A. GABUS.

JEWEL BLANK SHAPING MACHINE.

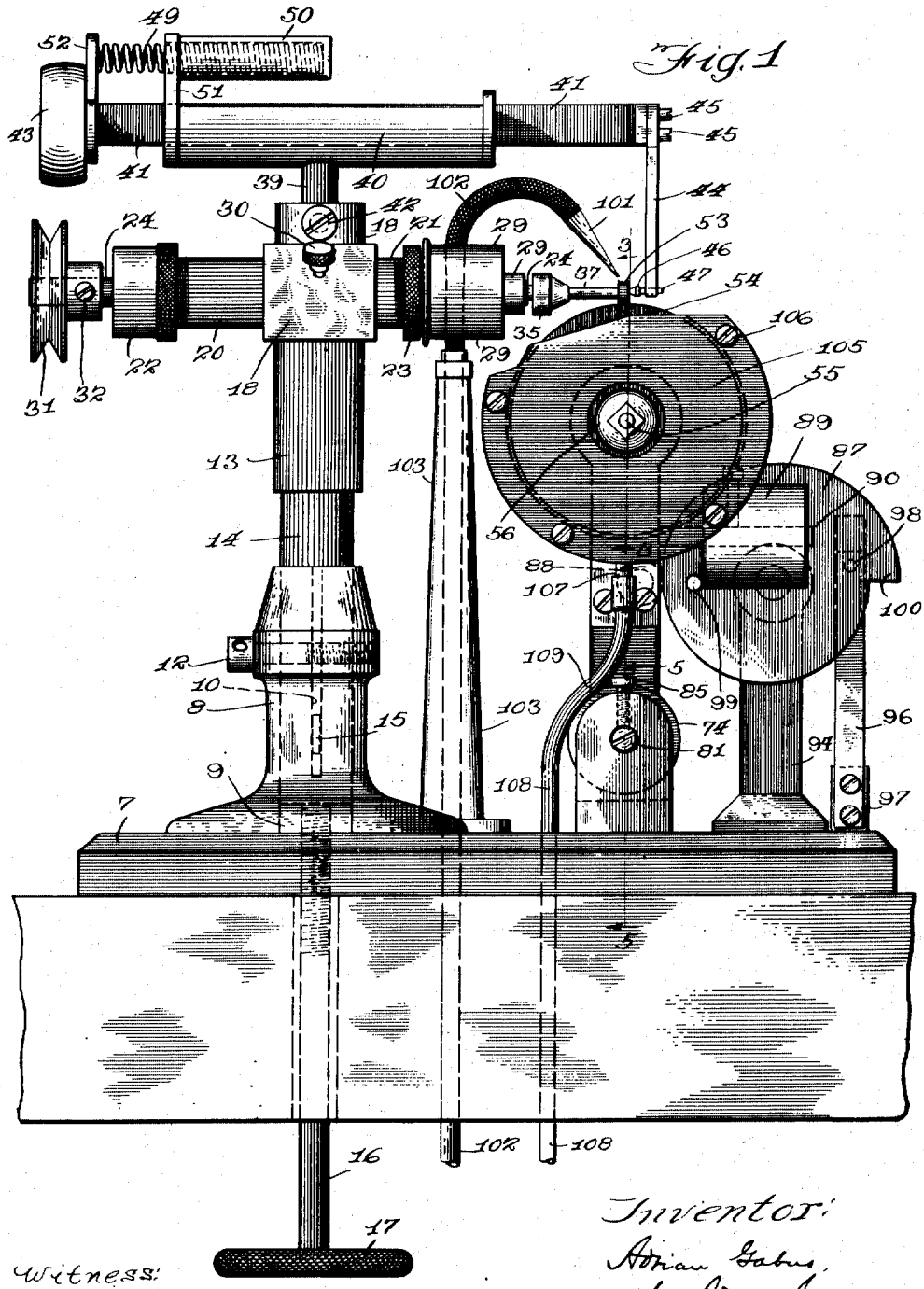
APPLICATION FILED DEC. 2, 1916.

1,302,907.

Patented May 6, 1919.

