

C. J. COLFMAN.

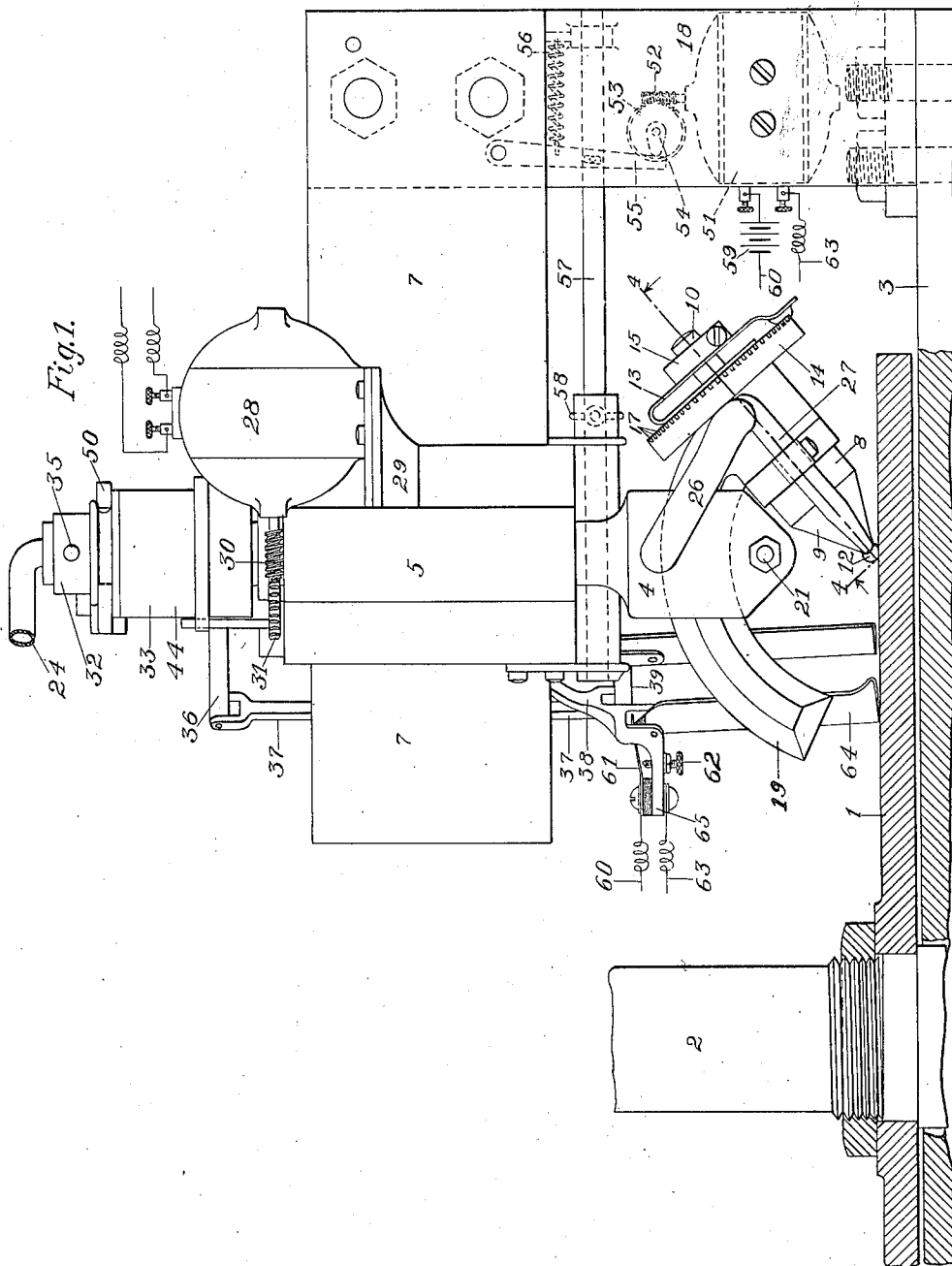
GEM POLISHING MACHINE.

APPLICATION FILED NOV. 25, 1912.

Patented Feb. 29, 1916.

3 SHEETS—SHEET 1.

1,173,173.



