No. 695,902. Patented Mar. 25, 1902.

# W. BOWKER, E. M. LONG & C. W. HOWLAND.

## MACHINE FOR DRILLING LENSES.

(Application filed July 25, 1901.)

(No Model.) 3 Sheets—Sheet 1.

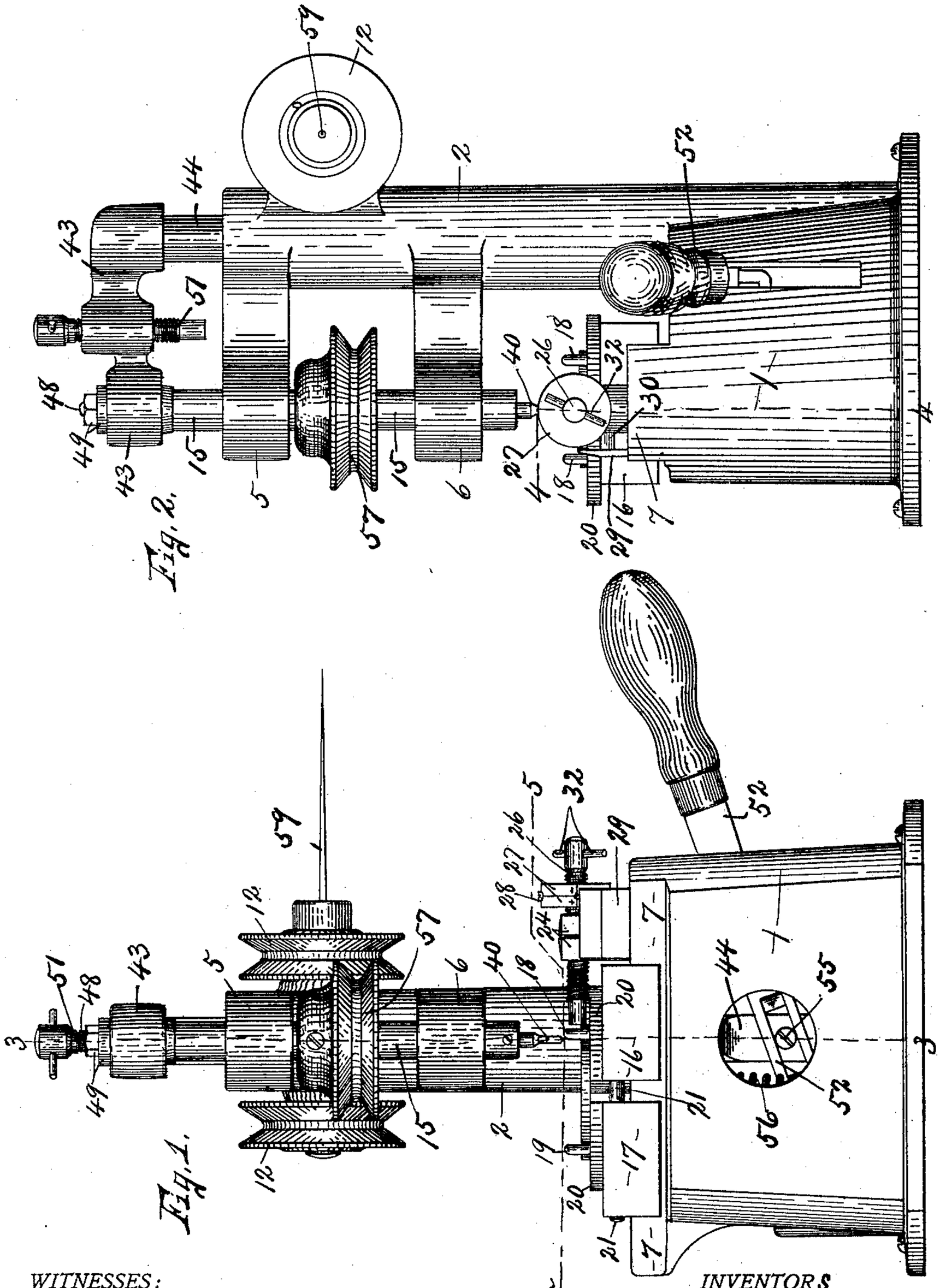


Fig. 2.

