A. BOERNER.

GEM GRINDING AND POLISHING MACHINE.

APPLICATION FILED SEPT. 7, 1917.

1,331,480.

Patented Feb. 24, 1920.

3 SHEETS—SHEET 1.

Fig. 2.

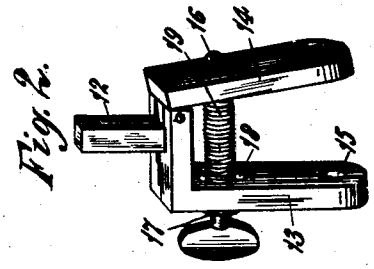


Fig. 1.

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Fig. 3.

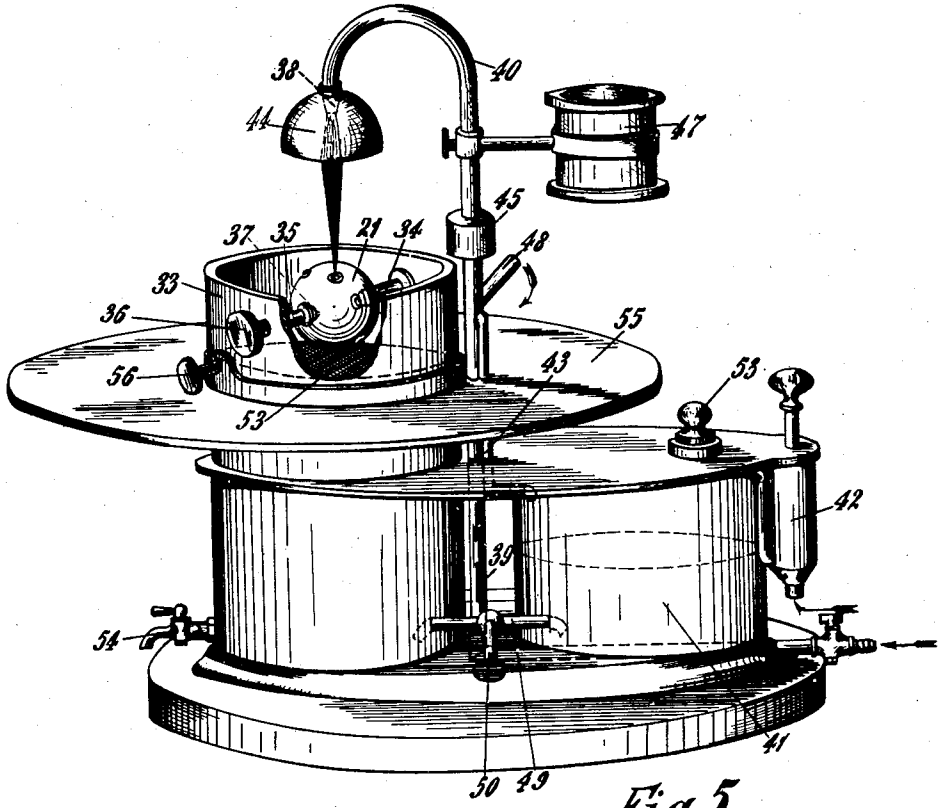


Fig. 4.

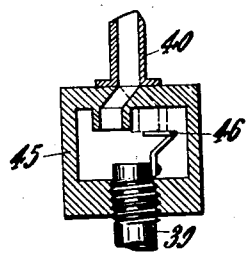
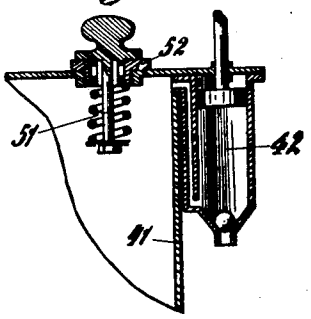


Fig. 5.



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3 SHEETS—SHEET 3.

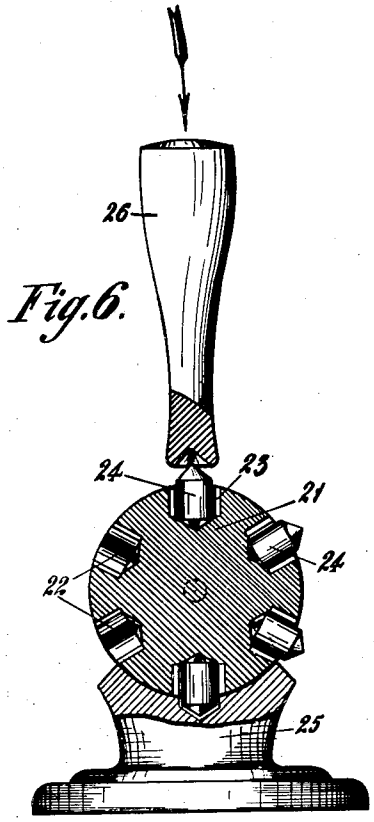


Fig. 6.

