platinum, cemented with wax to the clamp-shaped piece of gold, and removed from the bar. Teeth and gold clamp are then invested and soldered together. In investing, one end of a narrow strip of sheet iron is inserted in the slot of the gold clamp, and the other end extended into the body of the investment, to hold and steady the gold clamp in position, while the gold solder is flowed between it and the porcelain tooth after the wax is removed. When finished, the point of the gold clamp is to be bent

Fig. 505

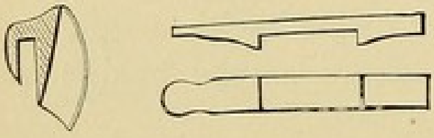
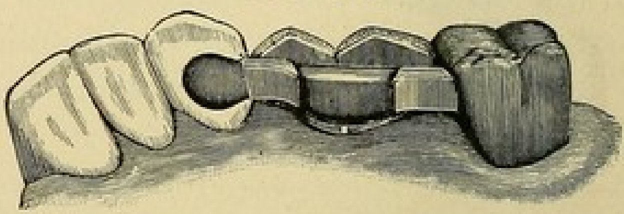


Fig. 506.



a little inward to secure and fasten the bridge section when slid into position on the bar. Firmness is also obtained by the slightly beveled form given to the slot in the bar. Fig. 505 gives a sectional side view of the bridge-tooth and bar. Fig. 506 represents the bar and bridge section in position.[1]

Dr. Morey's method of constructing a double bar-bridge with a removable molar or dummy is as follows:

The bar is formed as seen in Fig. 507. "A countersunk molar is ground and shaped as seen at A and B, Fig. 508. To the base of the molar and up in the slot is shaped and fitted the shell C, made of a very thin piece of gold and platinum crown-metal by

[1] A description of a removable bar-bridge, as given by Dr. J. G. Morey, was presented in the first and second editions of this work. A more extended description of bridge-work on this principle is given in the later editions, as many members of the profession seem to favor the various methods it involves. In England the method is designated the "Gartrell Bridge," having been introduced there by Dr. Gartrell, an American dentist, formerly of New York, now practicing at Penzance, England.

The models of a case similar to the one illustrated in Figs. 504 and 506 were exhibited at the Ninth International Medical Congress at Washington and presented by Dr. Morey to the author in 1887, and are still in his possession; but, as the method did not favorably impress him at the time, further description of it than had been given was withheld.—G. E.

first stamping it on a fusible metal die of the base and then adapting it to the part. A thin piece of clasp-metal (D) is then formed to fit over the bar and in proper position into the slot of the shell (C, Fig. 507), to which it is fastened by investing and soldering on the inside of the shell. The shell is then cemented with oxyphosphate onto the base of the molar as seen at A and B, Fig. 507, and is secured to the bar by springing together the edges of the metal at D, Fig. 508. Fig. 509 illustrates the tooth in position."

Fig. 507.

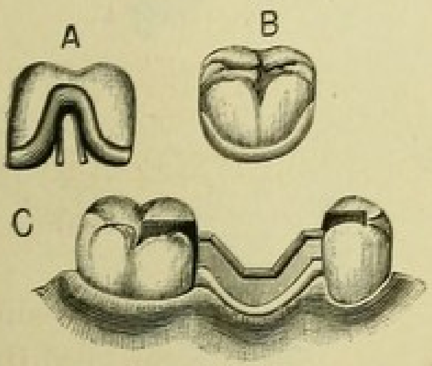


Fig. 508.

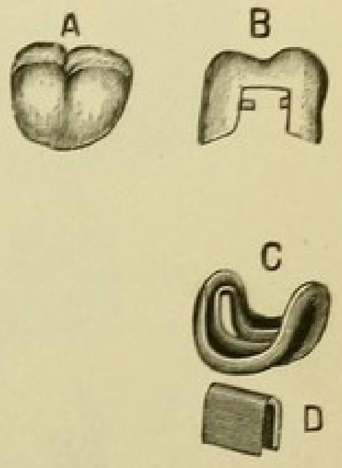
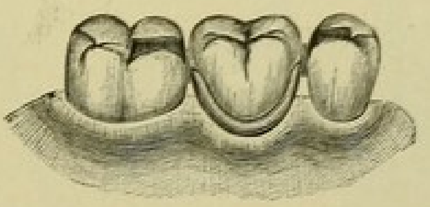


Fig. 509.



A variation in the method of construction of removable bar-bridges involving the principle above demonstrated is given by Dr. G. L. Curtis in the following case, illustrated in Fig. 510. The bicuspid and molar are capped with gold, and models made. In the construction of the dummies, the caps and backing at first are merely joined together with solder just sufficient to prevent movement of the caps. The sockets, like A, Fig. 511, which are made of thin gold, are then placed in position and held by means of *fluxed* wax, and the entire piece again encased as before, so that the ends of the sockets project beyond the cusp-surface of the bridge and are imbedded in the plaster, which holds them in position. The wax is melted out and the sockets soldered into place. After cooling, the projecting parts of the sockets are cut away until the bridge fits perfectly between the crowns, and the soldered surface is ground away to the proper fullness, and the whole piece rendered quite smooth or ready for polishing (C, Fig. 510). Arms like B, Fig. 511, are now placed into the sockets and cut off until a perfect adjustment with the crown is

Fig. 510.

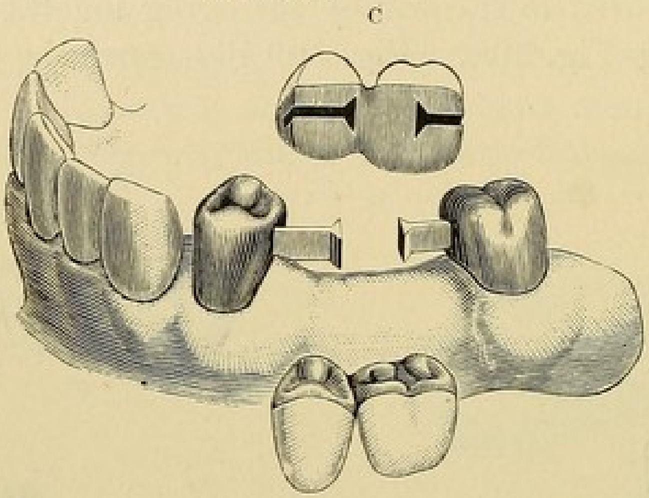


Fig. 511.

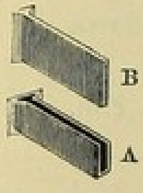


Fig. 512.

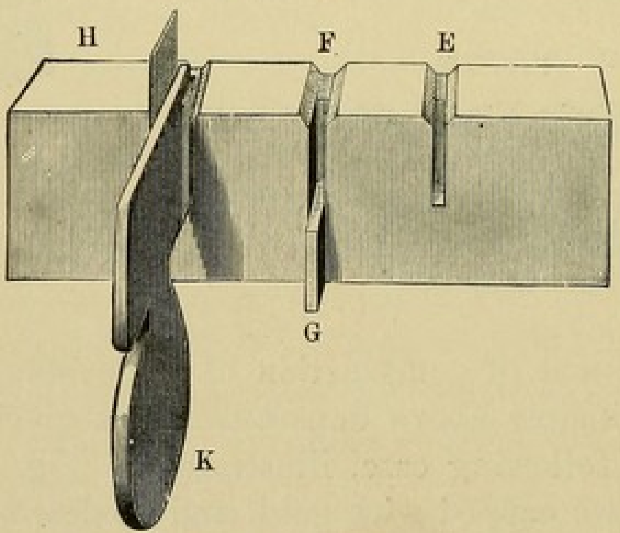
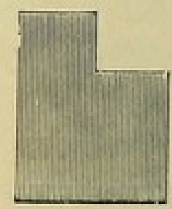


Fig. 513.



obtained. It will be found that the arms are considerably wider than the sockets are deep, allowing them to project one-sixteenth of an inch or more. Secure the bridge in position by a drop of wax at the junction of the porcelain surface and the cast, then varnish the palatal surface of the cast and pour soft plaster and marble-dust over the surface until it is on a level with the masticating surface, and allow it to harden. Then carefully remove the bridge and replace the arms in position as marked in the plaster, and retain them by means of additional plaster, or by steel springs, and solder them to the crowns, first placing in the joint sufficient fluxed wax so that in the process of soldering the arms will be perfectly united to the crown, which requires a very small quantity of solder. The case is now ready to finish.

FIG. 514.

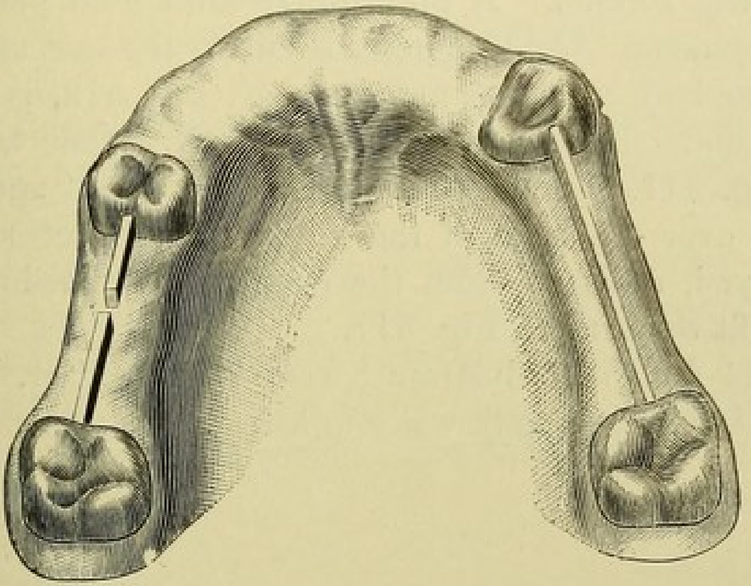
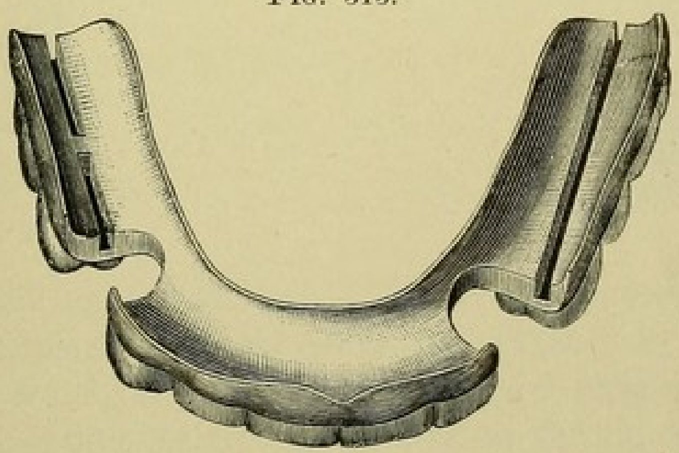


FIG. 515.



If the adjustment of arm and socket is perfect, the structure will be found to fit so snugly that it is only with considerable effort that the bridge can be removed. With everything in readiness for cementing, the crowns are quickly forced into position, the bridge carried to place, and the cement allowed to harden.

Should any alteration be necessary in the articulation that cannot be made by grinding off the cusps of the antagonizing teeth, the bridge can readily be removed without disturbing the crowns.

The arm B, Fig. 511, is made of a strip of clasp-metal, No. 16 gauge in thickness, and of any desired width or length. The strip is placed in a slot like E, Fig. 512, and the projecting end hammered to form a solid head as shown. A longer or shorter arm may be formed in the slot F, wherein the adjustable limit, G, may be set to mark the length of the arm while the hammered head is being formed. A piece of 20-carat gold plate, or preferably clasp-metal No. 33 gauge, is cut to the size and shape of Fig. 513, and by means of a former, K, Fig. 512, is forced into a suitable slot. The place of the former K is then taken by the arm B, Fig. 511, and the part H, Fig. 512, bent and delicately hammered over the head of the arm. The socket so formed is then removed, soldered from the outside, and finished as at A, to exactly fit the arm B, Fig. 511.

Figs. 514 and 515 illustrate a case by Dr. Parr, in which a removable bar-bridge plate was applied.

CHAPTER XIV.

DR. KNAPP'S METHODS.

Dr. J. Rollo Knapp has introduced some novel methods in crown- and bridge-work, for effecting artistic results and continuity of structure.

In crown-work, Dr. Knapp invests for soldering so that the parts to be united and filled form a miniature mold. Into this mold, at a high heat, with a pointed flame from his blow-pipe, he flows solder, which fills the interstices, joins the parts, and assumes the form of the mold. The following is a brief description of his methods:

Fig. 516.

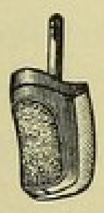


Fig. 517.

In constructing a gold collar crown with porcelain front, for an incisor or cuspid, 22-carat collar gold (The S. S. White Dental Mfg. Co.'s), No. 28 standard gauge, is used for the collar, which is formed by adapting the gold to the root by the aid of pliers. The cap to the band is then made of pure gold, No. 34 gauge, and a gold pin is soldered in position for the root-canal. A plate tooth is then ground in proper position, backed with pure gold, and fastened to the cap with wax. On being removed from the mouth after proper adjustment, the side and incisive portions of the wax, including the edges of the backing and contiguous portions of the cap, are completely enveloped with pieces of pure gold No. 34 gauge (Figs. 516 and 517). The crown is then invested so that when the wax is removed the backing on the tooth with the gold on the sides shall form a small mold or pocket (Figs. 518 and 519). When the investment is heated, the flame of his blow-pipe is played over its surface until the mass is aglow, when the point of the flame is thrown into the mold by rapid thrusts until the solder melts like wax and fills every part of the mold with liquid gold. This gives an excess of gold which affords ample facilities for contouring in the process of finishing (Figs. 520 and 521).

FIG. 518.

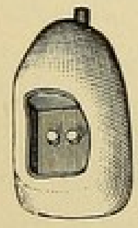


FIG. 519.

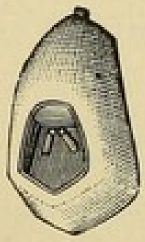


FIG. 520.

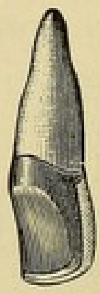


FIG. 521.

In constructing a bicuspid crown with porcelain face, the natural tooth is ground down to the gingival edge and capped similar to a cuspid. A bicuspid porcelain front is then ground and fitted in position (Fig. 522), and the remaining portion of the crown is shaped in wax to the form required. A die of the

FIG. 522.

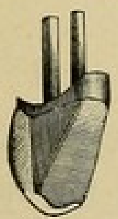


FIG. 523.

FIG. 524.

FIG. 525.

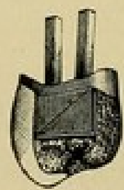


FIG. 526.

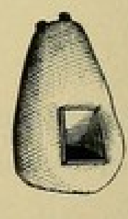
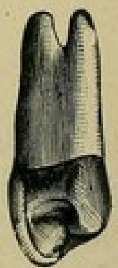


FIG. 527.



grinding-surface is then made in metal, a cap stamped in pure gold, No. 34 U. S. standard gauge (Fig. 523), and the cusps filled with 20-carat gold solder. This cap is next trimmed (Fig. 524) so as to fit when placed in proper position against the end of the porcelain cusp, for which purpose sufficient wax must be removed. The approximal surfaces are enveloped and the palatal portion of the collar protected with pieces of pure gold, No. 34 standard gauge, which are slit to facilitate their adjustment (Fig. 525). This leaves the palatal portion open when the crown is invested and the wax removed, which last should be done with hot water. Fig. 526 shows the invested crown ready for soldering, in which operation the parts are filled in and joined with 20-carat gold solder. The result when finished is a solid gold crown with a porcelain front (Fig. 527).

Dr. Knapp's method of constructing bridge-work is similar to that in general use except in the investing and the soldering together of the parts, the latter being done with the blow-pipe in a manner similar to that above described.

Figs. 528 and 529 illustrate specimens.

Fig. 528.

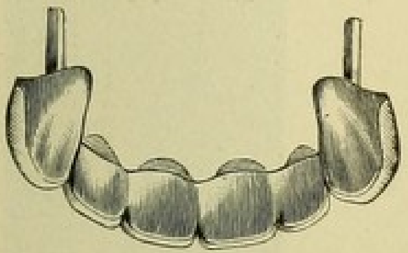
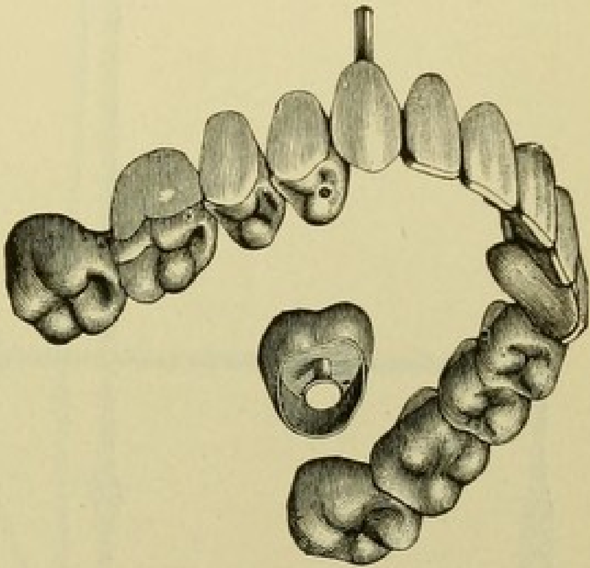


Fig. 529.



Dr. Knapp's compound blow-pipe (Fig. 530) consists of a miniature blow-pipe 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 of the cylinder is connected with the tubes and valves of the blow-

[1] The ordinary compound oxyhydrogen blow-pipe flame is produced by

2 volumes of hydrogen; 1 volume of oxygen.

Carburetted hydrogen consists of

2 volumes of hydrogen; 1 volume of carbon.