3 SHEETS—SHEET 1.

Fig. 1



Witness:
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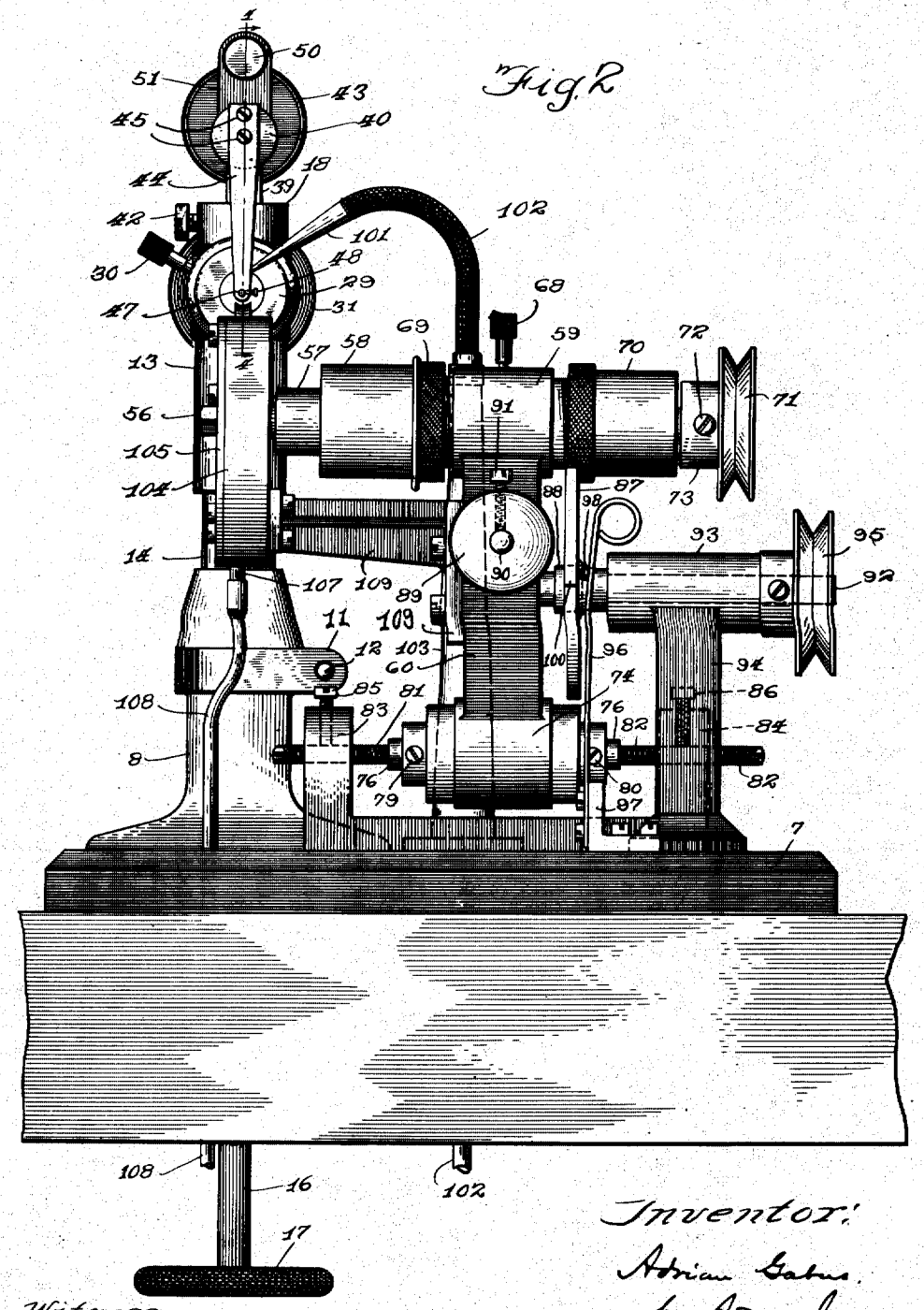
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3 SHEETS—SHEET 2.



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3 SHEETS—SHEET 3.

Fig. 3

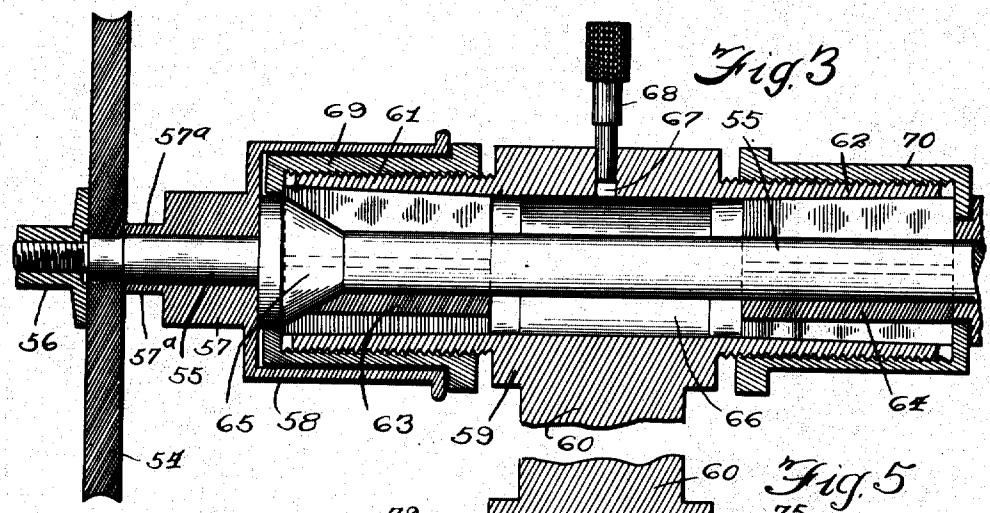


Fig. 5

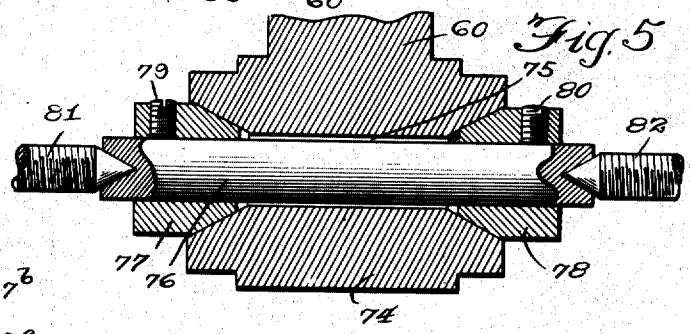


Fig. 6

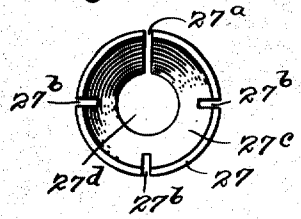
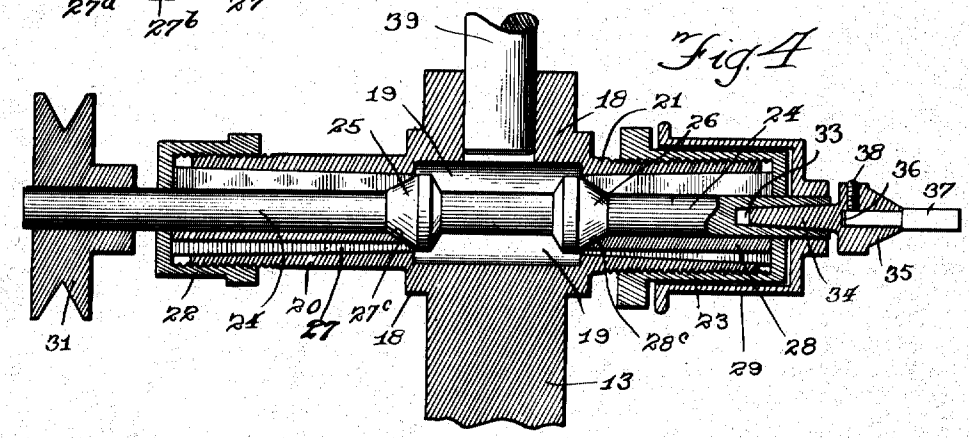


Fig. 4



Witness,
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UNITED STATES PATENT OFFICE.

