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BEZEL DOP AND GRINDING DEVICE

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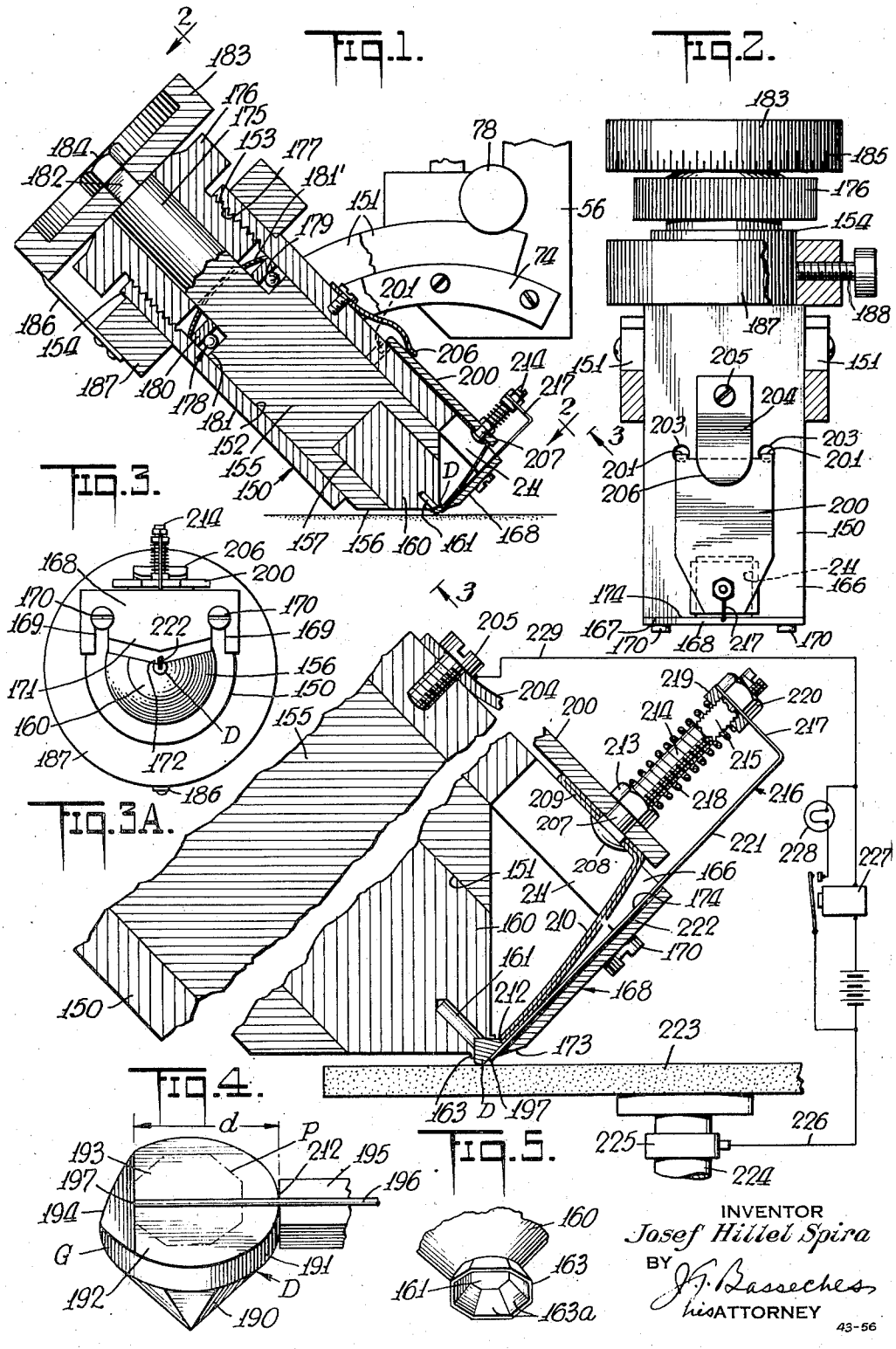

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BEZEL DOP AND GRINDING DEVICE

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13 Claims. (Cl. 51—229)

1

This invention relates to the field of grinding or cutting facets upon gems, and more particularly to a dop for the formation of the crown or bezel facets, and to a method of forming the crown or bezel facets.

