

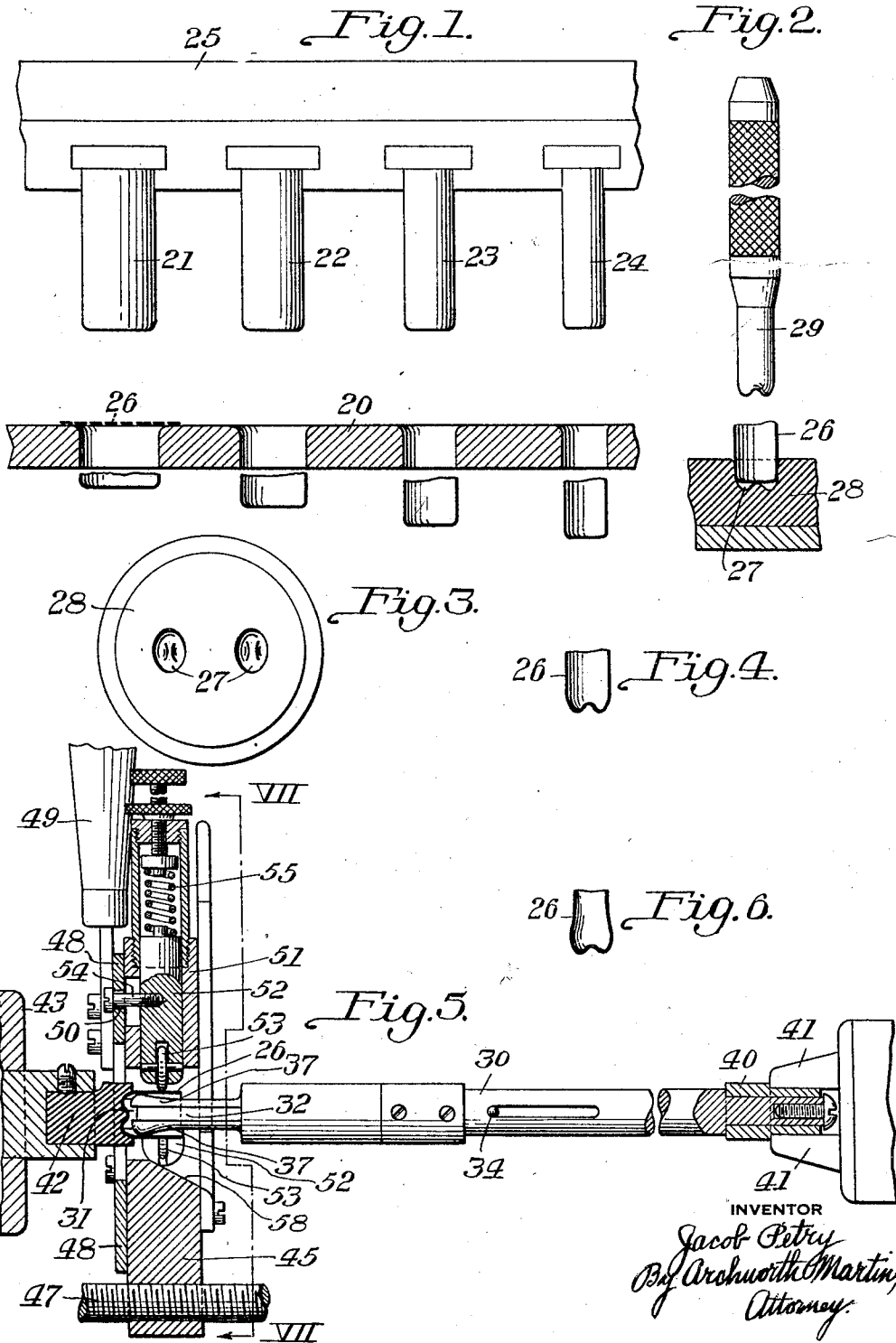
Nov. 26, 1929.

