S. M. SCHENKEIN & O. P. R. LEHMANN.

GEM POLISHING MACHINE.

APPLICATION FILED MAR. 17, 1913.

1,166,006.

Patented Dec. 28, 1915.

5 SHEETS—SHEET 1.

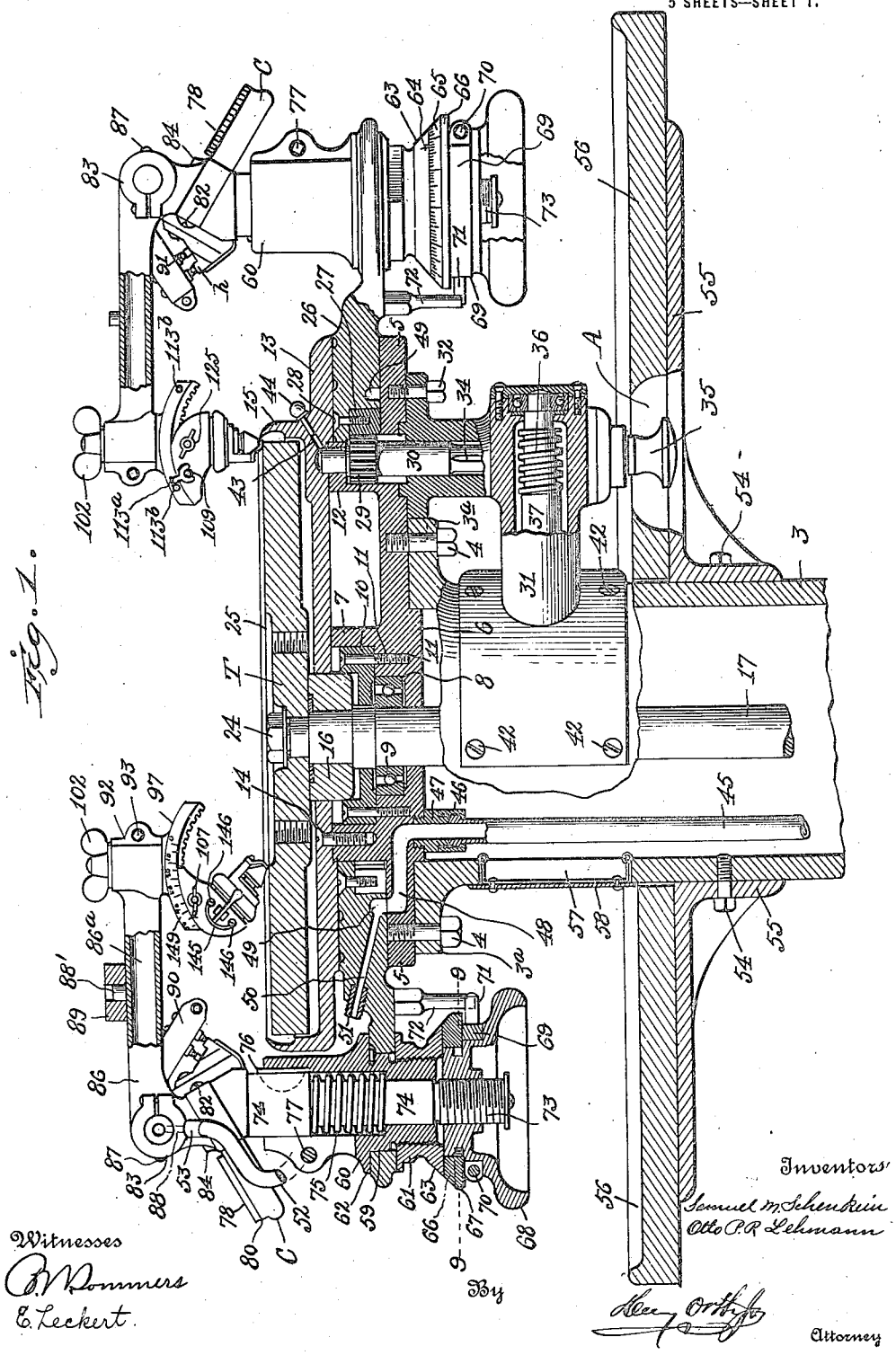


Fig. 1.

Witnesses

C. V. Bommers

C. Leckert.

Inventors

Samuel M. Schenkein

Otto P. R. Lehmann

By

Attorney

S. M. SCHENKEIN & O. P. R. LEHMANN.

GEM POLISHING MACHINE.

APPLICATION FILED MAR. 17, 1913.

1,166,006.

Patented Dec. 28, 1915.

5 SHEETS—SHEET 2.

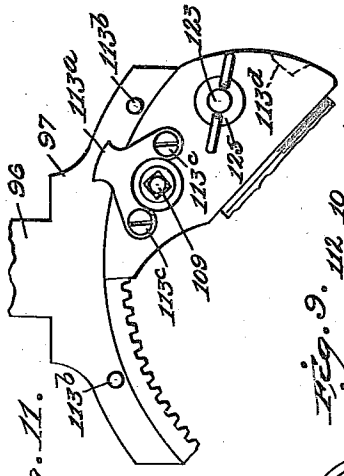


Fig. 11.

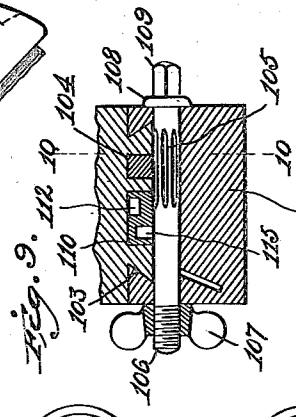


Fig. 9.

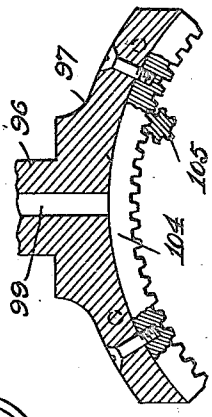


Fig. 10.