ADRIAN GABUS, OF SPRINGFIELD, ILLINOIS.

JEWEL-BLANK-SHAPING MACHINE.

1,302,907. Specification of Letters Patent. Patented May 6, 1919.

Application filed December 2, 1916. Serial No. 134,633.

To all whom it may concern:

Be it known that I, ADRIAN GABUS, a citizen of the Republic of Switzerland, and a resident of Springfield, in the county of Sangamon and State of Illinois, have invented certain new and useful Improvements in Jewel-Blank-Shaping Machines, of which the following is a specification, reference being had to the accompanying drawings.

My invention relates to the manufacture of jewels such as are used for the bearings of chronometers, electricity meters, and other delicate instruments. One of the materials commonly used for such jewels is sapphire, but various other precious or semi-precious stones are also used for the purpose. Such stones are furnished to the jewel maker in the form of thin slabs of approximately the proper thickness and of irregular peripheral contour, and such slabs must be made truly cylindrical and must be reduced very exactly to a predetermined diameter in order to fit in the socket in which they are to be set. The work of properly fashioning the raw material is one of extreme nicety, and as heretofore practised it has been expensive and difficult to perform. The object of my present invention is to provide a new and improved machine for shaping the slabs above mentioned into cylindrical blanks of the proper dimensions preparatory to their being further treated to make the finished jewel. It will be understood that the blank formed from the slab, which then is a thin flat disk, may be made either into a cup jewel or a ring jewel, depending on the purpose for which it is to be used. If it is to be made into a cup jewel, one flat surface is cupped or provided with a semi-spherical recess, whereas if a ring jewel is to be made, the blank is bored entirely through to give it the form of a ring, the edges being, of course, rounded and the surfaces polished so that friction will be reduced to the minimum. My present invention is not, however, concerned with the treatment of the jewel material beyond the stage of forming the blank from the slab.

The problem of devising a machine suitable for shaping jewel blanks is an exceedingly difficult one for several reasons. First, the work must be done with extreme accuracy in order that the jewel will fit closely and firmly in the place arranged to receive it, the difficulty of securing such accuracy being greatly increased because of the fact that such jewels are necessarily very small. The only practicable way of shaping the slab is to grind it to the proper shape, the slab being rotated at high speed during the grinding operation. It will be apparent, therefore, that the devices by which the slab is supported and rotated, and also the devices by which the grinding is effected, must all be so mounted as not to deviate even in the slightest degree from the position in which they are originally set, otherwise the blank formed would be imperfect since its peripheral surface would not be true. Second, the hardness of the material operated upon requires the use of a very hard abrasive, such as diamond dust, and the material ground from the slab is also given off in the form of dust, so that it is necessary to so construct the machine that the bearings which position the operating parts shall be protected from such dust, otherwise they will not only wear out rapidly but will also become inaccurate in a comparatively short time. Third, the machine must be capable of adjustment in a variety of ways to adapt it to operate on slabs of different thicknesses and to produce blanks of different diameters, but the adjusting devices must be so constructed as to be capable of very exact and fine regulation. Fourth, it is necessary that the machine, to be successful, be to a large extent automatic so as to require little or no attention beyond putting the slabs in place and removing them when the blank is finished.

The machine which forms the subject-matter of this application overcomes all these difficulties and operates with entire success to shape blanks from slabs having irregular peripheries so that such blanks are ready to be further treated, for the production of the finished jewel, by cupping or boring.

In the accompanying drawings,—

Figure 1 is an elevation of my improved machine, showing the manner in which the

slab is supported while being operated upon, and the lap by which the slab is ground down to cylindrical form, together with the devices by which the lap is supported and operated;

Fig. 2 is an elevation taken at right angles to the view of Fig. 1;

Fig. 3 is an enlarged detail, being a partial vertical section on line 3—3 of Fig. 1;

Fig. 4 is a partial longitudinal vertical section on line 4—4 of Fig. 2;

Fig. 5 is an enlarged detail, being a partial vertical section on line 5—5 of Fig. 1; and

Fig. 6 is an end view of one of the elastic tubular bearings which are used to support and protect the two main shafts of the machine.

Referring to the drawings, in which is illustrated the preferred embodiment of my invention,—7 indicates the base of the machine and 8 a tubular pedestal secured upon the base in any suitable way. As indicated by the dotted lines in Fig. 1, said pedestal is provided with a vertical passage therethrough, which is circular in cross-section, and extending downward from the upper end of the pedestal, at one side, is a slot 10, also indicated by dotted lines in Fig. 1. This slot extends downward a considerable distance, and its purpose is to permit the upper portion of the pedestal to contract and expand slightly so that it may operate as a clamp, as hereinafter described. At one side, near its upper end and at opposite sides of the slot 10, the pedestal 8 is provided with lugs 11, one of which is shown in Fig. 2, the arrangement being such that by passing a bolt 12 through said lugs, one of which is screw-threaded, the upper portion of the passage through the pedestal may be expanded or contracted, for the purpose stated.

13 indicates a standard, which is provided with a stem 14 of reduced diameter, adapted to fit telescopically in the bore or passage of the pedestal 8 so that the standard may be vertically adjusted with regard to the pedestal. By means of the clamping bolt 12 the pedestal may be clamped tightly upon the stem 14 so as to hold the standard 13 against vertical movement. The stem 14 is prevented from rotating in the pedestal 8 by means of a feather 15 which fits in the slot 10, as shown in dotted lines in Fig. 1. 16 indicates an adjusting-screw having a handle 17, said screw being fitted in a suitable screw-threaded bearing in the base 7 disposed concentrically with reference to the axis of the pedestal 8. The upper end of said screw bears against the lower end of the stem 14 so that by means of said screw the standard 13 may be raised. The standard may be lowered by moving the screw 16 down out of contact with the stem 14 so that said stem may be pressed down in its socket. By this construction a very fine vertical adjustment of the standard 13 may be obtained.