J. PETRY

1,737,539

METHOD OF AND APPARATUS FOR MAKING DENTAL CROWNS

Original Filed April 8, 1927 3 Sheets-Sheet 1



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METHOD OF AND APPARATUS FOR MAKING DENTAL CROWNS

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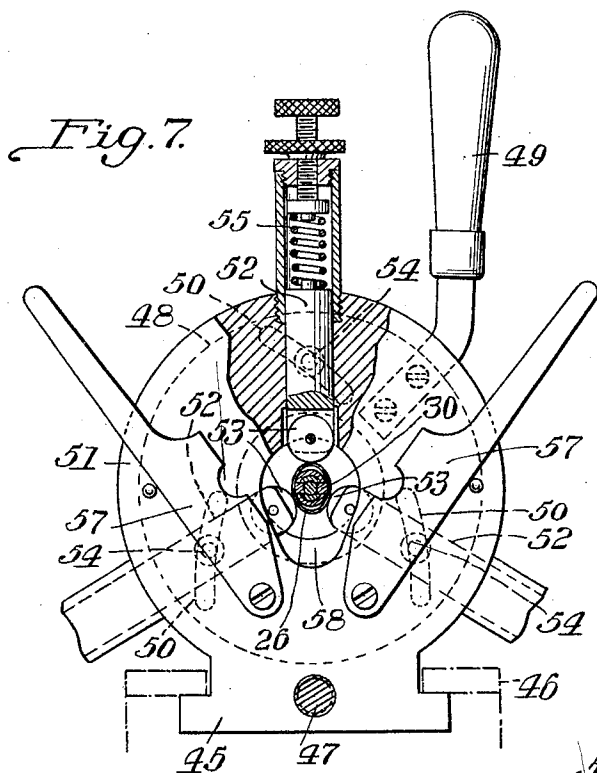


Fig. 8.

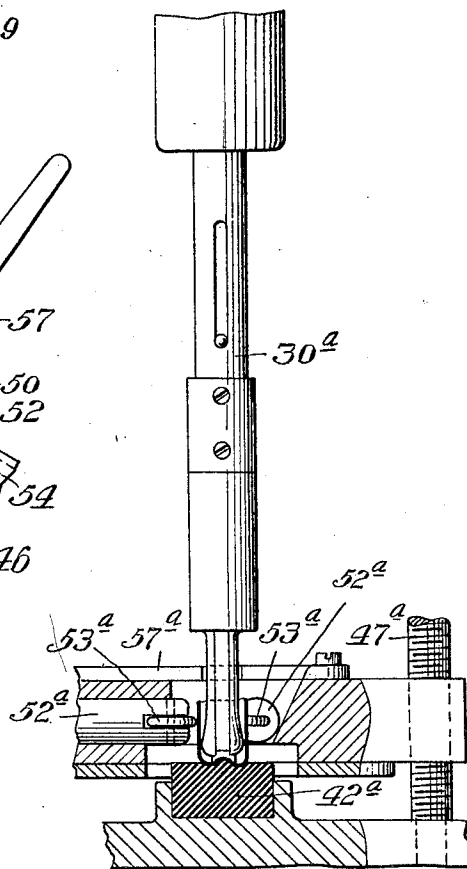
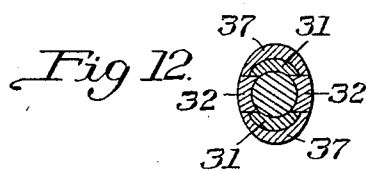


Fig. 9.

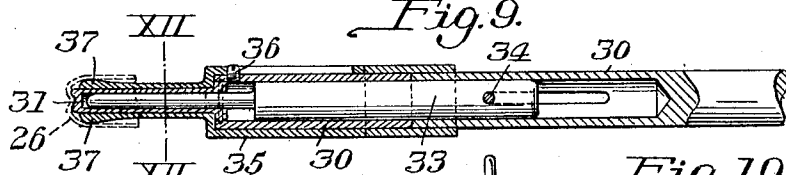


Fig. 10.