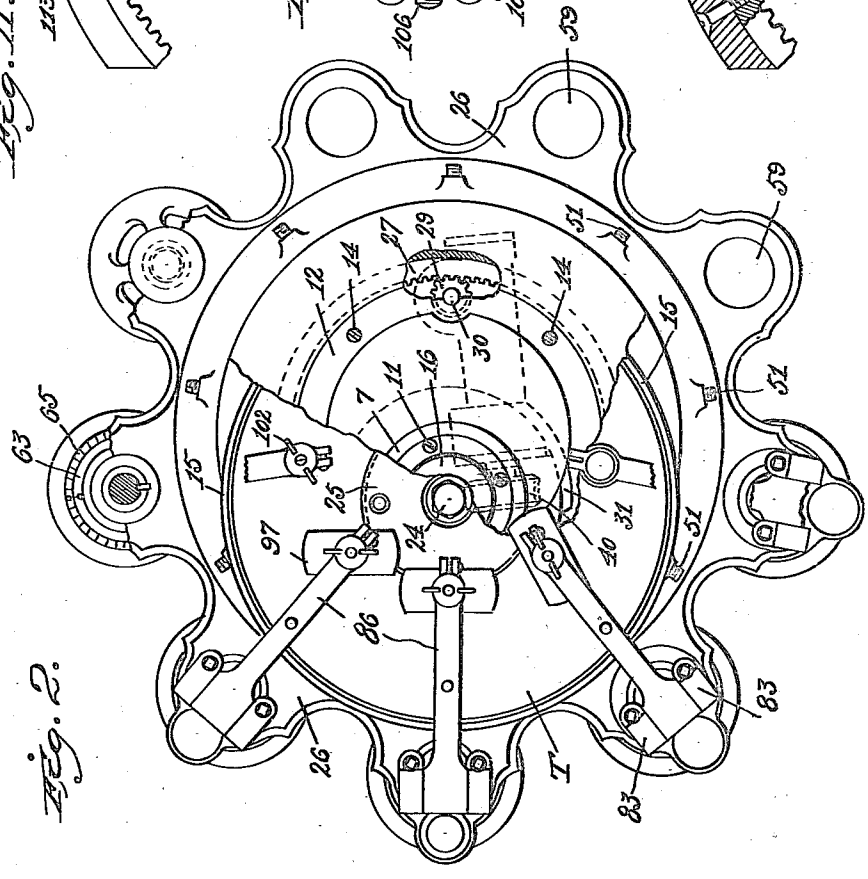


Fig. 2.

Witnesses

O. V. Sommers

E. Leckert

Inventors

Samuel M. Schenkein

Otto P. R. Lehmann

By Henry Orth Jr.

Attorney

S. M. SCHENKEIN & O. P. R. LEHMANN.

GEM POLISHING MACHINE.

APPLICATION FILED MAR. 17, 1913.

1,166,006. Patented Dec. 28, 1915.

5 SHEETS—SHEET 3.

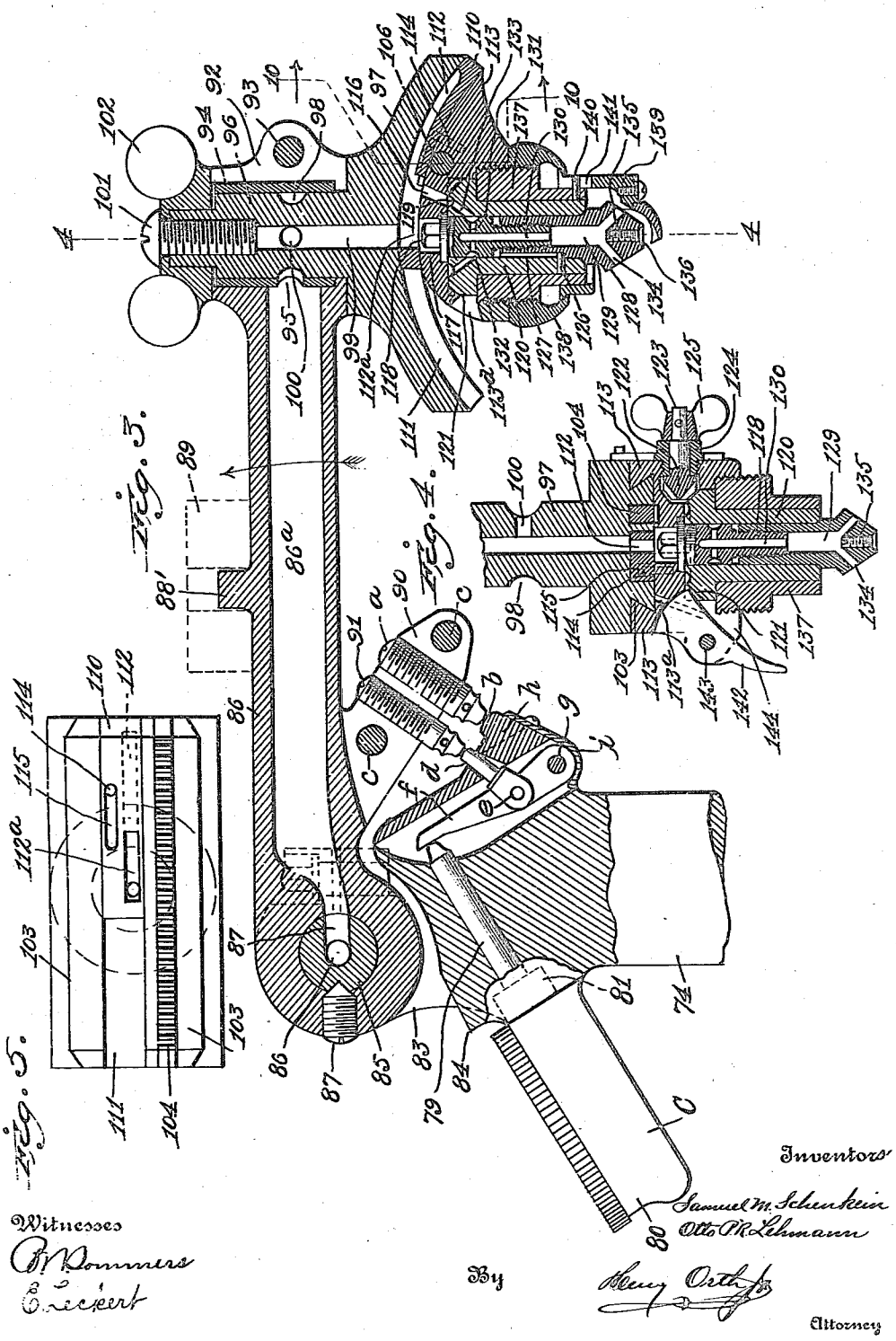


Fig. 3.

Fig. 4.

Fig. 5.

Witnesses

P. Bommers

E. Reichert

Inventors

Samuel M. Schenkein

Otto P. R. Lehmann

By Henry Orth & Co.

Attorneys

S. M. SCHENKEIN & O. P. R. LEHMANN.

GEM POLISHING MACHINE.

APPLICATION FILED MAR. 17, 1913.

1,166,006.

Patented Dec. 28, 1915.