Fig. 1.

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(No Model.) 3 Sheets—Sheet 2.

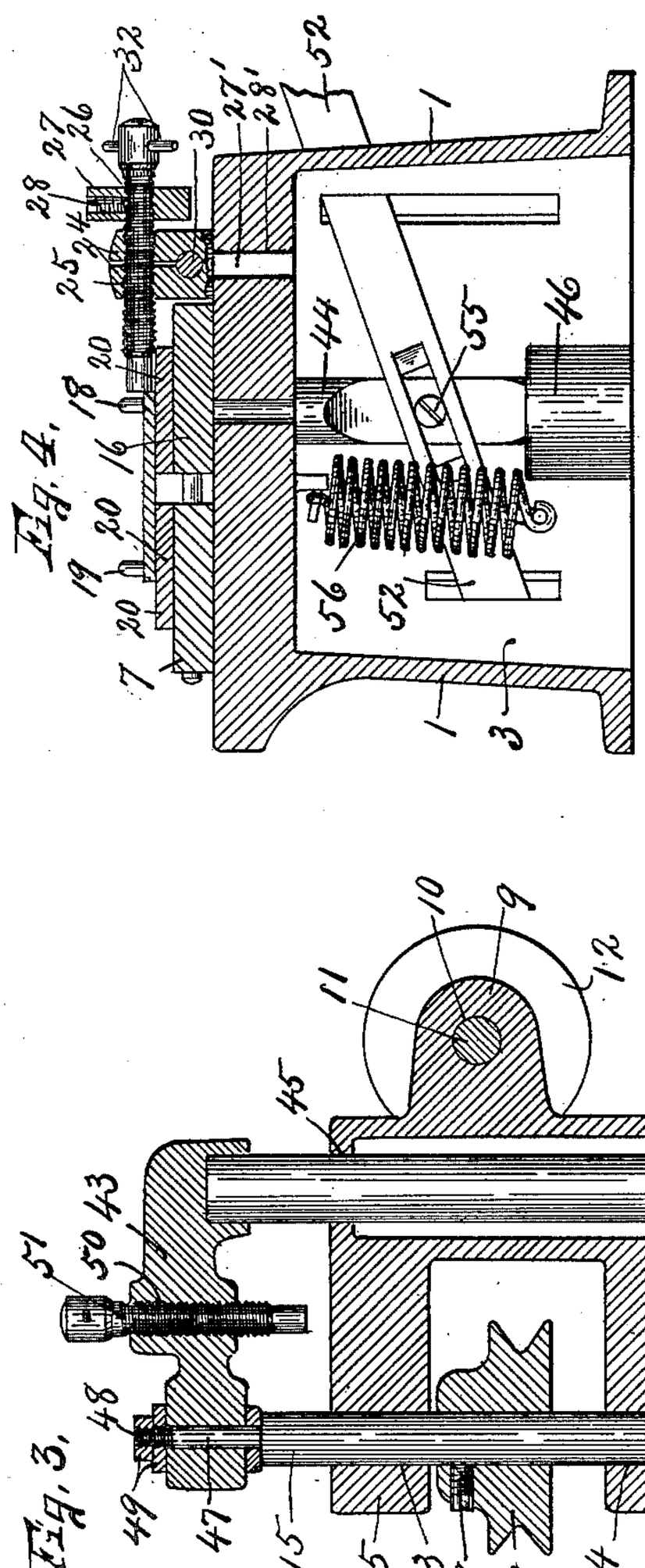

Fig. 4.

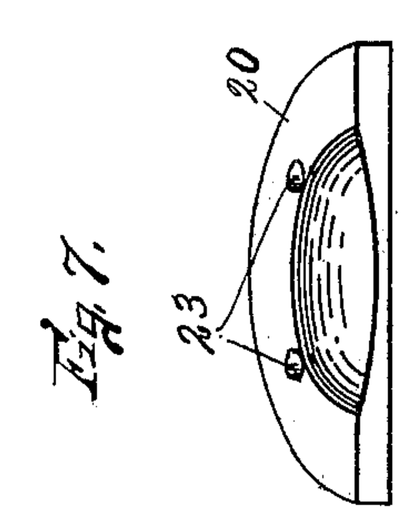

Fig. 7.