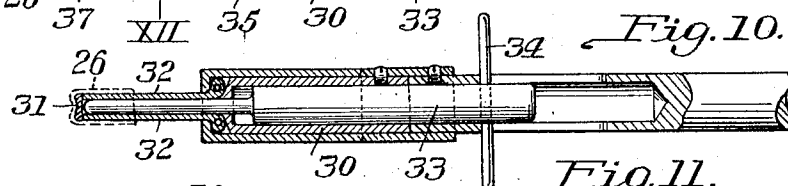
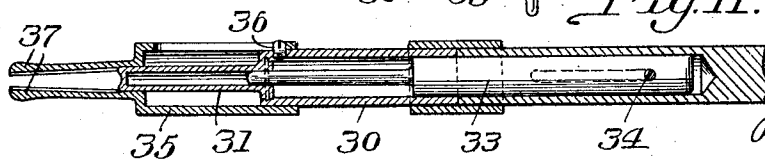


Fig. 11.



INVENTOR
Jacob Petry
 By *Archworth Martin*
 Attorney

Nov. 26, 1929.

J. PETRY

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Fig. 13.

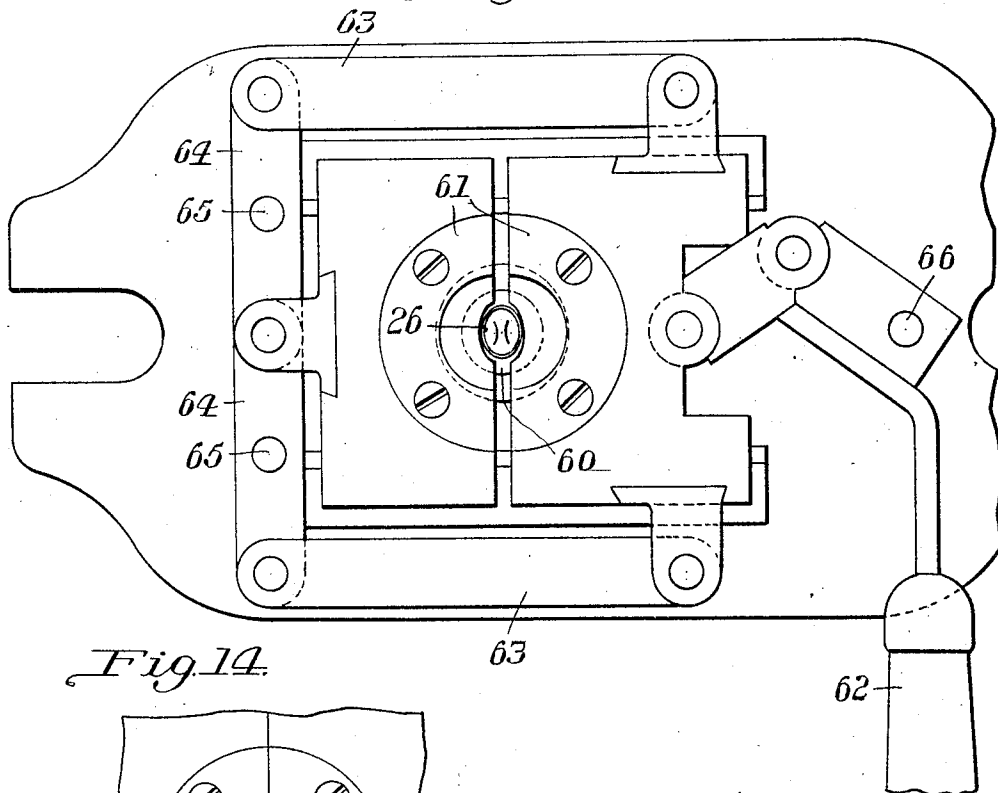


Fig. 14.

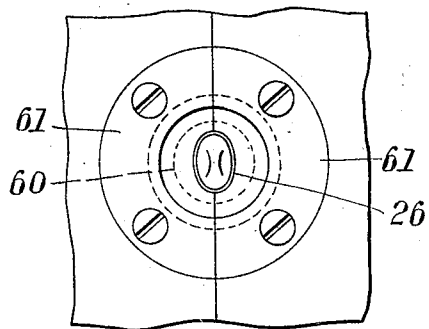
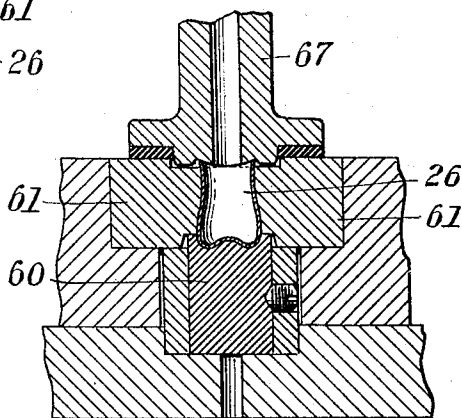


Fig. 15.