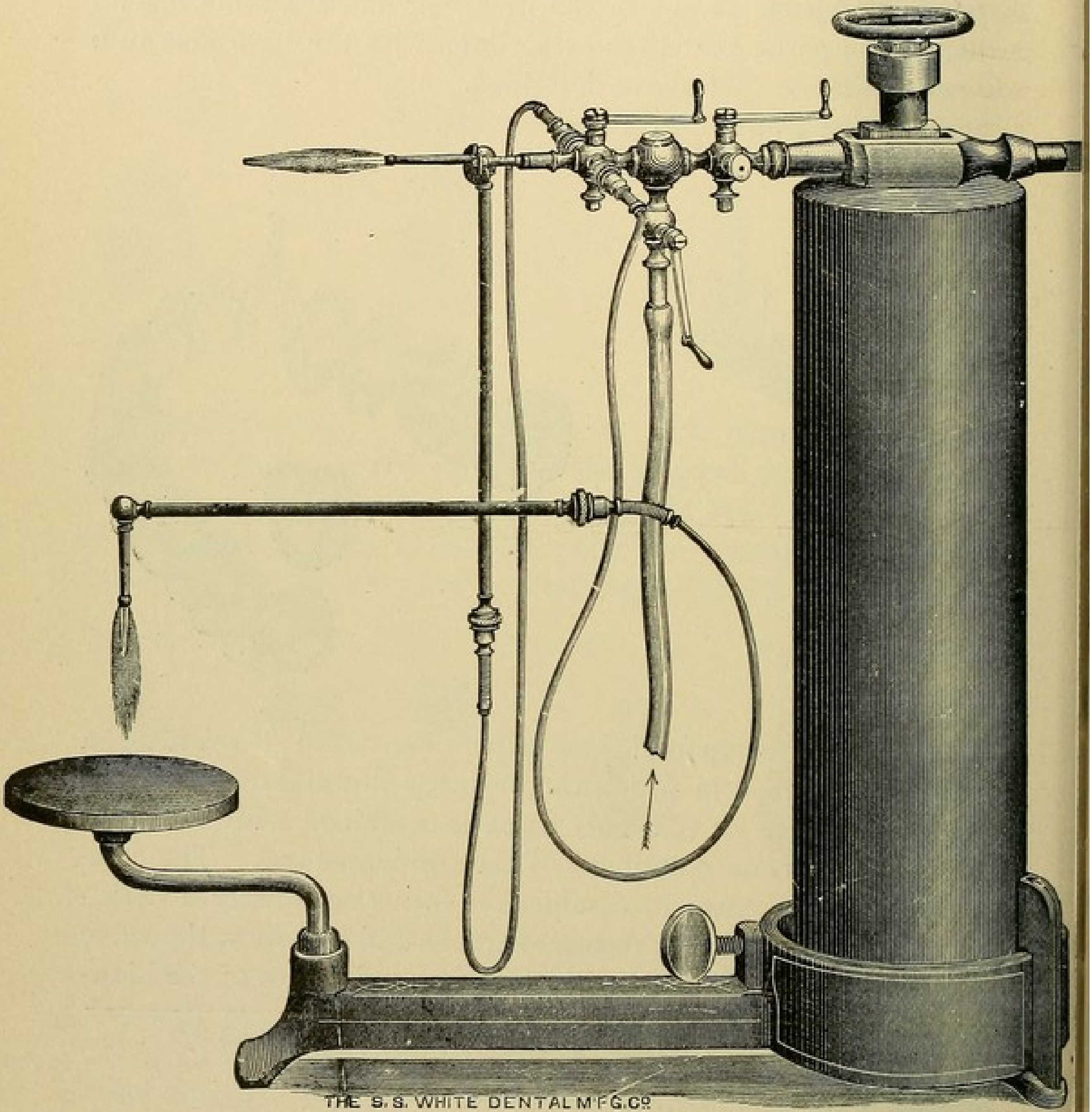
And nitrous oxid of

2 volumes of hydrogen; 1 volume of oxygen.

Consequently Knapp's blow-pipe flame is produced by a mechanical mixture of 2 volumes of hydrogen; 1 volume of oxygen; 1 volume of carbon.

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. 530.



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 blow-pipe 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.

Dr. Knapp has exhibited to the profession some very fine specimens of crown- and bridge-work, and presented much that is novel and interesting, as well as encouraging to the artistic element of prosthetic dentistry. His special methods, however, while admitting of the highest artistic results, embrace some processes which, on account of their intricacy, have not been very generally adopted in practice.

CHAPTER XV.

THE MANDREL SYSTEM.

In all styles of collar crowns the shaping and adapting of the collar is usually found by many dentists to be the most difficult part in their construction. To facilitate its performance the "Mandrel System" was introduced by The S. S. White Dental Manufacturing Co.[1]

"The configuration of the necks of all the teeth having been determined, a set of mandrels for shaping collars to fit them was devised. The set (Fig. 531) consists of seven tapering mandrels, six of which are double end, representing the average shapes of the necks of all the teeth. The illustrations are about two-thirds actual size, the longest instruments being nine inches in length. The cross-sections show the shapes and proportionate sizes at the greatest and least diameters.

"No. 1 is a double-end mandrel, for superior molars, right and left; No. 2 is a single mandrel, for superior bicuspids, right and left; No. 3 is double-end, for superior cuspids, right and left; No. 4, double-end, for superior centrals, right and left; No. 5, double-end, for inferior molars, right and left; No. 6, double-end, for the inferior centrals, laterals, cuspids, and first bicuspids, right and left; No. 7, double-end, one end for the superior lateral incisors, the other for those bicuspids in which a bifurcation of the roots, or a tendency in that direction, extends across the neck to the crown in the form of a depression on one or both approximal surfaces. The foregoing scheme comprehends all the teeth of the permanent set except the second inferior bicuspids. The necks of these approximate those of the superior central incisors so closely in shape that it was deemed inexpedient to make a separate mandrel, as the No. 4 mandrel will serve for both.

[1] *Dental Cosmos*, vol. xxviii, No. 8.

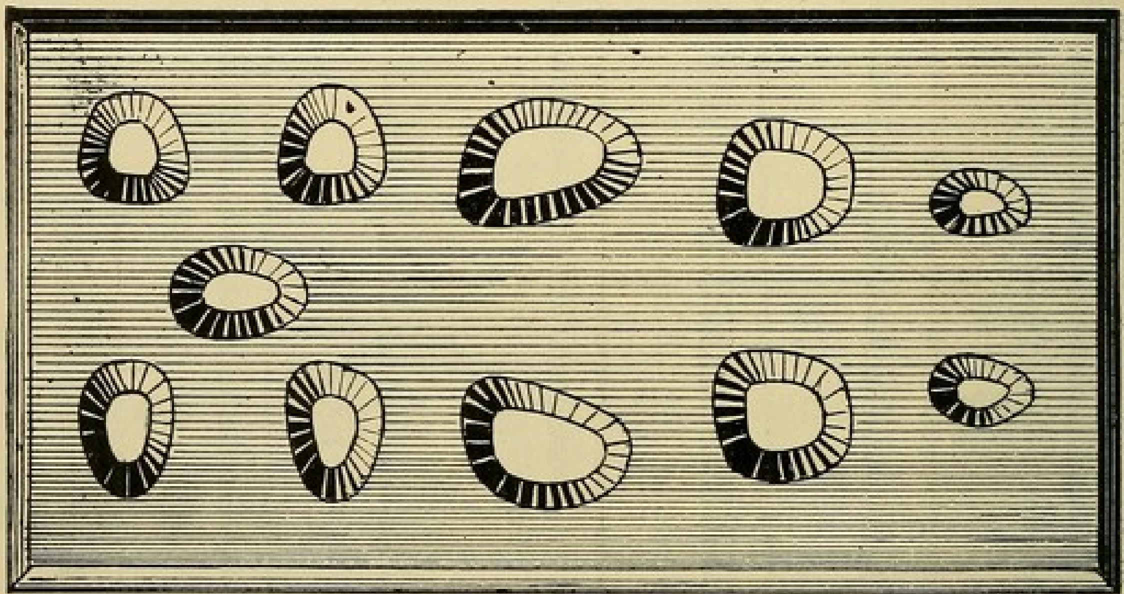
Fig. 531.

MANDRELS

FOR SHAPING SEAMLESS TOOTH-ROOT COLLARS.

"The collars or bands are made seamless, of No. 30 (American gauge) gold plate, 22 carats fine. Fifteen sizes, each of three widths ($\frac{1}{10}$, $\frac{2}{10}$, and $\frac{3}{10}$ inch) are made (Fig. 533), which it is believed will cover all requirements. These collars, although devised as a part of the system, can be used in all methods of crown- and bridge-work which require bands. They are so constructed that Nos. 1, 16, and 31 exactly fit into or telescope with Nos. 2, 17, and 32, and so on through the entire set, each collar fits into the series next higher; so that a root may be banded with one size and the size next larger used to form the tube for

Fig. 532.



the telescoping crown. When desirable, the 'seamless' collar can be strengthened, after being adapted to the conformation of the crown, by investing and flowing solder over the outer surface; or by fitting the next larger size of collar around the first, investing and soldering the two together.

"The other appliances devised for this system are, a reducing-plate or contractor, a pair of collar pliers, and a hammer.

"The contractor (Fig. 532) contains holes which are complementary in shape to the mandrels. The mandrels being applied to the inner circumferences of the collars, while the contractor must admit the collars themselves, the short taper of the holes in the contractor necessarily covers a somewhat greater range of size than is shown in the mandrels. With this appliance collars

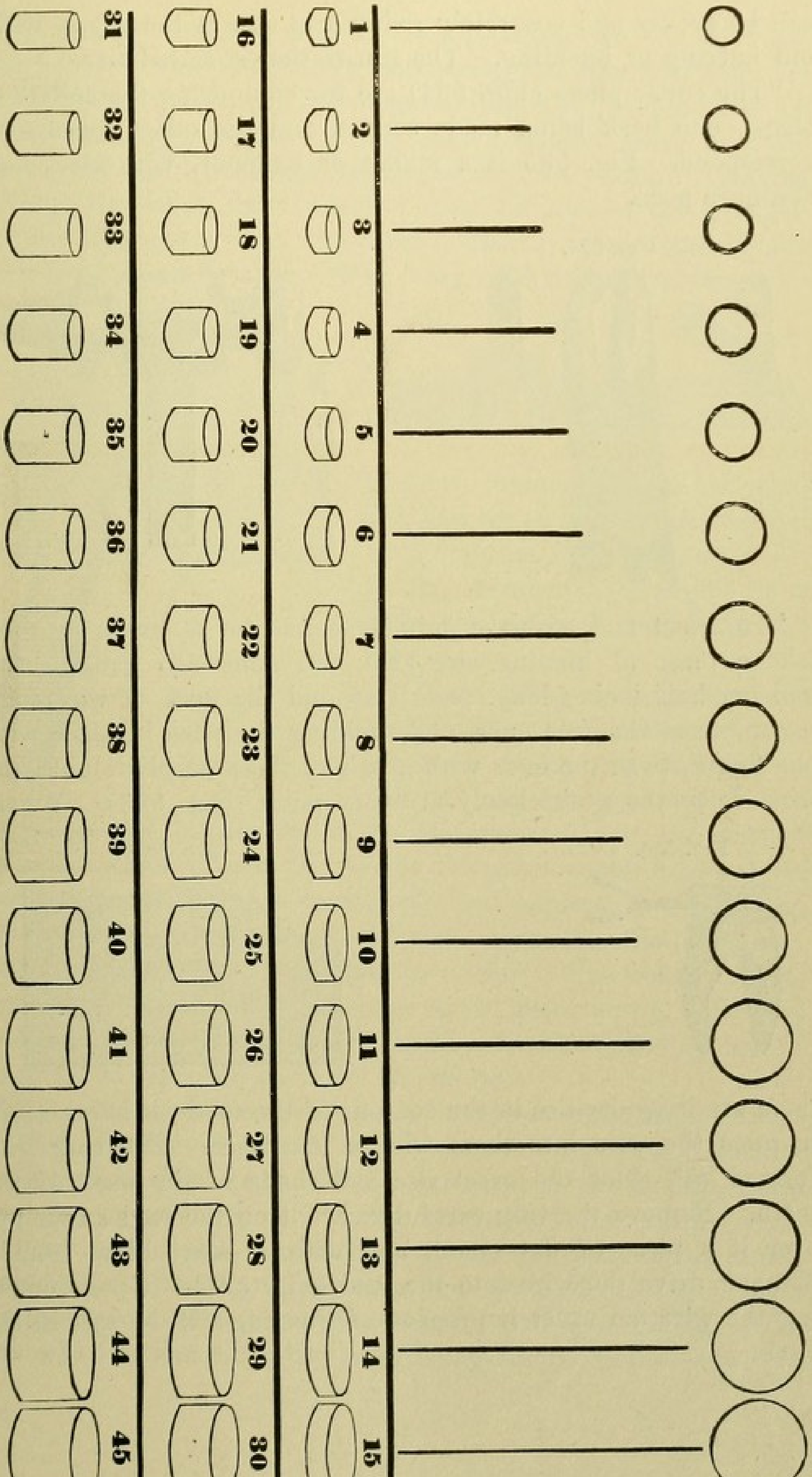

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FIG. 533.

can be evenly and accurately reduced in size at the edges, without burring or buckling. The illustration is actual size.

"The collar pliers (Fig. 534) are for contouring the collars to shape, one beak being made convex and the other concave to correspond. Fig. 535 is a mallet or hammer, with steel face and horn peen.

FIG. 534.

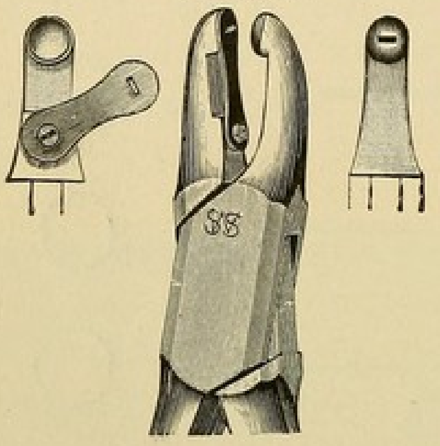
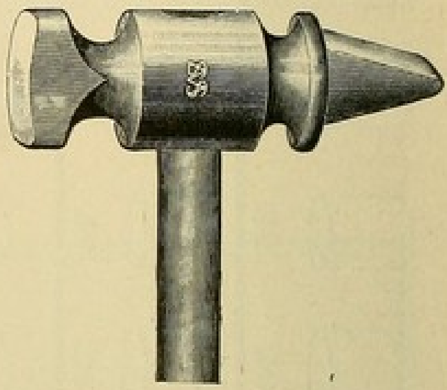


FIG. 535.



"To select and adjust a suitable collar for a crown or root, take a piece of binding-wire (No. 28, American gauge), two and one-half inches long, pass it around the neck of the molar stump, cross the free ends, and, holding the wire in place with one finger, twist the ends with a pair of flat-nose pliers until the wire clasps the neck closely at every point (Fig. 536). Where

FIG. 536.

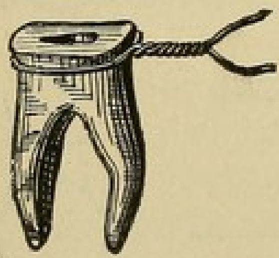
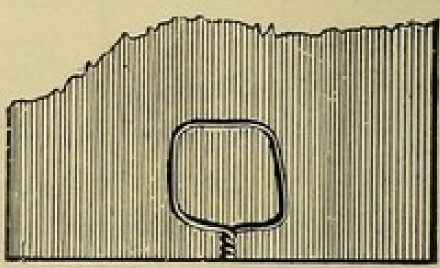


FIG. 537.



there are irregularities in the contour of the tooth, it is necessary to press the wire into them with a burnisher. The ring thus formed will show the exact size and shape of the neck of the tooth. Remove the ring carefully, lay it on the lead anvil, put over it a piece of flat metal, and with a smart blow from a hammer drive the wire into the lead (Fig. 537). Upon removing the wire, an exact impression of the ring will be left in the anvil.

"Next, cut the wire ring at the lap, straighten out the wire, and select a suitable collar by comparing the length of the wire with the straight lines in the diagram (Fig. 533), which show the inside diameters of the various sizes. Should none of these correspond exactly, take preferably the next size smaller. Having selected the collar, fit to mandrel with the peen of the hammer, holding it upon the lead, and using a slight pushing force to help in stretching and forming it (Fig. 538). Having driven the collar

FIG. 538.

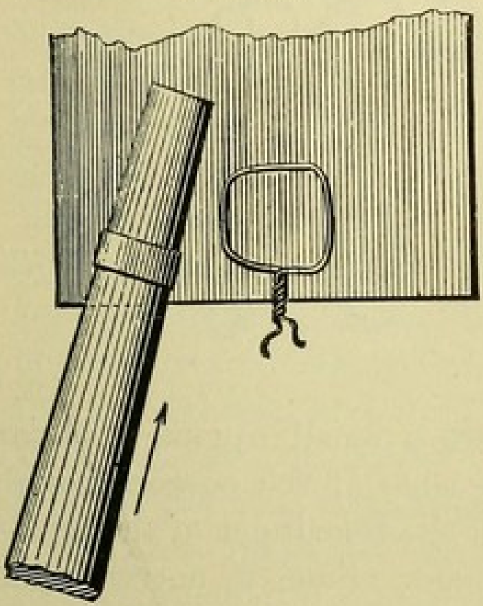


FIG. 539.

to form, remove it from the mandrel and try in the lead impression. If it does not fit exactly, return it to the mandrel and stretch it a little, when it will usually fit perfectly.

"If the collar or band has been accidentally stretched too much, or if for any reason it is too large, its root-end can easily be reduced to the proper size by the use of the contractor. Place the edge of the collar which is to fit the root in the proper hole; hold it level with a piece of file as in taking the lead impression of the ring, and tapping lightly on the file drive the collar into the plate (Fig. 539) until the proper reduction is made." The collar is next trimmed to correspond to the shape of the gum-margin. The cap section to represent the grinding-surface is then added by one of the methods described on pages 83 and 88.

The grinding section, in cases of pulpless roots, may be constructed of porcelain by the use of porcelain cusp-crowns, such as are shown in Fig. 540. Where porcelain is to be used, place the collar in position, and having ascertained how far it should go down on the root, remove it, and with the small spring punch in the collar pliers form projections on the inside of the collar at proper points to serve as stops, which, by resting on the top of the root, will prevent the collar from being forced farther down on it than is desirable (Fig. 541). Next fit and cement screw-posts in the root-canals, leaving the ends projecting in the space inside the collar, and cement the collar on the root, filling about two-thirds of the depth of the collar. Select a suitable cusp-crown, of the form illustrated in Fig. 540, and fit to inside of end of collar. If too long, shorten the cusps or reduce the length of the collar.

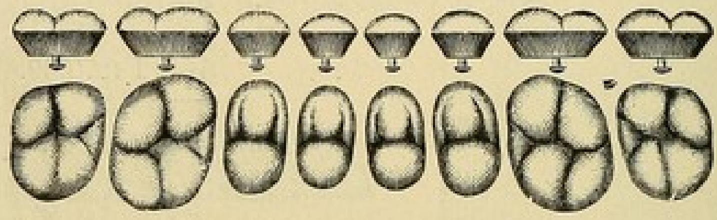


FIG. 540.

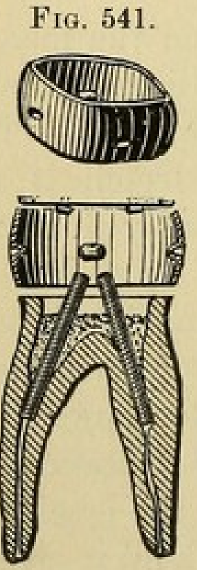


FIG. 541.

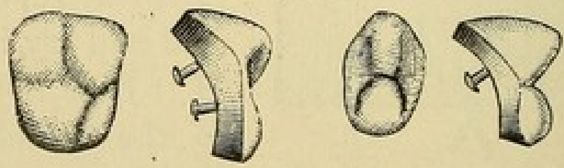


FIG. 542.

When articulated, form a small square shoulder around the line of the edge of the porcelain with a corundum disk. Fill the remainder of the inside of the collar with cement, mixed to a cream-like consistence, and set the porcelain in position. If there are antagonizing teeth, the mere closing of the patient's jaws will force the cusp to position in posterior teeth. In the front, or where there are no occluding surfaces, force to position with the mallet or a piece of wood as a driver.

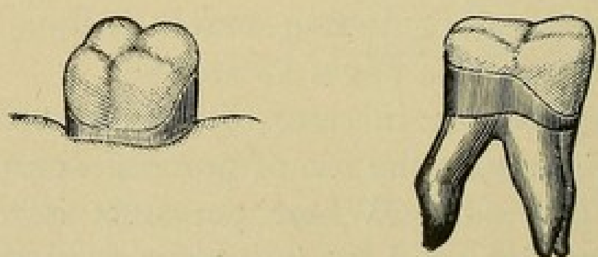


FIG. 543.