This application is a continuation-in-part of my application Serial No. 437,056, filed March 31, 1942, entitled Method for polishing or forming facets on gems, diamonds or the like, and apparatus therefor, now Patent No. 2,393,939, issued January 29, 1946.

In my prior application aforementioned, I have described and claimed a novel workholder or dop for the formation of the crown or bezel facets whereby mechanically held stock may be axially mounted, and by indexing the gem stock in the holder, the bezel or crown facets may be formed thereon by reason of the novel process I have devised.

Briefly, in my prior application, the process involves forming a bruted stock with a generally cylindrical portion axially disposed to the table forming portion of the gem, then forming the pavilion or base facets about an axial line perpendicular to the table of said stock, thereby providing an axial line of reference determined by the pavilion or base facets and the table, whereby the bezel or crown facets may then be accurately and symmetrically formed thereon.

While I have found that with the larger gems, say twenty or less to the karat, my holder or dop for the formation of the crown or bezel facets serves adequately for its intended purpose, I have found it economically unsuitable in my endeavor to extend the procedure to gems of the smaller sizes, such as, for example, twenty or more to the karat.

I have also found in the use of the crown or bezel dop of my aforementioned application that whether the small or large gems are employed, there are also other economic losses involved in the wear and tear in replacing the table engaging member, due to the close clearances entailed in the contact of the face of the table and its engaging member.

Accordingly, my present invention is directed to an improvement of my prior invention, and has for its object the provision of a holder or dop for the formation of the crown or bezel facets, whereby the grinding of small gems is made possible more economically than heretofore attainable, with accuracy in the formation of the crown or bezel facets, and with substantially the same accuracy in the shape and number of the facets, to secure the highest degree of brilliancy in the gem, in a manner heretofore deemed uneconomical in respect of the so-called small gems, and with unusual accuracy in the formation of the larger gems, so that the employment of unusually skilled labor is avoided.

2

It is a further object of my invention to provide a crown or bezel facet forming assembly whereby the crown and bezel may be quickly and economically formed, with accuracy, requiring minimum inspection and with little disturbance caused by the wear of the parts of the contrivance due to the abrasion on the metal parts in working with diamonds.

It is a further object of my invention to provide a workholder or dop for the formation of the crown or bezel facets in which this highly inaccessible portion of the gem may be worked accurately and facilely, without specially skilled labor, notwithstanding inaccuracies due to the normal wear and tear of metallic parts in handling material of the hardness of diamonds.

It is still further an object of my invention to provide an improved method for grinding and polishing the bezel or crown facets accurately to secure the maximum optical properties of the gem, while avoiding the laborious use of cements in the dop, by employing a mechanical means for holding the gem in position, in an indexing device.

Other objects of my invention reside in the provision of a workholder for small objects, whereby surfaces in the nature of facets, may be ground thereon symmetrically about the object, such as in forming the crown or bezel facets, without any disturbing factor due to eccentricity which might occur, especially in mounting in the workholder the so-called small gems of twenty or more to the karat, where purchase or holding surfaces are exposed to the minimum, and axial positioning experiences considerable difficulty.

Still further objects of my invention reside in the provision of electrically controlled means for automatically signalling the completion of a facet-forming operation, whereby polishing operations may be economically practiced.

For the attainment of these objects and such further objects as may appear herein or be hereinafter pointed out, I make reference to the accompanying drawing forming a part of this application in which:

Figure 1 is a longitudinal sectional view of a workholder or dop for the formation of the crown or bezel facets, and a fragmentary portion of its mounting assembly;

Figure 2 is a side elevation taken in the direction of lines 2—2 of Figure 1;

Figure 3 is an end elevation taken in the direction of lines 3—3 of Figure 1;

Figure 3A is a longitudinal sectional view of Figure 1, magnified to show the nose portion and connection to the wiring system;

Figure 4 is an enlarged perspective view of a detail showing the contacting element in position;

Figure 5 is an enlarged perspective view of the pavilion engaging cone.