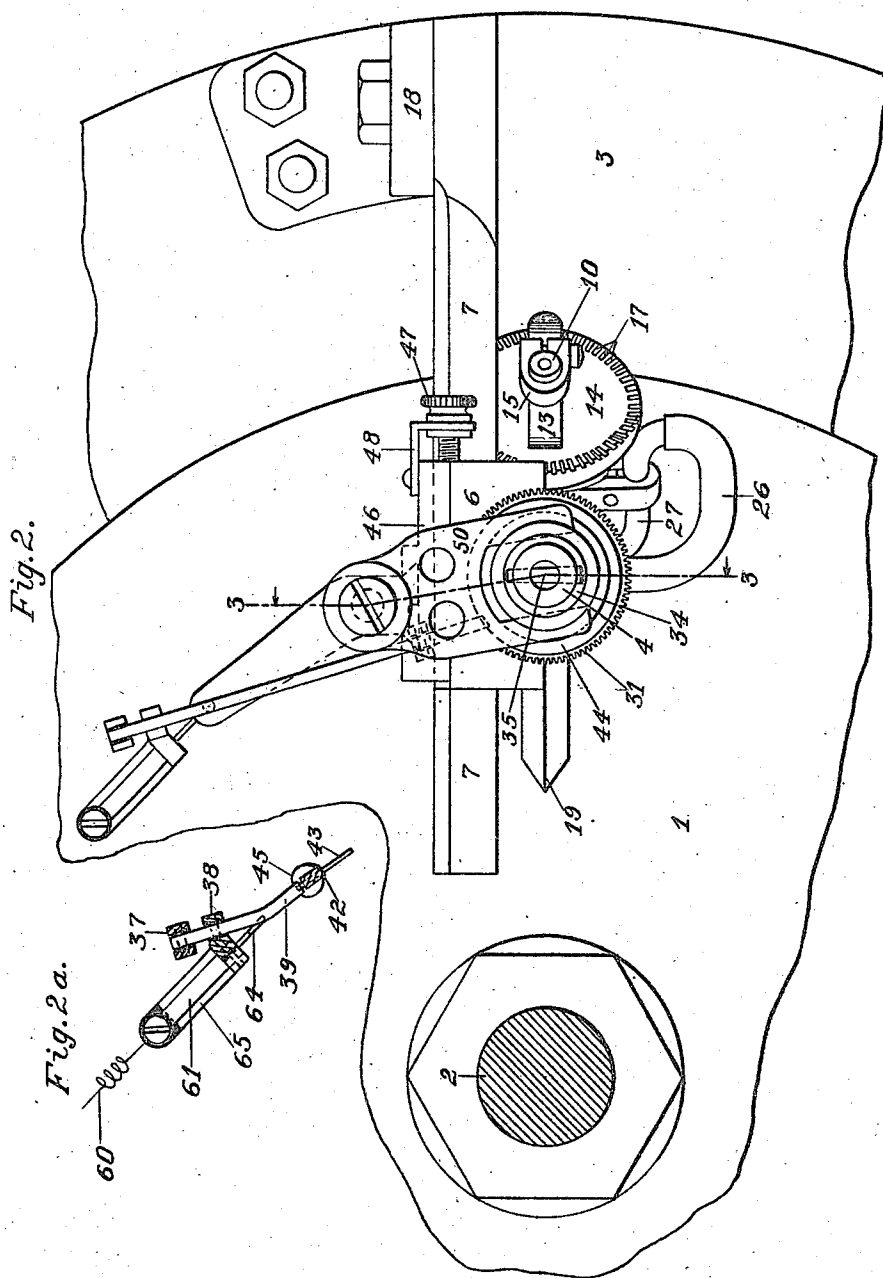
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3 SHEETS—SHEET 2.