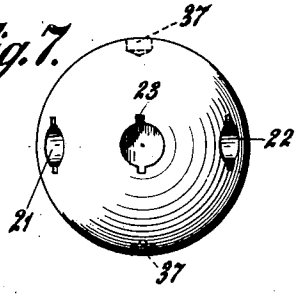


Fig. 7.

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UNITED STATES PATENT OFFICE.

ARNO BOERNER, OF SCHEVENINGEN, NETHERLANDS.

GEM GRINDING AND POLISHING MACHINE.

1,331,480. Specification of Letters Patent. Patented Feb. 24, 1920.

Application filed September 7, 1917. Serial No. 190,137.

To all whom it may concern:

Be it known that I, ARNO BOERNER, having no nationality, residing at Scheveningen, State of the Netherlands, have invented certain new and useful Improvements in Gem Grinding and Polishing Machines, of which the following is a specification.

This invention relates to gem grinding and polishing machines, and more particularly to machines to be used for grinding and polishing diamonds.

The contrivance generally used for grinding and polishing diamonds is called a "mill" and it comprises a lapping wheel, known in the trade as a "skive", and rotating at high speed in a horizontal plane; the polisher is supplied with hand tools called "tongs", which, as the name implies, is a tool for the purpose of firmly grasping a leaden "dop" in which the stone is, as it were, soldered in a proper position to expose the proper surface when touching the skive.

This known apparatus has obvious disadvantages. In the first place the dop as generally used cannot hold more than one stone; as this stone, every time when a facet has been completed by a polisher, must be adjusted in the proper position for the next facet by another operative, called "turner", it is clear that the work of the polisher is repeatedly interrupted, which necessarily interferes with his capacity. Moreover, the said apparatus does not permit the polisher to work with more than four stones at one and the same time, as it would entail too great risk to attempt to work with more than four tongs on one skive, because should the polisher go too deep on a facet he would be 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 the stones. In this connection it is to be noted that in the ordinary apparatus the progress of the grinding operation is not in any way limited by mechanical means, so that the polisher must use constant diligence and frequently pick up the tongs to examine the stone; if, therefore, the polisher should be obliged to temporarily leave his "mill", he must take his tongs from the skive to prevent overgrinding.

Another objectionable feature of the known apparatus is that the polisher for positioning the stone on the lapping wheel almost entirely depends upon the position in which the stone has previously been set in the dop by the turner. Should the stone not assume the proper position, so that it is not properly situated on the skive with respect to its "grain", the facet does not "run", *i. e.* the skive does not grind any material from the stone. In such case the dop must be returned to the turner for readjustment.

In accordance with the present invention the above disadvantageous features may be entirely obviated by employing in combination with the ordinary lapping wheel a dop adapted to hold a plurality of stones and provided with spherical bearing surfaces by means of which it is rotatably or adjustably mounted between spherical bearing recesses in a dop holder.

In a preferred form of execution the dop-holder comprises two fingers having at their free ends spherical bearing recesses to form bearings for the dop, means being provided for adjusting the distance between the said spherical recesses. The dopholder may be detachably secured to an arm, which is pivotally mounted on a horizontal shaft outside the lapping wheel in such a manner that it is movable in a radial plane with regard to the said wheel. For limiting the extent of vertical movement of the stone, *i. e.* the thickness that will be ground off, a positive stop, adapted to be raised or lowered by means of a micrometer screw, may be provided in such a manner that the arm for supporting the dop holder, when in its polishing position, may be engaged thereby.

In order that the stone, after the grinding operation proper has been finished, may be polished, *i. e.* reciprocated across the rotating lapping wheel, the supporting arm for the dop holder may be mounted in a slide adapted to be moved in a horizontal plane in a radial direction with regard to the wheel.