Making reference to the drawing, my invention is particularly valuable in connection with the dop or workholder for forming the crown or bezel facets shown and described in my prior application aforementioned, wherein a sleeve 150 is provided with spaced arcuate bearings 151—151 corresponding exactly to the spaced arcuate bearings 74 mounted upon the block 56, and arranged to be held by the set screw 76 in various angular positions, as more specifically described in my prior application. The sleeve 150 is formed with a boring 152, which is screw-threaded at 153, adjacent the end 154. A shaft 155 is provided to fit within the boring 152, and has at one end thereof, 156, a cup 157, within which is nested the pavilion engaging adapter 160. This adapter comprises a boring 161 of cylindrical contour. I prefer to make the apex 163 somewhat flared out, shown more clearly in Figure 5, by swaging the same with a punch or die pyramidally contoured with the same number of sides 163a as the pavilion facets of the gem to be formed.

Since, in accordance with my present invention, it is most adaptable to diamonds of the smaller sizes, such as twenty or more to the karat, commonly provided with eight facets, the punch used for making the flared seat 163 is an octagonal pyramid. The adapter 160 and the cup 157, arranged to receive the same, may however take the shape and contour of that shown in my prior invention, wherein the seat 163 need not be flared or faceted.

As in my prior invention, the slope of the conically formed adapter is calculated to be less than the angle of any bezel facet which terminates at the girdle of a gem, in relation to the axial line through the gem, thereby providing adequate clearance in the formation of the facets above the girdle in the crown or bezel forming portion of the gem. To adapt the holder or dop in Figures 1 to 3 to various sizes of gems, graduated sizes of adapters 160 are provided, each formed with different size orifices 161, but having the shank thereof to fit within the cup 157.

The sleeve 150 is formed with an extension 166 providing an edge 167, over which is mounted a plate 168. The plate 168 is provided with slots 169, through which the screws 170 are disposed, locking the plate 168 in position for variable movement to and from the axial line through the sleeve 150. The plate 168 is formed with an angularly directed lip 171, the apex 172 whereof terminates adjacent the axial line of the sleeve 150 and the adapter 160 fitted in the cup 157 thereof. The lip 171 of the plate 168 has a tapered section 173 and a generally flat face 174 on the inner surface thereof. This flat face 174 is directed to lie at right angles to the axial line through the sleeve 150, and the adapter seated in the shaft 155.

The shaft 155 has a neck portion 175 which carries a collar 176, having a screw-threaded portion 177 to interfit with the screw threaded section 153 of the sleeve 150.

Mounted upon the neck 175 I provide an antifriction thrust bearing 178 in the form of a ball race 179, positioned between the pressure washer 180 and the shoulder 181. A spring washer 181' is positioned between the screw-threaded portion 177 and the pressure washer 180. The neck 175 has a shank 182, preferably square or formed with a keying surface to receive the hand wheel 183 for positive rotation of the neck 175. The handwheel is held in this last position by the nut 184, engaging a threaded extension of the shank 182.

The hand wheel 183 is preferably indexed on its rim 185 to designate the indexing or axial position in relation to a pointer 186 mounted upon a sleeve 187. The sleeve 187 may be adjusted upon the neck 154 of the sleeve 150 by the set screw 188, to secure an adjustable zero reading.

As in, and in accordance with, my prior invention, the procedure in the polishing of the diamond involves forming the bruted stock as the initial operation, then forming the pavilion facets upon the bruted stock of the gem thus provided.

The invention of my present application is directed to the formation of the crown or bezel facets, and for this purpose I have illustrated in Figure 4 a perspective view of the bruted stock D, showing the pavilion facets 190 formed thereon, with the bruted cylindrical section 191 remaining and exposing the table forming face 192.

With stock at this stage of the operation, I position the pavilion 190 of the bruted stock D into engagement with the orifice 161 within the faceted lip 163 formed on the adapter 160, so as to nest the same therein, with the pavilion facets 190 interfitting the facets of the lip 163, formed on the adapter, as previously described. The table forming facet 192 is then brought in contact with the face 174 of the plate 168, adjustment of which is made through the medium of the screws 170 to axially position the apex 172 (see Figure 3) to coincide this apex as closely as possible to the axial line of the stock D.