Witnesses:
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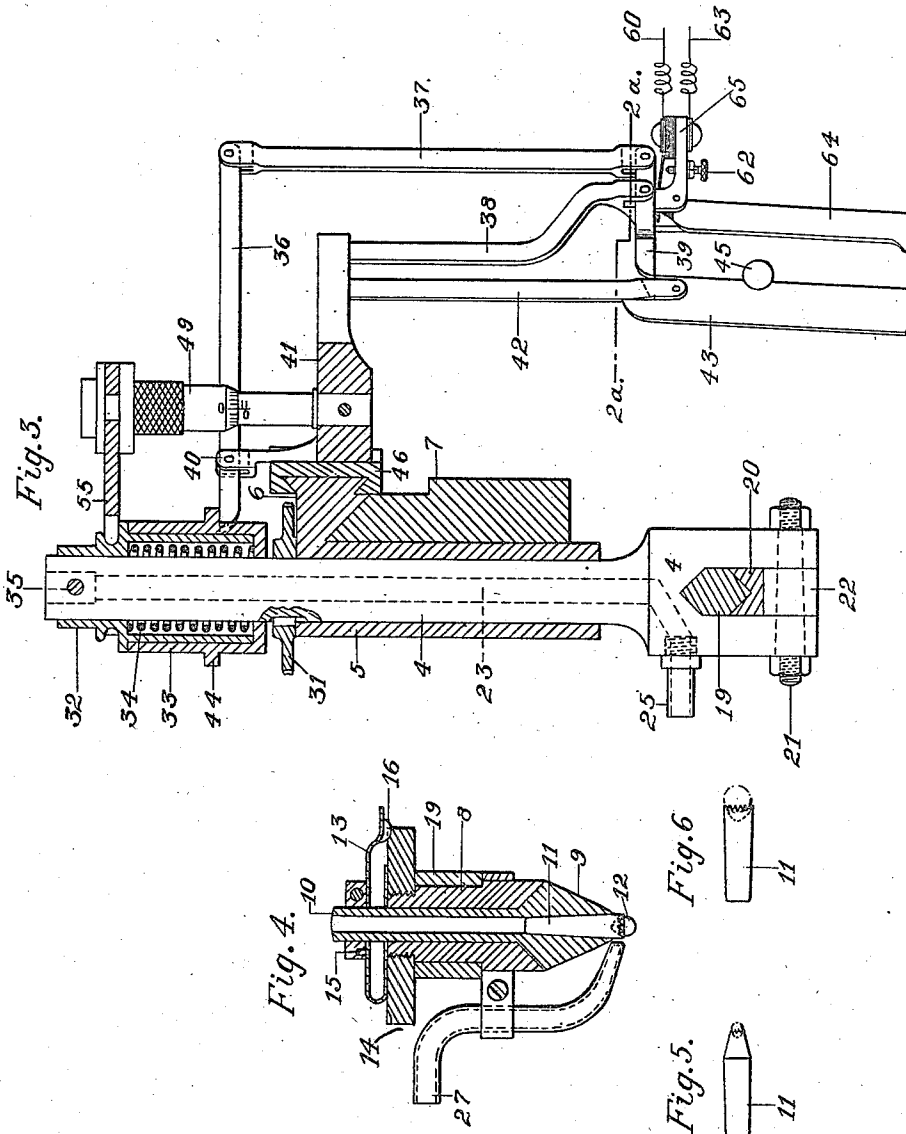
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3 SHEETS—SHEET 3.



Witnesses:
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UNITED STATES PATENT OFFICE.

CLYDE J. COLEMAN, OF NEW ROCHELLE, NEW YORK, ASSIGNOR, BY MESNE ASSIGNMENTS, TO STERN-COLEMAN DIAMOND MACHINE COMPANY, INC., A CORPORATION OF NEW YORK.

GEM-POLISHING MACHINE.

1,173,173.

Specification of Letters Patent.

Patented Feb. 29, 1916.

Application filed November 25, 1912. Serial No. 733,417.

To all whom it may concern:

Be it known that I, CLYDE J. COLEMAN, a citizen of the United States, residing at New Rochelle, in the county of Westchester and State of New York, have invented certain new and useful Improvements in Gem-Polishing Machines, of which the following is a specification, reference being had therein to the accompanying drawings, forming part thereof.

My invention relates to machines for grinding and polishing diamonds and other gems.

The brilliancy of polished gems depends in main upon the dimensions of the stone and upon the symmetrical arrangement of the facets about the geometrical center of the stone, since these facets produce the reflection and refraction of light entering the stone. Each facet contributes to this result and is an important element in the reflection and hence the improper disposition of any one facet may considerably impair the general effect. When polished by hand very skilful workmen are required because of the great precision required in the work, and even the most skilled workmen occasionally through accident or carelessness, irreparably injure a valuable stone, as by over polishing a facet and altering the proportionate dimensions of the stone.

A general object of my invention is to provide a machine which will automatically polish gems with the required precision and accuracy of operation.

Another object is to provide an arrangement whereby the gem will be reciprocated over the lap and the reciprocation will be started after the gem has been polished to a certain extent.

Further objects, features, and advantages will more clearly appear from the detailed description given below.

I shall now describe the embodiment of my invention illustrated in the accompanying drawings and shall thereafter point out my invention in claims.

Figure 1 is a side elevation partly in section, of a complete machine embodying my invention. Fig. 2 is a plan of the same with parts omitted. Fig. 2^a is a detail in plan of the tripping mechanism, taken on line 2^a—2^a of Fig. 3. Fig. 3 is a sectional elevation taken on line 3—3 of Fig. 2. Fig. 4

is a detail of the polishing head in sectional elevation, taken on line 4—4 of Fig. 1. Figs. 5 and 6 are details of gem holding arbors for holding different sized stones.