Porcelain cusp-crowns of the form shown in Fig. 542 are intended for use where the labial side of the collar is cut away, and that section is to be represented by the porcelain as shown in Fig. 543.

CHAPTER XVI.

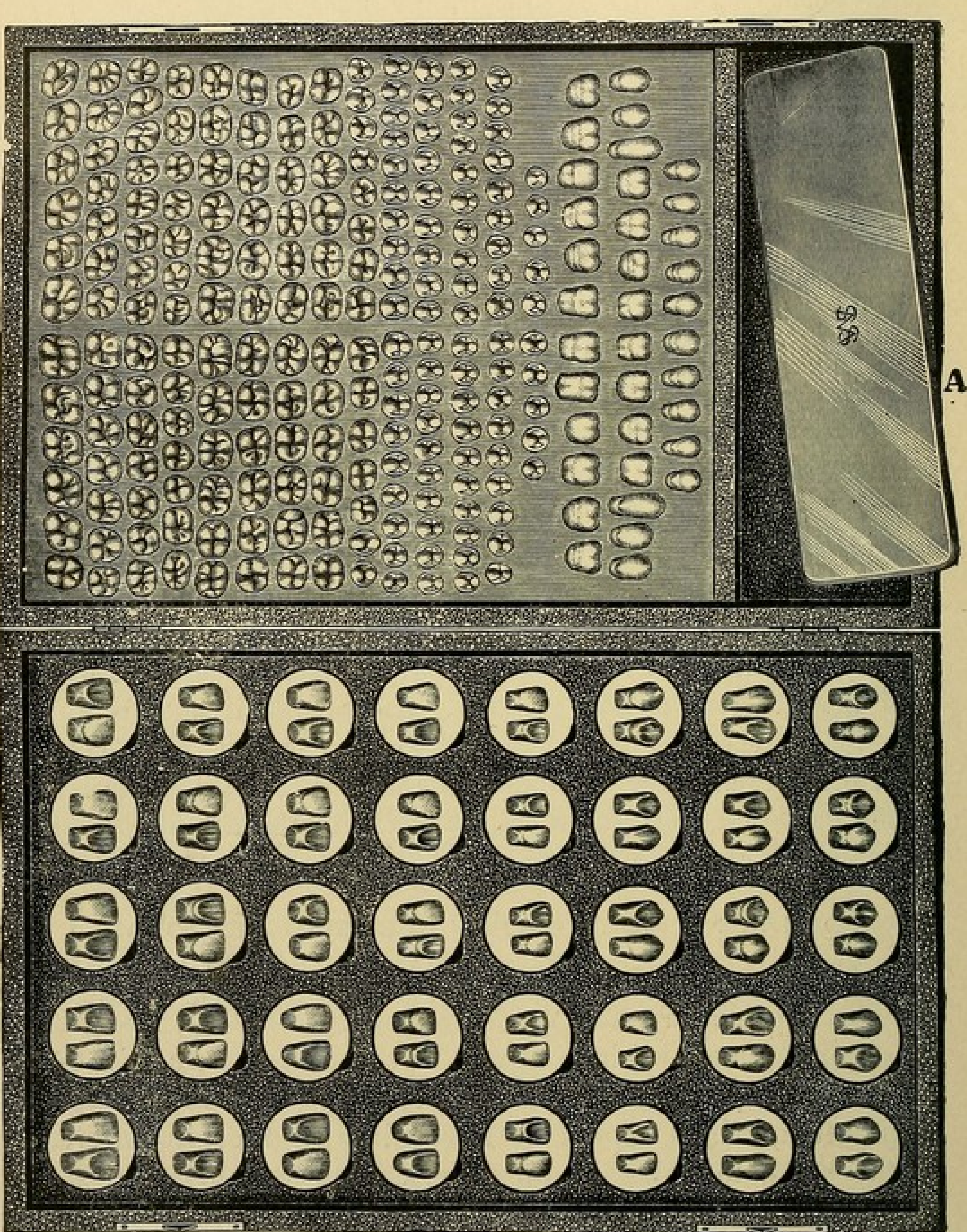
THE HOLLINGSWORTH SYSTEM.

The object of the "Hollingsworth System" 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 consists of a set of two hundred and four 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. 544; likewise (Fig. 544 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.

TO MAKE A GOLD CROWN (BICUSPID OR MOLAR).

Make a band to fit the root in the ordinary way. Place the band in the mouth (see Fig. 545), and cut off on a line where the adjoining teeth begin to turn to form the cusp (see *c*, Fig. 545). Place a small piece of wax inside the band to assist in holding the cusp-button, which should be selected to fit the circumference of the band, to articulate properly, and to correspond in shape with the other teeth (see *b*, Fig. 545). Remove the button, and place it on the molding-plate with the grinding-surface up (see Fig. 546). Place the small rubber ring around it, pour in a sufficient quantity of Melotte's metal to nearly fill the ring (Fig. 547). As soon as the metal sets, chill the surface by 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 die on

Fig. 544.



Set consists of the following: 204 Cusps, 36 Facings, 40 Forms for Incisors and Cuspids, in folding case, 1 Casting Plate (A), 3 Rubber Rings (E, F), 1 Carbon Rod (B), 1 Sheet Asbestos 10 x 7 in. (C), Box of Annealed Copper Strips (D). (See Fig. 544 A.)

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. 548) to form the counter-die (Fig. 548, *d*).

Fig. 544 A.

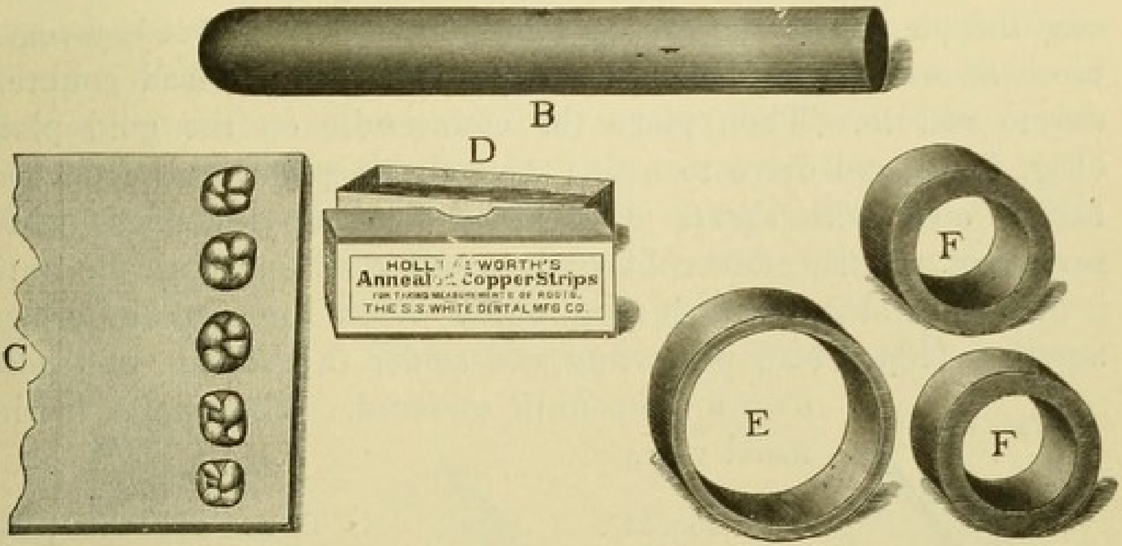


Fig. 545.

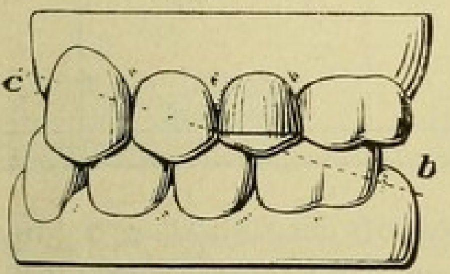


Fig. 546.

Fig. 547.

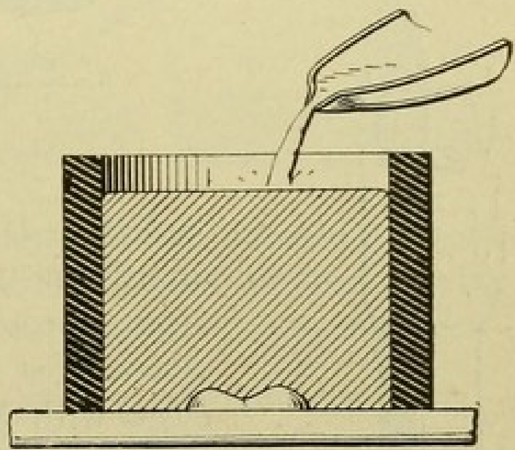


Fig. 548.

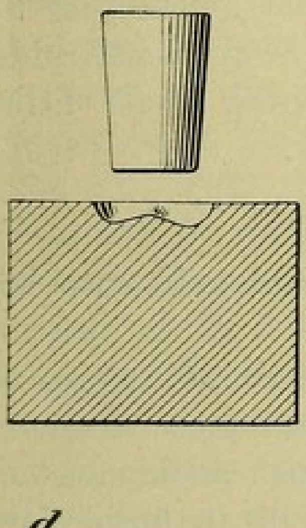


Fig. 549.

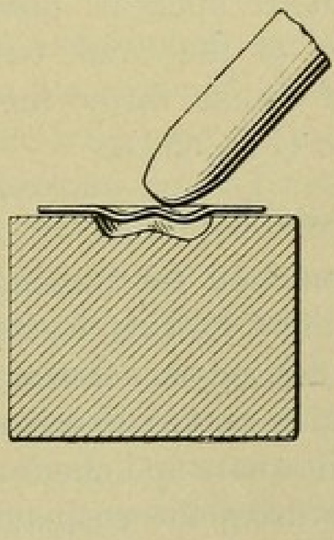


Fig. 550.

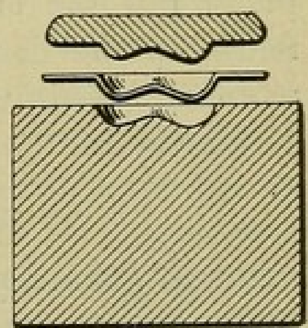
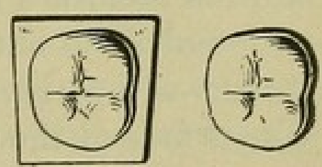
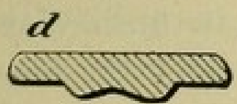


Fig. 551.





Anneal the gold plate, and start the swaging process by coaxing the plate into the die by hand-pressure (Fig. 549), 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. 550), and drive to a fit. Cut the surplus metal from the hollow cusp with shears (Fig. 551), filing up the edges when necessary, and rub down the under surface on a smooth file until it fits the band made for it (Fig. 545). Wire the cusp and crown together (Fig. 552), place flux and solder in the cap, and hold over a lamp until soldered. Then finish in the usual way.

FIG. 552.

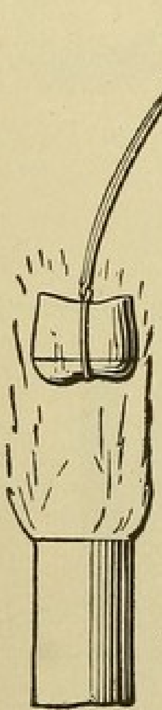
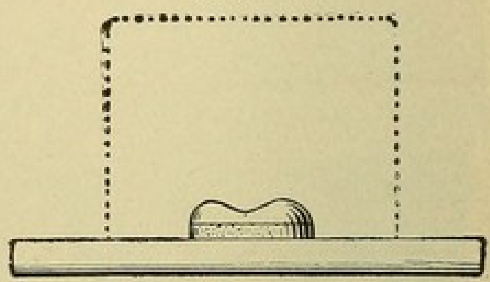


FIG. 553.

FIG. 554.



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. 553). If a band 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 band, cutting away the surplus moldine. This will of course throw the soldering line a little farther up on the crown (Fig. 554).

TO MAKE 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. 555, *a.*) Remove the button, and dry the asbestos in a flame (Fig. 555). When perfectly dry, place a sufficient quantity of gold scraps in the die made in the asbestos, and direct the blow-pipe 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. 556). *Avoid the use of flux when working with asbestos.*

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.

Fig. 555.

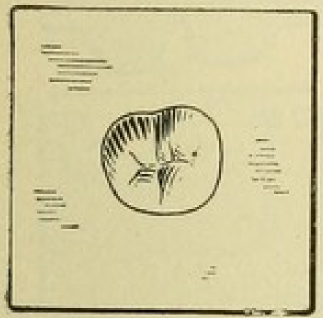
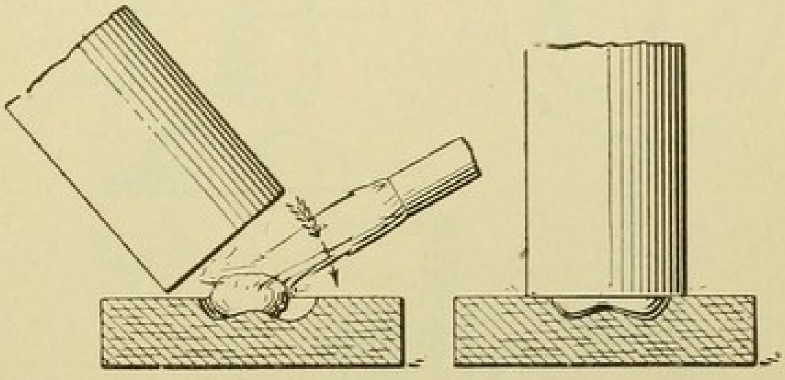


Fig. 555, *a*.

Fig. 556.



TO MAKE 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. 557). (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. 558, *a*). Take this measurement and cut it through the center (Fig. 558, *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. 559). 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. 559, *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. 560). Trim off the surplus plate (Fig. 561), and square the opposing edges of the two sections by rubbing them over a dead smooth file.

Fig. 557.

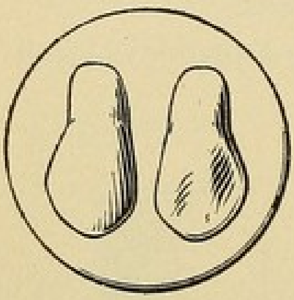


Fig. 558.

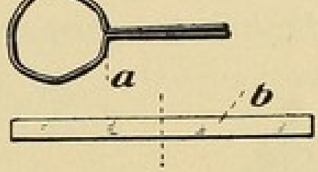


Fig. 559.

Fig. 560.

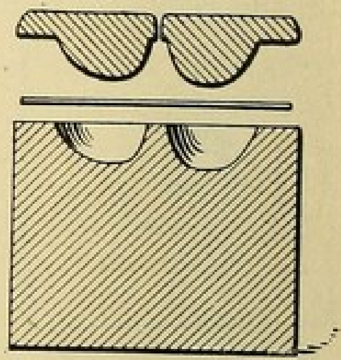


Fig. 561.

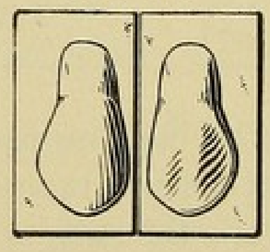


Fig. 562.

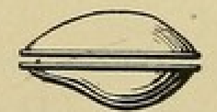


Fig. 563.

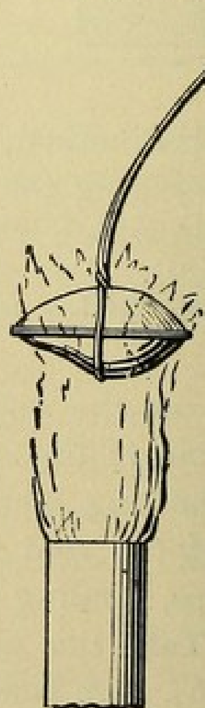
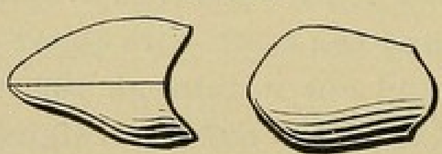


Fig. 564.



Bind the two sections together with wire with sufficient solder and flux inside (Figs. 562 and 563), and proceed as in soldering an ordinary band. With a small mechanical saw cut off the upper portion where the tooth begins to slope back (about the dotted lines in Fig. 563). This leaves the crown as shown in Fig. 564, approximal and labial views. Drive on the root. If too small, place on the horn of an anvil and enlarge by hammering; if too large, band 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. 565). Place the crown on the root in the mouth, and with an excavator mark on the face where

FIG. 565.

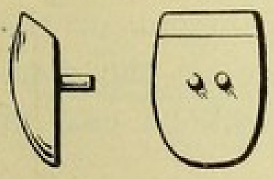


FIG. 566.

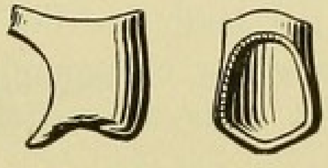


FIG. 567.

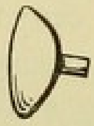


FIG. 572.

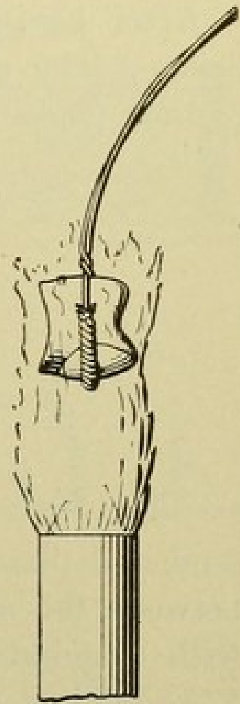


FIG. 568.

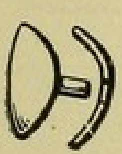


FIG. 569.

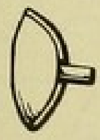


FIG. 570.

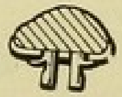


FIG. 571.

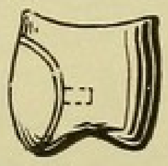


FIG. 573.

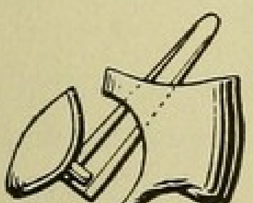
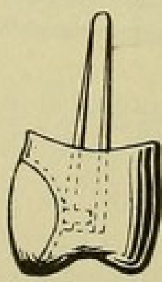


FIG. 574.



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. 566). Grind the facing to fit (Fig. 567). Back up the facing with No. 34 or 36 gauge pure gold, punching holes in the backing for pins, annealing as required to readily conform it to the tooth (Figs. 568 and 569). With a sharp knife cut a barb on each side of the pins in the facing, and press the barbs against the backing (Fig. 570), which keeps the backing in place. Burnish down the edges well, being careful not to let the backing overlap the facing.

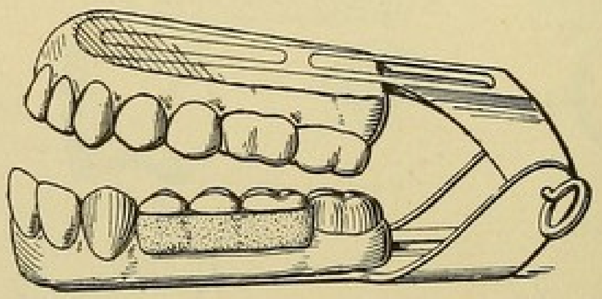
Place the facing in the space prepared for it in the crown (Fig. 571), and bind the two together (not too tight) with wire, wrapping the wire directly over the facing with asbestos to prevent discoloration of the porcelain. Flux and solder by holding over a lamp as in case of a band (Fig. 572). Finish 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. 573), finishing as before described. Fig. 574 shows a finished crown so made.