5 SHEETS—SHEET 4.

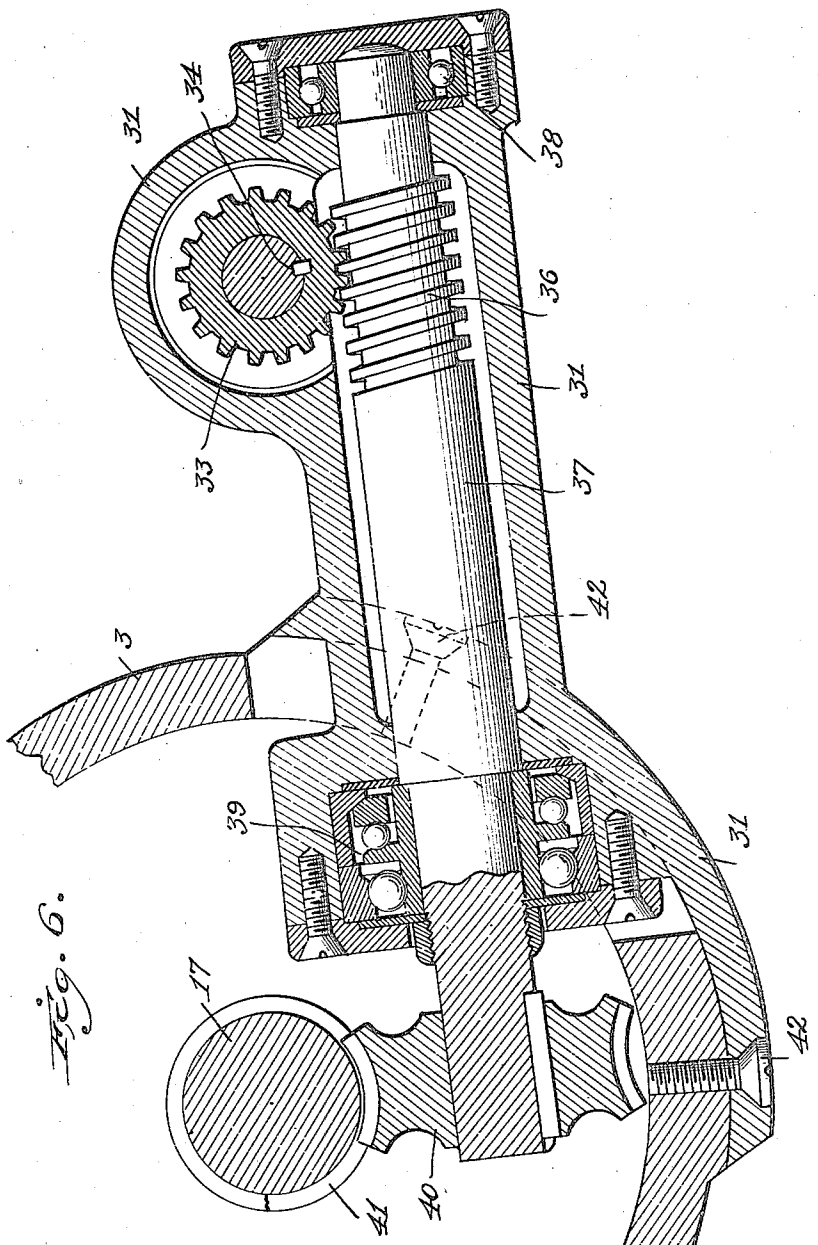


Fig. 6.

Witnesses
P. Dommers.
E. Liebert.

Inventors
Samuel M. Schenkein
Otto P. R. Lehmann

By Henry Orth Jr.

Attorney

S. M. SCHENKEIN & O. P. R. LEHMANN.

GEM POLISHING MACHINE.

APPLICATION FILED MAR. 17, 1913.

1,166,006. Patented Dec. 28, 1915.

5 SHEETS—SHEET 5.

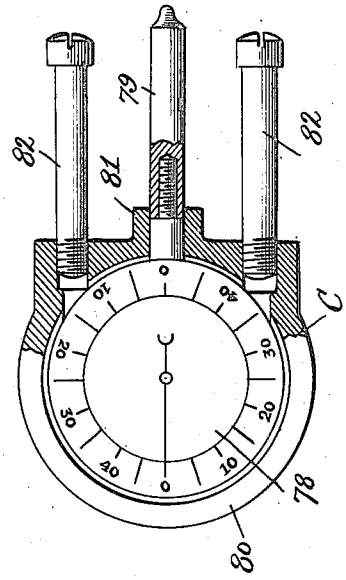


Fig. 7.

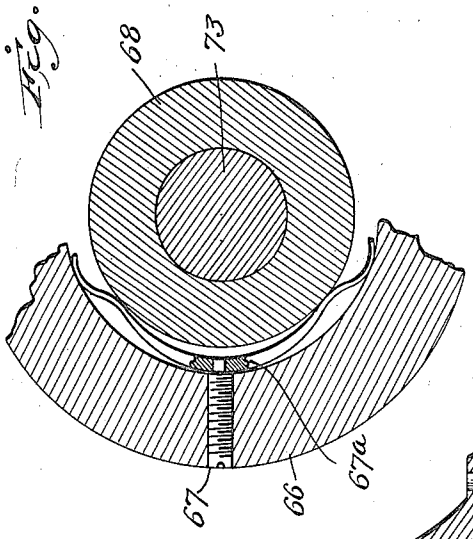


Fig. 8.

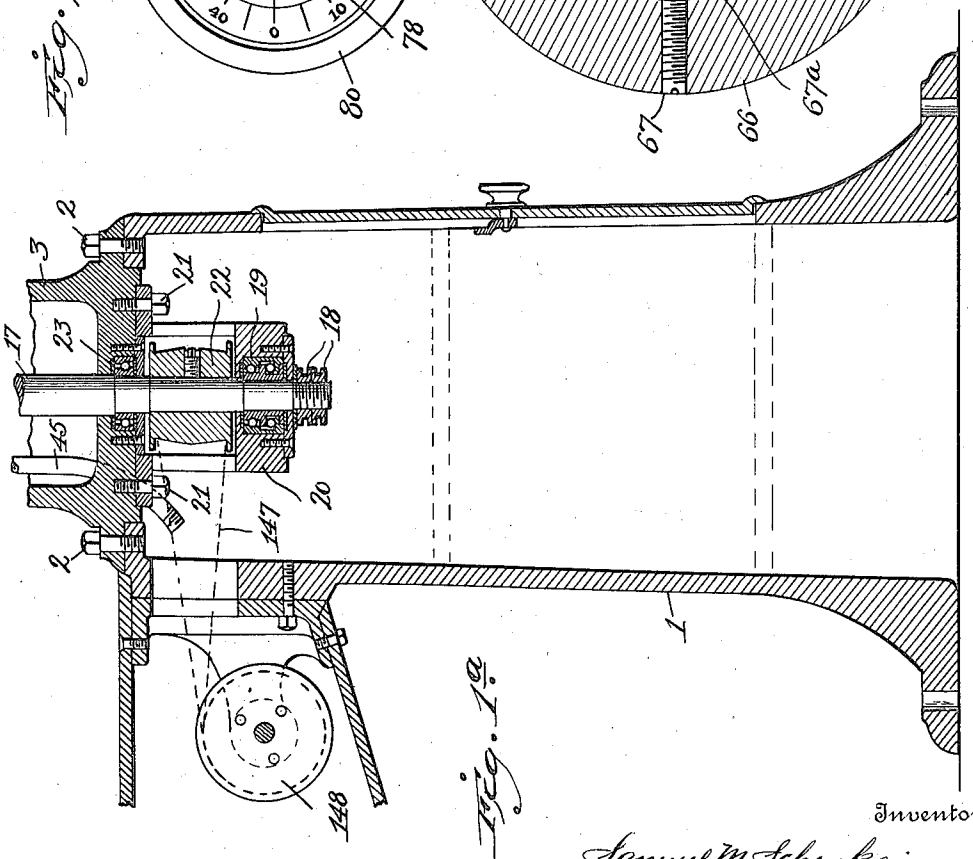


Fig. 1a.