The illustrated machine has a disk shaped rotative lap 1 rigidly mounted upon a vertical shaft 2, which bears in the table 3 of the machine and to which power is applied in any suitable way. The upper or the polishing surface of the lap is coated with diamond dust or other suitable abrasive, as is usual.

To hold the gem which is being polished in contact with the polishing surface of the lap 1, a polishing head is provided which is carried on the lower end of a vertical spindle 4. This vertical spindle 4 is mounted for free longitudinal movement within certain limits, as will hereinafter appear, in a spindle-supporting block 5 which has an undercut or beveled overhanging portion 6, which fits upon the upper beveled edge of an overhanging supporting arm 7. This supporting arm extends transversely of the lap 1, and is supported at its outer end upon a vertical standard 18 secured to the table 3 at its outer edge. The supporting block 5 is therefore, free to move longitudinally of the supporting-arm 7, and the sloping or beveled engaging faces of the two members cause the supporting-block to be held by gravity securely to its supporting arm 7, and the vertical engaging faces of the two members are of substantial length as shown, and the movement of the block along the supporting-arm is thereby rendered steady. In the machine shown, the supporting arm 7 extends parallel to the radial line of the lap 1 occupied by the gem or stone, and in the movement of the block 5 along the arm 7, the arm serves to guide the stone in a radial line transversely of the lap. The spindle 4 is normally held by gravity with the stone resting upon the polishing surface of the lap, in the position shown in the drawings, and it therefore, falls down with the stone as the stone is polished off, while being free to be moved longitudinally away from the lap.

The polishing head consists of a sleeve member 8 and a gem holder or dop inserted in the bore of the sleeve member and consisting of a hollow tubular tapered dop head 9 and upwardly extending shank or

stem 10 projecting through the sleeve member 8, the bore being tapered throughout the length of the head 9, as shown. The arbor 11 for the previously roughed out or bruted gem 12 is also tapered, and fits into the bore of the dop head with a wedging action, and may be removed therefrom by pressure upon its upper end with a drift pin inserted in the tubular shank 10. The gem is held in the lower cupped end of the arbor by any suitable cement, such as diamond cutters' cement or fused gum shellac mixed with pulverized silica.

To adjust the gem to present different facets to the lap, means are provided for rotating the dop in the sleeve member 8, consisting of a bent spring member 13 of substantial U-shape, both legs of which are perforated and are inserted over the upper end of the dop shank 10, with the lower leg bearing against an index head 14 secured to the top of the sleeve member 8, and with its upper end pinned or otherwise secured to a split collar 15 clamped on the end of the spindle 10. The outer end of the upper leg is provided with a downwardly projecting latch 16 which fits into properly calibrated locking notch 17 on the index head 14 and which locks the dop in adjusted position.

To vary the angle at which the gem 12 contacts with the lap, that is, to vary the angle formed by the longitudinal axis of the gem with the plane of the lap, means are provided for adjusting the upper end of the polishing head in an arc relative to the spindle 4. These arcuate adjusting means comprise an arcuate guide 19 clamped at one end to the polishing head in such a manner that the polishing head extends radially inward from the arcuate guide 19, and the lower end of the spindle 4 is made square, and is enlarged and bifurcated, as shown in Fig. 3, with the top of the bifurcated portion curved to receive and guide the arcuate guide 19. The arcuate guide 19 is clamped in adjusted position relative to the spindle 4 by a clamping block on its under side 20 which is adjusted to and from clamping position by a taper screw pin 21 and a cooperative locking block 22. It is manifest that as the arcuate guide 19 is adjusted through the spindle 4, the angle of inclination of the polishing head is adjusted and that the angle at which the gem contacts with the lap and of the facet polished thereby is correspondingly varied. In order that the gem may not be moved bodily during such adjustment, and that the gem will be so presented to the lap in every adjustment that every facet will have the same symmetrical disposition, the parts are so designed that the geometric center of the gem, the center of the arcuate guide 19, and the axial line of the spindle 4 coincide. The gem is consequently merely rotated about its geometric

center as the head is adjusted, and the plane of the facet being polished remains parallel to the face of the lap as the spindle 4 moves longitudinally. The workmen may therefore, freely lift the gem holder up to inspect the progress of the operation, and the stone is always maintained with the facet being polished parallel to the polishing surface of the lap.