The dop according to the present invention requires a special contrivance for "setting" the stones. This apparatus comprises a vessel containing a cooling liquid and provided with means for rotatably supporting the dop so that part of the dop is immersed in the liquid, and it further comprises a burner for directing a thin flame on the dop. The burner is preferably adapted to be moved with respect to the dop supported in the vessel, in such a manner that by said

movement the supply of gas to the burner is controlled. The apparatus for setting the stone may have some further special features as will be described hereinafter.

The accompanying drawing illustrates one embodiment of the invention. In this drawing Figure 1 shows a perspective view of the grinding and polishing machine, and Fig. 2 shows a perspective view of the dop holder. Fig. 3 is a similar view of the stone setting apparatus, whereas Fig. 4 represents a cross-sectional view of the device for controlling the supply of gas to the burner, and Fig. 5 a similar view of part of the compressed air reservoir from which the air is led to the burner. Fig. 6 is a perspective view, partly in section, showing a device for forcing the metal for soldering the stone into the dop, and Fig. 7 illustrates a spherical dop in detail.

In the arrangement illustrated in Fig. 1 there is the usual lapping wheel or skive 1 rotatably mounted on a vertical shaft (not shown). A stationary table 2 has a guide 3 in which a suitably formed slide 4 is adapted to reciprocate, a screw 5 serving the purpose of securing said slide in the proper position.

The slide 4 has a horizontal shaft 6 about which an arm 7 is rotatable in a vertical plane which is radial in respect to the skive 1. Said arm 7 is provided with a sliding weight 8 which can be secured at any desired distance from the shaft 6 by means of a screw 9. The said sliding weight consists of a number of loose disks, so that the pressure upon the stone may be regulated by increasing or decreasing the number of disks. Within the end of the arm 7 is a centrally disposed recess 11 which is square in cross section and which serves for the reception on a correspondingly formed pin 12 of the dop holder.

The dop holder consists of two fingers 13, 14, having near their lower ends oppositely facing spherical bearing recesses 15. The finger 13 is integral with a cross piece, to which the pin 12 is connected, and to which is hinged the finger 14. A bolt 16 bears against the exterior face of the finger 13 by means of a shoulder, and extends through an elongated slot 18 in this finger, the end of said bolt having a threaded connection with the second finger 14. Around said bolt 16 a spiral spring 19 is located which at its ends bears against the inner faces of the fingers 13, 14 and tends to separate said fingers. By turning the screw 16, however, the fingers may be drawn together to securely hold the dop positioned between the bearing recesses 15. The pin 12 of the dop holder can be held in place in the recess 11 in the arm 7 by means of a screw 20.

The dop 21 consists of a metal ball or sphere, having six cylindrical holes or depressions 22 for the reception of the alloy into which the stones are to be soldered. The filling of these holes may be effected in the manner illustrated in Figs. 6 and 7. In the metal of the ball 21 and opening into the said holes 22 narrow radial slots 23 are made. The alloy in which the stones are to be soldered is made in the form of small cylinders 24 with conical heads, the diameter of the cylinders 24 being just a little smaller than the diameter of the holes 22. For filling the holes 22 the ball 21 is placed upon a suitably formed standard or support 25, so that the series of holes 22 is located in a vertical plane. A cylinder 24 is then introduced into the hole or depression at the top of the ball, whereupon a suitably formed drift 26 is placed upon the conical head of said cylinder and the latter is forced into the hole by means of a heavy hammer-blow on the drift. The relatively soft metal is thereby caused to entirely fill up the hole and is forced into the slots 23 and immovably secured in the ball.

The arm 7 (Fig. 1) in its polishing position engages a positive stop consisting of a micrometer screw 27 passing through a nut 29 and provided at its free end with an antifriction roller 28. The nut 29, having a scale 30 coacting with an indicating hand 31, is rotatably mounted in a casing 32 integral with the slide 4.

The operation of the device is as follows:

After a bruted or rough cut stone has been soldered in each of the holes 22 of the dop 21 the latter is engaged between the fingers 13, 14 of the dop holder, the holder secured to the arm 7, and the latter swung into the polishing position. The spherical dop 21 is then turned by the operative so that one of the stones touches the skive. The spherical shape of the dop and its suspension between spherical pans permits the stone to be turned in every direction; the operative is therefore only within certain limits dependent upon the position in which the stone has previously been set by the turner, as he can adjust the gem in accordance with the "grain." The micrometer screw 27 is now turned by means of the nut 29 to such an extent that the antifriction roller 28 nearly engages the supporting arm 7, when the stone may be ground until the arm 7 engages the roller 28. If at such moment the facet has not yet been ground deep enough, the roller 28 is screwed down a little so that the arm 7 with the dot 21 can again descend a corresponding distance, and further material may be ground off. By rotating the nut 29 the operative can therefore always limit the depth of the cut, so that it is impossible for the stone to be overground provided the operative uses his normal diligence, and when the operative for some reason is obliged to leave his mill the stones need not be taken from the skive.