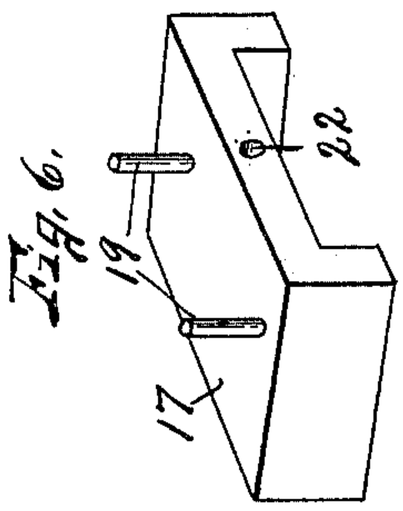

Fig. 6.

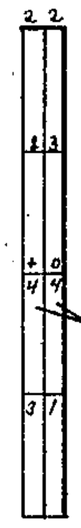

Fig. 8.



Fig. 9.

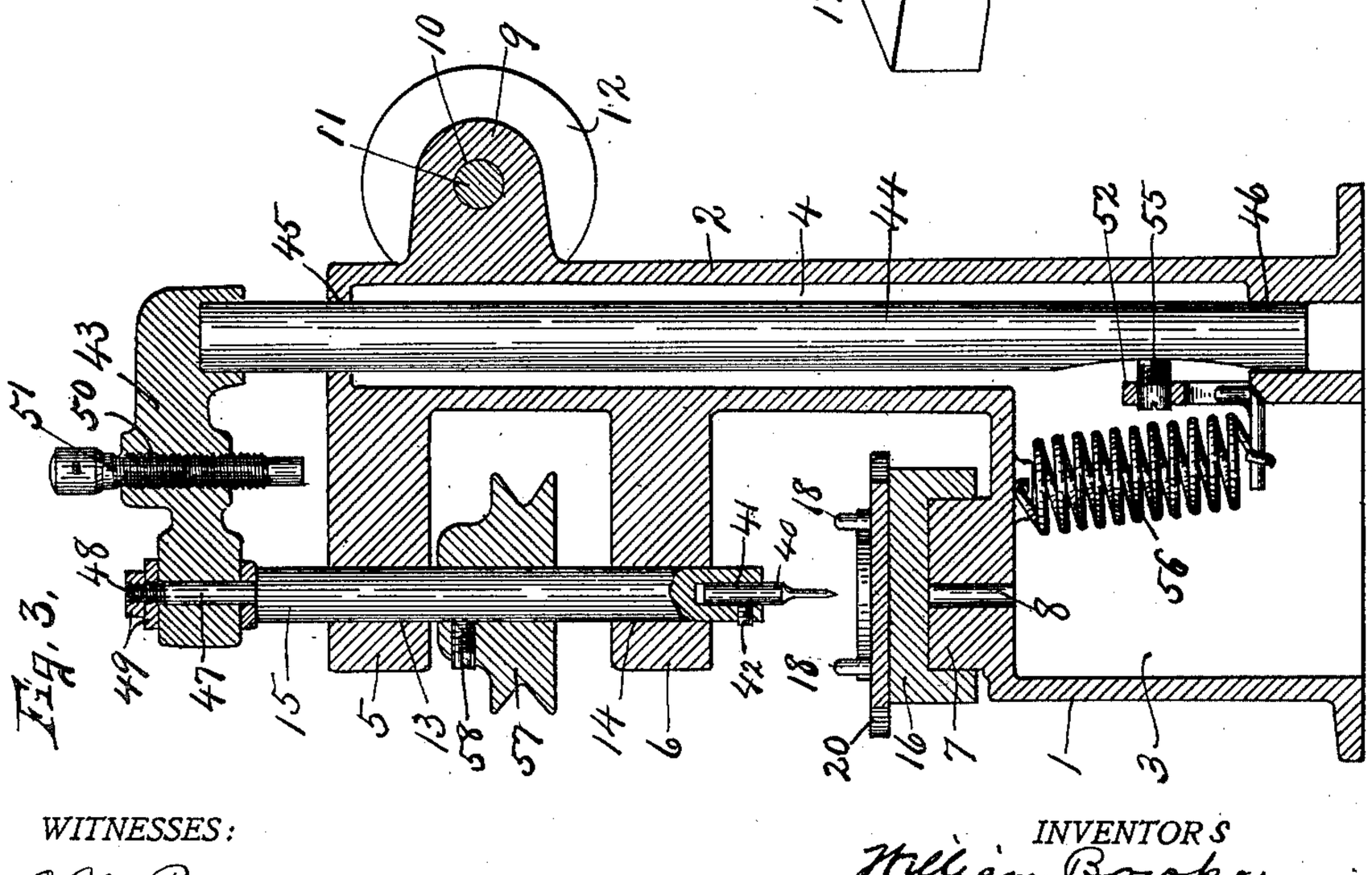

Fig. 3.

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## MACHINE FOR DRILLING LENSES.

(Application filed July 25, 1901.)

(No Model.) 3 Sheets—Sheet 3.