By reason of the internesting of the pavilion facets 190 with the facets of the lip 163 formed on the adapter 160, increased frictional contact is assured as the indexing rotation of the holder 155 is effected, and maximum pressure may be maintained between the plate 168 and the adapter 160, to secure the greatest degree of axial positioning of the stock D within the adapter 160, by reason of the flared seat provided by the lip 163 and the facets formed thereon.

With smaller gems, of twenty and more to the karat, the close tolerances which are utilized for the larger gems are in reality relatively large discrepancies, and result in proportionately large displacement in the axial position of the stock D, even though initial dimensions are of small magnitude.

While to the critical and highly skilled operator, symmetry of facets may be secured by constant inspection in working with the larger gems, the production of smaller gems entails a disproportionately higher degree of skilled laber because of the inaccuracies which may be encountered, as eccentricity of positioning becomes magnified due to the small sizes of stock in work.

I have discovered that the constant dimension provided by the perimeter at the girdle may be availed of to secure more or less automatic formation of the bezel or crown facets, despite the relatively large factor of error which may cause eccentricity or non-coincidence between the axial line of the gem and the axial line through the sleeve 150, due to the fact that operation is necessitated with the rather small stock of twenty or more diamonds to the karat.

Thus, by reference to Figure 4, it will be apparent that the table 193 is formed from the bruted stock D and may have the facets 194 formed thereon, by progressively forming the regular polygonal outline P shown in dotted lines which, in this instance, is an octagon, by segmentally grinding angularly from the table forming portion 192 toward the generally cylindrical girdle

191 to form the frustum of a pyramid, with the main or larger base adjacent the girdle and the upper base or smaller base coincident with the surface of the table forming face 192.

By retaining the angular position or slope to leave remaining during grinding a portion adjacent the girdle 191 cylindrical and unmodified, it will be apparent that the distance *d* between the perimeter of the girdle G and the chord lying in the surface table, and which forms the side of a regular polygon, is a constant.

Thus, by maintaining the rectangular gauge face 195 tangentially to the girdle 191 at its perimeter, and axially extending a pin 196 at right angles thereto, its end 197 may be utilized to measure or to gauge the distance *d*.

For convenience of reference, I will refer to the distance *d* set off by the end 197 and the gauge face 212 as the "differential bi-apothem," which may be defined as the distance measured in the upper base of a frustum of a regular pyramid extending normally and diametrically from one side of the regular polygon there defined to the point of intersection of a plane parallel to the axis and tangential to a circle circumscribing the regular polygon in the lower base.

It will also be observed that symmetry of the crown or bezel facets is assured as long as the differential bi-apothem remains constant in the formation of facets upon the crown bezel, with a regular polygon adjacent the table of the gem, regardless of the possible eccentricity of the diamond stock in relation to the axis of the dop.

With this premise, I will now refer to the views wherein I provide a gauge holder 200 comprising a generally rectangular plate, one end of which is provided with fingers 201—201, inwardly turned to seat in orifices 203—203 formed in the sleeve 150. A spring clip 204 is anchored by a screw 205 at one end. The free end 206 resiliently presses down upon the holder 200, thereby permitting pivotal movement of the gauge holder 200. The free end of the gauge holder 200 is provided with a bolt 207, having a riveted head 208, which clamps the L-shaped leaf 209 to the holder 200. The L-shaped leaf 209 has a branch 210 which projects through an orifice 211 formed in the extension 166. The branch 210 terminates into a rectangularly shaped bearing end or gauge face 195, which is arranged to be urged by the spring clip 204 to contact the perimeter of the girdle of the stock D.

For convenience, the gauge face 212 will be referred to as the girdle contact and the pin end 197 will be referred to as the control contact 197.

The bolt 207 previously described is fixed to th plate 200 by the nut 213, and along the shank 214, the bolt is formed with a longitudinal slot 215.

With the construction just described, there is then provided an L-shaped fine spring steel wire 216, of which the shorter branch 217 is disposed in the slot 215 by first mounting a coil spring 218 on the shank 214 of the bolt, thereupon positioning a washer 219 and gripping the branch 217 in position by the nut 220.