To prevent the cement which holds the gem in the arbor 11 from becoming fused by the heat developed during the polishing operation, means are provided for subjecting the gem to a blast of refrigerating fluid, such as refrigerated air, which means embody the invention described and claimed in my companion application filed July 20, 1912, Serial Number 710623. The spindle 4 has a longitudinal fluid-conveying conduit or passage 23, to the upper end of which the fluid is fed from any suitable source by a pipe 24. The lower end of the passage 23 opens at the side of the spindle near the lower end thereof and communicates with a nipple 25, and a flexible tube 26 connects the nipple 25 with a rigid pipe 27 which is clamped to the polishing head and terminates in a nozzle in proximity to the gem 12, and serves to direct the refrigerating fluid against the gem and absorb the heat developed by friction. The resultant low temperature permits the use of readily fusible cement or wax.

To produce the most satisfactory results in polishing gems, a proper arrangement of the grain of the gem relative to the polishing lap has to be taken into account. It is customary to first find the grain of the stone, and then to set the stone in the dop so that it will be polished most advantageously. This method however, is a very lengthy and unsatisfactory one. I have shown means for obviating this by turning the stone upon its axis at right angles to the plane of the lap, so that the facet is maintained in contact with the face of the lap. It is manifest, that, at a certain point in each complete rotation of the stone, the grain will be properly adjusted relative to the lap to secure the most advantageous results, without any effort on the part of the operator to find the grain of the stone. This rotation may be as rapid as is desirable and may be either intermittent or continuous. The illustrated means for rotating the stone comprise an electric motor 28 supported upon a bracket 29 on the spindle supporting-block 5, a worm 30 on the armature shaft of the motor, and a worm wheel 31 splined on the spindle 4. By these means, the spindle 4 is continuously rotated upon its longitudinal axis when the motor 28 is energized and since the axial line coincides with the geometrical center of the gem 12 and is perpendicular to the plane of the lap 1, it coincides with the

center of the facet being polished, and the facet is, therefore, rotated upon its own central axis and in the plane of the polishing surface of the lap. In accordance with this method the facet of the stone is simultaneously subjected to the polishing operation and is rotated upon a perpendicular axis.

To prevent a stone from being polished to too great a depth at any facet, automatic tripping means are provided which become operative at the conclusion of the polishing operation upon every facet, and the illustrated tripping mechanism is an embodiment of my invention described and claimed in my companion application Serial Number 733,418, filed on even date herewith. This mechanism consists of means for raising the gem holder and gem away from the lap, and a trigger for operating this mechanism which follows in the path of the gem upon the lap and is so adjusted that it strikes the lap at a predetermined stage of the polishing operation, and is tripped thereby and operates the lifting mechanism. Two coöperative spring cups 32 and 33 are arranged upon the upper end of spindle 4, the former being pinned to the spindle by the pin 35, and the latter telescoping over the stationary spring cup 32, and being reversely arranged thereto. A coiled thrust spring 34 surrounds the spindle 4, and bears at its upper end against the top of the stationary cup 32, and at its lower end against the bottom of the slidable cup 33, and tends to spread these cups apart, until the bottom of the cup 33 strikes the worm wheel 31 which rests upon the spring supporting block 5, and then the further separation of the cups raises the spindle 4 as far as the spline connection between the worm wheel 31 and the spindle 4 will permit. The outer slidable cup 33 is however normally locked against the tension of the spring 34 by a series of levers, comprising a latch lever 36, a connecting lever 37, a fulcrum lever 38, and a locking lever 39.

The latch lever 36 is pivoted near its front end to an upwardly extending bifurcated arm 40 on a vertical slidable lever-supporting block 41, to which is secured the fulcrum lever 38 and a trigger-supporting arm 42, on the lower end of which is pivoted a trigger 43, provided with a shoulder on which the free end of the locking lever 39 is adapted to rest. The free end of the latch lever 36 is arranged to latch under a flange 44 on the slidable cap member 33. It is apparent that with the latch lever 36 under the flange 44 and with the locking lever 39 upon the locking shoulder of the trigger 43, the cup members 32 and 33 will be held closed against the tension of the spring 34, in the position shown in the drawings, and that when the trigger 43 is rocked upon its pivot or when the locking lever 39 becomes disengaged from the locking shoulder, the spring 34 be-

comes effective and spreads the two cup members apart, and raises the spindle 4, and lifts the gem off the lap.

The trigger 43 is arranged to engage the lap at a predetermined time, so that it will be rocked upon its pivot by the movement of the lap, and thus trip the lifting mechanism, as previously described. This trigger 43 is provided on the side toward the locking lever 39 with a weight 45, which tends to hold the trigger in locked engagement with the locking lever, until it is rocked by engagement with the lap.