18 indicates a hollow block, carried at the upper end of the standard 13, inclosing a chamber 19, as shown in Fig. 4. 20—21 indicate horizontal sleeves which extend in opposite directions from the ends of the chamber 19, as shown in Figs. 1 and 4. The outer end portions of these sleeves are provided with screw-threads to receive deep cup-like caps 22—23, respectively, which fit upon them, as shown in Figs. 1 and 4. 24 indicates a shaft or mandrel which extends longitudinally through the sleeves 20 and 21 and the chamber 19, and also through the caps 22 and 23, said caps being perforated centrally to fit closely upon said mandrel. 25—26 indicate oppositely-disposed conical bearings carried by the mandrel 24 at points corresponding approximately with opposite ends of the chamber 19. These bearings are preferably formed integral with the mandrel, and their conical bearing surfaces extend toward the ends of the sleeves 20—21, respectively. 27—28 indicate two similar tubular bearings, which are split longitudinally as shown at 27^a in Fig. 6, and are also provided with longitudinal grooves 27^b suitably spaced apart, preferably ninety degrees from each other and from the slot 27^a, as shown in said figure. While I prefer to use three of such grooves, any suitable number may be employed. As best shown in Fig. 4, the tubular bearings 27—28 are tapered externally, and at their inner ends are beveled, as shown at 27^c and 28^c in Fig. 6, so as to fit closely against the conical bearing surfaces 25—26, as shown in Fig. 4. The inner surfaces of the sleeves 20—21 are also tapered to receive the tapered tubular bearings 27—28, and the length of said bearings is such that when in position they project slightly beyond the ends of said sleeves 20—21, so that the caps 22—23 may engage the outer ends of said tubular bearings and act to force them closely against the conical bearing surfaces 25—26 and hold them in position. Owing to the fact that the bearings 27—28 are slotted or grooved longitudinally and are made of material sufficiently elastic for the purpose, they may be seated tightly in their respective sleeves 20—21 by means of the caps 22—23. Each of the tubular bearings 27—28 is bored centrally, as shown at 27^d in Fig. 6, so as to fit closely upon the mandrel 24, and they are so proportioned that when in operative position they are not contracted sufficiently to close the slots 27^a.

A suitable lubricant is placed in the chamber 19, and by the rotation of the mandrel

24 and its conical bearings 25—26 oil is supplied to the longitudinal slots 27ª of both bearings 27, 28, and through such slots is supplied to the surface of the mandrel. At the same time some of the lubricant passes down between the conical bearings 25—26 and the adjacent ends of the tubular bearings 27—28, so that all portions of the mandrel are efficiently lubricated. By providing extended bearing surfaces for the mandrel and using the deep cup-like caps 22—23, the bearings are sufficiently protected against the admission of abrasive material, such as diamond or sapphire dust, which, while the machine is in operation, is carried by the air in the vicinity of the machine. As the air nearest the work carries a larger percentage of such abrasive dust, I provide a rotating supplemental cap 29, which fits loosely over the cap 23, and fits closely upon the adjacent end of the mandrel 24 so as to be held thereon by friction, as best shown in Figs. 1 and 4. The cap 29 serves as a hood to prevent abrasive material in the air from coming immediately into contact with the bearing surfaces of the mandrel and cap 23, and also by its rotation acts to direct abrasive particles away from said cap. Oil is supplied to the chamber 19 through a suitable opening closed by a cap 30, shown in Fig. 1, or in any other suitable way. By providing a chamber for lubricant, such as that described, before beginning operations for the day, a sufficient supply of lubricant may be placed in the chamber to last all day, so that the necessity of opening the lubricant chamber while the air is more or less impregnated with abrasive dust is avoided, and besides, the workman is not required to give any attention to the matter of lubrication while operating the machine.

31 indicates a pulley mounted upon the mandrel 24, at the left-hand end thereof as shown in Fig. 4, and held in position by a set-screw 32 so that it may readily be removed when necessary. The pulley 31 is driven from any suitable source of power, preferably by a belt, but I wish it to be understood that any other suitable means may be employed for rotating the mandrel. The opposite end of the mandrel is provided with a tapered socket 33 concentric with the axis of the mandrel and adapted to receive the tapered shank 34 of a chuck 35. The shank 34 fits closely in the socket 33, in which it is held by friction, so that the chuck rotates with the mandrel. The chuck 35 is also provided with a socket 36 which is concentric with the axis of the mandrel and is adapted to receive the stem of a pin 37, the outer end of which is adapted to engage the slab to be operated upon, and coacts with a center to support the slab while it is operated upon by the lap, as will be hereinafter described. The pin 37 is secured in the chuck 35 by a set-screw 38 so that it may easily be removed, or be adjusted to compensate for variation in the thickness of the slabs operated upon.

39 indicates a cylindrical stem, which fits in a suitable socket in the upper end of the head 18, so disposed that the stem 39 is concentric with the axis of the standard 13, which axis also intersects the axis of the mandrel 24. 40 indicates a horizontally-disposed head mounted on or integral with the stem 39, said head being grooved longitudinally in its upper surface to receive a slide-bar 41, as shown in Fig. 1. The slide-bar 41 is preferably rectangular in cross-section and fits closely in the groove in the head 40 so that while it may move longitudinally it is incapable of rotation. The head 40 overlies the sleeves 20—21, and is normally held fixedly in such position by a set-screw 42, shown in Fig. 1. 43 indicates a knob provided at the left-hand end of the slide-bar 41, as shown in Fig. 1. 44 indicates a depending arm secured at the opposite end of said slide-bar, preferably by screws 45. The arm 44 carries at its lower end a center 46, the point of which is adapted to be brought into alinement with the axis of the pin 37, as shown in Figs. 1 and 2. The center 46 is provided with a stem 47 which fits in a suitable socket in the lower end of the arm 44, and said stem is secured in position by a set-screw 48, shown in Fig. 2. By this means the center may be easily removed when necessary, or may be adjusted. 49 indicates a spring, which normally presses the slide-bar 41 to the left, as shown in Fig. 1, said spring being mounted in a pocket 50 carried by a plate 51 secured to the head 40. The outer end of the spring 49 bears against a plate 52 secured to the slide-bar 41 near the handle 43, as shown. Thus the tendency of the spring is to move the slide-bar 41 to the left, thereby moving the center 46 toward the pin 37. The operator, by placing the palm of his hand on the handle 43 and seizing the head 40 with his fingers, may easily compress the spring 49 and move the slide-bar 41 to the right when he wishes to release the slab operated upon, or to place a new slab in position. When he relaxes his grip, the spring will automatically move the slide-bar 41 to the left and cause the center 46 to engage the slab. 53 indicates a slab in position between the end of the pin 37 and the center 46. The tension of the spring 49 is sufficient to hold the slab in place while it is being operated upon. It will be apparent that when it is desired to do so the operator may swing the slide-bar 41 about its stem 39 as an axis by first loosening the set-screw 42, but ordi-