Witnesses
P. Dommers
E. Leckert.

Inventors
Samuel M. Schenkein
Otto P. R. Lehmann

By Henry Orth & Co.

Attorney

UNITED STATES PATENT OFFICE.

SAMUEL M. SCHENKEIN AND OTTO P. R. LEHMANN, OF NEW YORK, N. Y.; SAID LEHMANN ASSIGNOR TO SAID SCHENKEIN.

GEM-POLISHING MACHINE.

1,166,006. Specification of Letters Patent. Patented Dec. 28, 1915.

Application filed March 17, 1913. Serial No. 754,998.

To all whom it may concern:

Be it known that we, SAMUEL M. SCHENKEIN, a citizen of the United States, and OTTO P. R. LEHMANN, a subject of the Emperor of Germany, both residing in the city of New York, county and State of New York, have invented certain new and useful Improvements in Gem-Polishing Machines; and we do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters or figures of reference marked thereon, which form a part of this specification.

This invention relates to gem polishing machines, and more particularly to a machine to be used for polishing diamonds, in which a bruted, or rough cut stone, provided with more or less conically shaped ends, is so polished as to present as nearly as possible symmetrically arranged facets that increase the brilliancy of the gem.

In polishing diamonds the style and arrangement of facets most prevalent is that known as the "brilliant cut".

The object of our invention is to insure as nearly as possible mathematical accuracy in the polishing of the facets, irrespective of the size of the gem to be polished. This involves carefully constructed and accurate mechanism for holding the gem with respect to the lapping wheel, generally known in the trade as the "skive", and it is necessary to provide a traverse of the gem across the face of the wheel during the polishing to prevent wearing grooves in the face of the wheel, and to avoid grinding marks or scratches on the facets of the gem.

The mechanism should be capable of micrometer adjustment, in order that too much of the gem shall not be ground off, and a carefully arranged and accurate mechanism should be provided to limit the movement of the gem across the polishing wheel, to prevent injury to the gem or damage to the skive.

The invention consists in the construction of a machine which will fulfil all the various requirements and conditions incident to the polishing of diamonds or other gems, the detailed construction of which will be hereinafter referred to and specifically claimed.

Referring to the accompanying drawings, which illustrate a machine embodying one form of our invention, and in which like parts are similarly designated—Figure 1 is a vertical section of the upper part of the machine, parts thereof being shown in elevation. Fig. 1ª illustrates the lower part thereof on a smaller scale. Fig. 2 is a plan view, partly in section, showing some of the parts removed and some of the parts broken away, in order to facilitate the understanding of the construction and operation of the machine. Fig. 3 is an enlarged sectional detail view of one of the arms that is mounted on the rotating table. Fig. 4 is a section on the line 4—4 of Fig. 3, of the head and dop. Fig. 5 is an underside view of the slide and ports controlling the admission of air to the pot for cooling purposes. Fig. 6 is a section through the driving mechanism for the table. Fig. 7 shows an arrangement of one of the micrometer indicators. Fig. 8 is a horizontal section through the micrometer post on the line 9—9, Fig. 1. Fig. 9 is a section taken on the line 10—10 of Fig. 3, and Fig. 10 is a section taken on the line 10—10 of Fig. 9. Fig. 11 is a detailed side elevation of the polishing head, showing the limit stops.

Present and past methods of diamond polishing.—Present day methods of polishing the facets on a diamond are substantially the same as when the art was first practised several hundred years ago. The contrivance used is called a "mill" and consists of two iron frames supporting a wooden bench between them with a round hole through its center. Across the frames and fastened thereto both above and below the bench are iron brackets, in the center of which are wooden plugs which act as bearings for the "skive" that comprises an iron plate of about ten inches in diameter shrunk onto a spindle that is pointed at both ends. Below the plate is a cord and weight device for balancing the skive, and below that, fastened to the spindle, is a pulley having a belt connection between it and a line shaft or motor which drives the skive at high speed.

Each polisher looks after his own mill;

he is usually supplied with three skives, and it requires both strength and skill to properly fasten the skive between its wooden bearings.

The polisher is supplied with hand tools called "tongs", which, as the name implies, is a tool for the purpose of firmly grasping the copper wire which is fastened at one end in the "dop". It is the bending of this wire that gives the angle of inclination for the facets and for the table and culet, and it goes without saying that this requires long practice and skill in order to become proficient. It also requires practice and skill to know if the facet is "running" which means whether the stone is so situated on the skive with respect to its grain that its surface is being polished.

The "dops" (holders for the stones) used are of two kinds; one style, the "leaden dop" has been in use since the beginning of the art and is still used exclusively for all stones weighing less than half a carat in the rough. About fifteen years ago dops having steel claws or fingers were introduced, and they are used extensively to-day on all stones weighing over half a carat in the rough; they are time saving devices, inasmuch as the polisher can quickly adjust the stone in such a position as to expose the surface required to come in contact with the skive, while with the leaden dop the lead or solder of the dop must be heated, and the stone is, as it were, soldered therein in proper position to expose the proper surface. The dops having steel fingers or claws for holding the gem therein are only operative by the manipulation of a copper wire to which they are attached, and it is deemed by those knowing the art that greater skill and care are required in their use than with the old time leaden dop.

In these hand methods of working it has been found advantageous to divide the operatives into three groups, one group, known as the "turners" set the stones up in the lead, another group make the "eight-square" (eight primary facets above the girdle and eight primary facets below the girdle) the table and culet, while the last group, known as the "brillianders" make the eight star facets and sixteen girdle facets above the girdle and the sixteen girdle facets below the girdle. The obvious reason for this division of the work is that the turners, as they do nothing else but set the stones, become very skilful, and they are, as it were, assistants to the polisher, and he always has material at hand to work with. Were he to attempt to set the stones, it would interfere with his work of polishing, which requires his constant attention.

As there is more of the material to be removed from the primary facets than from the star or girdle facets, the "eight square" operative is usually enabled to work with four tongs at the same time, that is, he is capable of making four facets at one and the same time, one on each respective stone, but he must use constant diligence, and frequently pick the tongs up to examine the progress of the work, because should he go too deep on a facet, he is compelled to take more than is required from some of the others in order to compensate his error, and this means a loss of weight to that particular stone.

The brillianders can only work with one stone at a time, as there is so little to take off it would entail a risk to attempt to make more than one facet at the same time.