TO MAKE 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 modelling compound, remove the compound, place the crowns in their impressions, make a cast of

FIG. 575.



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 you would for plate teeth (Fig. 575). Then, to remove the buttons without destroying the articulation, make a cup by pouring Melotte's metal, as cool as it will 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 you would a soldering iron (Fig. 576). Then place a thin coating of moldine upon the molding plate. Remove the cup from the articulator with the cusp-buttons in place (Fig. 576, *a*). Transfer the cusps by inverting the molding plate (Fig. 577), and turn the cusp-buttons out upon the moldine on the plate with the grinding-surface up (Fig. 577, *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. 578). 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. 579). 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. 580), annealing as often as necessary. Trim

Fig. 576.

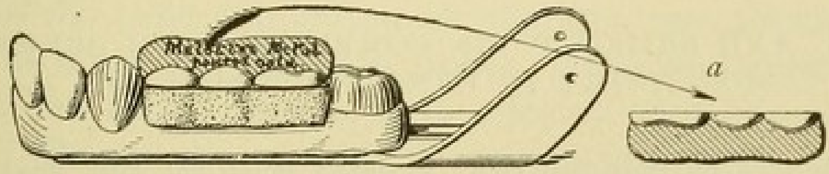


Fig. 577.

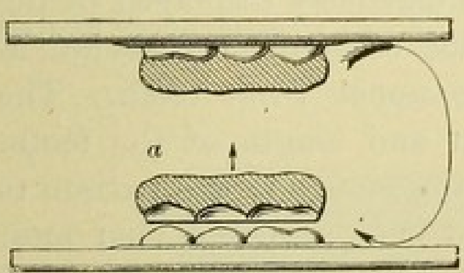


Fig. 578.

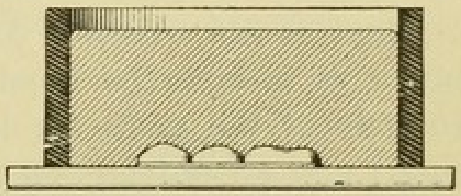


Fig. 579.

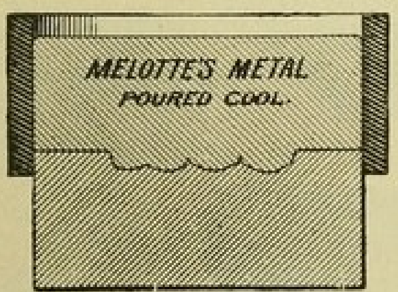


Fig. 580.

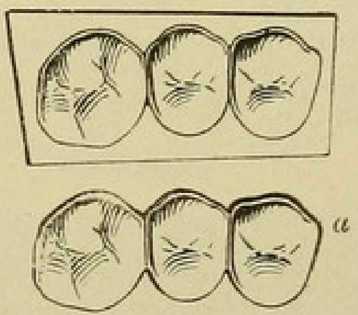
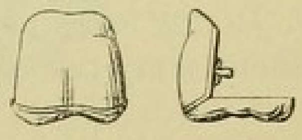


Fig. 581.



off the surplus plate (Fig. 580, *a*), and place in position on the articulator. Cut the cusps out on the buccal face to avoid showing the gold (Fig. 581), grind the porcelain facings to fit the cusps, and back with gold, No. 34 or 36, letting the gold come to the cutting-edge, the same as in a single crown, as before described.

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.

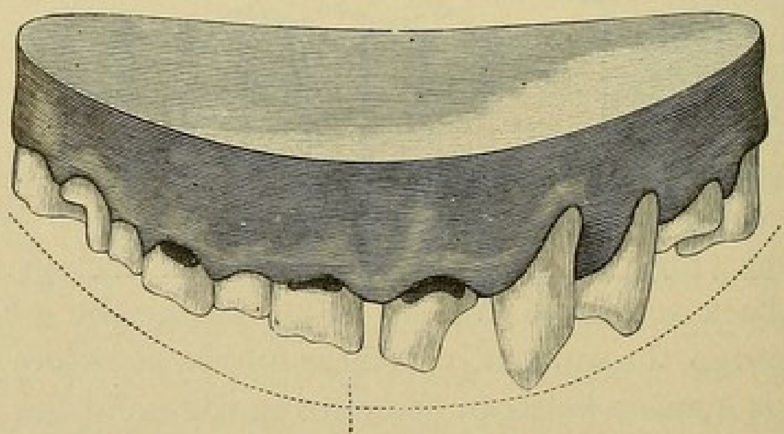
CHAPTER XVII.

CROWN- AND BRIDGE-WORK COMBINED WITH OPERATIVE DENTISTRY IN DENTAL PROSTHESIS.

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 as much as possible be imparted 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:

In the case presented in Fig. 582, that of a gentleman of about sixty-two years of age, is to be seen the irregularity of

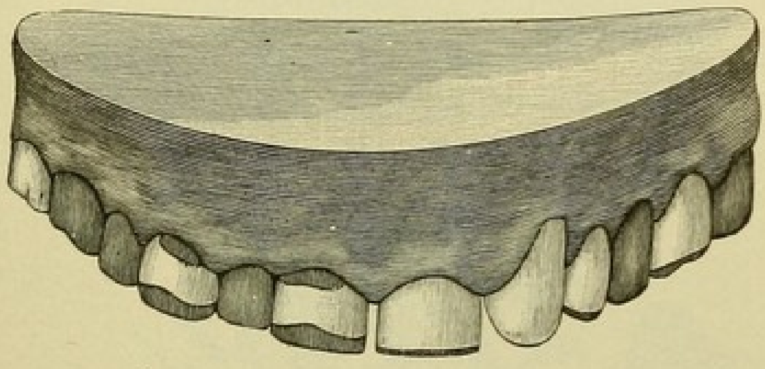
Fig. 582.



the teeth present and the unevenness of their incisive edges and occluding surfaces, the condition having arisen from the combined effects of decay, erosion, mechanical abrasion, and mal-occlusion. 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. 582 and 583), 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. 583.

Fig. 583.



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. 584. 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 incisive 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 113) inserted, and the atrophied incisive edge of the left central removed, all the incisive 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. 585.

Fig. 584.

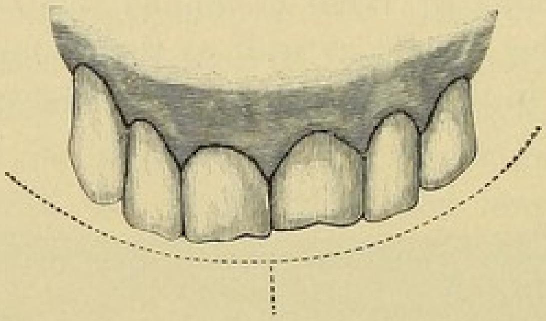
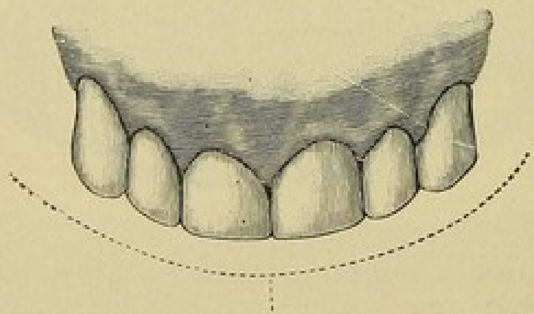


Fig. 585.



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.

A case which was interesting, owing to the conditions presented and the various operations connected with it, is illustrated in Fig. 586. Fig. 587 shows the methods and operations practiced, and Fig. 588 the case completed.

The upper front teeth show the effects of abrasion on the incisive 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 properly treated. Gold collar crowns with porcelain fronts, having flat incisive edges which perfectly protected the porcelain fronts and slightly opened the bite, were made for the incisors and left cuspid (Fig. 587). The bicuspids and molars were placed

Fig. 586.

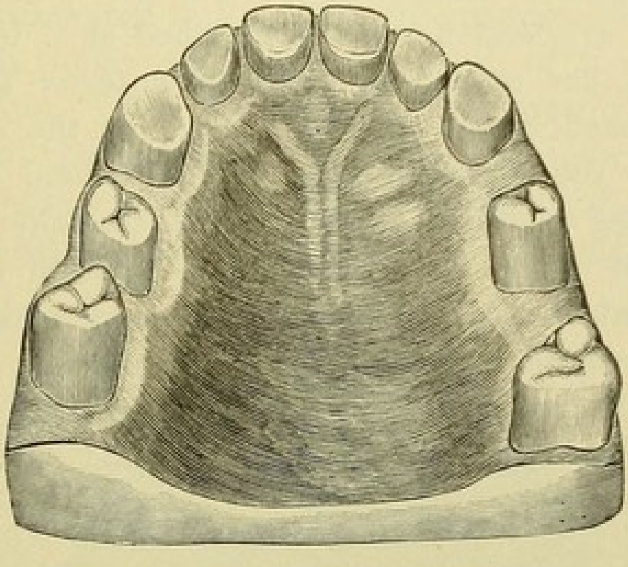
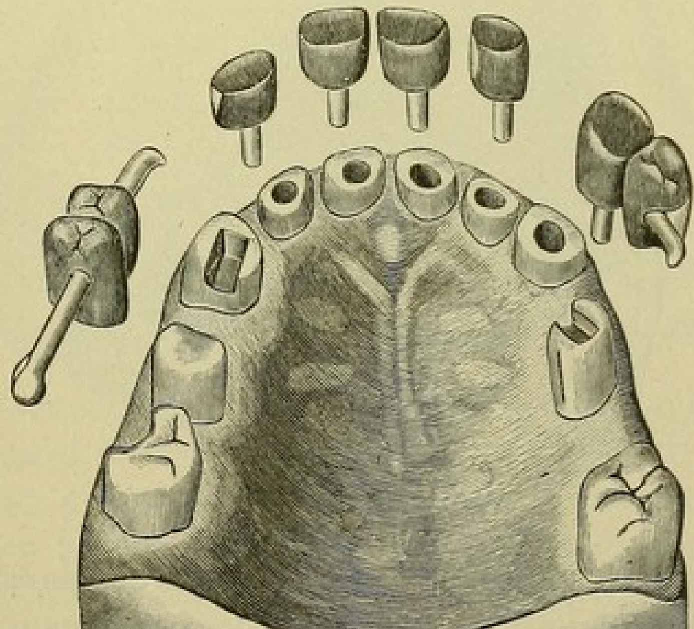
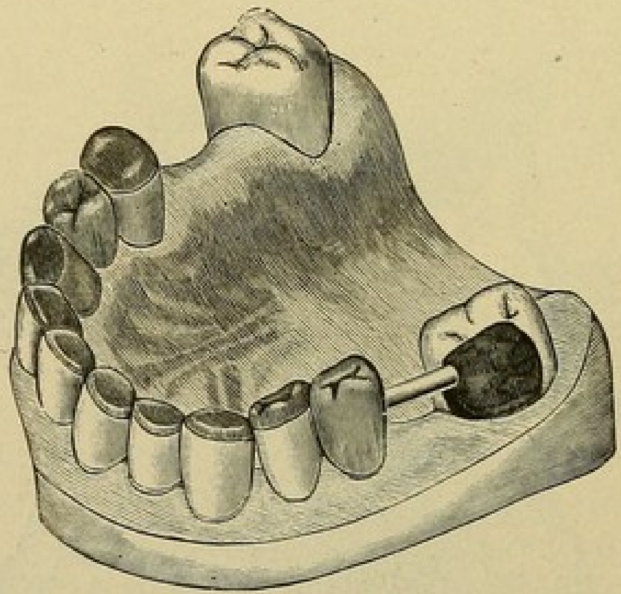


Fig. 587.



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 into a slot formed in the incisive 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 incisive 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

Fig. 588.



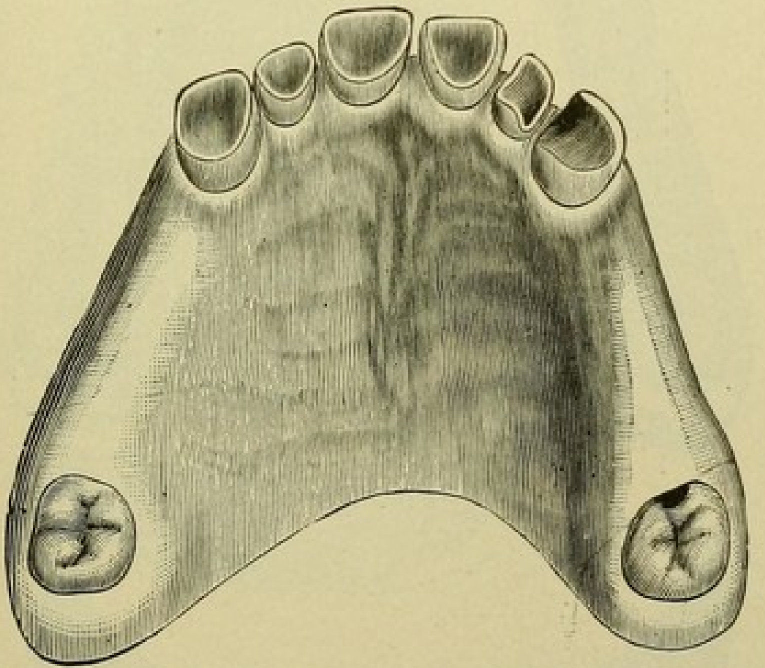
loose in its socket, and the molar, though comparatively more stable, was also similarly affected. The attachment of the bar in the cuspid supported the dummy bicuspid and steadied the second bicuspid, and the extension of the posterior bar into the molar likewise afforded additional support to the bicuspid. The pulp of the molar being exposed, was devitalized, removed, and the canal properly filled. Fig. 588 shows the completed case.[1]

[1] During the presence of the patient in the writer's office, four years after the work was completed, the operations were examined by members of the profession,

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. 589 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, and the incisors and cuspids showed the effects of extensive abrasion. The occlusion was sustained and the principal part of mas-

FIG. 589.



tication 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. 591, and a wire post was inserted in the right lateral, which was pulpless. At the occluding section of

and pronounced apparently in as perfect condition as when first completed. The treatment of the teeth affected with pyorrhea and the support imparted to them by their attachment to the other firm teeth and to one another had apparently checked the disease, and the affected teeth appeared to be more secure in their sockets than before the insertion of the bridge-work and crowns.

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

FIG. 590.

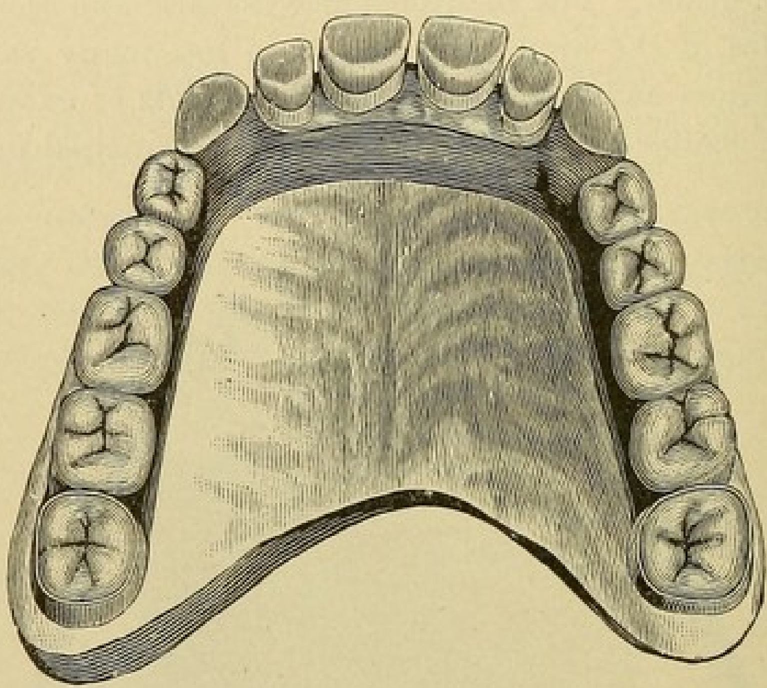
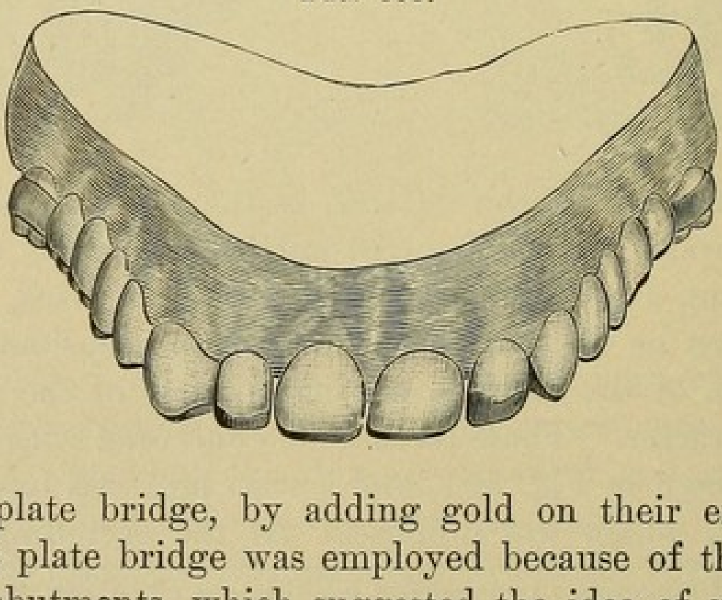


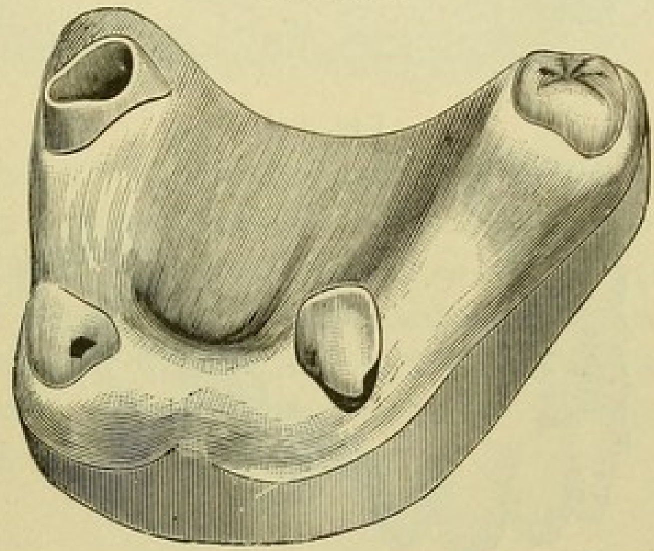
FIG. 591.



removable plate bridge, by adding gold on their external surfaces. 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. 590 shows the completed denture, and Fig. 591 an anterior view of the same.[1]

In the case illustrated in Fig. 592, 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

Fig. 592.



sides, while the third surrounded the labial wall, joining the other 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. 593.

[1] Case operated on in 1888.

A plate bridge (Fig. 594) was then constructed, the attachments for which were collars on the molars, and half-collars or clasps

Fig. 593.