When the operative wishes to examine the progress of the work he may disengage the dop holder from the machine and examine the stone with a magnifying glass; if the dop after this examination is again mounted in the machine, the stone necessarily reassumes its original position with respect to the lapping wheel, so that the grinding operation may be continued without any further adjustment.

The sliding weight 8 has for its object to regulate the pressure with which the stone is pressed upon the lap.

When a facet has been ground, the slide 4 is reciprocated in its guide 3 across the rotating lapping wheel, by which the facet is polished. This being done the operative does not proceed to the grinding of a second facet on the same stone, such as is usual in present day practice, but he now turns the dop 21 to such an extent that the next stone assumes its proper grinding position. In this manner the polisher continues his work until one facet has been made on all stones, after which the dop is taken out of the machine in order that the stones may be adjusted in the proper position for a second facet to be ground, and so on.

With the usual dimensions of the lapping wheel or skive nine grinding machines as described may be arranged radially around the wheel. Assuming now that the dop of each machine holds six stones, and that with each mill one spare dop is used, it is clear that one polisher can attend to sixty stones without requiring a readjustment of the stones in the dop; this great number of stones does not interfere with the exactness of the grinding and polishing operation, as the micrometer screw 27 always permits of limiting the depth of the cut.

The dop containing six stones each of which has one of its facets ground and polished is substituted by the spare dop (so that the grinding operation may be continued without interruption) and placed in the setting apparatus. This apparatus is illustrated in Figs. 3, 4 and 5 and comprises a vessel 33 which is open at its top and has two horizontal pivots or trunnions 34, 35, the pivot 34 being fixed, and the pivot 35 forming the end of a screw 36 extending through the wall of the vessel, so that the distance between the two pivots may be increased or decreased as the case may be. Between said trunnions the dop 21 may be rotatably mounted in the vessel 33, and for this purpose the dop 21 is provided with pans or holes 37.

The vessel 33 contains a cooling liquid the level of which should be so high that about one half of the dop 21 is immersed in the liquid.

A burner 38 is so arranged that it may assume a central position over the dop 21 so that a flame may be directed upon the dop at a point adjoined the top hole 22. The soldering metal in said hole may in this manner be melted down or at least be made so plastic that the stone may be adjusted. By turning the spherical dop about the pivots 34, 35, all stones may successively be set, during which operation the cooling liquid keeps the dop at a comparatively low temperature.

The combustion gas for the thin flame is supplied through a pipe 39, 40, and the required air is stored in a compressed air reservoir 41, in which the necessary pressure is maintained by means of a small pump 42 of some known construction, as illustrated in detail in Fig. 5. From the reservoir 41 the air flows through a pipe 43 to the gas pipe 39, 40 of two-part formation. The bottom part 39 of said pipe is stationary whereas the top part 40, supporting the burner 38 and a protecting cap 44, is adapted to rotate in a horizontal plane with respect to the bottom part 39. The bottom part 39 has a threaded connection with the bottom of a casing 45 (Fig. 4) secured to the lower end of the pipe 40; and on the top of pipe 39 a small plate 46 is secured within the casing 45. The pipe 40 opens into the casing eccentrically with respect to the mouth of the pipe 39 in such a manner, that on rotation of the pipe 40 with respect to the pipe 39 the mouth of pipe 40 is for the greater part shut off by the said plate 46. Under these circumstances only a very small quantity of gas can flow to the burner 38, so that the flame will burn very low, and no gas is wasted.

To the pipe 40 a magnifying glass is secured in such a manner that if the burner 38 from the position shown in Fig. 3 is turned 180° in a horizontal plane, the said glass assumes a central position over the dop 21, so that the proper setting of the stone may be observed. A positive stop 48 serves for limiting the extent of horizontal rotary movement of the said glass 47 when turned for controlling the stone.