The trigger 43 is arranged so that it engages the lap directly behind the gem, as shown, so that it will engage precisely the same path upon the lap that the gem does, and the two will not be differentially affected by unevennesses upon the lap.

To adjust the trigger 43 radially of the lap so as to bring it within the path of the gem, and also to adjust it vertically to set it in accordance with the depth of the facet to be polished, suitable means are provided for adjusting the lever-supporting block 41. This block is carried by an adjusting block 46, which is slidably mounted upon the overhanging portion of the spindle supporting-block 5, and is provided with a dove-tail engagement to permit adjustment longitudinally thereof. To effect this adjustment a manually adjustable screw 47 is provided, which bears at one end against the spindle-supporting block, and is collared into an angle member 48 carried by the adjusting block 46. By adjusting this screw 47, the lever supporting block 41 and the trigger 43 are, therefore, adjusted relatively to the lap to bring the trigger in the track of the gem. To adjust the trigger vertically in accordance with the depth to be polished, a micrometer 49 is provided, the upper end of which is secured by a bifurcated supporting arm 50 which straddles a collar on the hub of the inner cap 32, and is held thereby in fixed relation to the spindle 4, the lower end of which is secured to the lever-supporting block 41. It is apparent that by adjusting the micrometer 49, the trigger 43 is raised and lowered relative to the spindle 4 and the gem 12 carried thereby. This mechanism provides an extremely simple and accurate means for automatically stopping the polishing operation, as soon as the facet has been polished to a predetermined depth, and the adjustment permits this depth to be accurately determined, while this operation is not affected by any irregularities on the lap, due to the fact that the trigger follows in the track of the gem upon the lap.

As is well known, unevenness on the polishing surface of the lap produces streaks or grooves in the facet of the gem, particularly if the gem be held stationary and in a fixed position. To obviate this it is customary

in automatic machines to subject the gem to a transverse movement upon the lap during the entire polishing operation. At the early stages of the polishing however, and before the bruted stone has been somewhat smoothed off, this transverse movement produces marked zigzag streaks or grooves upon the lap, and this soon renders the lap useless. I obviate this by not reciprocating the stone upon the lap until near the end of the polishing movement, when the polishing operation is so far advanced that no streaks will be produced upon the lap. This I find to be ample duration of time for removing all streaks from the facet and the machine is thereby not subject to any unnecessary wear. To effect this, I provide normally inoperative means for reciprocating the stone and means for rendering the inoperative means operative near the end of the polishing operation, such means being controlled by the movement of the holder toward the lap as the gem is polished off.

As shown, an electric motor 51 operates a worm 52 and a worm wheel 53, on the shaft of which is mounted a cam 54 which serves to operate the reciprocatory lever 55 against the tension of a spring 56. This lever 55 has a slot and pin connection with a rod 57 which is clamped to the spindle-supporting block 5 by a clamp 58, as shown. This rod 57 extends parallel to the overhanging guide arm 7, and through the connection just described it will be apparent that the motor 51 serves, when energized, to reciprocate the spindle supporting-block 5 upon the arm 7, and thereby to impart a transverse movement to the gem 12. The circuit of the electric motor consists of a battery 59, wire 60, spring contact 61, stationary contact 62, rearwardly extending supporting-arm 65 integral with the fulcrum lever 38, wire 63, and the field of the motor back to the battery 59. This circuit is, however, normally held open by a tracker 64, which is arranged directly behind the trigger 43 and is slightly longer than the trigger 43, and will consequently engage the lap slightly in advance of the trigger 43. This tracker 64 is pivoted at its upper end to the arm 65, and is provided at its upper end with an insulating contact operating projection, as shown, in Fig. 3, which in the normal position of the tracker 55 holds the spring contact 61 away from the stationary contact 62, but when the tracker engages the lap and is rocked upon its pivot thereby, in the manner previously described with reference to trigger 43, the contact operating projection on the tracker is moved from underneath the spring contact 61, and permits it to engage the stationary contact 62 and thereby close the electric circuit and energize the motor 51, which thereupon becomes operative to reciprocate the gem trans-

versely of the lap, as previously described. While this reciprocatory mechanism may be used in conjunction with the means for rotating the gem 12 upon the axis perpendicular to the plane of the lap, it will be most useful when the motor 28 is not operated, and the stone is held in a fixed position.