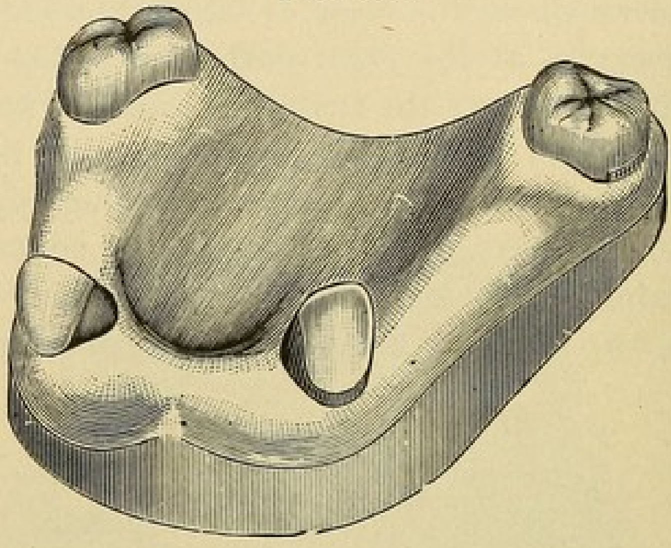
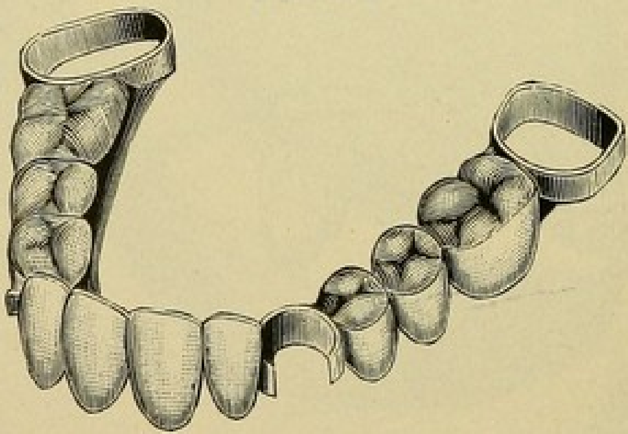


Fig. 594.



on the cuspids. The former rested on shoulders formed on the gold crowns, and the latter on the palatal curves of the cuspids.

Fig. 595.

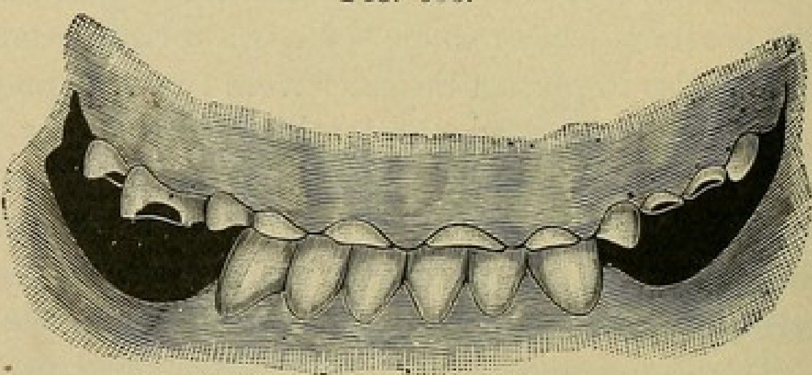
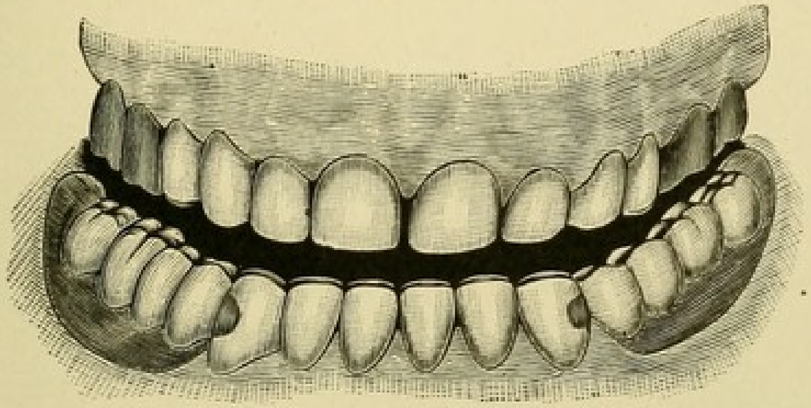


Fig. 595 illustrates a case as presented for treatment to Dr. H. A. Parr. The loss of the posterior teeth of the lower jaw and the abrasion of the anterior teeth had resulted in the abnormal occlusion shown. The incisive edges of the lower teeth were lengthened with gold contour fillings. Gold collar crowns with porcelain fronts were placed on the upper anterior teeth, to lengthen them sufficiently to restore the occlusion. The upper

FIG. 596.



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. 596 shows the appearance of the case when completed.

PART IV.

PORCELAIN DENTAL ART.

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 porcelain inlays, a department which has come into especial prominence within the past few years.

CHAPTER I.

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. Both methods are still employed to a limited extent, the last-named being especially adapted to 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.—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. Two general grades of porcelain are in use for inlay work, made respectively from "High-Fusing Body" and "Low-Fusing Body."

A high-fusing body is one which does not fuse until a temperature above the melting point of gold is reached; and which consequently requires that the matrix in which the inlay is formed shall be of platinum. In some operations the body used requires as high a temperature as the fusing of the ordinary porcelain teeth.

A low-fusing body, on the contrary, is one which fuses before the melting point of gold is reached. The "Jenkins" body, for instances, fuses at at least 100 degrees of Fahrenheit below it. For low-fusing bodies, gold, which is a more tractable metal than platinum, is used for the matrix.

The respective merits of high- and low-fusing porcelains for inlay work have been much discussed, and wide differences of opinion prevail concerning them. The characteristics of both and the methods of manipulation and their application to various operations will be impartially presented.

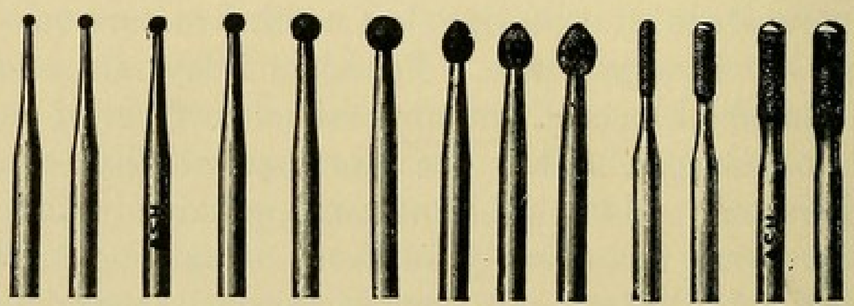
A properly made and inserted porcelain inlay affords the very decided advantage of restoring lost tooth-structure not only in substance, but in appearance. Porcelain inlays are used principally on the labial, buccal, and approximal surfaces of teeth from bicuspid to bicuspid. They are also used on the occlusal surfaces of bicuspids and upon the anterior approximal sides of molars where the tooth immediately in front is missing. 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 base of the inlay rests on the center of the bottom of the cavity. 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.

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 wise 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 incisor edge. The orifice of the cavity should be given an oval or oblong form with one end or side differing

Fig. 597.



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. It is well to polish around the margins inside the cavity with soft iron burs, charged with diamond dust, kept wet during the polishing. A set of forms such as are illustrated in Fig. 597 are suitable for the purpose. The use of sand-paper disks or strips across the surface of the enamel should be avoided, as it is apt to make a coarse joint.

Figs. 598, 599, 600, and 601 illustrate teeth with prepared cavities and their inlays of the classes commonly involved in the practice of porcelain work.

Fig. 602 outlines, in section, the preparation of an ordinary

FIG. 598.

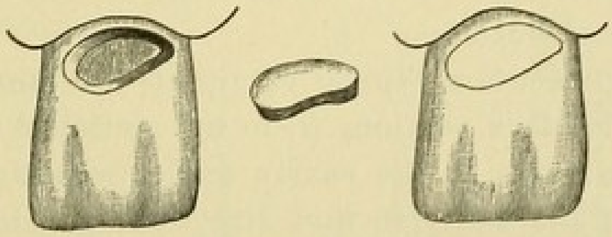


FIG. 599.

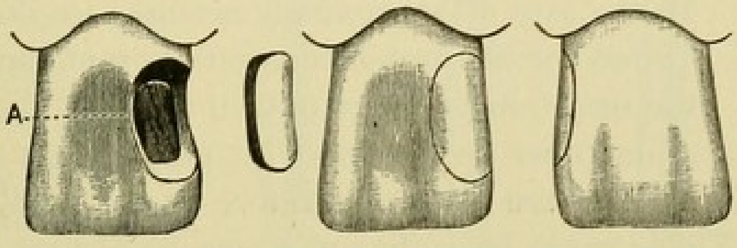


FIG. 600.

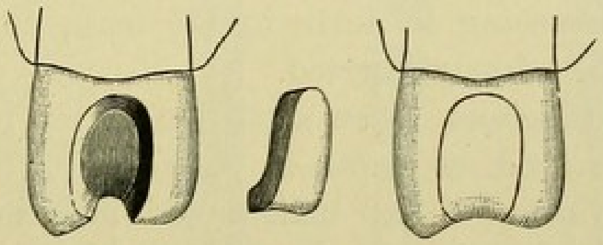


FIG. 601.

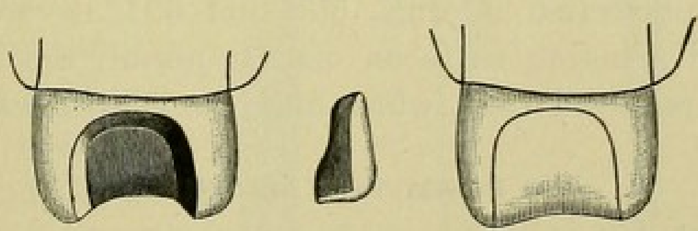
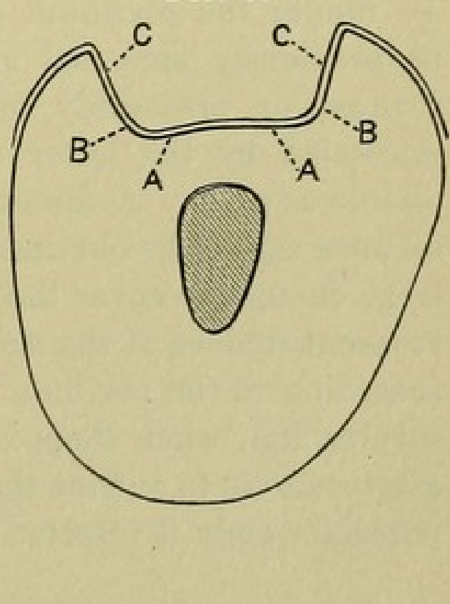


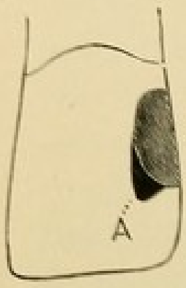
FIG. 602.



cervical cavity. The line A A represents the prepared cavity. B B, the point where an undercut may be made when the porcelain is ready for insertion. C C, the gold or platinum matrix. Such cavities require to be moderately deep, in order that the inlay shall be of sufficient thickness 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. 603 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. 603.

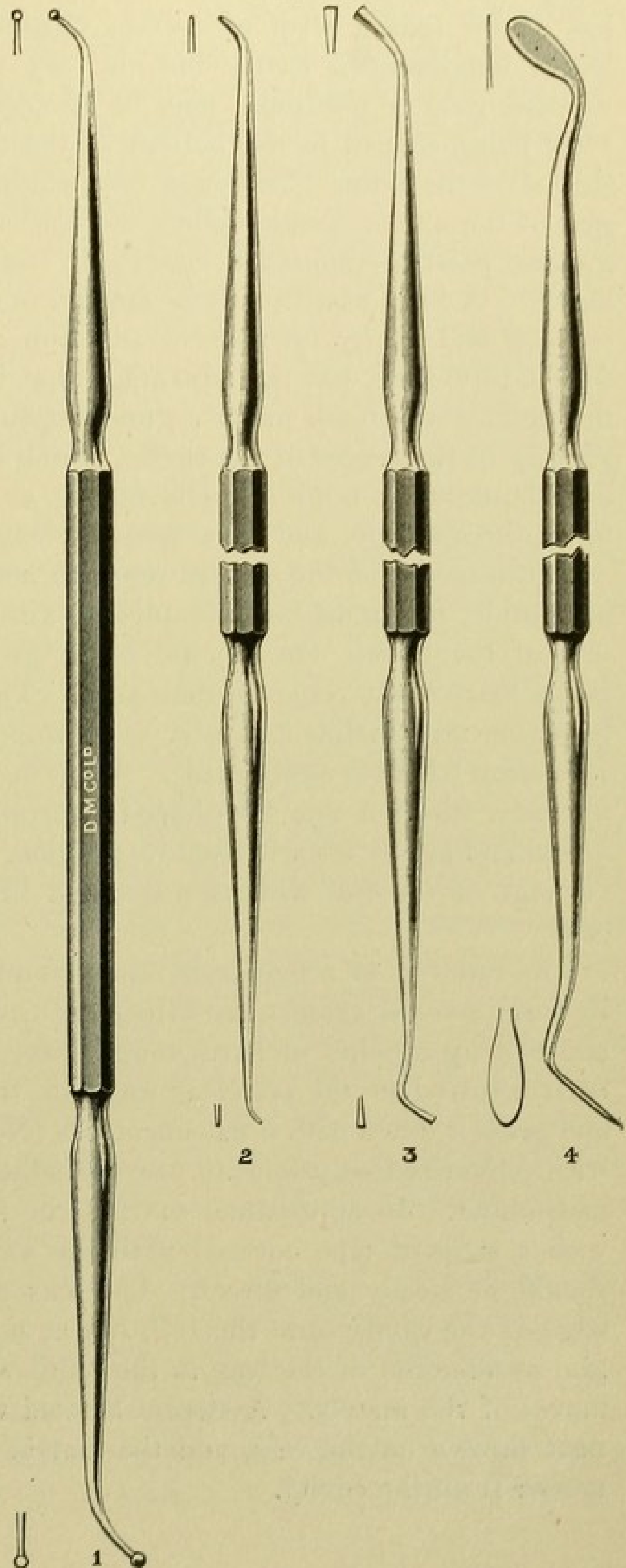


In the upper incisors, when a portion of the palatal wall can properly be removed, as shown at A, Fig. 599, less space is required, and removal of the matrix and insertion of the inlay are considerably facilitated. Cavities in bicuspids and molars, such as are illustrated in Figs. 600 and 601, involving the approximal and grinding surfaces, usually permit the matrix to be more easily removed than when only an approximal surface is involved.

TO FORM THE MATRIX.

Rolled gold foil No. 30,—for large cavities No. 40 is used,—or platinum foil 1-2000 to 1-1000 of an inch in thickness is used. 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. The foil should be cut large enough to cover the walls of the cavity and extend over the adjacent surface of the enamel one-eighth of an inch, more or less, according to the position, character, and size of the cavity. 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 foil-tweezers, or when necessary by a ball burnisher, as No. 1 of the set illustrated in Fig. 604, and then against the walls. Remove the spunk, see if the adjustment of the foil to the 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 is shown in No. 2, Fig. 604. In the adaptation of the foil to the cavity, and especially for holding it in position in the center

Fig. 604.



while the marginal section is being manipulated, the author has found that a wisp of cotton, twisted around an old-fashioned, long-handled cavity bur, is very serviceable. The foil, whether gold or platinum, may be removed and again annealed, after being shaped to the bottom of the cavity, and before it is shaped to the sides. Thorough burnishing of the sides and margins of the matrix should follow the final annealing to impart the greatest possible amount of rigidity to the foil before its final removal. A little vaselin may be applied to the surface of the gum, enamel, and cavity, to prevent adhesion of the foil. Platinum foil, 1-1000-inch, has the advantage that it can be burnished on the surface of a tooth under a gum-margin. Should the foil tear slightly in the center of the cavity, which it is very apt to do during adaptation, it is not a serious matter, as the porcelain body will fill in the aperture, and draw from the edge in the first fusing.

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. Deep in the cavity, at the slanting side, insert a fine hoe-shaped instrument into the foil, and loosen and gently coax it from its position. When loosened, take an edge of the foil with tweezers and lift the matrix from the cavity.

The removal of a matrix is much simplified, and alteration of its form assured against, by filling the cavity 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. 4, Fig. 604), 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 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.

To facilitate the shaping of either a gold or a platinum foil 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. 599, to be assumed by the matrix, has also been suggested, but preferably is to be avoided.

A mold of the cavity has also been used to some extent. In the case of a cervical cavity, the impression is taken on the end of a cone of impression compound. For an approximal cavity, a small piece of the compound is fitted to the cavity, chilled with water from a syringe, and withdrawn or tipped 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. Another method is to make a mold from the compound impression in plaster and then boil the plaster in stearin to toughen it.

Oxyphosphate is also used to form the mold. The cavity and surface of the tooth are dried and dusted with soapstone applied with a camel's-hair brush. A ball of oxyphosphate mixed moderately stiff, and kneaded with the fingers, is pressed into the cavity and over the margins. When set, this oxyphosphate impression or die of the cavity is removed, and its base inserted in the surface of a small mass of plaster and the plaster trimmed either round or square. The surface of the die is next dusted with soapstone and a small mass of oxyphosphate, mixed to a plastic consistence, pressed over it. When the oxyphosphate has set, it is separated from the die and replaced, the surface of the plaster oiled, and plaster poured over it sufficient to complete this section of the mold. By this method so accurate a mold of the cavity is obtained that it is possible to shape a matrix and entirely form an inlay without fitting in the mouth.

The first described method is a very practical one and the work is easily performed. The gold or platinum foil, after being first shaped in the mold, is then fitted to the cavity in the tooth.

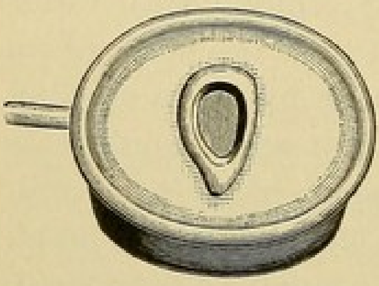
INVESTING THE MATRIX.

In the use of a 1-1000-inch platinum foil matrix, for high-fusing porcelain, investment of the matrix is not generally practiced.

The gold foil or the 1-2000 platinum foil matrix requires investment, owing to the great shrinkage that occurs, especially in the fusing of the first application of the porcelain body. Dr. Jenkins's method of investing a gold foil matrix, which may also be used for platinum foil, 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. 605, 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. 605 shows an invested matrix.

Fig. 605.



When wax is used in the matrix, to assist its removal the matrix should be invested the same as for the formation of a gold inlay. 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. 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.

Should an invested matrix formed of gold or extremely thin platinum be removed from its investment and fitted to the cavity between fusings, it will have to be again invested.

SELECTING THE COLOR OF THE PORCELAIN BODY.

The proper color of porcelain should be selected from the samples while the tooth is wet, as dryness affects the shade. In 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, owing to the translucency of the porcelain, have a tendency to darken the appearance of the inlay. Should none of the samples properly correspond in color, it is customary to mix different shades of the porcelain body to obtain the desired one. 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. Insufficient fusing will render the porcelain a trifle darker than the true shade, and excessive heat will lighten it.