The compressed air reservoir 41 may oe partially filled with a cooling liquid, and may be placed in communication with the vessel 33 by means of a pipe 49 opening into said reservoir near its bottom, and provided with a cock or valve 50, so that by opening the cock or valve 50 liquid from the reservoir 41 may be pressed into the vessel 33 should the level in the latter have sunk due to evaporation.

The compressed air reservoir 41 is provided with a safety valve 51 shown in detail in Fig. 5, and mounted in a sleeve 52 screwed into a hole of the cover of the reservoir 41. The said hole may be used for filling the reservoir with liquid after the said sleeve 52 has been unscrewed.

The vessel 33 contains a strainer 53 at some distance below the supporting device for the dop 21, and a drain cock 54 near its bottom. A table 55 may be secured to the vessel 33 by means of a screw 56, and serves for supporting the operative's tools.

What I claim and desire to secure by Letters Patent is:

1. In combination with a gem grinding and polishing machine of the type referred to, a spherical dop adapted to hold a plurality of stones, a dop holder comprising two fingers hinged together and provided with spherical pans for the reception of said dop, a bolt passing through an elongated opening in one finger and having a screw connection with the second finger, and a spiral spring located around said bolt and tending to increase the gap between said fingers.

2. In combination with a gem grinding and polishing machine of the type referred to, a dop adapted to hold a plurality of stones and rotatably mounted in an arm, a lapping wheel or "skive", a stationary support outside the lapping wheel, a pivotal joint between said arm and said support permitting a movement of the said arm in a vertical plane radially disposed with respect to the lapping wheel, and a positive stop adapted to limit the extent of movement of the said arm.

3. In combination with a gem grinding and polishing machine of the type referred to, a dop adapted to hold a plurality of stones and rotatably mounted in an arm, a lapping wheel or "skive", a stationary support outside the lapping wheel, a pivotal joint between said arm and said support permitting a movement of the said arm in a vertical plane radially disposed with respect to the lapping wheel, and a positive stop vertically adjustable by means of a micrometer screw.

4. In a gem grinding machine, in combination, a rotatable lapping wheel, a dop holder, means for supporting said holder, and a spherical dop having a plurality of stones mounted in spaced relation on the periphery thereof mounted in said dop holder for rotational adjustment therein in all directions.

5. In a gem grinding machine as claimed in claim 4, a dop holder comprising separated relatively movable members and means operable to clamp said members upon opposite sides of said spherical dop to hold the latter in adjusted positions.

6. In a gem grinding machine, in combination, a rotatable lapping wheel, a dop holder having opposite facing spherical bearing recesses, means for supporting said holder, and a dop having a plurality of stones mounted in spaced relation on the periphery thereof and having spherical bearing surfaces seated in said bearing recesses.

7. In a gem grinding machine as claimed in claim 6, a dop holder comprising a relatively fixed member, having one of said recesses formed therein, a relatively movable member having the other recess formed therein, and means co-acting with said members operable to move the second member toward the first to clamp the bearing surfaces on the dop between said bearing recesses.

8. In a gem grinding machine, in combination, a rotatable lapping wheel, a dop holder, means for supporting said holder, and a dop carried by said holder and rotatably adjustable therein on an axis substantially parallel with the surface of said lapping wheel, said dop having a plurality of stones mounted thereon and successively positioned in engagement with said wheel by said adjustment of said dop.

9. A spherical dop having a plurality of recesses in the periphery thereof and means within said recesses for securing a plurality of stones upon the periphery of said dop.

10. A dop having a series of recesses in the periphery thereof and having spherical bearing surfaces at opposite sides thereof, said series of recesses lying in a plane between said bearing surfaces, and means within said recesses for securing a plurality of stones upon the periphery of said dop.

11. A rotatable dop having a circular series of recesses lying in a plane perpendicular to the axis of rotation of the dop and means within said recesses for securing a plurality of stones upon the dop.

12. In a gem grinding machine, in combination, a rotatable lapping wheel, a stationary support, an arm pivoted to said support and having its free end movable about said pivot in a vertical plane, toward and from the surface of said wheel, a dop holder carried by the free end of said arm, a dop carried by said holder, and means for limiting the movement of said arm toward the surface of the lapping wheel.

13. A gem grinding machine as claimed in claim 12, wherein said limiting means comprises a sleeve rotatable upon said support but held from axial movement, and a member screw-threaded within said sleeve and having its outer end positioned to engage said arm.

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

ARNO BOERNER.

Witnesses:
PLAUTO FIBURE,
H. VUHAGRE.