INVENTOR
Jacob Petry
By *Archibald Martin,*
Attorney.

UNITED STATES PATENT OFFICE

JACOB PETRY, OF PITTSBURGH, PENNSYLVANIA

METHOD OF AND APPARATUS FOR MAKING DENTAL CROWNS

Application filed April 3, 1927, Serial No. 131,982. Renewed April 23, 1929.

My invention relates particularly to tooth crowns such as are employed in dentistry.

My invention has for its object the provision of an improved apparatus for and a method of making tooth crowns, whereby a better fitting crown is obtained, and one which is free from various imperfections heretofore commonly present therein.

Another object of my invention is to simplify and improve generally the construction of and form of dental tooth crowns.

In making the tooth crowns it is desirable that the occlusal portion be provided with a chewing surface that shall be of such diameter or width as to leave no space between it and adjacent teeth or crowns, in order to present a substantially continuous chewing surface and to avoid the unsightly appearance which would result in cases where a considerable space was present. Such spaces not only result in collection of food particles and the breeding of germs, but the gum tissues at those points will be irritated through pressure while masticating food, causing bleeding and receding of the gums, as well as unnecessary pain.

The natural tooth at the gingival or gum line is ordinarily of smaller diameter than at its outer or occlusal end. Therefore, in order that a crown may fit properly, it is necessary that it tapers from its occlusal portion to its gingival opening.

Crowns are commonly made from what might be termed "cartridges" of gold or other suitable metallic substance that are of substantially uniform diameter from their closed ends to their open ends. The problem then is to reduce the diameter thereof toward the open end, but difficulty has been experienced by reason of the fact that in making such reduction in diameter objectionable irregularities, such as indentations, creases or fold-lines, and the like occur. In some cases the crown has been split for a portion of its length and the edges of the split portion overlapped and soldered in order to cause it to closely embrace the tooth at the gingival line. In either instance, it is almost impossible to secure the desired closeness of fit between the crown and the tooth, so that destructive for-

eign matter finds its way into the space between the crown and the teeth and decay results.

It has also been customary to expand the occlusal end of the crowns somewhat but, by the methods heretofore employed, such expansion often results in excessive thinning of the metal so that the finished crown is weakened to an objectionable degree and perhaps even torn when expanded.

In the manufacture of seamless crowns, it has been the custom to employ male and female die members of such form that the upper or open end of the crown is of at least as great diameter as the lower or occlusal end thereof, and usually of slightly greater diameter, owing to the necessity of removing the expanded crown from a female die member. This is directly the opposite of the shape desired, that is, in the completed form the crown should be wider at its base, and relatively narrow at its open or gingival end. By employing the dies shown in the accompanying drawing, it is possible to form a crown with a relatively large lower end, in a mold or die having two relatively movable parts, and nevertheless permit convenient removal of the crown from the dies without distortion.

In the accompanying drawing, I have shown means for practising my invention. Fig. 1 is a schematic view showing the manner in which the crown blank may be passed through the early stages of formation; Fig. 2 is an elevational sectional view of the apparatus, by means of which the occlusal formation is given to the closed end of the crown; Fig. 3 is a plan view of the occlusal-forming block of Fig. 1; Fig. 4 is a view showing the form of the blank after the occlusal-forming operation has been performed; Fig. 5 is a longitudinal sectional view of apparatus for reducing the diameter of the blank above its occlusal end; Fig. 6 is a view showing the blank after it has been operated upon by the apparatus of Fig. 5; Fig. 7 is a view taken on the line VII—VII of Fig. 5; Fig. 8 is a view, partially in elevation and partially in section, of a modification of the apparatus of Figs. 5 and 7; Fig. 9 is a longitudinal sectional view of the mandrel of Fig. 5; Fig. 10

is a sectional plan view of the device of Fig. 9; Fig. 11 is a view similar to the device of Fig. 9, but showing the movable head portion of the mandrel in projected position to permit the removal of a crown; Fig. 12 is a view taken on the line XII—XII of Fig. 9; Fig. 13 is a plan view of the structure wherein the final forming operation is performed; Fig. 14 is a view of a portion of the apparatus of Fig. 13, but showing the lateral dies in closed position, and Fig. 15 is an elevational sectional view of the die structure of Fig. 14, but showing the fluid pressure crown-expanding apparatus in operative relation thereto.