Our machine, being semi-automatic in its operation, requires no division of the facet work, nor does it require the services of a "turner". The stone comes from the "bruter" already set and fastened in a pot; directions on a tag attached to the pot tell the polisher just what he has to do, and there is no possibility of polishing a facet too deep with the consequent loss of weight to the stone, for the reason that the arm holding the dop is stopped automatically when the facet is completed, and the stone will ride free and clear of the polishing wheel or skive, until such time as the operative sees fit to rotate the dividing-head of the dop into another position, for a new facet to be polished. The machine permits this one operative to work with nine or more stones at one time, and it makes no difference whether primary facets are being made on some stones and star or girdle facets on the others, everything works to a given stop, and there cannot be any over-polishing.

The capacity of the machine is only limited by the diameter of the polishing wheel, and the greater its diameter, the greater number of dops may be placed around its circumference.

The division of responsibility among different classes of operatives eventually all handling and working on the same article is avoided, the operative on the machine is responsible for the complete work as represented by the finished stone. Possible damage to the stone is reduced to a minimum for the reason that the stone is lowered to the polishing plate by a micrometer movement, and the "test-indicator" indicates its slightest contact with the plate.

No great skill is required to know if the facet is "running," the "dial test-indicator" acts as a grain finder in the respect that the hand on the indicator will quickly move if the facet is being ground; should the hand not move at all, all that is necessary is for the operator to turn the handle of the polishing head gradually, without removing the

stone from the wheel, and the hand on the dial test-indicator will indicate as soon as the facet "runs."

Referring more particularly to Fig. 1ª, we provide a pedestal 1, which is columnar in form and hollow, as shown, on which is secured by bolts or equivalent fastening devices 2, a hollow column 3. This column has a flange 3ª at its upper end, through which pass bolts 4 for securing thereto a plate 5. This plate 5 is circular, and is eccentrically mounted on the column 3, being provided at its bottom with a boss 6 that enters the top of the column, and on its upper face this plate 5 has an annular flange 7 within which is a recess 8. This recess 8 serves for the reception of a ball bearing 9 for the upper end of the main spindle, and is held in place by an annular centrally recessed cover plate 10 fitting within the flange 7, and held seated against the plate 5 and ball bearing 9 by means of screws 11. Eccentric to the flange 7 and merging into the same at one side, is a flange 12 of the same height as the flange 7, more clearly shown in Fig. 2. Secured on top of the flanges 7 and 12 by screws 14, is a pan 13. These several parts being secured together and to the column, are stationary. The pan 13 is provided with a rim 15 concentric with the column, and has a central hole in which is mounted a steel collar 16, shrunk on the main spindle, said steel collar entering the recess in plate 10.

Concentric with the column 3 is a main driving spindle 17 whose lower end, Fig. 1ª is threaded and provided with capstan nuts 18, and has bearing in a combined radial and axial ball bearing 19. This ball bearing 19 is mounted in a casting or bracket 20 secured by bolts 21 to the bottom face of the column. Secured to the shaft 17 and within the bracket 20 is a belt pulley 22. We also provide a ball bearing 23 secured to the bottom of the column through which the shaft 17 extends upward to the ball bearing 9, collar 16, and through the lapping wheel T, said lapping wheel T being secured to the shaft and on the collar 16 by any suitable means, as by a nut 24 and washer, or other suitable securing means. This wheel is of cast iron, is very heavy, has a central depression 25, and rotates at high speed. The level of this wheel is slightly below the upper edge of the flange 15 of the plate 13. Mounted to rotate between the plates 5 and 13 and on the eccentric flange 12 as a center, we provide an annular rotating table 26. This table rotates at a slow speed, say once in seven minutes, more or less, and carries with it during its rotation a number of mechanisms for holding gems to be polished, as will be hereinafter more particularly described. These mechanisms, by virtue of their travel eccentrically to the lapping wheel T will traverse the lapping wheel during one rotation of the table 26 from the edge of the wheel to the edge of its central depression 25.

The table 26 is provided with a rack 27, preferably but not necessarily made as a separate element from said table and secured in place by screws 28. This rack is engaged by pinion 29 on a vertical shaft 30 mounted in a bracket or casting 31, secured to the bottom of plate 5 by screws 32 and to the column by screws 42, Figs. 1 and 6. The lower end of shaft 30 passes through a worm gear 33, best shown in Fig. 6, and has a pin and slot, or other sliding connection 34, therewith. The lower end of this shaft is provided with a handle 35, Fig. 1, by means of which the shaft 30 may be pulled down and thereby cause the disengagement of a pinion 29 and rack 27, to stop the rotation of table 26 at will. Worm gear 33 is engaged by a worm 36 on one end of a shaft 37 mounted in ball bearings 38 and 39 in the casting 31. The shaft 37 carries at its other end a worm wheel 40 that is driven by a worm 41 on the main spindle 17.

Passing through the plate 13 is an oil conduit 43 closed by pin 44, for supplying oil to shaft 30. Passing up through the column is an air pipe 45 coupled at 46 to a nipple 47 of a passage 48 in the plate 5. This passage registers with a circular groove 49 in the rotating table 26, Fig. 1, so that said table can rotate while the passage 48 remains stationary, the groove 49 always being supplied with compressed air through pipe 45 and passage 48.

Radiating from groove 49 are small air ducts 50, corresponding in number to the number of gem holding mechanisms, there being one duct for each such mechanism. These ducts terminate in nipples 51, to which are attached flexible connections 52, such as rubber tubes, leading to nipples 53 on the polishing mechanisms.

The object of supplying compressed air to the polishing mechanisms is, that by reason of the great speed of the lapping wheel T, the gems held in the gem holder become hot. This heat is communicated to the holders and other adjacent parts, and the expansion due to such heat will cause a variation of the level of these holders, dependent upon the degree of expansion of the parts and upon the degree of heat generated. It is therefore advisable to keep these parts free from expansion as much as possible, and this we do by blowing cold air through them and around the gem being polished, as will be hereinafter more fully explained.

Secured to the column 3 by bolts 54 are brackets 55 or the equivalent, for supporting a workman's tray 56 on which he may place such tools and implements as are necessary

or desirable for assisting him to properly execute his work. Above the tray 56 we provide a hand hole 57 in the side of the column, closed by a removable cover 58 for permitting access to the table driving mechanism for oiling and other purposes. The tray 56 also has a hole A, Fig. 1, registering with the handle 35, which handle is positioned for stopping the table.

As more clearly shown in Fig. 2, we have indicated nine mechanisms for holding the gems that are supported on and carried by a rotatable table 26, and in the periphery of the table 26 we have provided openings 59. The gem holding mechanisms are mounted in these openings 59, and comprise post housings 60 and the parts supported and carried thereby. These post housings are threaded on their lower ends and are provided each with a nut 61. The post housing is clamped to the rotating table 26 by the nut 61 and a securing flange 62 on the housing above the table. The lower end of the nut is provided with a beveled face 63 provided with a zero mark 64 on the right hand mechanism shown in Fig. 1.

The beveled face 63 is continued by the beveled face 65 of a collar 66 detachably secured by a screw 67 to a hand wheel 68. Between the collar 66 and the hand wheel 68, Fig. 8, is a spring 67^a that is engaged by screw 67, whereby the frictional resistance of this collar can be adjusted, and if desired clamped tight to the hand wheel.