Fig. 5,

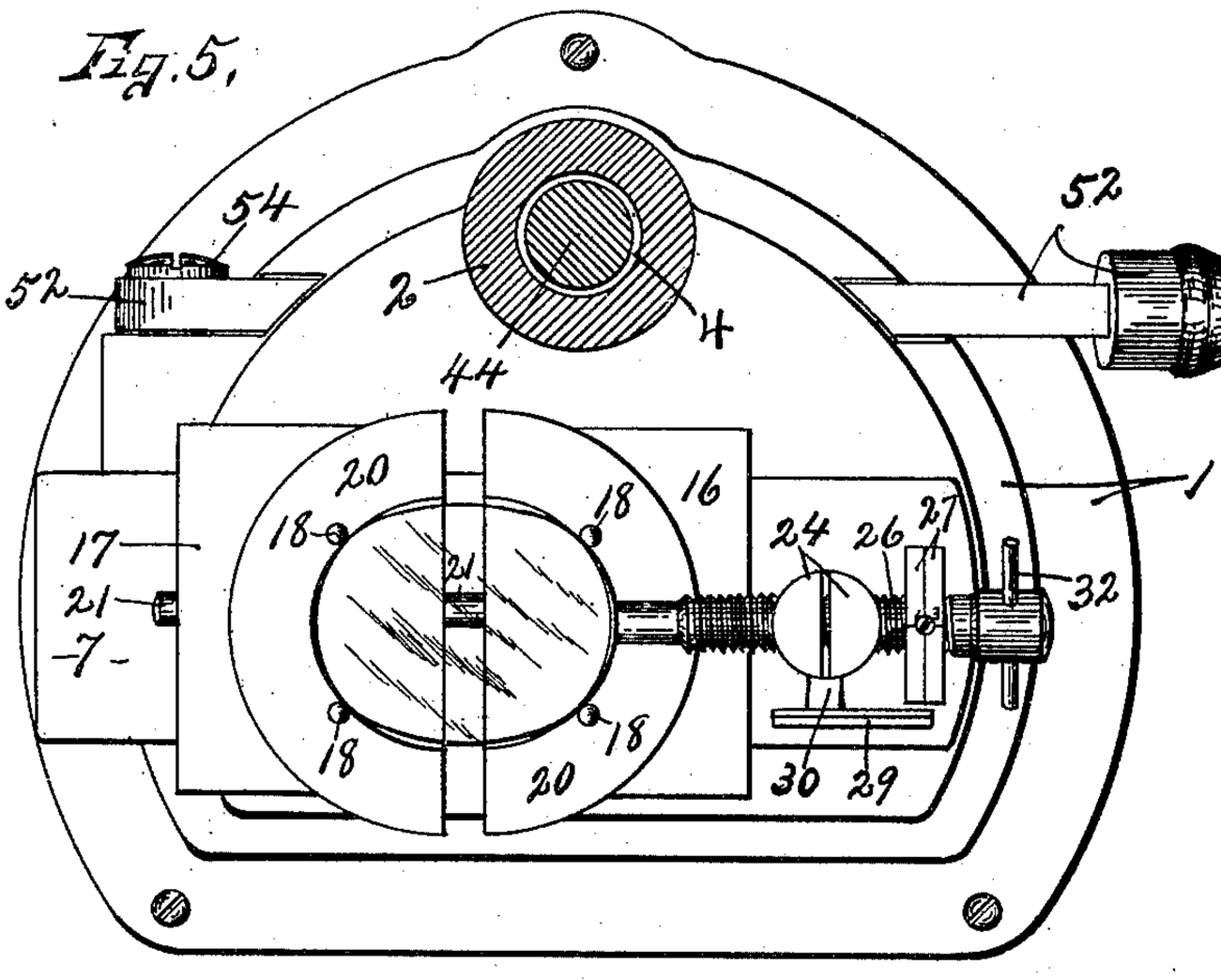



Fig. 9,

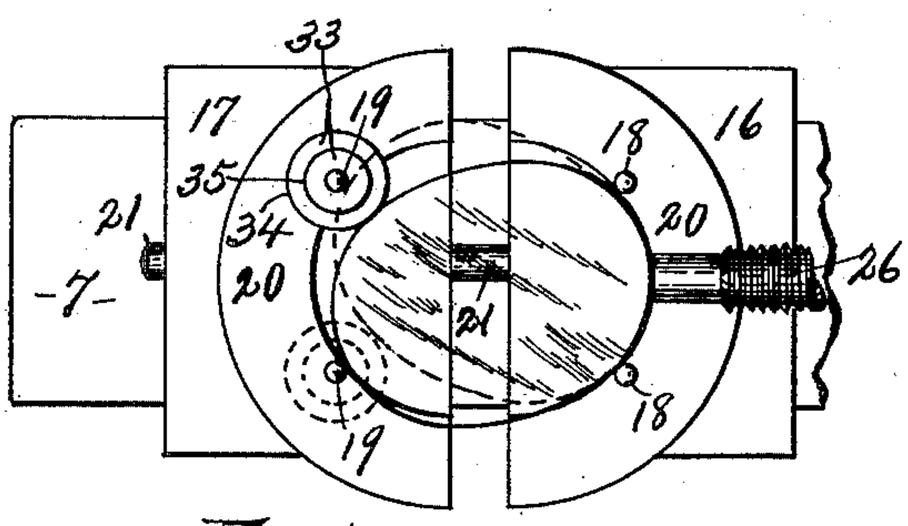



Fig. 10,

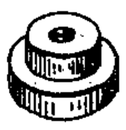


Fig. 15,

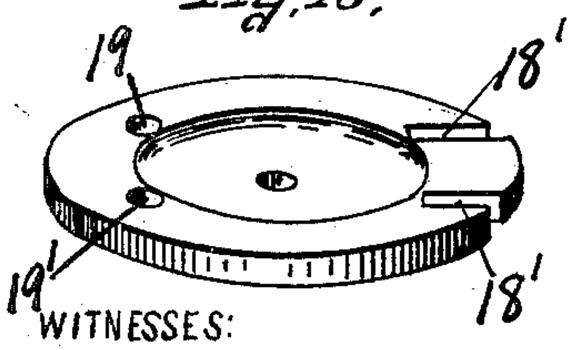



Fig. 11,

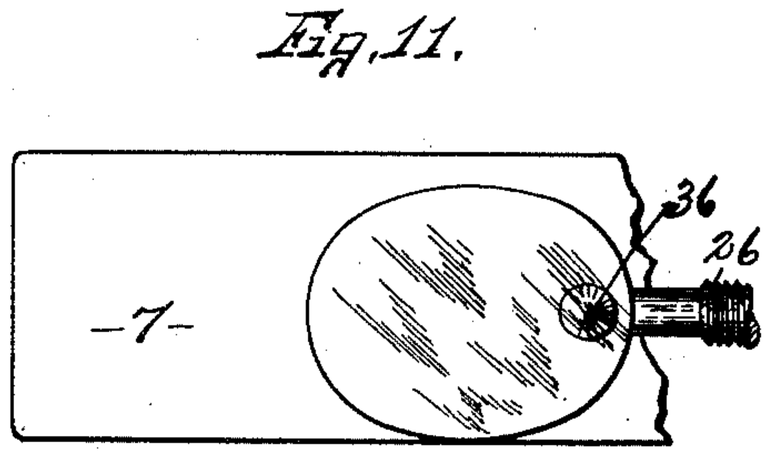



Fig. 13,

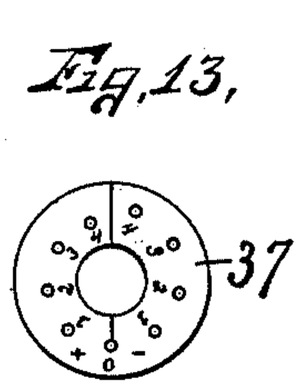



Fig. 12,

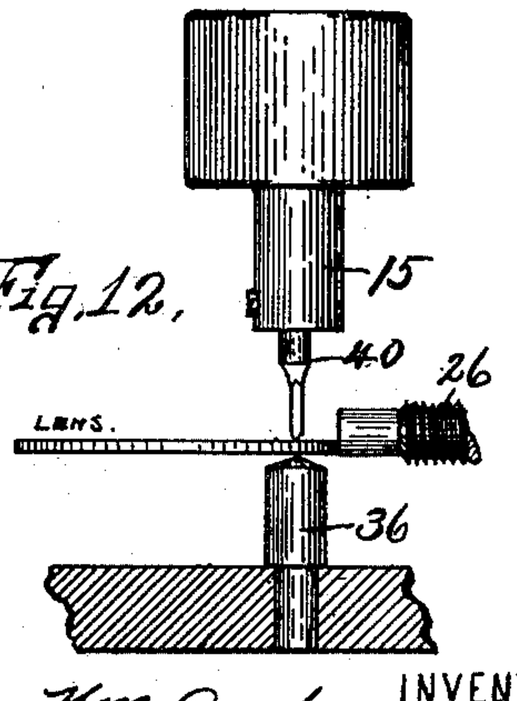
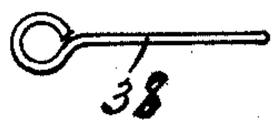



Fig. 14,

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# UNITED STATES PATENT OFFICE.

WILLIAM BOWKER, ELI M. LONG, AND CHAUNCY W. HOWLAND, OF GENEVA, NEW YORK, ASSIGNORS TO THE STANDARD OPTICAL COMPANY, OF GENEVA, NEW YORK, A CORPORATION OF NEW YORK.

## MACHINE FOR DRILLING LENSES.

SPECIFICATION forming part of Letters Patent No. 695,902, dated March 25, 1902.

Application filed July 25, 1901. Serial No. 69,649. (No model.)

*To all whom it may concern:*

Be it known that we, WILLIAM BOWKER, ELI M. LONG, and CHAUNCY W. HOWLAND, of Geneva, in the county of Ontario, in the State of New York, have invented new and useful Improvements in Machines for Drilling Lenses, of which the following, taken in connection with the accompanying drawings, is a full, clear, and exact description.

This invention relates to improvements in machines for centering and drilling lenses.

The object of this invention is to produce a simple, compact, and efficient device for drilling lenses at any predetermined position relative to its perimeter or to one of its axes—as, for instance, its major axis—the essential object being to enable the operator to quickly and accurately center the lens upon a suitable support and to drill said lens at uniform or predetermined distances from the end of the major axis or at either side thereof.

A further object is to provide means whereby the entrance of the drill into the lens is automatically limited—as, for instance, when drilling the lens substantially half-way through from each side.

Another object of this invention is to provide means actuated by the power-driving mechanism for rotating the drill for reaming or finishing the drill-hole of the lens.

To this end the invention consists in the combination, construction, and arrangement of the parts of a machine for centering and drilling lenses, as hereinafter fully described, and pointed out in the claims.