The longer branch 221 extends against the face of the plate 174, which is formed with a groove 222 deeper than the wire to center the free end and provide the control contact 197 previously mentioned. The branch 221 is held in the groove 222 by the branch 210, to slide freely within the groove, notwithstanding any pressure which the face 174 may exert upon the table 192 of the stock diamond D.

It will thus be seen that a variable dimension may be secured between the free end 212 of the leafs 209 and the control contact 197 which may be extended to bear upon the table 193 of the stock D when guided in the groove 222. The contact 197 projects beyond the apex 172 of the plate 168 and therefore "leads" in its contact to the turn table or skeif 223.

The turn table or skeif 223 is usually made of cast iron upon whose face diamond dust is provided for the polishing or facetting operation. as will be understood by the worker in the art. The shaft 224 thereof carries a commutator 225, making contact with the conductor 226 leading to a make and break device 227, which actuates a signalling or like device 228, then leading through the conductor 229 connected to the set screw 205 on the sleeve 150. It will be apparent that the circuit will be completed or made when the control contact 197 comes in contact, or reaches a predetermined closed circuit making position with the skeif 223.

Having now described the installation, the operation of the mechanism is as follows: The bruted stock D with the pavilion facets 190 already formed thereon, is positioned upon the adapter 160 to have the pavilion facets in contact with the facets of the flared seat 163, formed in the adapter 160, exposing the table 193 and the cylindrical section G. The plate 168 with the branch 221 fitted within the groove 222 is then availed of to seat the stock D in position, care being taken to nest the facets 190 and those on the flared seat 163 into contacting engagement, and to press the surface 174 against the table forming portion 192.

The branch 221 should be free to move in the groove 222.

Pressure is then applied by the collar 176 to grip the gem firmly in the dop. When in this position, the branch 210 is then brought into contact with the bruted girdle or cylindrical perimeter 191. The thickness of the branch 210 is calculated to exceed the height or altitude of the cylindrical perimeter 191 and the layers forming the branch 210 may be laminated or built up, or diminished, in accordance with the height of this cylindrical perimeter.

With the stock D so positioned, by manipulation of the nut 220, the control contact 197 is brought into the position which it is desired to have, outlined on the table forming face 192 by the regular polygonal outline P. The dop is thereupon mounted on the block 56 and the angularity of the dop is adjusted in respect of the turn table or skeif 223, to form the facet 194. This angular position is one which will assure a remnant of the circular perimeter 191 and which, of itself, will be completely circular and which will be in constant contact with the gauge face contact 195, previously mentioned, and referred to as the girdle contact.

Upon effecting the grinding operations, the assembly gravitates or moves under pressure with the diamond in contact with the surface of the turn table or skeif 223. This operation progressively brings the control contact 197 into closer position in respect of the skeif, to complete the signal circuit when the proper depth of cut has been reached.

The assembly is then conveniently raised, and then the hand wheel 183 may be indexed preparatory to cutting the next facet. The same operation is then repeated in accordance with the number of facets outlined by the regular polygon

P, without any other adjustment of the control contact.

It will be observed that in view of the fragment of circular contour left at the periphery 191, the assembly automatically serves to provide a symmetrical formation of the facets despite any eccentricity of the stock D on the dop or holder, since the measurement, so to speak, is made by reference to the perimeter 191 and not by reference to the axial line of the dop.

Thus, it will be seen that this arrangement provides means to predeterminedly "measure off" the distance *d* on the differential bi-apothem, which is also the major diametric chord intersector in reference to the chordal position of the facet edge terminating in the table 193.

It will also be observed that by this arrangement the wear and tear on the nose of the adapter 160, due to the difference in hardness of the diamond stock D and the material of which the adaptor 160 is made, does not critically affect the installation.

Eccentricity due to this type of wear is compensated for by the control as determined by the differential bi-apothem measurement.

The utilization of an anti-friction spring fed thrust bearing serves to press the stock D against the plate 168, with pressure permitting of the rotative indexing operation, without the necessity for releasing the grip upon the stock in moving from one indexing position to another. This is peculiarly valuable in connection with the measurement gauge provided by this installation.