narily there is no occasion to swing the slide-bar 41, as after it is once set so that the center 46 is in axial alinement with the pin 37, it is seldom necessary to adjust those parts with relation to each other. If it should be necessary to adjust the standard 13 vertically, the head 40 goes with it, and therefore the relation of the center 46 to the pin 37 is not varied by reason of such vertical adjustment of the standard 13.

The shaping of the slab into cylindrical form is effected by means of a lap 54 rotated at high speed and carrying a suitable abrasive, such as diamond dust, on its periphery. The maner in which the lap is mounted and operated will now be described. Referring particularly to Figs. 2, 3 and 4, 55 indicates a shaft or spindle, upon one end of which the lap 54 is mounted, as shown in Fig. 3, it being held in position by a clamping nut 56 screwed upon the end of said shaft, as shown. The lap is clamped against the reduced end 57ª of the hub 57 of a cap 58 similar to the cap 29. The hub 57 fits closely upon the shaft 55 and frictionally engages the same so that the cap 58 rotates therewith, in the same way and for the same purpose as the cap 29. The shaft or spindle 55 extends through a head 59 carried at the upper end of a pivoted arm 60 which is mounted as will be hereinafter specifically described. Said head is provided with oppositely extending sleeves 61—62 which are externally screw-threaded and internally tapered in much the same way as the sleeves 20—21. Mounted in said sleeves are tubular bearings 63—64 very similar to the bearings 27—28. The only difference between the bearing 63 and the bearings 27—28 is that it is internally beveled at its larger end instead of at its smaller end, as is the case with the bearings 27—28. This difference is to adapt the bearing 63 to fit upon a conical bearing 65 carried by the shaft 55 adjacent to the hub 57, as shown in Fig. 3. The tubular bearing 64 differs from the bearing 63 in that it is not internally beveled, since there is only one conical bearing on the shaft 55. The head 59 between the tubular bearings 63—64 forms a chamber 66 for lubricant, similar to the chamber 19. The chamber 66 is supplied through a passage 67, closed by a cap 68, as shown in Fig. 3. 69—70 indicate cup-like caps which screw upon the sleeves 61—62 in the same way as the caps 22—23, and in like manner act to force the tubular bearings 63—64 down in their seats and hold them in position. 71 indicates a pulley mounted on the spindle 55 adjacent to the cap 70 and secured to said spindle by a set-screw 72, or other suitable means. The pulley 71 is provided with a hub 73 which preferably extends through the cap 70, as shown in Fig. 3. The pulley 71 is driven from any suitable source of power, and accordingly drives the spindle 55 and lap 54 at the requisite speed.

The arm 60 which carries the head 59 is provided with a hub 74 having a horizontal passage 75 therethrough, the ends of which are flared, as shown in Fig. 5. 76 indicates a rock-shaft which extends through the passage 75 and is of slightly less diameter than said passage. 77—78 indicate wedge-blocks which are fitted upon the shaft 76 and are movable longitudinally thereon into engagement with the flared end portions of the passage 75. By adjusting the blocks 77—78 upon the shaft 76, the arm 60 may be moved longitudinally of said shaft, and by removing one of said blocks, the shaft may be withdrawn from the hub 74. 79—80 indicate set-screws for securing the wedge-blocks 77—78 in position. The rock-shaft 76 is mounted between trunnions 81—82, in the form of screws fitted in standards 83—84, respectively, which are mounted on the base 7. By this means the trunnions may be adjusted longitudinally of the hub 74 to move said hub in one direction or the other, thereby adjusting the spindle endwise of itself and adjusting the lap transversely with reference to the vertical plane in which the mandrel 24 lies. 85—86 indicate set-screws for securing the trunnions 81—82, respectively, in their different positions of adjustment, said set-screws being mounted in the standards 83—84, as shown in Fig. 2.

As best shown in Fig. 2, the lap 54 is mounted so that its periphery is in the same vertical plane as the axis of the mandrel 24, and it will be apparent from the foregoing description that the lap may be swung in said plane toward and from the work by rocking the head 59 about the axis of the shaft 76, thereby moving the lap into engagement with a slab held in position between the pin 37 and the center 46. It will be evident that the diameter of the jewel blank formed will be determined by the position of the highest peripheral point of the lap, and the lap reaches its highest position when the axes of the shafts 55 and 76 are in the same vertical plane. Normally, the head 59 is thrown back, or to the right of the position shown in Fig. 1, in which position it is supported by a disk-cam 87 which bears against a roller 88 mounted at one side of the arm 60, as shown in Figs. 1 and 2. Said roller is normally held in contact with said cam by means of a counterbalancing weight 89 carried by a rod 90 which projects from the arm 60, as shown in Figs. 1 and 2. The weight 89 may be adjusted to vary its action by sliding it upon the pin 90, and it may be secured in position by a set-screw 91, shown in Fig. 2. The cam 87 is mounted upon a shaft 92 pivoted