In Fig. 1 of the drawing, I show a die block or plate 20 that is provided with a number of holes with which plungers 21, 22, 23 and 24 cooperate. The plungers are shown as mounted on a vertically reciprocable head 25 that may be operated in any desired manner, to move the plungers into the holes in the plate 20.

In making tooth crowns, a disc 26 of gold or other suitable metal is placed in the position shown, and the plunger head 25 brought down to depress said disc. The partially formed cartridge is then moved into the next smaller hole and its diameter reduced by the plunger 22. In the drawing, I have shown four plungers of progressively smaller diameter, but a greater or less number may be provided, depending upon the size and character of the crown to be formed.

After the crown has been operated upon by the plunger 24, it is placed in one of the occlusal-forming depressions 27 in a metal die block 28 or preferably of relatively soft material such as a fiber block that will not injure the crown. A tool 29 that is provided with occlusal surfaces which are complementary to the depressions 27, is inserted into the crown, as shown more clearly in Fig. 2, and pressed downward or struck, to give such crown approximately the formation shown in Fig. 4. The depressions 27 in the block 28 may be of different sizes so that the crown can be given a preliminary formation in one of such depressions and then moved to the other depression to complete the formation of the occlusal surface or cutting edge.

The blank 26 of Fig. 4 will then be placed upon the head of a mandrel bar 30 in order that it may be spun or rolled to reduce the diameter of its open end, to approximately the formation shown in Fig. 6. The mandrel bar 30 carries at its forward end a central head portion 31 (Fig. 11) that engages the inner end wall of the crown. Mandrel head members 32 are pivotally mounted on the bar 30 and are held in the radially expanded positions shown in Figs. 10 and 12, by means of a plunger 33 that is slidably mounted within the mandrel bar 30. The plunger 33 is operated by a pin 34 that extends through such plungers and through slots in the walls of

the mandrel bar 30. A sleeve 35 is slidable on the mandrel bar 30, its movement thereon being limited by a pin 36 which is carried by the bar 30 and extends through a slot in the sleeve 35. The forward end of the sleeve 35 is provided with extensions 37 that form a portion of the mandrel head.

When the plunger 33 is in its forward position and the sleeve 35 in its retracted position, as shown in Figs. 9 and 10, the parts 31, 32 and 37 together form an annular surface upon which the crown may be spun. The crown 26, when it reaches the stage of formation shown in Fig. 4, is placed upon the mandrel head as indicated in Fig. 10 and will then be rolled to the form shown in Figs. 9 and 6, by mechanism to be hereinafter described. When the crown has been given the formation shown in Fig. 6, the plunger 33 is drawn back by means of the pin 34, to release the plunger head members 32 and permit them to swing radially inward, while the sleeve 35 is pushed outward to the position shown in Fig. 11, thus carrying the crown clear of the central head member 31 and permitting the extensions 37 of the sleeve to spring inward to allow withdrawal of the crown. After removal of the crown, the parts of the mandrel are returned to operative position, by pulling back the sleeve 35 to bring its extensions into radial alignment with a central head member 31; and the plunger 33 is then pushed out to move the fingers 32 into the position shown in Fig. 12, between the edges of the extensions 37.

Referring now more particularly to Figs. 5 and 7, the mandrel 30 is rotatably supported at its rear end in a bearing block 40 that is rigidly clamped between blocks 41. The die block 42, preferably of fibrous material that will not injure the crown, is detachably mounted in a head block 43 which may be the rotating head of a lathe (not shown), or any other suitable rotatable apparatus.