While I have described that the workholder or dop and the measurement gauge are peculiarly valuable in forming the crown facets where the diamonds run twenty or more to the karat, it is to be understood that the same principle is involved in the faceting of larger stock material, where the faceting operation may be performed with unusual uniformity and more or less automatically, so that a single workman may supervise a number of machines simultaneously.

It will also be understood that while I have described and set forth an arrangement for securing the most desirable results by employing the complete assembly, novelty is attributed to the use of segregated parts of the installation, as more specifically set forth in the appended claims.

Having thus described my invention and illustrated its use, what I claim as new and desire to secure by Letters Patent, is:

1. In a dop provided with means for rotationally mounting a gem with the girdle portion exposed, the combination comprising a girdle guide movable during rotation of the gem in accordance with any eccentric location thereof, a contact arranged to diametrically extend across said gem, said contact being mounted to move in synchronism with said guide whereby to gauge the distance for cutting a facet on said gem.

2. In a dop for faceting the bezel of diamond stock having a pavilion segment, a table and a generally cylindrical segment providing a girdle, a mechanical dop having opposed seats for engaging said pavilion and table including a body portion in which one of said seats is journalled for indexing, an electrical signalling system therefor, the combination of means to gauge the depth of the facet to be formed including a contact arranged to lie on the girdle of the diamond, a carrier for said contact mounted on said body, including means on the body for resiliently maintaining the contact in engagement with said girdle, a facet edge limiting control contact coupled to said girdle contact extended toward the opposite side of said girdle whereby the portion of said control contact is made constant irrespective of eccentricity of said diamond stock by the indexing means, whereby the differential bi-apothem may be gauged during indexing, and electrical conductor means for connecting said contacts in said signal indicating system.

3. In a dop for faceting the bezel upon stock having a pavilion segment and a table forming portion outlining therebetween a girdle forming portion, said dop including opposed seats for said pavilion and table, means for rotating said pavilion engaging element including indexing means, gauge means including a portion urged in contact with said girdle and extending diametrically from said girdle adjacent a portion of the stock to have a facet formed thereon, means on said table engaging seat for guiding said gauging means slidably in relation thereto whereby said gauging means is slid in any eccentric movement of said stock during indexing.

4. A dop for holding bruted gem stock for faceting the same comprising a body portion, a pavilion seat and a table engaging seat axially disposed from said body, and means for journalling said pavilion seat whereby said stock may be indexed while held between said seats, in combination with means for gauging the differential bi-apothem including means on said body supporting a girdle contact resiliently, a control contact diametrically disposed with relation to said stock and guided in said table seat, means for adjustably positioning the girdle and control contacts in relation to each other whereby the predetermined depth of facet may be formed irrespective of any eccentric indexing of said stock.

5. In a diamond holder or dop, a seat against which a diamond is held, a guide on the holder, a feed member adjustable along said guide, a contact finger at one end of the feed member and projecting from said guide, and adapted to have its end located in a predetermined position relative to a diamond held against the seat, spring means engaging said feed member and acting to urge the finger toward the diamond, and at least one adjusting member on the feed member to determine the extent to which the finger is urged by the spring means toward the diamond, to indicate a point to which the diamond shall be ground.

6. In a diamond holder or dop as called for in claim 5, including signalling means, an electric circuit for actuating said signalling means, the diamond holder being so connected in said circuit together with the polishing wheel against which it holds the diamond, that contact of the finger with said wheel will close the circuit, to actuate the signalling means.

7. A dop for faceting a gem having a generally cylindrical segment and a pavilion segment including opposed members, one for engaging the table forming portion of the gem, the other including a seat for engaging the pavilion forming portion, means for directing said members toward each other to bind said gem and to expose the girdle forming portion adjacent the bezel of said gem and means for angularly directing said dop and holding it for rotatably exposing said girdle forming portion in combination with a gauging element carried by one of the members including a portion to contact the girdle forming portion and extending to a point indi-

cating the extent of the differential bi-apothem whereby said point may serve to indicate the depth of cut of the facet.