The hand wheel 68 carries a split ring 69 which may be frictionally locked to the wheel by means of a screw 70 passing through the split portion and has a pin 71 projecting therefrom. The pin 71 projects into the path of a stop or pin 72 depending from the bottom of the table 26. The hand wheel 68 is in threaded engagement with the micrometer thread 73 on the lower end of post 74, said post being urged upward by a stiff coil spring 75, as is customary, surrounding the same, and is prevented from turning by key 76.

The housing 60 is split at its upper end longitudinally, and the parts are connected by a screw 77, which screw, by drawing the split housing together, will vary the frictional engagement between the post 74 and the housing.

Secured to each post 74 is a micrometer indicator 78, the specific construction of which is well known and forms no part of this invention. These micrometer indicators are bought from manufacturers of micrometer instruments, and it will be sufficient for an understanding of this invention to state that such micrometer instrument has an indicating hand and is operated by the reciprocation of a pin, such as pin 79. A casing C is provided for the micrometer indicator, which casing comprises a recessed plate 80 having a radial, tubular extension 81, Figs. 3 and 7, through which the actuating pin 79 of the micrometer indicator passes. Said pin 79 passes through the post 74, and the casing C is held to the post by means of screws 82, and is guided by the boss 81 shown in Figs. 3 and 7. The upper end of the post 74 is provided with ears 83, one of which has a nipple 53 for the rubber tube 52, and between the ears 83 is a stop 84, more clearly shown in Fig. 3. Passing through the ears is a hollow pivot pin 85 having a central bore 86, a horizontal radial port 87 extending therefrom, and a port 88 leading to the passage in the nipple 53. Pivot pin 85 is locked in proper position to a hollow arm 86 by means of a set screw 87. The stop 84 is so arranged as to prevent the hollow arm 86 from being rotated against the test indicator 78, as shown in Fig. 3.

When lifting the arm in the direction of the arrow, Fig. 3, its pivot pin 85 rotates with it, thereby causing the port 88 to disconnect from the passage of the nipple 53 and cut off the supply of air to the interior of the arm, so that the operator may keep the arm lifted as long as desired without wasting compressed air. The arm 86 is provided with a boss 88′ for the reception of a weight 89 additionally loading the arm when necessary. The arm 86 also has an inclined split stop arm 90 containing a hard steel set-screw 91 for operating the pin 79 that controls the operation of the indicator. The head of the pin 79 and the contact end of the set-screw 91 are preferably, but not necessarily, spherical. When the arm 86 is not perfectly level, it may be adjusted by the set-screw *a* that engages stop *b* on hardened steel boss *h*, the indicator at the same time indicating zero, the object being to enable the operator to always operate to zero position, as will be more fully explained hereinafter.

Both screws 91 and *a* are locked against accidental rotation in the split arm 90 by screws *c*. The screw 91 engages a pin *d* pivoted at *e* to lever *f* mounted at one end on a pivot pin *g* in the post 74. The free end of this lever engages the end of the indicator actuating pin 79; the construction being such that the indicator hand will be in accordance with the reading on ring 65.

i represents a cover to prevent dust or dirt from entering housing of lever *f*.

The forward end of the hollow arm 86 is provided with a split boss 92 held together by a screw 93, Fig. 3. Within this boss is a split bronze collar 94 having an opening 95 registering with the interior 86^a of the arm, and within the bronze collar is mounted a shank 96 of a polishing head 97. This shank is provided with a peripheral groove 98 registering with the perforation 95. Passing through the shank and head is a

bore 99 communicating with the groove 98 by radial port 100. The upper end of the bore 99 is closed by screw 101 that screws the shank to the thumb-nut 102, as will be clearly seen in Fig. 3. The lower end of the polishing head 97 is arcuate and is provided on its under face with dovetail slideways 103 on which the dop is slidably mounted. Between the slideways 103, to one side of the bore 99, is mounted a rack 104 whose teeth project beyond the slideways and are engaged by a pinion 105 in the dop, which pinion is formed, as more clearly shown in Fig. 9, on shaft 106, whose threaded end is engaged by thumb-nut 107, and whose opposite end is provided with a collar 108 and a squared head 109. This shaft 106 performs a double function. By placing a key on the squared end 109, the dop can be moved along the arcuate end face of the polishing head, and after being so positioned, the dop can be clamped in position by the thumb-nut 107. In order to provide greater resiliency to the dop, *i. e.*, to those portions engaging the dovetail 103, and to secure a better clamping action, the part 113 is cut or slotted at 113ª, Fig. 4. Also mounted between the dovetail slideways 103 is a sliding air-distributing valve 110. This valve 110 slides in the groove 111, more clearly shown in Fig. 5. On one side of this valve is an air port 112, having a portion 112ª passing entirely through the valve, of which the portion 112 forms a grooved extension whose open side is directed toward the top and against the bottom of the groove 111 in which the valve 110 slides. This air port registers with the bore 99, and by reason of the grooved portion 112, the dop can be moved to any angular position along the arcuate slides within its limit of movement, and always be supplied with air from the bore 99. The dop 113 is provided with a pin 114 that enters a groove 115 in the valve 110, said groove being adjacent or parallel to the port 112. The pin and slot connection permits the dop 113 to have an arcuate movement to an extent equal to the length of the slot 115, before the valve 110 is moved along with it.

113ª is a stop fastened on dop 113, and is for the purpose of limiting the movement of the dop 113 on the arcuate part 97 by pins 113ᵇ fastened therein. When the dop is moved to the left so that the stop 113ª makes a perfect contact with the pin 113ᵇ the longitudinal central line of the dop is exactly on the center line, and when the dop is moved to the right, and the stop 113ª makes a perfect contact with the right hand pin 113ᵇ, it is at an angle of 50°, and exposes the square-headed screw 118.

In the dop is an air passage 116, to the side of a central bore 117 containing the square-headed screw 118. Said air passage 116 registers with a circular groove 119 formed in the top of a dividing head 120, which dividing head at its top is beveled off, and gear teeth or a circular rack 121 is formed on this beveled portion. This rack 121 is engaged by a bevel pinion 122 whose shaft 123 is mounted in the bushing 124 screwed in the side of the dop 113, and is turned by means of a thumb-nut 125. The dividing head 120 is also provided with a pin 126, which pin projects into the central bore of the dividing head and enters a groove 127 in a pot 128, and prevents the pot from rotating except with respect to the rotation of the dividing head.

The pot 128 has a central bore 129 into the upper threaded end of which screws the retaining screw 118, previously referred to. This retaining screw has a central bore 130 and radial passages 131 therefrom, that lead to a peripheral groove 132. This groove communicates with inclined air passages 133 from the circular groove 119. The head of the screw 118 has a flange seating on the dividing head and is not longitudinally movable.