A carriage 45 is slidably mounted in a slide way 46 and is reciprocable thereon by means of a screw 47 that is operable in either direction through any suitable means. Upon the carriage 45, a cam disc 48 is rotatably mounted, the disc being provided with a handle 49 by means of which it may be oscillated. Cam slots 50 are provided in the disc 48. A disc-like bracket member 51 is secured to the slide 45 and supports three plungers 52 which are provided on their inner ends with rollers 53. Each of the plungers 52 carries a pin 54 that extends through one of the slots 50, so that as the handle 49 is oscillated, the walls of the slots 50 cause the plungers 52 and the rollers carried thereby to be moved radially of the mandrel 30. The slots 50 are somewhat wider than the diameter of the pins 54, so that there will be some lost motion between the walls of the slots and such pins, to permit slight radial movement of the rollers independently of the disc 48, as when the rollers

53 encounter irregularities on the crown that is being operated upon. Compression springs 55 tend to hold the plungers 52 at their innermost positions.

5 With the parts in the position shown in Fig. 5, rotative movement is given to the head block 43, thereby rotating the crown 26 and the mandrel 30. During this rotative movement, the handle 49 is operated to move the
10 plungers 52 inwardly to cause reduction in diameter of the crown 26 by the rollers 53. As the rolling progresses, the screw 47 is operated to shift the slide 45 and carry the rollers 53 longitudinally of the crown, so that
15 all reduced portions of the crown are engaged by the rollers 53 and a smooth contour given thereto, thereby avoiding the formation of irregularities or creases such as would be formed if reducing devices of other kinds
20 were employed.

Upon completion of the rolling operation, the head block 43 is withdrawn and a pair of stripper bars 57 that are pivotally mounted on the slide 45 are moved so that their semi-
25 circular recessed portions encircle the shank of the mandrel head as indicated in Fig. 5. The plunger 33 is retracted to permit inward movement of the head members 32 and allow the sleeve 35 to be projected so that its extensions 37 will pass beyond the end of the central head member 31, as above explained, to permit contraction of the members 27. Movement of the mandrel bar to the right, or movement of the slide 45 away from the,
35 mandrel, will cause the crown to be stripped from the extensions 37 by the stripper bars 57. The crown will then roll down the slide-way 58 into a suitable receptacle.

In Fig. 8, I have shown rolling apparatus
40 similar to that just described, but the crown and the rollers are rotated about vertical axes instead of on horizontal axes. In this arrangement, a rubber block 42^a may be mounted upon a suitable rotatable support. Rollers
45 53^a are mounted in a suitable support and are carried by plungers 52^a that are radially movable as in the manner shown in Fig. 5 and have rolling movement about the periphery of the mandrel. The mandrel 30^a has a head structure similar to that of Figs. 9 to 12. Stripper bars 57^a are provided for stripping the crown from the mandrel head when the mandrel is being elevated. Either the mandrel 30^a, or the block 42^a and the roller carriage may be rotated and the rollers will be moved longitudinally of the mandrel by a screw 47^a. The body portion of the crown is of oval form in cross section at the completion of the rolling operation, as will be apparent from a view of Fig. 12, but the oval
60 formation is preferably somewhat less pronounced than desired for the completed crown. The partially-formed crown is then placed upon a bottom die block 60 as shown
65 in Figs. 13 to 15 and between lateral dies 61.