Application of the Porcelain.—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.

DR. JENKINS'S LOW-FUSING PORCELAIN.

This is a porcelain introduced by Dr. N. S. Jenkins, of Dresden. It is compounded according to formulas and knowledge acquired of the porcelain workers of Dresden. It fuses at at least 100 degrees of Fahrenheit below the melting point of gold. It forms a dense, hard porcelain with a glossy surface resembling in appearance the porcelain of the 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: Place upon the agate pallet with a spatula (see No. 2, Fig. 606) a small quantity of the selected color and mix it with absolute alcohol. With the small thin blade of the spatula carry the well-moistened powder into the matrix, filling it up but taking care not to overflow the edges. If, in this packing, the powder gets too dry, either in the matrix or on the pallet, add more alcohol with the drop tube. Carefully avoid the introduction of foreign matters into the porcelain powder. Put the small cover on the fusing-cup with the opening toward the handle. Then hold the cup across the hole in the heater and turn a very fine flame from the blowpipe onto the handle about an inch from the fusing-cup, thus gradually drying the asbestos. Do this without hurry. The moisture must be evaporated, not boiled out. Next, turn the flame upon the bottom of the cup, slowly and gently increasing the flame and the draft from the foot-bellows until the porcelain enamel is fused (see Fig. 607). No violent action of the bellows is necessary; a small flame and a little draft are sufficient in

FIG. 606.

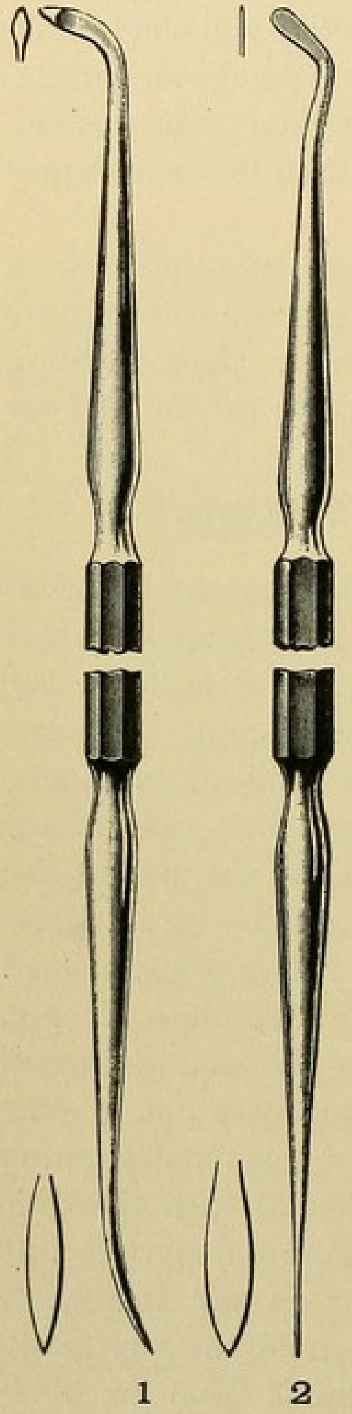
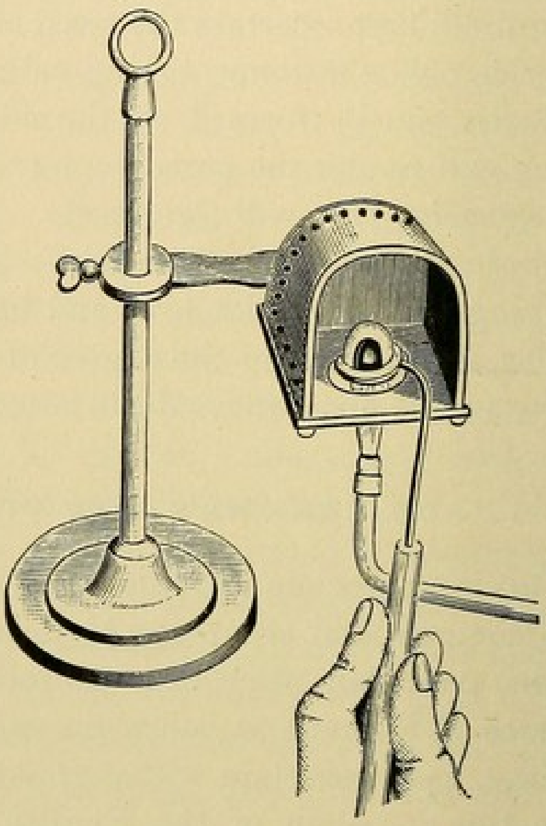


FIG. 607.



most cases. It is of no consequence if the first fusing is rough and irregular. The material is not designed to flow easily. 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. The process of fusing can be seen clearly through the opening of the platinum cover. The first fusing will not be sufficient, as the powder contracts greatly, but the cover can be at once removed and the cooling hastened by wetting the bottom of the cup with water, as the material is not liable to crack. Next pack the matrix with powder as before. Keep wetting it with alcohol if it dries quickly. It does no harm if the asbestos becomes moistened with alcohol, but avoid wetting it with water after the first heating. Turn a small flame, at first, on the handle and presently a blue flame will appear at the opening of the cover. Let the alcohol burn until it is quite consumed and then fuse the porcelain body as before. Generally a third packing and melting are necessary for exactness of edges and contour. Examine the inlay with a magnifying glass to be sure that the edges are exact, both in packing 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 melting it is better to let the piece cool somewhat slowly. This style of porcelain can be baked in a gas or electric furnace as well as by the process described by Dr. Jenkins.

HIGH-FUSING PORCELAIN.

High-fusing porcelain involves the use of a platinum matrix, as it requires a very high temperature to fuse it. The shade of body selected as suitable is wet with distilled 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, the body is placed in it, and settled to the bottom by a few taps on the pliers. The body should not be allowed to come quite up to the edge of the matrix. The matrix is then placed in the furnace, heated up slowly, and the body baked. When not invested, the matrix should be placed on a bed of finely pulverized silex on a slab. The heat should be sufficient to give the body a slight gloss. The first baking is termed "biscuiting," and considerable shrinkage takes place. The matrix is again placed in the cavity, and the edges, which are always drawn from the original form by the contraction of the porcelain, are thoroughly burnished to the tooth. The larger the matrix, the more noticeable the shrinkage will be. More porcelain body is now placed in the matrix, filling it to the edges, and a second baking given. A third addition of body and baking is generally necessary. The porcelain, after the final baking, should be cooled slowly.

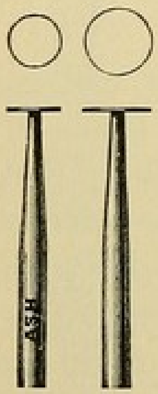
REMOVING THE FOIL MATRIX.

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.

CEMENTATION.

When an inlay is ready to be inserted it should be placed on the operating case in the same relative position it will take in the tooth, or, the surface of the tooth and of the inlay at one side of the cavity may be given a pencil or ink mark. Such precautions prevent mistakes and instantly indicate the position the inlay is to assume as it is being inserted with the cement. Grooves are to be made in the porcelain with a small diamond disk (see Fig. 608), or the gloss removed for better adhesion of the cement. When the inlay is too small to handle conveniently, the gloss can be removed by covering the front and edges with wax and applying hydrofluoric acid for a few minutes. A few grooves may be made in the walls of the cavity, but this is not considered necessary always. The oxyphosphate cement should be mixed to the consistence of a thick cream. 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 the grooves. The inlay is then placed in the cavity and gradually pressed home. Before it is quite in place, the surplus cement should be removed, 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 can be used to press an inlay in 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, but in a case where the dam is inapplicable, paraffin should be melted on or varnish painted over the inlay. At a subsequent sitting, any particles of oxyphosphate which may be still clinging to the tooth or inlay should be removed.

Fig. 608.



POINTS TO BEAR IN MIND.

In the adaptation of a matrix the process is greatly simplified by freedom from interference by the gum and the presence of abundant approximal space. 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. This method, although increasing the detail of the operation, compensates by simplifying it and assuring its successful performance.

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.

In the use of any grade of porcelain the most extensive shrinkage occurs in the first baking. The porcelain contracts from the sides toward the center. Dr. J. L. Williams suggests that for the first baking the porcelain body be placed like a ring around the sides of the matrix, leaving the center open. This gives a tendency to the porcelain to shrink from the center toward the sides.

To cause the edges of the inlay to fit very closely to the margins, in case of a large cavity, it has been suggested that an extra form of foil be adapted to the bottom of the cavity, extending slightly up on the sides, leaving some space between the upper edge of the foil and the orifice of the cavity. Over this form the regular matrix is then adapted. The idea is that the edge of the inlay will approximate the margin of the cavity more closely by the thickness of the foil than it otherwise would.

Few experts in the formation of porcelain inlays use a die or mold of the cavity 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 317), then dismiss the patient, and have the inlay formed by the next appointment.

In atrophy of the enamel, as illustrated in Fig. 609, 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. 610, the section of the inlay over the root can be enameled with gum-colored porcelain.

Fig. 609.

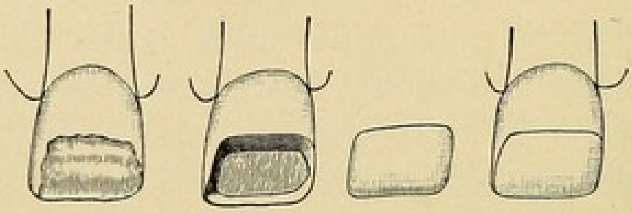
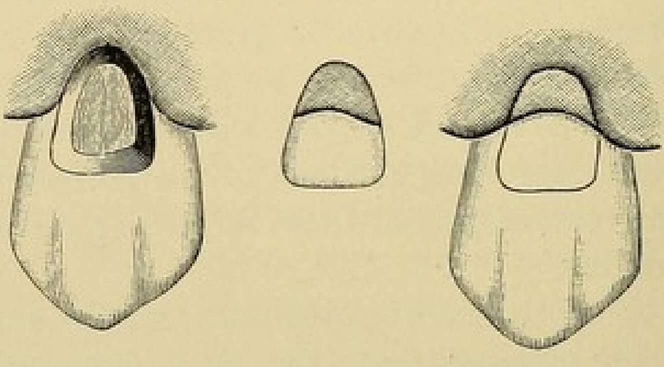
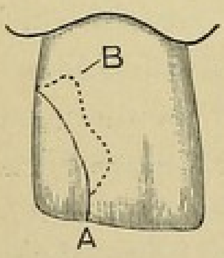


Fig. 610.



When considerable contour is given or a corner is built out, for instance in a case such as is represented in Fig. 611, the porcelain should 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 such cases a projecting horn of the porcelain (B) will make a much stronger anchorage than a platinum pin. A platinum pin in a small mass of porcelain has a tendency to weaken it by breaking up the continuity of its structure.

Fig. 611.



In building up corners of large contours a piece of a porcelain tooth of the proper color can be placed in the matrix, and the body built around and over it. This prevents excessive contraction and simplifies the construction of a sharp corner. After one of the bakings the matrix may be fitted to the cavity, the position of the porcelain examined, and, should any point of the piece of porcelain tooth project, it can be trimmed off with a corundum wheel. The porcelain should then be washed and cleaned of the débris resulting from the grinding.

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.

Good edges are difficult to obtain in porcelain inlays smaller than a pinhead when made in a matrix. In such cases the use of the porcelain rod method is preferable.

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.

An inlay should fit the cavity perfectly and not rock or move when in place, and the occlusion must be correct. The edges should be absolutely exact and not perceptible.

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 is to be avoided 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.

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 forms of abrasion.

Fig. 612 represents the restoration of a broken central incisor. Three pins were used to retain the platinum cap, Fig. 613, which was constructed as described in the discussion of gold tips on page 131. One of the pins of the porcelain tooth was removed; the other was retained and bent against the cap, and soldered to it with pure gold. The palatal side of the porcelain tooth was then contoured and attached to the cap with porcelain body.

Fig. 614 illustrates a case of atrophy in which the tips of the central incisors were contoured with porcelain by Dr. C. H. Land. 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

Fig. 612.

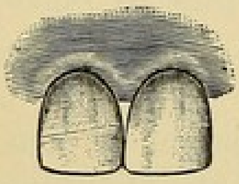
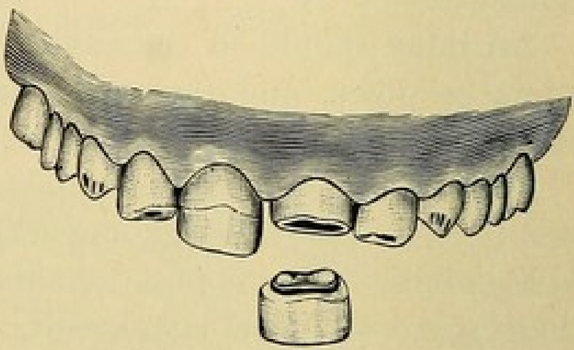


Fig. 613.

Fig. 614.



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.

CHAPTER II.

PORCELAIN AND PLATINUM CROWNS.

A Porcelain and Platinum Collar or Partial-Collar Crown.—A collar or partial-collar cap is first constructed and fitted to the end of the root, as illustrated in Figs. 615 and 616, according to one of the methods described at page 113. The post should be long enough to extend beyond the cap. A suitable cross-pin tooth is selected, and ground and fitted on the cap. Usually it will be necessary to reduce the post in thickness and to grind a groove, for its reception, in the porcelain tooth between the pins, to allow the tooth to assume its proper position on the cap, as shown in Fig. 615. The pins should be soldered to the post unless they can be bent around it in such a manner as to retain the porcelain tooth in position during the baking of the porcelain body.

FIG. 615.

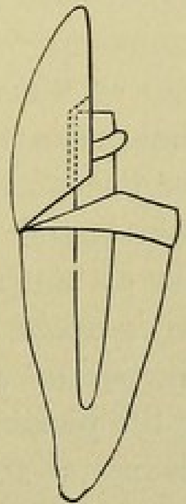
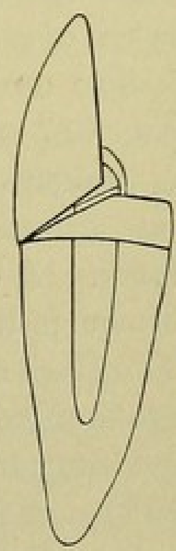


FIG. 616.



The soldering of the sections of the cap or the pins should be done with the least possible quantity of pure gold.

Another method is to cut the post off nearly to the surface of the cap, and when the porcelain tooth is invested, bend the pins down on the cap and post, and connect with solder, as seen in Fig. 616.

In either case porcelain body is next applied, and the porcelain front and cap properly united and shaped. Should the upper edge of the porcelain tooth extend over and beyond the cap or collar, the aperture should be filled in with porcelain body and baked. The collar also can be enameled at this point if desired.

A porcelain and platinum crown without a collar is made by fitting into the root a substantial iridio-platinum post, a Logan post for instance, and capping the root with a disk of platinum as described on page 111. A porcelain front is then fitted and mounted on the cap as just described.

Porcelain and Platinum 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. It combines natural appearance and strength, and admits of the performance of operations of a most artistic character. The jacket crown consists of a cone-shaped platinum and porcelain cap fitted over the natural crown or so much of it as remains.

Fig. 617.

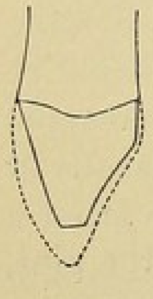
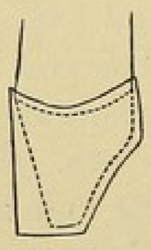
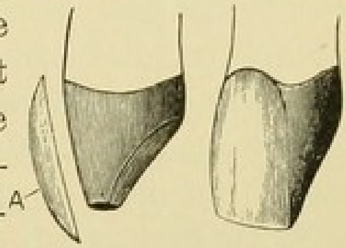


Fig. 618.



The crowning of a central incisor will serve as a typical case. Fig. 617 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 gauge), 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. 618). A piece of platinum, of the same gauge, 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 platinum solder should be used, or only the least possible quantity of pure gold. At this stage the cap will assume the form seen at Fig. 619. A thin veneer of porcelain (A, side view Fig. 619), to represent the tooth, is now ground and fitted, and held in proper position by the porcelain body (see chapter on Porcelain Teeth: Veneers). It is possible to fit the cap and veneer in the mouth when thus held by the body, if considered necessary. The body is next carefully dried and fused in the furnace. The crown is again fitted in the mouth, and all requirements, such as size, shape, and thickness, and necessary changes noted. If the surface of the veneer requires grinding, it should be done at this stage so that it can be glossed in the final baking, which should be strong and uniform. After the final baking the exposed surface of the platinum should be polished, The crown should be cemented with a thin mixture of oxyphosphate. Fig. 620 represents the finished crown.

Fig. 619. Fig. 620.



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. 621). If badly broken down it should be built up with a post and amalgam (see page 39). 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 gauge, 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. 622), 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. It will then appear as shown at Fig. 623. 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. 624 represents the finished crown.

FIG. 621.

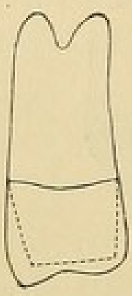


FIG. 622.

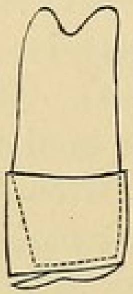


FIG. 623.

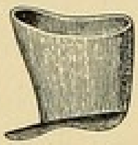
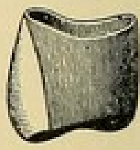


FIG. 624.



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 Bicuspid 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, the same as for the method just explained. The edge of the collar should clear the occluding teeth about one-thirty-second of an inch (see Fig. 625). 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 and the cavity 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, and the final fusing of the porcelain performed. Fig. 626 illustrates the completed crown.

FIG. 625.

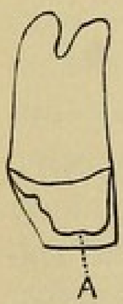
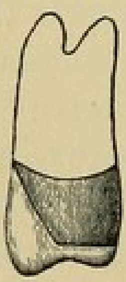


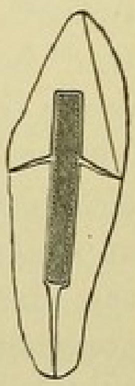
FIG. 626.



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, and amalgam is packed around its base, as seen in section in Fig. 627. Take a piece of wire, of the gauge 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 in 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. 627) in proper position against the body, remove, and bake. 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 or not, but the front portion is generally removed for the sake of appearance. Fig. 627 shows the finished crown in section. Should this crown fracture in use it can be replaced without disturbing the post in the root.

Fig. 627.



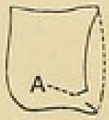
The methods in porcelain and platinum crown-work described are those specially identified with it, but porcelain work can be still further extended by substituting platinum for gold in many operations described under gold crown-work.

PORCELAIN INLAYING OF GOLD CROWNS.