Through the head of the pot are inclined radial passages 134 for the exit of air, and the head is also provided with a central ejector screw 135 for ejecting a gem from the seat 136 at the apex of the pot, and also for the purpose of giving the table of the stone a firm seat. The dividing head 120 is retained in the dop by means of a shouldered nut 137. The threaded portion of this nut is longer than the interiorly threaded portion of the dop with which it is in screwed connection, and on this projecting threaded portion we provide a collar 138, which collar engages and draws down onto the gem a gem retainer 139. The shouldered nut 137 is provided with a radially projecting pin 140 adapted to engage a longitudinal slot 141 in the gem retainer.

By releasing the collar 138 the gem retainer 139 may be moved longitudinally an amount sufficient to release the gem, said gem having been held in place by suitable mechanical means, not shown.

On the side of the dop opposite the rack 104 and the pinion 122 we provide a pawl 142 pivoted at 143 in ears 144, said ears being on the dop. The pawl passes through a slot in the dop and is arranged to engage the teeth on the dividing head (Fig. 4), being urged into engaging position by an arcuate spring 145, Fig. 1, secured to the dop by screws 146.

113ª, Fig. 11, represents a square opening in the dop 113 for reading the numbers of the respective slots in the dividing head 120 as they are brought, successively or otherwise, in register with the square opening.

The driving pulley (Fig. 1ª) is actuated by a belt 147, guided over a guide pulley 148

and driven from a line shaft, or otherwise as may be most convenient, or the belt pulley 22 may either be replaced by an electric motor directly operating the shaft 17, or may be geared to such motor contained within the base 1, as may be found most expedient.

The operation of the device is as follows: The shaft 17 is rotated at a high speed, thereby rotating the lapping wheel T at its upper end at high speed, and simultaneously imparting a low speed to the eccentrically rotating table 26 through the speed reducing mechanism shown in Fig. 6. This table makes one revolution in about seven minutes, and is stopped by disconnecting the pinion 29 by pulling knob 35. The operator swings arm 86 over on its pivot until it strikes the stop 84, thereby turning the dop upside-down. If the pot-retaining screw 118 is not in position to be operated by socket wrench, then the operator applies his socket wrench to the squared head 109 (Fig. 9) to operate the pinion 105 and move the dop 113 to the left on the slideways 103 (Fig. 3) until the pot-retaining screw 118 clears the slideways, or to its extreme left position. The pot 128, with the gem temporarily held therein by glue, is then placed in the dop, pin 126 entering the slot 127 in the pot. The screw 118 is then operated by a socket wrench to screw the pot tight. The gem retainer 139 is then put in place, and the collar 138 is screwed down tight on part 137 to cause the gem retainer to firmly grasp the gem. The dop 113 is then moved by operating the pinion 105 to the proper angle at which the facet is to be made, which angle is indicated by means of a scale 149 (Fig. 1) on the polishing head. The operator then swings the arm 86 into polishing position and starts the table 26, the screw 91 resting against the indicator pin 79, the indicator hand will, however, not register zero position, owing to the thickness to be polished off. The polishing head 97 can be rotated by thumb-nut 102 in order that the facet may be positioned relatively to the lapping wheel, so that said wheel will polish across the grain of the gem. When the indicator indicates zero, no more can be ground from the bruted gem, and if enough has not been polished off, the hand wheel 68 (Fig. 1) is rotated to lower the post 74 until the stone touches the wheel, thereupon slightly lifting the arm 86 and causing the indicator hand to move again from its zero position. This is repeated, until the first facet is completed.

The extent of movement of the indicator hand is a guide to the operator of the distance that the arm has been raised, and consequently, of the thickness that will be polished off of the bruted stone. The hand wheel 68 is operated from time to time by the polisher, as the table brings the particular arm in front of the operator during its revolution.

When the first facet of a series of like facets to be polished has been completed, the operator will release the screw 70 and turn ring 69 until pin 71 contacts with stop 72, then the scale ring 66 is rotated to indicate zero. The hand wheel 68 is then rotated to lift the gem from the polishing wheel, the arm 86 is swung over, a mechanical clamp is placed on the stone in the pot to hold it tightly in its seat, the gem retainer 139 is released by collar 138, and the pot is rotated by thumb-nut 125 and pinion 122, (Fig. 4,) first releasing the pivoted dog 142, to position the gem for polishing the next facet, after which the gem retainer is again caused to hold the gem, the mechanical gem holder is removed, and the arm 86 is returned to polishing position.

Inasmuch as we prefer to operate on stones which have been accurately bruted, that is to say, whose ends are true cones, after one facet has been polished a like amount will have to be polished off, to produce the next facet, therefore, when the arm 86 is level and is in contact with the stop b the indicator 78 will indicate zero, which signifies that the second facet is completed. This operation is repeated until all of a series of like facets are completed.

During the polishing operation, air is supplied through pipe 45, passage 48, groove 49, passage 50, nipples 51, flexible tube 52, nipple 53, passage 83, interior of arm 86^a, perforation 95 (Fig. 3) groove 98, perforation 100, bore 99, valve passage 112, bore 116, groove 119, inclined radial bores 133, groove 132, radial bores 131, central bore 130, center of pot 129, and radial passage 134. This air being forced through, keeps the pot and gem cool, and prevents expansion of the metal, due to the heat from grinding, and thereby increases the accuracy of the machine.

When the operator wishes to stop the rotation of the table 26, he simply reaches under his tool tray 56, and pulls knob 35, thereby causing pinion 29 to move down and out of engagement with rack 27. The operator can do this at will, in order to give him sufficient time to examine the stone or change the position of the pot, or to place a new pot with a gem therein, in the dop.

We claim—

1. In a machine for polishing diamonds, the combination with a rapidly rotating lapping wheel, of coöperating gem holding means projecting over and revolving about said wheel.

2. In a machine for polishing diamonds, the combination with a rapidly rotating lapping wheel; of coöperating gem holding means revolving about said wheel eccentrically thereto, thereby imparting to said gem

holding means a traverse during their revolution.

3. The combination with a vertical shaft, a lapping wheel mounted thereon and means to drive them at high speed; of a table eccentrically mounted with respect to said wheel, gem holding means carried by the table and means to rotate the table at low speed.

4. The combination with a vertical shaft and a lapping wheel mounted thereon; of a table eccentrically mounted with respect to said wheel, gem holding means carried by the table, and speed reducing driving mechanism between said shaft and table.

5. In a gem polishing machine, the combination with a main shaft and a polishing wheel thereon; of a table mounted eccentrically to said shaft and wheel, a rack on the table, a pinion and vertical shaft therefor for driving the rack, a worm wheel on the latter shaft, worm driving mechanism to drive said worm wheel from the main shaft, and a sliding connection between the vertical shaft and worm wheel, whereby said pinion may be disengaged from said rack to stop the rotation of the table.

6. The combination with a main shaft and a lapping wheel mounted thereon; of a table eccentrically mounted with respect to said wheel, gem holding means carried by the table, and speed reducing driving mechanism between said shaft and table, including disengaging means for stopping the rotation of the table at will.