The bottom die 60 is recessed to permit formation of the completed occlusal surface and the lateral dies have recesses that are of semi-oval form, whose longer axes are of slightly greater length than the longer axis of the partially-formed crown 26, as will be apparent from inspection of Fig. 3. Upon closure of the dies 61, the shorter diameter of the crown will be reduced and its longer diameter increased. Such increase of diameter will cause the crown to snugly fill the recesses in the lateral dies, without being pinched between opposing surfaces of the dies. The dies 61 are operated by a handle 62 that is connected to one of the dies, such die block
70 being connected to the other die block through links 63 and levers 64. The levers 64 are mounted on fixed pivots 65 and are pivotally connected at their inner ends to one die block 61. The handle 62 is mounted on a fixed pivot 66 and its inner end pivotally connected to the other die block 61. It will be seen that when the handle 62 is oscillated about its pivot 66, its associated die block 61 will be moved laterally and that the links 63 and levers 64 will be simultaneously moved to effect movement of the other die block 61, so that the die blocks 61 will both be symmetrically moved with respect to the bottom die 60 and the crown evenly compressed.
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In order to cause the crown to assume its final contour (that of a natural tooth including its depressions and protuberances) within the dies 60 and 61 and to remove any irregularities which may be present, as through distortion of the occlusal portion during the rolling operation, I provide a fluid pressure head 67 that is brought into engagement with the upper sides of the dies 61 and against the open end of the crown. Liquid or air, under pressure sufficient to expand the crown, is then admitted through the head 67. After completion of the expanding operation and removal of the crown, the upper edge thereof may be trimmed to properly finish the same or to secure the desired length of crown. The gingival or upper portion of the crown may be made of such length as to allow considerable trimming in order to permit the blanks to be formed into crowns of various lengths.
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While I have herein described the blocks 28 and 42 as being preferably of relatively soft material such as fiber, they may be of metal or any other suitable material. Furthermore, the lateral dies of Fig. 13 need not both be movable, and a series of such dies could be mounted in a multiple arrangement to be served from a common source of fluid supply and operated in unison to permit formation of a number of crowns simultaneously.
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While the drawing discloses a tooth having the general appearance of a bicuspid, various portions of the apparatus can obviously be so altered as to form molars.
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I claim as my invention:—

1. The method of making dental crowns which consists in forming an occlusal surface upon a cartridge-like blank and shaping a portion of the blank to oval form in cross section by a rolling operation.

2. The method of making dental crowns which consists in forming an occlusal surface upon a cartridge-like blank and reducing the diameter of a portion of the blank by a rolling movement directed circumferentially thereof, simultaneously upon a plurality of circumferentially spaced points.

3. The method of making dental crowns which consists in forming an occlusal surface upon a cartridge-like blank and shaping a portion of the blank to oval form in cross section by rolling movement directed circumferentially and longitudinally thereof.

4. The method of forming dental crowns which consists in shaping the closed end of a cartridge-like blank to form an occlusal surface and shaping the remaining portion of the blank to oval form in cross section and of tapering form toward its open end, by rolling the same.

5. The method which comprises reducing the diameter of a body portion of a cartridge-like blank by imparting a rolling operation thereto in directions circumferentially and longitudinally thereof, the radial pressure being yieldable.

6. The method of making dental crowns which consists in forming an occlusal surface upon a cartridge-like blank, reducing the diameter of a portion of the blank by a rolling operation, and thereafter expanding the blank under fluid pressure within a die having the contour of a finished crown.

7. The method of forming dental crowns which consists in imparting a preliminary formation to a blank by indenting the closed end thereof, reducing its diameter at points removed from said end, by a tool movable circumferentially and longitudinally thereof, and expanding the blank within a die having the contour of a finished crown.

8. The method of forming dental crowns which consists in imparting a preliminary formation to a blank by indenting the closed end thereof, reducing its diameter at points removed from said end by inserting a die into the blank and pressing the crown against the die by a tool movable circumferentially thereof, and thereafter expanding the blank within a die having the contour of the finished crown.

9. Apparatus for forming dental crowns comprising a collapsible mandrel head that tapers rearwardly and a roller movable circumferentially of said head, and means for moving said roller longitudinally of the head during its circumferential movement.

10. The method of making dental crowns which consists in shaping a cartridge-like

blank to oval form in cross section by a rolling operation, and thereafter further shaping the blank to complete the formation of a crown.

11. The method of making dental crowns which consists in forming an occlusal surface upon a cartridge-like blank and reducing the diameter of a portion of the blank by a rolling operation, and thereafter expanding the blank within a die having the contour of a finished crown.

12. Apparatus for forming dental crowns comprising a mandrel form composed of segmental portions which, when expanded, present substantially a continuous annular periphery, means for moving one mandrel section longitudinally and radially of the other sections to permit collapsing of said sections, and a member movable circumferentially of the mandrel for compressing a crown blank against the same.

In testimony whereof I, the said JACOB PETRY, have hereunto set my hand.

JACOB PETRY.