in a sleeve 93 carried by a fixed standard 94 mounted on the base, as shown in Fig. 2. The shaft 92 carries a pulley 95 by means of which it may be rotated from any suitable source of power. 96 indicates a spring carried by a bracket 97 secured to the base, as shown in Fig. 2, and having a pin 98 which is adapted to enter a hole 99 in the cam 87, as shown in Fig. 1. The tension of the spring 96 tends to press the pin 98 against the face of the cam 87, and consequently when the hole 99 registers with the pin 98 said pin enters the hole and locks the cam against rotation. These parts are so adjusted that the cam is locked immediately after the roller 88 passes off the highest point 100 of the cam. When this happens, the cam stops and the head 59 is free to swing to the right until the roller again engages the periphery of the cam at the point where its radius is shortest. The stoppage of the cam is permitted by the slipping of the driving belt upon the pulley 95. It will be understood that the cam 87 is rotated slowly, its rotation being instituted by manual movement of the spring 96 to the right, as shown in Fig. 2, so as to release the pin 98 from the hole 99. The belt which drives the pulley 95 being constantly driven, as soon as the pin 98 releases the cam, the latter begins to rotate, and, owing to the eccentricity of its periphery, moves the head 59 to the left or toward the standard 13. This carries the lap over toward the work and at the same time raises it so that when it approximates the position shown in Fig. 1 it engages the slab and grinds it. While this operation is taking place, both the lap and the slab are being rotated at high speed. As the lap advances, the grinding operation continues until the lap reaches its highest point and passes across the peripheral portion of the slab. Soon after this occurs the high point 100 will pass off the roller 88, thereby permitting the head 59 to swing back to its inoperative position, and the rotation of the cam will be arrested by the engagement of the pin 98 with the hole 99. The jewel blank formed by this operation may then be removed and another slab put in place.

Water is applied to the slab and lap during the grinding operation through a nozzle 101 connected to a tube 102 which extends through a tubular standard 103 and is supplied with water from any suitable source. I prefer to make the upper end of the tube 102 flexible and it is preferably covered by a suitable wrapping, as illustrated in the drawings. All but the operating portion of the lap 54 is inclosed in a housing 104 having a removable front plate 105 preferably secured in place by screws 106, as shown in Figs. 1 and 2. This housing is fitted around the reduced portion 57ª of the cap 58 and approaches closely thereto so that the water passing down over the lap does not leak out around said bearing to any objectionable extent. The lower portion of the housing is provided with a discharge tube 107 which connects with a waste pipe 108, as best shown in Figs. 1 and 2. This waste pipe conducts the effluent to any suitable receptacle, where the diamond and sapphire dust resulting from the grinding operation may be recovered. The housing is firmly supported in place by a bracket 109 secured to it and to the arm 60, as shown in Fig. 2.

It will be evident from the foregoing description that the machine described operates to a large extent automatically, since all that the operator has to do is to apply the slabs and remove the jewel blanks, and operate the spring 96 to release the cam 97 whenever a new slab has been put in place. The several parts of the machine may be very accurately adjusted, and the bearings, and particularly those exposed to the fine dust caused by the grinding operation, are fully protected, and consequently the machine may be operated for a long time without requiring any adjustment, or the replacement of parts.

It will be understood that while I have described with considerable particularity the construction illustrated in the drawings, my invention is not limited to the specific construction shown except in so far as it is particularly claimed, but includes generically the subject-matter of the broader claims.

That which I claim as my invention, and desire to secure by Letters Patent, is,—

1. A machine of the class described, comprising means for supporting and rotating a slab, a lap, and swinging means movable longitudinally of the axis of the slab for supporting and rotating said lap, the axis of the lap being disposed transversely of the axis of the slab.

2. A machine of the class described, comprising means for supporting and rotating a slab, a lap, means movable longitudinally of the axis of the slab for supporting and rotating said lap, the axis of the lap being disposed transversely of the axis of the slab, and means for moving the lap into engagement with and across the periphery of the slab.

3. A machine of the class described, comprising means for supporting and rotating a slab, a lap, means for supporting and rotating said lap, the axis of the lap being disposed transversely of the axis of the slab, and a cam for moving the lap into engagement with and across the periphery of the slab.

4. A machine of the class described, com-

prising means for supporting and rotating a slab, a lap, means movable longitudinally of the axis of the slab for supporting and rotating said lap, the axis of the lap being disposed transversely of the axis of the slab, means for moving the lap into engagement with and across the periphery of the slab, and means for moving the lap out of operative position upon the completion of each operative movement thereof.

5. A machine of the class described, comprising means for supporting and rotating a slab, a lap, means for supporting and rotating said lap, the axis of the lap being disposed transversely of the axis of the slab, a cam for moving the lap into engagement with and across the periphery of the slab, and means for moving the lap out of operative position upon the completion of each operative movement thereof.

6. A machine of the class described, comprising means for supporting and rotating a slab, a lap, a spindle upon which said lap is mounted, a movable support in which said spindle is rotatably mounted, the axis of said spindle being transversely disposed relatively to the axis of the slab, and means for moving said spindle to carry the lap across the peripheral portion of the slab.

7. A machine of the class described, comprising means for supporting and rotating a slab, a lap, a spindle upon which said lap is mounted, a movable support in which said spindle is rotatably mounted, the axis of said spindle being transversely disposed relatively to the axis of the slab, means for moving said spindle to carry the lap across the peripheral portion of the slab, and means for restoring the spindle to its initial position after each operative movement thereof.

8. A machine of the class described, comprising means for supporting and rotating a slab, a lap, a spindle upon which said lap is mounted, a movable support in which said spindle is rotatably mounted, the axis of said spindle being transversely disposed relatively to the axis of the slab, and a cam for moving said spindle to carry the lap across the peripheral portion of the slab.

9. A machine of the class described, comprising means for supporting and rotating a slab, a lap, means for supporting and rotating said lap, the axis of the lap being disposed transversely of the axis of the slab, a cam for moving the lap into engagement with and across the periphery of the slab, and means for automatically stopping the cam upon the completion of each operative movement thereof.

10. A machine of the class described, comprising means for supporting and rotating a slab, a lap, a spindle upon which said lap is mounted, a movable support in which said spindle is rotatably mounted, the axis of said spindle being transversely disposed relatively to the axis of the slab, a cam for moving said spindle to carry the lap across the peripheral portion of the slab, and means for automatically stopping the cam upon the completion of each operative movement thereof.