7. In a machine for polishing diamonds, the combination with a rapidly rotating lapping wheel; of gem holding means slowly revolving about said wheel and means to supply a cooling medium to the gem during its polishing operation.

8. The combination with gem holding means for holding a gem during the polishing thereof; of means to supply a cooling medium to said gem holding means to cool it and the gem during the polishing operation.

9. The combination with a lapping wheel; of a rotating table, pivoted arms mounted on the table, gem holding devices on said pivoted arms and means for supplying a cooling medium through the interior of said pivoted arms and gem holding means.

10. The combination with a lapping wheel; of a rotating table having an air channel therein, radial passages from said channel to the edge of the table, means to supply air to said channel, a pivoted arm, gem holding devices on the arm, means to connect the radial passages and said arms to supply air through the interior of the arm and gem holding devices.

11. In a gem polishing machine, a polishing wheel, a pivoted arm, an indicator, means on the arm to operate the indicator, and means operating to stop the movement of the arm toward said wheel at a pre-determined point.

12. In a gem polishing machine, a polishing wheel, an indicator, a main arm, a depending stop arm thereon to operate the indicator, said indicator registering zero when said arm is parallel to the wheel, and means to stop the arm in horizontal position.

13. In a gem polishing machine, a micrometer post, a hand wheel on the bottom thereof, an arm pivoted to the top thereof, gem holding means in the end of the arm, a micrometer gage acted on by said arm and a positive limit stop for said arm to prevent over polishing.

14. In a gem polishing machine, a rotating table, a micrometer post mounted thereon, a hand wheel for longitudinally moving the post, a stop depending from the table and an adjustable stop on the hand wheel coöperating with the stop on the table.

15. In a gem polishing machine, a rotating table, a micrometer post on the table, a stop on the table, a hand wheel on the post for longitudinally moving it, a collar provided with a scale on the hand wheel and adjustable with respect to a stationary index, and an adjustable stop on the hand wheel coöperating with the table stop.

16. In a gem polishing machine, an arm, a rotatable polishing head thereon, a dop angularly adjustable on the head and a pot rotatably positionable with respect to the dop.

17. In a gem polishing machine, a pivoted arm, a rotatable polishing head thereon, a dop angularly adjustable on the head, a pot in the dop and mechanism to rotate the pot.

18. In a gem polishing machine, a pivoted arm, means to prevent the arm from swinging beyond the horizontal, a rotatable polishing head thereon, a dop angularly adjustable on the head, a pot in the dop, means to rotate the pot and means to cool the pot.

19. In a gem polishing machine, an arm, a rotatable polishing head thereon, a dop angularly adjustable on the head, a pot, means to rotate the pot, a gem retainer, means on the dop to cause the gem retainer to engage a gem in the pot and means to rotate the pot independently of the gem retainer.

20. In a gem polishing machine, a dop, a dividing head rotatably mounted therein, means to rotate the head, a pot in said head, a pin and groove connection between the pot and head, a gem retainer coöperating with the pot and means including a pin and slot connection to hold the retainer in operative position and prevent its rotation.

21. In a gem polishing machine, a pot

having a longitudinal air passage and auxiliary air passages radiating therefrom in proximity to the gem seat in the pot.

22. In a gem polishing machine, a dividing head, a pot having a longitudinal passage, means to hold the pot against rotation in the head, a screw entering one end of said passage to draw the pot into seating engagement in the head.

23. In a gem polishing machine the combination with a polishing head having arcuate guideways thereon and a rack; of a dop mounted on the guideways, means on the dop coöperating with the rack to move the dop along said guideways, and means to clamp the dop to the ways.

24. In a gem polishing machine, the combination with a polishing head having an air passage therethrough and arcuate guideways on the head; of a dop mounted to travel on said guideways, a movable air distributing valve between the dop and head and means between the dop and valve to permit limited movement of the dop with respect to the head without moving the valve.

25. In a gem polishing machine, a polishing head having an air passage therethrough, a dop slidable on the head having an air passage, a rotatable dividing head mounted in the dop and having a central bore, air passages between the bore and air passages in the dop, a pot retaining screw having a central air passage in communication with the passages in the head, and a pot engaged by said screw and having air passages communicating with those in the screw.

26. In a gem polishing machine, the combination with a hinged hollow arm, a polishing head in said arm having an air passage communicating with the arm, a ported dop on the head, a pot and pot holding devices in the head having air passages, and means to automatically cut off air to the hollow arm when said arm is moved to inoperative position.

27. The combination with a rotating lapping wheel, of a table rotating eccentrically to the wheel, a pivoted arm mounted on said table and movable to and from said wheel, means to indicate when the lapping wheel is polishing a gem in said arm and means to stop the movement of the arm toward said wheel at a predetermined point.

28. The combination with a rotating lapping wheel; of a slowly rotating table mounted to rotate eccentrically of said wheel, a main arm pivotally mounted on and rotating with said table, an indicator, a depending stop on said arm to actuate the indicator and indicate when said wheel is polishing, said indicator registering zero when the arm is parallel to said wheel, and means to stop the movement of the arm toward said wheel when the arm has reached said parallel position.

29. The combination with a rotating lapping wheel, and a table in operative relation to the said wheel; of a post on the table, means to raise and lower the post, an arm pivoted to the post and projecting over said wheel, gear holding means on the end of said arm and means to limit the movement of the arm and gear holding means toward said wheel.

30. In a gem polishing machine, the combination with a rapidly rotating lapping wheel; of a slowly rotating table in operative relation thereto, a post mounted on the table, a hand wheel for raising and lowering the post, a stop depending from the table, an adjustable stop on the hand wheel coöperating with the stop on the table to determine the extent of longitudinal movement of the post, an arm carried by the post and gem holding means on the arm.

31. In a gem polishing machine, the combination with a lapping wheel; of a table rotatable eccentrically to said wheel, an arm pivotably mounted on the table, a polishing head mounted on the end of the arm and rotatable therein on a vertical axis, a dop angularly adjustable in the head, a pot in the dop and means to rotate the pot without removing it from the dop.

32. In a gem polishing machine, the combination with a lapping wheel, a table, a pivoted arm on the table extending over the wheel, means to prevent the arm from moving beyond a horizontal toward the table, a polishing head adjustable on a vertical axis in the arm, a dop angularly adjustable on the head, a pot rotatably mounted in the dop and means to cool the pot.

33. The combination with a lapping wheel; of a rotatable table, a pivoted arm on the table, a rotatable polishing head in the arm, an adjustable dop on the head, an adjustable pot in the dop, said arm, head, dop and pot provided with air passages communicating under all conditions of operation, and means to supply air to the arm and said passages during the rotation of the table.

In testimony that we claim the foreboing as our invention, we have signed our names in presence of two subscribing witnesses.

SAMUEL M. SCHENKEIN.
OTTO P. R. LEHMANN.

Witnesses:
HARRY RICHARD,
WILLIAM K. GILCHRIST.