Gold seamless crowns, as the "Evans crowns," can be easily inlaid with porcelain body. Properly fit and articulate an Evans gold crown to the tooth or root. In some cases this will be facilitated by taking an impression of the natural crown in a tube with plaster, making a fusible metal die, and giving the gold crown the exact shape of the natural tooth, the same as described on page 109, the operation requiring but a few minutes. Place the fitted crown in the mouth, with a sharp instrument mark the labial portion of the gold that is exposed to view, and remove the crown. With a small corundum wheel thin the part marked to about the thickness of No. 60 foil, and puncture it in several places, as shown in Fig. 628. The narrow line of the cervico-labial portion of the gold under the gum must be left intact. The crown is now placed in the mouth and the thinned labial section is pressed inward against the natural tooth, to give depth and strength to the porcelain inlay. If necessary, the natural tooth must be trimmed

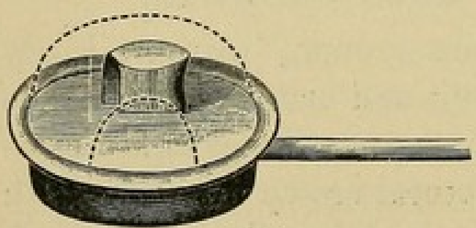
FIG. 628.

FIG. 629.



sufficiently to permit this allowance. The gold at the point A, Fig. 629, should be slit across the line of the grinding-surface and pressed inward, leaving an opening. This opening permits the porcelain body to be well anchored and given a thick base for strength at this point. A suitable shade of the "Jenkins porcelain" body is selected, and applied to the prepared section and inside the grinding-surface, the same as to the matrix of an inlay. The crown is next placed in position on the natural tooth in the mouth and removed. This imparts to the porcelain body inside an exact impression of the form of the natural tooth, which, in the first baking, is slightly enlarged by the contraction of the porcelain, and assures a slight space between the tooth and the porcelain. The porcelain also strengthens the grinding-surface and renders thickening with metal unnecessary. The crown is placed in the baking cup on the bed of pulverized asbestos (see Fig. 630), and the body fused in the same manner as an inlay. Three applications of body and bakings will be necessary.

FIG. 630.



A porcelain veneer can be attached to a gold crown with the Jenkins porcelain body by the same process. Grind and shape the veneer to fit the edges, and properly fill the indented section of the gold crown (see Veneers, chapter on Porcelain Teeth). Place the porcelain body in position, press the porcelain veneer to place, and fuse. The veneer may not become attached at the first fusing, on account of the shrinkage of the body. So much the better if it does not, as more body can now be placed under the veneer and the next fusing will solidly secure it. Next fill in all interstices around the veneer and give the final fusing.

Where a veneer is used with the Jenkins porcelain, there is not so much danger of changing the shade of the porcelain veneer 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. This can be remedied, in a measure, by applying with a brush to the margins of the platinum and close to the inlay a thick mixture of the preparation of chlorid of gold used to decorate china, and which fuses in the furnace at the melting point of 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.

THE RESPECTIVE MERITS OF VARIOUS GRADES OF PORCELAIN FOR DENTAL OPERATIONS.

High- and low-fusing body porcelains differ considerably in character. Their suitability for certain classes of operations must materially vary also. At the present time operators in porcelain work generally express a preference for some one of the special grades of porcelain and use it to the entire exclusion of others. This is probably attributable in great measure to the fact that as yet the knowledge and experience of a large proportion of inlay workers is confined to the grade they have in use and the methods associated and apparatus connected with it.

The value of the respective grades of porcelain for the work in hand is governed by the resemblance to tooth-structure, density, strength, permanency 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 incisive 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 incisive edge, approaching in character body such as composes artificial teeth,—the pulverized artificial tooth being used by some for the purpose, requiring a most intense heat to fuse it,—be as suitable, even judged from a practical standpoint, for use in forming an inlay. A high-fusing body is used by some to form the foundation and one or two successively lower-fusing ones for shaping and finishing. For instance, a porcelain tooth may be devitrified by heating and plunging into water, and then ground in a mortar into a fine powder. This powder may then be used as a porcelain body to form the foundation. After it has been fused the "Close" porcelain body is next added and fused, and a still lower-fusing porcelain applied to finish with.[1]

All grades of porcelain shrink in fusing. This shrinkage seems more controllable in a low-fusing porcelain than in a higher grade, possibly owing to the high heat required by the latter or to the development in it of a greater force of contraction.

According to the conditions discussed, the use seems to be suggested, in the present development of the art, of low-fusing porcelain, which combines the required properties for inlays at labial and approximal surfaces, and of high-fusing porcelain for inlays at or extending to the grinding-surface or incisive edge and for crown operations, where a porcelain as nearly analogous in structure to an artificial tooth in part or whole is required.

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[1] A comparative grade of fusing points of various makes of porcelains, placing Jenkins as the lowest, is as follows: Jenkins, Ash's High-fusing, Whiteley, Close, the porcelains of an artificial tooth.

CHAPTER III.

PORCELAIN BRIDGE-WORK.

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 is a more complex operation.

In practical application the scope of porcelain bridge-work is limited. This is owing 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. 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.

In porcelain bridge-work the metallic 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.

Fig. 631.

Fig. 632.

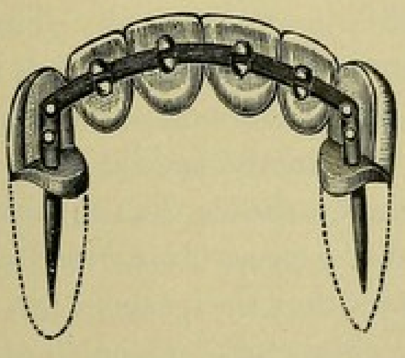


Fig. 633.

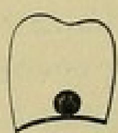
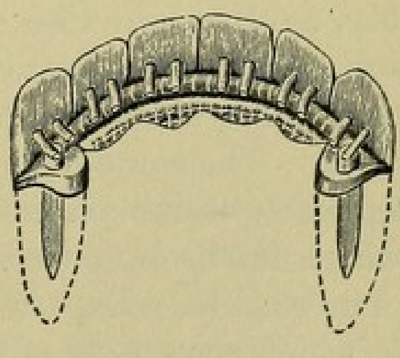


Fig. 634.



Figs. 631 and 632 represent an improper, and Figs. 633 and 634 the proper, placing of the bar in a tooth and in a bridge in porcelain work. In Fig. 631 the continuity of the porcelain is broken by the presence of the bar in the center. Fig. 633 shows the bar at the base united to a cap or saddle. The bar as shown in Fig. 634, united to the caps and saddle, affords far greater strength and rigidity than either would separately as illustrated in Fig. 632, largely through avoiding interruption of the continuity of the structure of the porcelain.

The metallic 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 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 metallic 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. 635) of

Fig. 635.

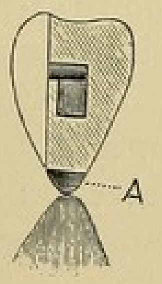
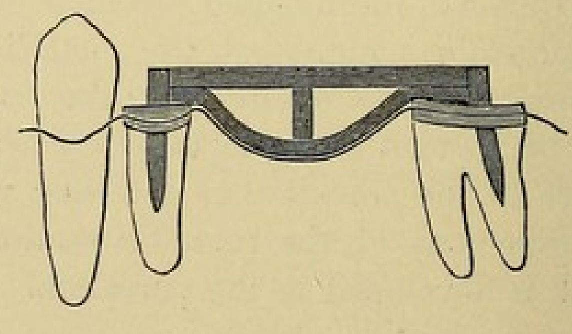


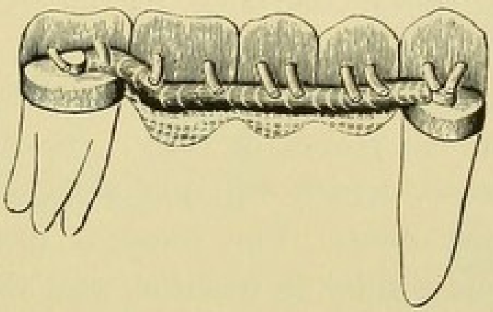
Fig. 636.



iridio-platinum, in connection with a flattened cross and upright bar, as shown in Figs. 635 and 636, may be used. 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 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.

The case illustrated in Fig. 637 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 soldered with 25 per cent. platinum solder. An impression is taken of the alveolar ridge and a platinum saddle struck up to span the space. The platinum is cut to the size of the combined bases of the artificial teeth which are to rest upon it. The caps are placed in the mouth, an impression is taken, and the caps withdrawn in position in the impression. The struck-up saddle is turned upside down, trimmed, fitted, and placed in position between the caps on the surface of the plaster impres-

FIG. 637.



sion. The gauge of the platinum is to be decided by the operator. If the gums are exceedingly hard and unyielding, No. 31 to 32 gauge should be used, varying from that to No. 22 gauge as the gums are soft and spongy.

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 will be found imbedded in the model to the depth of the thickness of the platinum used. In this manner a uniform pressure of the saddle on the gums is secured, which cannot properly be effected by scraping so large a surface of plaster.

Another method of obtaining a similar result is: Strike up on the die a piece of sheet lead rolled to the desired gauge and of the size the saddle is to be, and place it on the impression between the caps, in the same manner as has been described regarding the platinum saddle. Run the model and then remove the impression. The removal of the lead will exhibit a uniformly depressed space on the model, into which the struck-up platinum saddle can be fitted. By this latter method any degree of pressure on the alveolar ridge on the part of the saddle is obtained and any gauge of platinum desired can be used.

An iridio-platinum cross-bar, made of No. 14 gauge round wire flattened to No. 16 gauge 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. 637). The saddle is next soldered to the caps, and the cross-bar to the caps and saddle, with 20 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 frame-work makes a metallic 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 15 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 not done 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. Next wax is placed inside each of the caps to exclude the plaster and 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 for 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. 637 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 two 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. 638 illustrates the bridge ready for cementation.

Fig. 638.

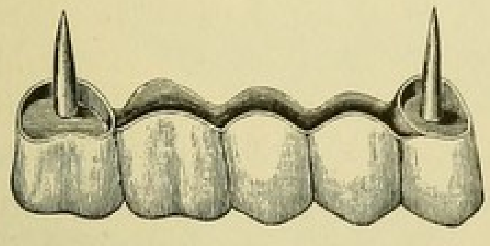
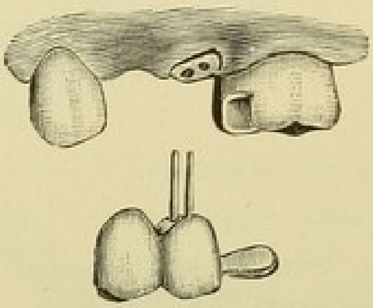


Fig. 639.



A case of porcelain bridge-work, such as has been described, is best cemented with gutta-percha. (See Part II, Chapter XII: Cementation.)

Fig. 639 represents a porcelain extension bridge in which the support consists of a crown and bar combined.

In porcelain bridge-work artificial gum to a moderate amount can be formed above the teeth of the bridge.

Fig. 640 represents a case by Dr. M. L. Rhein. To remedy the abnormal character of the occlusion, the lower anterior teeth and the right upper cuspid were trimmed to the dotted line seen in the figure. To replace the missing teeth porcelain bridge-work was then constructed. The lateral and central roots, and the right cuspid and the molar, constituted the abutments. On the central and lateral roots were mounted caps with collars. A platinum crown was then made for the cuspid (Fig. 641), and to this crown was attached the bar, which was extended to its anchorages in the molar crown and the lateral and central roots, the caps on the ends of which the posts pierced. Owing to the large quantity of porcelain body to be used in forming the artificial gum, a strip of platinum plate was extended above the bar to stiffen its projecting ends and prevent warpage in baking. The artificial teeth were then articulated to meet the incisive edges of the inferior natural teeth, and thus in a measure overcome

Fig. 640.

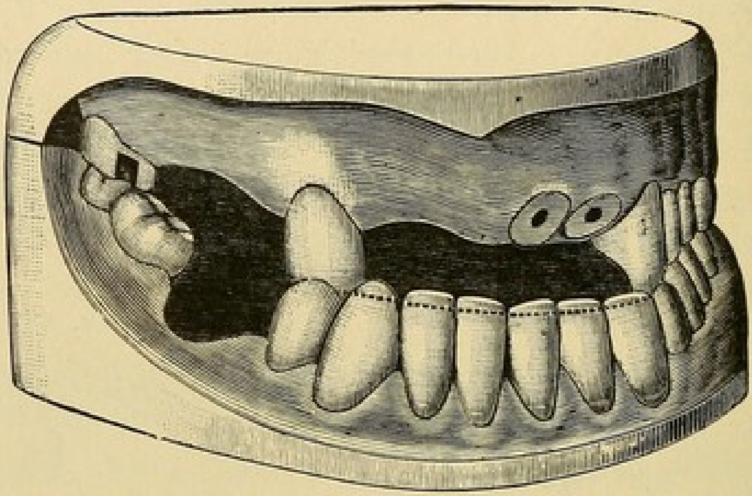


Fig. 641.

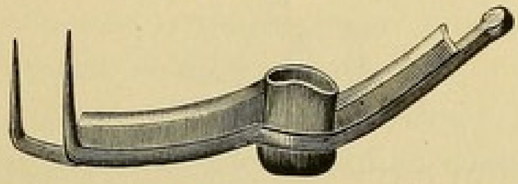


Fig. 642.

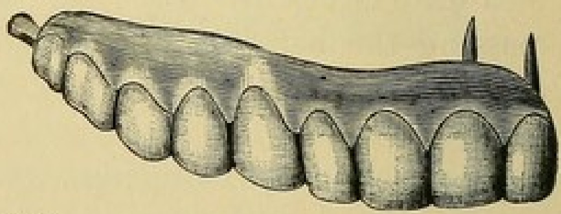
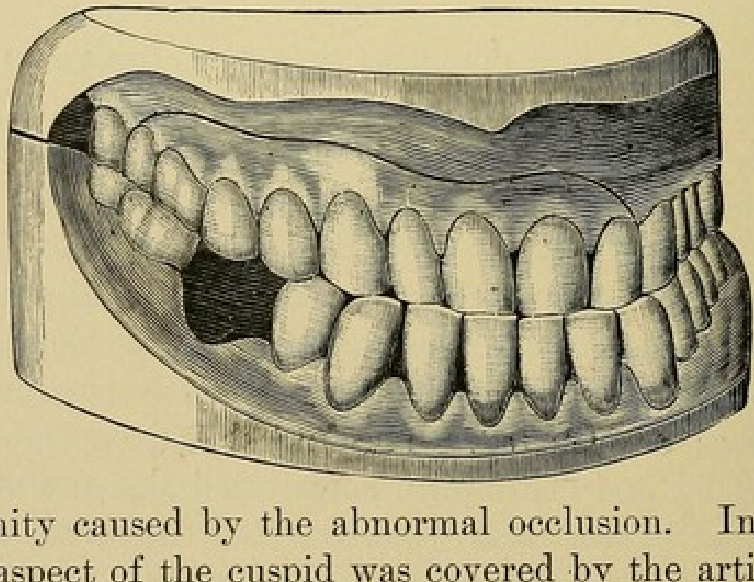


Fig. 643.



the deformity caused by the abnormal occlusion. In doing this the labial aspect of the cuspid was covered by the artificial teeth. Porcelain gum was then formed above the teeth in sufficient quantity to restore the contour of the parts. It was brought to a feather edge and pressed hard against all the tissues to insure a hygienic condition. Fig. 642 shows the finished bridge. In Fig. 643 the bridge is seen in position. The artistic result and improved appearance effected are at once apparent. The mechanical construction of the piece was intrusted to Dr. C. L. Andrews.

Fig. 644.

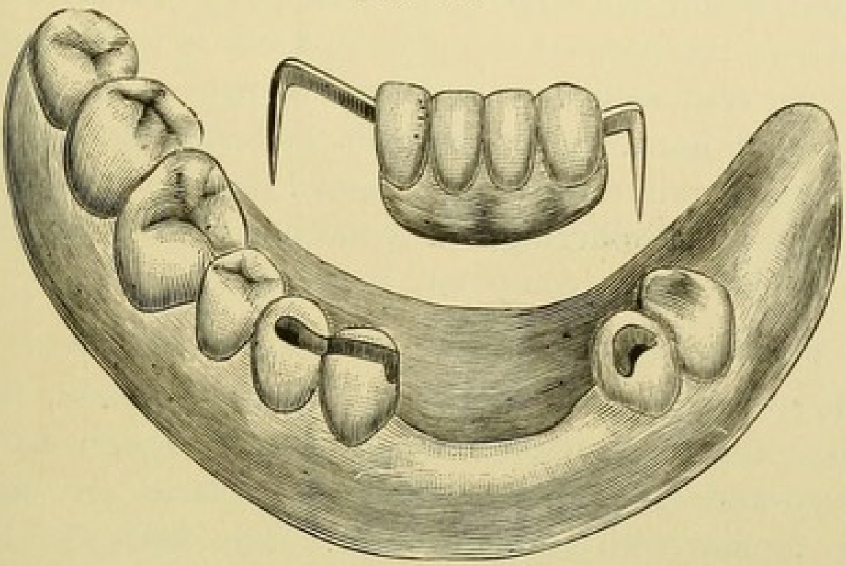


Fig. 644 is a lower bridge firmly supported on the right side by passing the bar through the cuspid and inserting the end in the pulpless bicuspid as illustrated. The pulpless bicuspid on the left constitutes the other abutment.

PLATINUM SOLDER.

Gold, either pure or alloyed with platinum, is used as the solder for uniting sections of platinum in porcelain work. No alloy of the baser metals is permissible, because it would affect the color of the porcelain. On the other hand, gold exposed to a temperature much beyond its melting point in contact with platinum will be absorbed by the latter, so great is the affinity of the two metals. In constructing the platinum frame-work for a porcelain bridge, it is necessary, therefore, to use a solder which will resist the fusing temperature of the porcelain; otherwise, the gold would be absorbed by the platinum, and vacuoles would be formed in the porcelain at the points from which the solder was absorbed, thus weakening the piece. When a low-fusing porcelain is used, pure gold answers very well as the solder; but for the higher-fusing porcelains, which are used in making porcelain bridge-work, the gold must be alloyed with platinum, in various proportions, to raise the fusing point, according to the body to be used.

Platinum solders, for this use, are made by alloying the gold with from 5 to 30 per cent. of platinum. "Close's" body, which is largely used in this work, fuses at about the same temperature as a 15 per cent. platinum solder. The fusing point of a 20 per cent. solder will be well above that required for this body. A 25 per cent. solder will stand any heat applied in this line of work, except where the body of a porcelain tooth is to be fused. For this a 30 per cent. solder would be necessary.

It is well to use a higher per cent. solder in the early steps of an operation than in the later stages, and thus avoid the possibility of melting the first soldering. The melting of all platinum solders requires the use of the compound blow-pipe.

FURNACES FOR HIGH-FUSING PORCELAIN.

A proper furnace is essential in baking porcelain, for which small gas or electric furnaces or ovens specially designed for crown- and bridge-work are used. 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 "gas" the porcelain, altering the color and causing porosity, a condition that can only 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. Fig. 645 illustrates the "Land Midget Gas Furnace."

In the electric furnace the heat is generated around a small muffle or oven by electricity. Electric furnaces or ovens are a little slower in heating up to the required temperature as compared with gas, but they have the merit of under no circumstance "gassing" the porcelain. Fig. 646 illustrates the "Custer Electric Furnace." A furnace, whether gas or electric, to meet all the requirements for general work, should be capable, if necessary, of generating a heat of at least 3000° F., as some operations in porcelain work require that temperature to develop strength and color. A platinum muffle, although seamless, will not assure against "gassing" the porcelain. In the use of electric furnaces, the fine platinum wires which encircle the muffle and form the resistance which generates the heat require to be renewed at intervals, depending on the frequency of use and amount of heat generated.