It is obvious also that the gem might both be rotated and reciprocated by hand to find the best position of the grain with respect to the lap and the desired polishing band on the lap in case it is not desired to continuously rotate or reciprocate the gem and in such case by arranging the apparatus so that the geometric center of the gem always lies in the axis of rotation, the desired results are more efficiently and effectively accomplished.

The stones are so set in their arbors that, when the arbor is secured in the dop head, as previously stated, the geometrical center of the stone will be in the central axial line of the spindle 4. The facet which is therefore presented to the lap is always parallel to the plane of the lap, irrespective of the size of the stone, and it maintains this parallel relation as the spindle 4 is moved longitudinally. In Figs. 5 and 6 arbors are shown for holding different sized stones. These two arbors are so shaped and the two stones are so set, that the geometric center of either of the stones will coincide with the central axial line of the spindle 4, when the arbor 11 is inserted in the dop head 9.

It is obvious that various modifications may be made in the construction shown in the drawings and above particularly described within the principle and scope of my invention.

I claim:

1. A gem-polishing machine having in combination a polishing lap, means for holding a gem on the lap to be polished and means for starting the reciprocation of the gem over the lap transversely of the movement of the lap after the gem has been polished to a predetermined extent.

2. A gem-polishing machine having in combination a polishing lap, means for holding a gem on the lap to be polished, means for starting the reciprocation of the gem over the lap transversely of the movement of the lap after the gem has been polished to a predetermined extent and means for controlling the starting of said reciprocation dependent upon the movement of the gem-holder toward the lap.

3. A gem-polishing machine having in combination a polishing lap, means for holding a gem on the lap to be polished, means for starting the reciprocation of the gem over the lap transversely of the movement of the lap after the gem has been polished to a predetermined extent and means for controlling the starting of said reciprocation dependent upon the movement of the gem-

holder toward the lap, said last-mentioned means comprising a member movable with the gem toward the lap and adapted to engage the lap to start the reciprocation.

4. A gem-polishing machine having in combination a polishing lap, means for holding a gem on the lap to be polished, means for starting the reciprocation of the gem over the lap transversely of the movement of the lap after the gem has been polished to a predetermined extent and means for controlling the starting of said reciprocation dependent upon the movement of the gem-holder toward the lap, said last-mentioned means comprising a member movable with the gem toward the lap and adapted to engage the lap in the path of the gem to start the reciprocation.

5. A gem-polishing machine having in combination a polishing lap, means for holding a gem on the lap to be polished, means for starting the reciprocation of the gem over the lap transversely of the movement of the lap after the gem has been polished to a predetermined extent and means for adjusting the position of the gem transversely of the movement of the lap independently of the reciprocating means.

6. A gem polishing machine comprising a rotary lap, a gem holder arranged to hold a gem in contact with the lap and to approach the lap as the gem is polished, normally inoperative reciprocatory means adapted to reciprocate the gem holder across the lap, and means controlled by the movement of the gem holder toward the lap and adapted to render the reciprocatory means operative at a predetermined stage of the polishing operation.

7. A gem polishing machine comprising a rotary lap, a gem holder arranged to hold a gem in contact with the lap, and to approach the lap as the gem is polished, a normally deenergized electric motor operatively connected to reciprocate the gem holder across the lap, and means controlled by the movement of the gem holder toward the lap and adapted to energize the electric motor at predetermined stage of the polishing operation.

8. A gem polishing machine comprising a rotary lap, a gem holder arranged to hold a gem in contact with the lap, and to approach the lap as the gem is polished, normally inoperative reciprocatory means adapted to reciprocate the gem holder across the lap, and means movable with the gem holder and disposed in the path of the gem upon the lap and arranged to engage the lap at a predetermined stage of the polishing operation and to be operated thereby to render the reciprocatory means operative.

9. A gem polishing machine comprising a rotary lap, a spindle arranged perpendicular to the lap, a gem holder carried by the

spindle and arranged to hold a gem in contact with the lap and to approach the lap as the gem is polished, normally inoperative reciprocatory means adapted to reciprocate the gem holder across the lap, means movable with the gem holder and disposed in the path of the gem upon the lap and adjustable longitudinally of the spindle and arranged to engage the lap at a predetermined stage of the polishing operation and to be operated thereby to render the reciprocatory means operative.

10. A gem polishing machine comprising a rotary lap, a spindle arranged perpendicular to the lap and mounted for free axial movement and normally held at its closest approach to the lap, a polishing head carried by the spindle and arranged to hold the gem in contact with the lap, a normally deenergized electric motor operatively connected to reciprocate the spindle across the lap, a tracker carried by the spindle in the path of the gem upon the lap and arranged to engage the lap and to be rocked thereby at a predetermined stage of the polishing operation, and means operated by the rocking of the tracker and arranged to energize the electric motor.