Figures 1 and 2 are respectively front and side elevations of a machine embodying our invention. Figs. 3, 4, and 5 are sectional views taken, respectively, on lines 3 3 and 5 5, Fig. 1, and line 4 4, Fig. 2. Figs. 6 and 7 are perspective views showing, respectively, one of the detached sliding heads or lens-supports and one of the yielding platens or pads for the lenses. Fig. 8 is a plan view showing the face of the graduated disk as extended. Fig. 9 is a detail plan view of the lens-supporting heads and our improved decentering-gage mounted thereon. Fig. 10 is a detached view of the decentering-gage. Fig. 11 is a plan view of a device for drilling odd-shaped lenses in which the centering device is omitted. Fig. 12 is an elevation showing, further, the operation of the devices seen in Fig. 11. Figs. 13 and 14 are face views of the disk gage and pin adapted to be used with the micrometer attachment. Fig. 15 is a perspective view of a modified form of platen or pad for supporting the lens during the process of drilling the same.

Similar reference characters indicate corresponding parts in all the views.

Heretofore in drilling lenses it has been customary to previously mark the lens at a particular point where the hole was to be drilled and to hold the lens against the stop by hand and drill the hole at the point indicated by the mark. This method is entirely dependent upon the skill and accuracy of the sight of the operator, and in view of the fact that the lenses are usually drilled half-way from either side it is highly essential that when the lens is drilled half-way through from one side and then reversed for drilling the other half the drill must be in exact alinement with the portion of the hole already drilled. This, it will be apparent, is an extremely difficult operation and can only be accomplished by a skilled operator having an absolutely perfect and trained sight.

Our invention is designed to obviate these difficulties and to expedite the centering of the lens and also to enable the operator to drill the hole from the opposite sides of the lens with the utmost precision and exactness either upon the major axis at a predetermined point from the edge of the lens or at predetermined points at either side of the major axis, as may be desired.

In carrying out the objects of our invention we have shown a drill-frame consisting of a base 1 and an upright standard 2, the base being formed with an internal chamber 3, and the upright standard is provided with a lengthwise guide or opening 4 and laterally-projecting arms 5 and 6. This frame 1 may be of any desired form, size, or material, being preferably formed of cast metal, and is provided with a substantially horizontal guide or way 7 and a vertical aperture 8, extending upwardly through the guide or way 7. The

upright standard 2 is usually formed integral with the base and is provided with a rearwardly-extending lug 9, having a bearing 10, adapted to receive a shaft 11, which supports suitable idlers 12, hereinafter described. The arms 5 and 6 are preferably formed integral with the upright standard 2, being extended laterally one over the other above the intermediate portion of the guide or way 7, and are provided with bearings 13 and 14, in which is journaled a rotary shaft 15, having its axis alined with the vertical aperture 8 for a purpose hereinafter described.

Mounted upon the guide or way 7 are suitable sliding heads or lens-supports 16 and 17, the head 16 being provided with a pair of upwardly-projecting pins 18, and the head 17 is provided with a similar pair of pins 19, these pins being fixed to the heads and are adapted to engage the perimeter of the lens at opposite sides of its major and minor axes—that is, the pins of each pair are arranged substantially equidistant at opposite sides of a line drawn through the axis of the shaft 15 and corresponding to the major axis of standard forms of lenses. It may also be stated that the distance between the pins of each pair is less than the length of the minor axis, in order that when the sliding blocks are moved toward each other the pins will engage the edges of the lenses at opposite sides of its minor axis and positively center said lens with its major axis substantially parallel with the line of movement of the sliding head. These heads are movable either simultaneously or independently of each other and are each provided with a yielding platen or pad 20, similar in form and usually of hard rubber or similar material, each being provided with apertures 23 for receiving the pins 18 and 19, said pins serving to positively lock the pads or platens 20 to their respective heads.

One of the sliding heads or lens-supports, as 16, is provided with a lengthwise horizontal pin 21, which enters a suitable socket 22 in the opposite sliding head 17, whereby both heads are held in perfect alinement with each other during their simultaneous or independent movement along the guide or way 7.