FIG. 645.

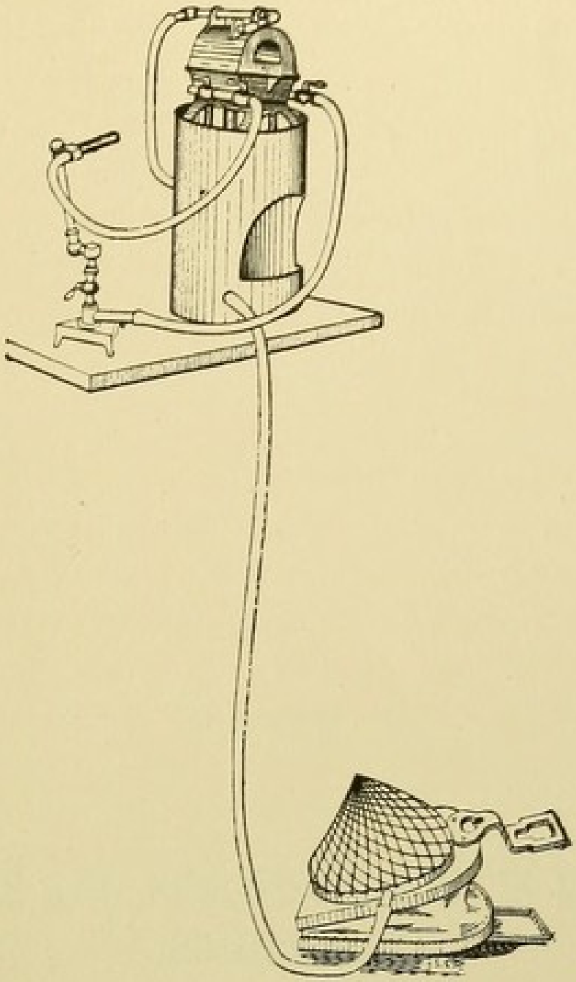
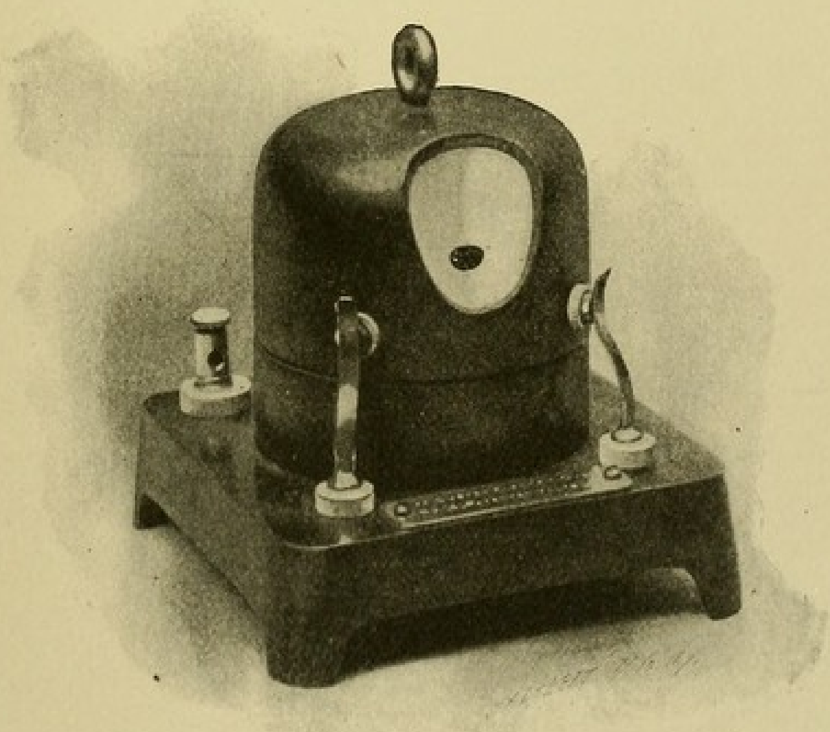


FIG. 646.



PART V.

MATERIALS AND PROCESSES USED IN CROWN- AND BRIDGE-WORK.

CHAPTER I.

PLATES AND SOLDERS.

Plates.—In the construction of crown- and bridge-work, gold, platinum, or iridio-platinum is used in the following forms and grades in carat, as suits the requirements of the case and the preference of the dentist:

Gold plate, 24 carats, from No. 28 to No. 30 U. S. standard gauge,[1] for constructing the collars and caps to collars of crowns and seamless crowns, and for backing porcelain fronts.

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 standard gauge, in constructing collars for crowns with porcelain fronts and all-gold crowns made in sections.

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 saliva exists. For this reason, United States gold coin, containing 10 per cent. copper, so much used for collars, is not quite suitable. It is also too stiff, and collars made of it are not readily burnished to fit at the edges. Dr. J. J. R. Patrick's formula, which is equal parts of coin and pure gold, affords a plate which is decidedly preferable, inasmuch as the proportion of copper is reduced to 5 per cent.

Gold plate, 24 carats, with a lining of platinum, can be used in any of the processes connected with crown- and bridge-work, and is especially recommended to the inexperienced, for the reason that the melting of a part of a crown in the soldering process

[1] The United States standard is the only gauge referred to in the original descriptive matter of this treatise.

is prevented by its use. It is formed by placing together an annealed gold plate and a platinum plate (the gold about No. 20 gauge 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.

Platinum and iridio-platinum plate are used for forming crowns for use in connection with porcelain bridge-work. Platinum plate for forming collars need not be over No. 30 to 32 gauge. At this thickness it can be easily adapted to the cervix of the tooth.

Pure platinum rolled very thin is used for forming caps to collars, backing teeth, and for various purposes connected with this class of operations. Iridio-platinum wire is used for pivots, pins, or posts, being more rigid than pure platinum. A wire of gold and platinum alloy is used on account of its elasticity for split or spring pivots or posts in removable bridge-work.

Solders.—Gold solder, 18 and 20 carats fine, is used for crowns and bridges, but 18 is considered by some too low a carat.

14 carats for strengthening seamless crowns; used only in crowning operations.

Successive grades of solder from hard to easy flowing can be used in the regular soldering of crown- and bridge-work; gold plate or a hard-flowing solder for the first, a medium-flowing solder for the next, and an easy-flowing one for the finish. This avoids melting or flowing of the gold at any point previously soldered.

Any grade of solder can be made according to the following formula:

Zinc, $1\frac{1}{2}$ grs.;
Pure gold,
Silver solder, in quantity sufficient to make up
the $22\frac{1}{2}$ remaining parts in weight.

The quantity of silver solder used will regulate the grade in carat of the solder. Thus:

Zinc, $1\frac{1}{2}$ grs.;
Pure gold, 20 grs.;
Silver solder, 3 grs.,

will, by the burning out of a portion of the zinc in the process, make a solder about 20 carats fine.

By lessening the proportion of zinc from $1\frac{1}{2}$ grains to 1 grain, the proportion of silver solder being kept the same, the solder will become harder-flowing and a little finer.

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:

1 part pure silver;
2 parts pure zinc;
3 parts pure copper.

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 pipe-clay 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.

As a solder for crown- and bridge-work constructed of 22-carat gold plate, Dr. Litch's formula is as follows:

Gold coin (ten dollars), 258 grs.;
Spelter (or brazier's solder), 24 grs.;
Silver coin, 24 grs.

This is a proportion of about 26 grains of pure copper and 232 grains of pure gold to the remaining 48 grains of the alloy, and makes a good solder a little over 18 carats fine.

Dr. C. M. Richmond originally used American gold coin for forming gold crowns, rolling it out in the form of plate. The scraps he formed into solder by melting and adding one-fifth of their weight of fine brass wire cut in small pieces, using plenty of borax.

Dr. Low's formula for solder in bridge-work is:

1 dwt. coin gold;
2 grs. copper;
4 grs. silver.

This makes a solder about 19 carats fine.

The following formula[1] gives a 20-carat solder which is specially recommended for crown- and bridge-work:

American gold coin (21.6 carats fine), $10 piece, 258 grs.;
Spelter solder, 20.64 grs.

[1] American System of Dentistry, vol. iii, p. 849.

Hard-flowing gold solder, for use in bridge-work, 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 desired gauge.[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 in 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.

[1] This formula is the one used by the author, and is convenient and reliable.

CHAPTER II.

PORCELAIN TEETH.

The qualities specially requisite in the body of porcelain teeth 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.

Teeth are sometimes fractured in the process of soldering, caused by 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 by melting solder on some point 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.

Veneers.—A veneer consists of a thin piece of porcelain representing the labial aspect of the natural tooth.

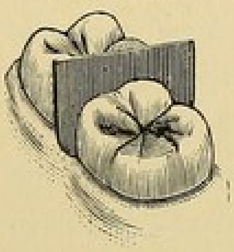
To form a veneer select a porcelain tooth of the required shade and size. On the end of a piece of wood, about the size of the tooth, melt and attach a mass of shellac, heat the porcelain tooth and imbed the labial surface into the shellac. Clip off the pins and with a corundum wheel on the lathe uniformly 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.

MOLDS AND DIES.

METALLIC models 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. 647, 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. 647.



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. 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—

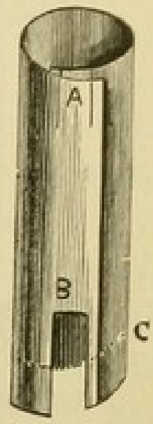
Tin, 5; Lead, 3; Bismuth, 8.

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.

HOW TO QUICKLY MAKE A TUBE AND FUSIBLE METAL DIE.

Take a thin strip of copper plate, at least 35 gauge, 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. 648, 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. 648.



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 84, 93, and 97.

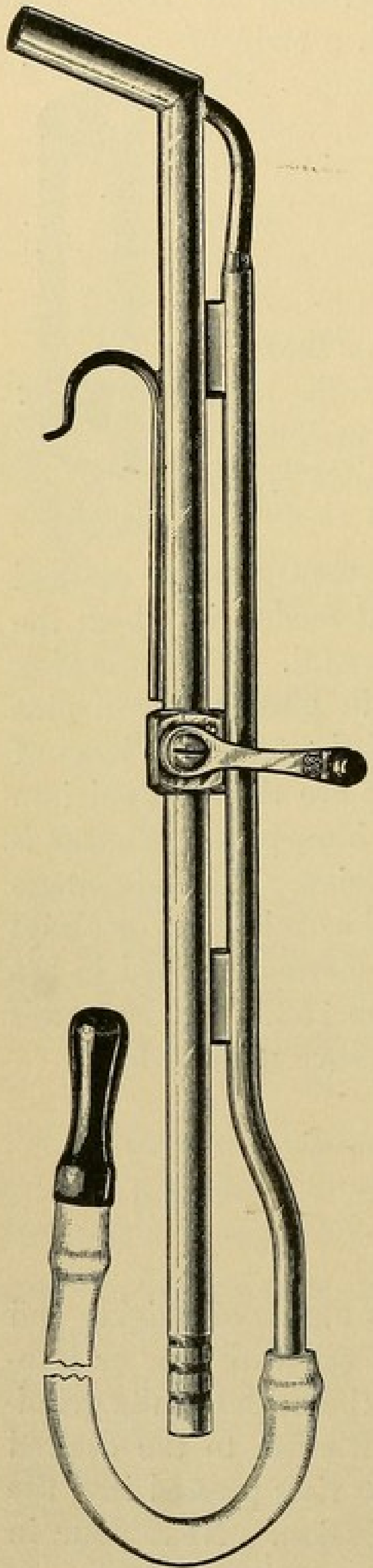
Dr. Melotte has introduced for special cases a novel method of forming a combination plaster and metal model, in which the parts representing the teeth are of fusible metal. The following is a description: The impression is taken in plaster. Iron pins to act as dowels are placed in the molds of the teeth. 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 blow-pipe. 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 153. 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.

Cuttle-fish, as a molding 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 cuttle-fish to the desired depth, withdraw model and place a metallic ring pressed into the surface of the cuttle-fish around the impression. Next pour in the metal to form the die.

FIG. 649.



CHAPTER IV.

SOLDERING.

Models and Investments for Soldering.—Models on which the soldering is to be done for bridge-work are made of calcined marble-dust and plaster, in the proportion of equal parts.

For small investments, such as single crowns, 2 parts calcined marble-dust and 1 of plaster.

For large investments, including pieces of bridge-work, 1 part calcined marble-dust, 1 part common white sand, and 1 part plaster. The reason for the use of the latter proportions is that the sand prevents the excessive contraction that is liable to take place in large masses of investing material entirely composed of plaster and marble-dust when subjected to great heat for a considerable time. The marble-dust in combination with sand renders the material more suitable to fill interstices and the insides of caps. In cases of bridge-work of any great size, a loop of iron wire should encircle the piece in the investment. Sulfate of potassium, used in place of common salt, but in smaller quantity, will cause the mixture to set quickly and hard. The best method is to place a small teaspoonful of the sulfate of potassium in a pint bottle of water, and thus have it always ready for use in the proper proportion. The investment should always be made as small as the case will properly admit.

Soldering.—When it is desired to remove the wax cement connecting sections of a crown or bridge in an investment before heating, it should be done by pouring boiling water on the parts. It is not advisable to remove the wax with an instrument, as parts delicately held in position are liable to become displaced. Many prefer to let the wax burn out of the investment as it is heated. This is always done when fluxed wax is used and the benefit of the flux is to be obtained. The objection to burning out wax is that pits are more liable to be found afterward in the solder.

In soldering crown- and bridge-work or sections of it containing porcelain fronts, the investment should be first uniformly and thoroughly heated. A full flame should be directed against and under the investment, and the heat uniformly raised to a temperature that will melt the solder without pointing the flame. This is especially necessary in the soldering of gold crowns with porcelain fronts, also dummies, as the solder if the investment is properly placed flows by gravitation into the interstices between the porcelain and the caps, and gives continuity of structure to the crown. When the solder has filled the interstices, the flame may be pointed for a moment to guide it to some desired point.

A large piece of charcoal, concave on the side to be used, and the other side invested with a thin covering of plaster, furnishes a good soldering support, as it retains the heat. A hand gas blow-pipe, operated by a foot bellows, and so constructed that the flame is under perfect control, is the most suitable (Fig. 649).

The Use of Borax.—In soldering invested sections of crown- or bridge-work, borax which has been reduced to a vitreous state by heat and then finally pulverized is the preferred form for use. Prepared in this manner it should be sprinkled on the part previous to the commencement of the soldering, and a little added at any time it is needed during the continuance of the process.[1]

In small, fine soldering of invested or uninvested work, the lump borax ground with water on a slab to a cream-like consistence, and applied with the point of a stick or brush only where it is desired to have the solder flow, is the most suitable. In

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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.

open-flame soldering,—for instance, where solder is to be flowed only on the external surface of a cap or collar by holding in the Bunsen flame,—dampened calcined marble-dust applied in a thin layer on the inner surface of the cap or collar will prevent the solder from flowing there. The marble-dust is afterward easily washed out, which is not the case with whiting, which is often used for this purpose.

CHAPTER V.

INSTRUMENTS AND APPLIANCES.

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 rubber and corundum disks (see page 35).

Pliers for shaping collars (see page 67), and a pair of excising forceps.

Soldering clamps (see page 85) 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 blow-pipe with bellows, and a mouth blow-pipe.

Charcoal soldering block.

Calcined marble-dust.

Sulfate of potassium.

Melotte's moldine and fusible metal.

Wax cement (resin two parts, wax one part), or Parr's fluxed wax.

Dies for forming gold caps for use in constructing crowns and capping dummies.

Copper plate Nos. 34 to 35 gauge, copper wire No. 30 gauge, fine iron binding wire, and heavy iron wire to encircle investments.

Pure gold plates Nos. 28 to 30 gauge, 22-carat gold plate Nos. 28 and 30 gauge, and 18- and 20-carat gold solder.

Platinum plate Nos. 30 and 32 gauge for collars, both heavy and very light platinum foil for backings, and some platinum and iridio-platinum wire Nos. 15 and 17 gauge for posts, and fine platinum wire for pins in either gold tips or crowns.

FIG. 650.

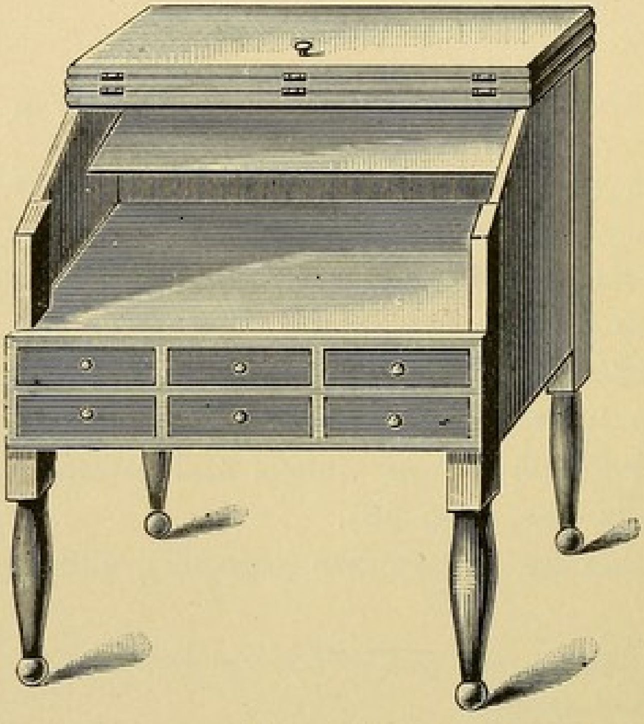
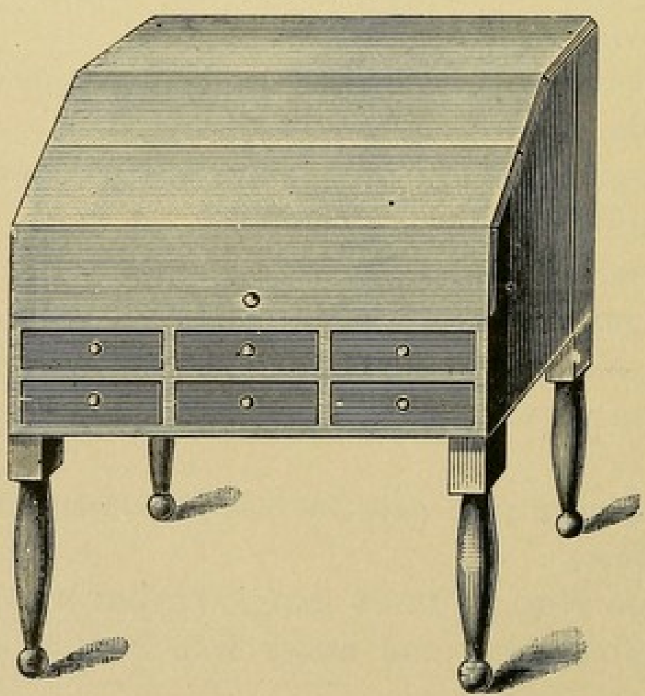


FIG. 651.



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.

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. 650 and 651.

An office lathe should be kept next to the bench, or a small lathe-head can be mounted on the bench and operated by the aid of an electric motor.

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