8. In a diamond or the like polishing device including a dop for holding a bruted diamond stock defined by a generally cylindrical segment terminating in a table and a pavilion, said dop comprising the combination of a body portion, an axial member journalled therein, a seat on said member for engaging the pavilion of said diamond, an extension from said body including a plate for engaging the table of said diamond, means for supporting said dop to direct the girdle forming portion to the polishing surface, an element carried by a portion of the body contacting the girdle forming portion and having another portion extending diametrically across said gem to be polished to expose a contact portion spaced from the girdle contacting part and to contact the stock to outline the differential bi-apothem, and to indicate on the stock the terminal edge of a facet, signalling means, an electrical circuit for actuating said signalling means, said contact being connected in said circuit so that predetermined contact of the element with the polishing wheel against which the diamond is held will actuate the signalling means.

9. In a diamond or like gem facet polishing device including the combination with the dop for forming the facets by holding the gem to expose the girdle portion adjacent a polishing surface of a lap and to form the facets adjacent the girdle comprising means to rotate the gem to index it for the facets to be formed, including means to mount the dop and the polishing surface with respect to each other, of a gauge having a portion for contacting the girdle of the stock, and means for mounting said gauge to yieldingly urge said portion into contact with the girdle during indexing of the gem, and another portion of the gauge to contact the stock to outline the differential bi-apothem to indicate on the stock the terminal edge of a facet and the distance to feed the stock and polishing surface with respect to each other.

10. In a diamond or like gem facet polishing device including the combination with the dop for forming the facets by holding the gem to expose the girdle portion adjacent a polishing surface of a lap and to form the facets adjacent the girdle comprising means to rotate the gem to index it for the facets to be formed including means to mount the dop and the polishing surface with respect to each other, of a gauge having a portion for contacting the girdle of the stock, and means for mounting said gauge to yieldingly urge said portion into contact with the girdle during indexing of the gem, and another portion of the gauge to contact the stock to outline the differential bi-apothem to indicate on the stock the terminal edge of a facet and the distance to feed the stock and polishing surface with respect to each other, and signalling means to indicate when the gauged distance has been so fed.

11. In a dop for a bruted gem stock having a pavilion segment, a bezel forming segment and a girdle formed thereon, said dop including means for holding the gem stock upon a seat including indexing means for rotatively applying said gem stock upon a polishing lap surface, the combination of means to gauge the stock to indicate on the stock the terminal edge of a facet in the indexing positions of the stock, said gauging means including a portion contacting the girdle of the stock and including another portion extending diametrically across the gem stock and toward the facet to be formed, to have an end of the latter named portion indicate on the stock the terminal edge of the facet, a signalling device, an electrical circuit for actuating said signalling device, said portion extending diametrically across said stock being connected in said circuit of said device so that contact of the said end with the polishing lap against which the gem is held will actuate the signalling means.

12. In a dop for a bruted stock having a table forming portion, a generally cylindrical segment and a pavilion forming portion, stock holding means comprising opposed seats on said dop, each having means for engaging the table and pavilion and including means for journalling said holding means for rotatably mounting the stock, means for indexing said stock in accordance with the number of facets desired, the combination of gauging means having oppositely spaced portions, one portion of which has a contacting area which rides on the said cylindrical segment, the other portion of which extends diametrically across the stock to outline on the stock the limits of the side of a facet coincident with the differential bi-apothem which is positioned to contact a grinding lap when a facet is completed, signalling means, and a connection between said signalling means and gauging means for indicating said contact.

13. In a diamond holder or dop for faceting gems including means for holding the gem against a polishing surface and axially adjustable on said dop for indexing, and with the girdle exposed to facet the gem circumferentially adjacent the girdle and to one side thereof, the combination comprising a gauge having a portion for contacting the girdle of the gem stock and means for mounting said gauge, yieldingly to urge said portion into contact with the girdle of the gem during the indexing of the dop and another portion of the gauge to contact the stock to outline on the stock the terminal edge of a facet and the distance to feed the stock and polishing surface with respect to each other, and signalling means to indicate when the gauged distance has been so fed.

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