11. A machine of the class described, comprising means for supporting and rotating a slab, a lap, a spindle upon which said lap is mounted, a rocking support in which said spindle is rotatably mounted, the axis of said spindle being transversely disposed relatively to the axis of the slab, and means for rocking said support to carry the lap across the peripheral portion of the slab.

12. A machine of the class described, comprising means for supporting and rotating a slab, a lap, a spindle upon which said lap is mounted, a rocking support in which said spindle is rotatably mounted, the axis of said spindle being transversely disposed relatively to the axis of the slab, and a cam for rocking said support to carry the lap across the peripheral portion of the slab.

13. A machine of the class described, comprising means for supporting and rotating a slab, a lap, a spindle upon which said lap is mounted, a rocking support in which said spindle is rotatably mounted, the axis of said spindle being transversely disposed relatively to the axis of the slab, a cam for rocking said support to carry the lap across the peripheral portion of the slab, and means for stopping the cam upon the completion of each operative movement thereof.

14. A machine of the class described, comprising means for supporting and rotating a slab, a lap, a spindle upon which said lap is mounted, a rocking support in which said spindle is rotatably mounted, the axis of said spindle being transversely disposed relatively to the axis of the slab, a cam for rocking said support to carry the lap across the peripheral portion of the slab, means for stopping the cam upon the completion of each operative movement thereof, and means for moving said support in the opposite direction upon the completion of the operative movement thereof.

15. A machine of the class described, comprising means for supporting and rotating a slab, a lap, a spindle upon which said lap is mounted, a movable support in which said spindle is rotatably mounted, the axis of said spindle being transversely disposed relatively to the axis of the slab, means for moving said spindle to carry the lap across the peripheral portion of the slab, and means for adjusting said support to move said spindle longitudinally of itself.

16. A machine of the class described, comprising means for supporting and rotating a slab, a lap, a spindle upon which said lap

is mounted, a rocking support in which said spindle is rotatably mounted, the axis of said spindle being transversely disposed relatively to the axis of the slab, and trunnions between which said support is mounted.

17. A machine of the class described, comprising means for supporting and rotating a slab, a lap, a spindle upon which said lap is mounted, a rocking support in which said spindle is rotatably mounted, the axis of said spindle being transversely disposed relatively to the axis of the slab, a shaft forming the axis of said support, and trunnions engaging the ends of said shaft for pivotally supporting the same.

18. A machine of the class described, comprising means for supporting and rotating a slab, a lap, a spindle upon which said lap is mounted, a rocking support in which said spindle is rotatably mounted, the axis of said spindle being transversely disposed relatively to the axis of the slab, a shaft forming the axis of said support, oppositely-disposed blocks mounted upon said shaft and engaging said support, and means pivotally supporting the end portions of said shaft.

19. A machine of the class described, comprising a standard, a rotatable mandrel mounted on said standard, a chuck carried by said mandrel, means coöperating with said chuck for holding a slab in position while the same is rotated, a lap movable longitudinally with reference to the axis of said mandrel for grinding the slab, and means for simultaneously rotating said lap and mandrel at high speed.

20. A machine of the class described, comprising a standard, a rotatable mandrel mounted on said standard, a chuck carried by said mandrel, means coöperating with said chuck for holding a slab in position while the same is rotated, a rocking support, a lap rotatably mounted upon said rocking support and movable longitudinally of the axis of said mandrel for grinding the slab and means for simultaneously rotating said lap and mandrel at high speed.

21. A machine of the class described, comprising a standard, a rotatable mandrel mounted on said standard, a chuck carried by said mandrel, means coöperating with said chuck for holding a slab in position while the same is rotated, a lap movable longitudinally with reference to the axis of said mandrel for grinding the slab, means for rotating said lap, means for simultaneously rotating said lap and mandrel at high speed, and means for adjusting the mandrel vertically.

22. A machine of the class described, comprising a standard, a rotatable mandrel mounted on said standard, a chuck carried by said mandrel, means coöperating with said chuck for holding a slab in position while the same is rotated, a rocking support, a lap rotatably mounted upon said rocking support and movable longitudinally of the axis of said mandrel by the rocking of said support for grinding the slab, means for simultaneously rotating said lap and mandrel at high speed, and means for adjusting the mandrel vertically.

23. A machine of the class described, comprising a standard, a rotatable mandrel mounted on said standard, a chuck carried by said mandrel, means coöperating with said chuck for holding a slab in position while the same is rotated, a lap movable longitudinally with reference to the axis of said mandrel for grinding the slab, means for rotating said lap, means for adjusting the mandrel vertically, and means for holding the standard against rotation.

24. A machine of the class described, comprising a standard, a rotatable mandrel mounted on said standard, a chuck carried by said mandrel, means coöperating with said chuck for holding a slab in position while the same is rotated, a rocking support, a lap rotatably mounted upon said rocking support, and movable longitudinally of the axis of said mandrel by the rocking of said support for grinding a slab, means for adjusting the mandrel vertically, and means for holding the standard against rotation.

25. A machine of the class described, comprising a standard, a rotatable mandrel mounted on said standard, a chuck carried by said mandrel, means mounted on said standard and coöperating with said chuck for holding a slab in position while the same is rotated, a lap movable longitudinally with reference to the axis of said mandrel for grinding the slab, and means for simultaneously rotating said lap and mandrel at high speed.

26. A machine of the class described, comprising a standard, a rotatable mandrel mounted on said standard, a chuck carried by said mandrel, means mounted on said standard and coöperating with said chuck for holding a slab in position while the same is rotated, a rocking support, and a lap rotatably mounted upon said rocking support and movable longitudinally of the axis of said mandrel for grinding the slab.

27. A machine of the class described, comprising a vertically-adjustable standard, a rotatable mandrel mounted on said standard, a chuck carried by said mandrel, means mounted on the standard and adjustable therewith and coöperating with the chuck for holding a slab in position while the same is rotated, a lap movable longitudinally with reference to the axis of said mandrel for grinding the slab, and means for rotating said lap.