11. A gem polishing machine comprising a rotary lap, a spindle arranged perpendicular to the plane of the lap, a polishing head carried by the spindle and including a gem carrier arranged to hold a gem to present different facets of the gem to the lap, and driving means for rotating the spindle upon its axis.

12. A gem polishing machine comprising a rotary lap, a spindle arranged perpendicular to the plane of the lap, a polishing head carried by the spindle and including a gem carrier arranged to hold a gem to present different facets of the gem to the lap, driving means to rotate the spindle upon its axis, and an arcuate guide arranged to permit adjustment of the polishing head relative to the spindle to vary the angle of contact of the gem with the lap.

13. A gem polishing machine comprising a rotary lap, a spindle arranged perpendicular to the plane of the lap, a polishing head carried by the spindle, normally inoperative reciprocatory means adapted to reciprocate the spindle across the lap, and means controlled by the movement of the spindle toward the lap and adapted to render the reciprocatory means operative at a predetermined stage of the polishing operation.

14. A gem polishing machine comprising a rotary lap, a spindle arranged perpendicular to the lap and mounted for free axial movement and normally held at its closest approach to the lap, a polishing head carried by the spindle and arranged to hold a gem in contact with the lap with the geometric center of the gem in the axial line of

the spindle, an arcuate guide having its center coincident with the geometric center of the gem and arranged to permit adjustment of the polishing head relative to the spindle
5 to vary the angle of contact of the gem with the lap, normally inoperative reciprocatory means adapted to reciprocate the spindle across the lap, a tracker carried by the spindle and adapted to engage the lap, at a predetermined stage of the polishing operation
10 and to be rocked thereby, and means operated by the rocking of the tracker for rendering the reciprocatory means operative.

15 15. A gem polishing machine comprising a rotary lap, a spindle arranged perpendicular to the lap and mounted for free axial movement and normally held at its closest approach to the lap, a polishing head carried by the spindle and arranged to hold a
20 gem in contact with the lap with the geometric center of the gem in the axial line of the spindle, an arcuate guide having its center coincident with the geometric center of the gem and arranged to permit adjustment
25 of the polishing head relative to the spindle to vary the angle of contact of the gem with the lap, normally inoperative reciprocatory means adapted to reciprocate the spindle across the lap, a tracker carried by
30 the spindle and arranged to engage the lap at a predetermined stage of the polishing operation and to be rocked thereby, means operated by the rocking of the tracker for rendering the reciprocatory means operative,
35 and means for adjusting the tracker longitudinally to the spindle.

40 16. A gem polishing machine comprising a rotary lap, a spindle arranged perpendicular to the lap and mounted for free axial movement and normally held at its closest approach to the lap, a polishing head carried by the spindle and arranged to hold the gem in contact with the lap with the
45 geometric center of the gem in the axial line of the spindle, an arcuate guide having its center coincident with the geometric center

of the gem and arranged to permit adjustment of the polishing head relative to the spindle to vary the angle of contact of the gem with the lap, a normally deenergized
50 electric motor operatively connected to reciprocate the spindle across the lap, a tracker carried by the spindle and arranged to engage the lap at a predetermined stage of the polishing operation and to be rocked
55 thereby, and means operated by the rocking of the tracker for energizing the electric motor.

17. A gem polishing machine comprising a rotary lap, a gem holder and a supporting
60 arm for the gem holder arranged to support the gem holder removably thereon and to permit movement of the gem holder longitudinally of the arm and to guide the gem holder across the lap, during such longitudinal
65 movement.

18. A gem polishing machine comprising a rotary lap, a gem holder, and a supporting
70 arm for the gem holder arranged to support the gem holder removably thereon and to permit movement of the gem holder longitudinally of the arm and to guide the gem holder across the lap, during such longitudinal movement, and means to reciprocate
75 the gem holder upon the supporting arm.

19. A gem polishing machine, having in combination, a rotatable polishing lap, a supporting arm, a gem holding head adjustable or movable longitudinally of said arm
80 and over the polishing surface of the lap, an actuating member and mechanical connections between said actuating members and gem holding head whereby the actuating member causes the gem holding head and
85 gem to be moved over the lap from one polishing band to another.

In testimony whereof I have affixed my signature in presence of two witnesses.

CLYDE J. COLEMAN.

Witnesses:

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