28. A machine of the class described, comprising a vertically-adjustable standard, a rotatable mandrel mounted on said standard, a chuck carried by said mandrel, means mounted on the standard and adjustable therewith and coöperating with the chuck for holding a slab in position while the same is rotated, a rocking support, and a lap rotatably mounted upon said rocking support and movable longitudinally of the axis of said mandrel for grinding the slab.

29. A machine of the class described, comprising a vertically-adjustable standard, a rotatable mandrel mounted on said standard, a chuck carried by said mandrel, means pivotally mounted upon the standard and coöperating with said chuck for holding a slab in position while the same is rotated, a lap movable longitudinally with reference to the axis of said mandrel for grinding the slab, and means for rotating said lap.

30. A machine of the class described, comprising a vertically-adjustable standard, a rotatable mandrel mounted on said standard, a chuck carried by said mandrel, means pivotally mounted upon the standard and adjustable therewith and coöperating with the chuck for holding a slab in position while the same is rotated, a rocking support, and a lap rotatably mounted upon said rocking support and movable longitudinally of the axis of said mandrel for grinding the slab.

31. A machine of the class described, comprising a standard, a continuous tubular member carried thereby, a mandrel mounted in said tubular member, separated bearings for the end portions of said mandrel mounted in said tubular member, caps mounted upon the end portions of said tubular member for inclosing said bearings, a chuck connected with said mandrel, means coöperating with said chuck for holding the work in operative position, means carried by the mandrel for rotating the same and a lap adapted to operate upon the work and movable into and out of operative position.

32. A machine of the class described, comprising a standard, a continuous tubular member carried thereby, a mandrel mounted in said tubular member, bearings for said mandrel mounted in said tubular member, caps mounted upon the end portions of said tubular member for inclosing said bearings, a chuck connected with said mandrel, a support carried by said standard above said tubular member, a slide-bar mounted in said support, an arm connected with said slide-bar and depending therefrom, and a center carried by said arm in axial alinement with the chuck.

33. A machine of the class described, comprising a standard, a horizontal tubular member carried thereby, a mandrel mounted in said tublar member, bearings for said mandrel mounted in said tubular member, caps mounted upon the end portions of said tubular member for inclosing said bearings, a chuck connected with said mandrel, means carried by the mandrel for rotating the same, a support carried by said standard above said tubular member, a slide-bar mounted in said support, an arm connected with said slide-bar and depending therefrom, a center carried by said arm in axial alinement with the chuck, and a spring tending to move the center toward the chuck.

34. A machine of the class described, comprising a standard, a horizontal tubular member carried thereby, a mandrel mounted in said tubular member, bearings for said mandrel mounted in said tubular member, caps mounted upon the end portions of said tubular member for inclosing said bearings, a chuck connected with said mandrel, means carried by the mandrel for rotating the same, a support carried by said standard above said tubular member, a slide-bar mounted in said support, an arm connected with said slide-bar and depending therefrom, a center carried by said arm in axial alinement with the chuck, a spring tending to move the center toward the chuck, and a handle carried by the slide-bar.

35. In a machine of the class described, the combination of a tubular pedestal, a standard non-rotatably mounted in said pedestal and movable vertically therein, means for moving said standard vertically, a horizontal tubular member carried by said standard, a mandrel rotatably mounted in said tubular member, means carried by the mandrel for rotating the same, caps inclosing the ends of said tubular member, a chuck carried by said mandrel, means coöperating with said chuck for holding the work, a lap for grinding the work, and means independent of said standard for supporting the lap.

36. In a machine of the class described, the combination of a tubular pedestal, a standard non-rotatably mounted in said pedestal and movable vertically therein, means for moving said standard vertically, a horizontal tubular member carried by said standard, a mandrel rotatably mounted in said tubular member, means carried by the mandrel for rotating the same, caps inclosing the ends of said tubular member, a chuck carried by said mandrel, means carried by the standard and coöperating with the chuck for holding the work, a lap for grinding the work, and means independent of said standard for supporting the lap.

37. In a machine of the class described, the combination of a tubular pedestal, a standard non-rotatably mounted in said pedestal and movable vertically therein,

means for moving said standard vertically, a horizontal tubular member carried by said standard, a mandrel rotatably mounted in said tubular member, means carried by the mandrel for rotating the same, caps inclosing the ends of said tubular member, a chuck carried by said mandrel, means pivotally carried by the standard to swing about a vertical axis and coöperating with the chuck for holding the work, a lap for grinding the work, and means independent of said standard for supporting the lap.

38. In a machine of the class described, the combination of a tubular pedestal, a standard non-rotatably mounted in said pedestal and movable vertically therein, means for moving said standard vertically, a horizontal tubular member carried by said standard, a mandrel rotatably mounted in said tubular member, means carried by the mandrel for rotating the same, caps inclosing the ends of said tubular member, a chuck carried by said mandrel, means pivotally carried by the standard to swing about a vertical axis and coöperating with the chuck for holding the work, a lap for grinding the work, means independent of said standard for supporting the lap, and means for locking the latter member against rotation.

39. In a machine of the class described, the combination with a tubular member, of a rotary shaft extending therethrough, a pulley mounted on said shaft outside of said tubular member, bearings in said tubular member supporting said shaft, caps at the end portions of said tubular member for closing the same, and a rotary cap mounted on said shaft and rotating therewith, said rotary cap extending over one of the ends of said tubular member.

40. In a machine of the class described, the combination with a tubular member, of a rotary shaft extending therethrough, a pulley mounted on said shaft outside of said tubular member, bearings in said tubular member supporting said shaft, caps at the end portions of said tubular member for closing the same, and a rotary cap mounted on said shaft and rotating therewith, said rotary cap extending over one of said first-mentioned caps.

41. A machine of the class described comprising means for rotatably supporting a slab with its margin exposed, a lap mounted to rotate in a plane which intersects the plane of the slab and having its periphery arranged to engage and grind the marginal portion of the slab, and means for simultaneously rotating said slab and lap when they are in operative relation to each other.

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