The heads 16 and 17 may be entirely removed from the guide or way, if desired, this being an important feature of our invention in view of the fact that it is sometimes desired to drill odd forms or shapes of lenses, in which the centering device could not conveniently be used.

Secured to the upper face of the base 1 is a split stud 24, having a threaded aperture 25, adapted to receive a substantially horizontal adjusting-screw 26, presently described. This split head is provided with a depending shank 27′, tightly fitting in a socket 28′ in the upper wall of the base 1 for holding said head firmly in position. The reason for splitting the head transversely of the threaded aperture is that by so doing the opposite walls of the head spring into engagement with the threads and produce more or less friction for preventing undue displacement or rotation of the screw.

The screw 26 is preferably arranged in a line substantially coincident with the major axis of the lens or, in other words, with a line drawn between the centering-pins of each pair substantially midway between their adjacent faces, the end face of said screw being adapted to engage the edge of the lens, and the position of said end face may be varied relatively to the drilling-point by simply rotating the screw, which permits the lens to be drilled upon the major axis or at either side thereof at any predetermined distance from the edge of the lens. In order to accurately and quickly determine the distance of the drilling-point from the edge of the lens, we provide said screw with a disk or gage 27, having separate series of graduations upon its periphery, one of which graduations forms the starting-point and is generally marked with a zero, the graduations of each series being numbered in this instance from "1" to "4," inclusive, in opposite directions from the zero graduation, one series being marked "plus" and the other "minus." This disk or gage 27 is preferably provided with a screw-threaded aperture adapted to receive the screw 26, said gage being adjustable on the screw and is secured in position by a suitable set-screw or equivalent means 28.

The split hub 24 is provided at its base with a transverse aperture which receives a projecting stud 30 of a suitable indicator-plate 29, having a substantially horizontal upper edge arranged in close proximity to the periphery of the disk or gage 27, the said indicator-plate having its lower face normally resting upon the upper face of the base 1. The stud or pin 30 snugly fits within the aperture provided therefor in the hub 24, being frictionally held in position and capable of being removed when desired.

The lenses are usually drilled at standard distances on the major axis from one edge of the lens, and the screw is adjusted with its end face adjacent to the drill arranged at such standard distances from the drilling. The disk or gage 27 is then adjusted on the screw 26 with the zero graduation registered with the upper edge of the indicator-plate 29, the disk or gage being then firmly secured to the screw by the set-screw 28, and when desired to increase the distance of the drill-hole from the edge of the lens the screw 26 is turned to rotate the graduations "1," "2," "3," and "4" of the plus series successively toward the upper edge of the indicator-plate each quarter-rotation, or, rather, each partial rotation from one graduation to the next successive rotation, indicating a certain distance of the endwise movement of the screw, and therefore a corresponding change in the position of the end stop-face of the said screw and also of the drilling-point in the lens, and

when it is desired to diminish the distance from the drill-point to the end of the stop-face the screw is rotated in the opposite direction for moving the successive graduations of the minus series into registration with the upper face of the indicator-plate 29. The purpose of said gage and indicator is to accurately determine the exact distance of the drill-hole from the edge of the lens and by arranging the graduations in a series plus and minus, as described, it is evident that the lens may be drilled at standard distances from its edge or may be readily changed to a greater or less distance from the edge of the lens as desired.

In order to permit the screw to be readily operated, we provide the same with a suitable handpiece 32, and owing to the fact that the spring-jaws of the hub 24 produce a suitable friction upon the threads of the screw 26 it is evident that when said screw is rotated or adjusted to the desired position it is firmly held in position by said friction against accidental displacement or rotation.

It is sometimes desirable to drill the lens at certain predetermined distances from its edge at one side or the other of its major axis, and we therefore provide a decentering-gage 33, Figs. 9 and 10, which is provided with a substantially central aperture to receive one of the pins, as 19, said decentering-gage being usually provided with one or more annular surfaces 34 and 35 of unequal diameters, which surfaces are concentric with the pin 19, upon which the gage is mounted. The annular surfaces of these decentering-gages are usually of standard sizes in order that any number of lenses may be drilled at substantially the same point with reference to their major axes and to their perimeters.

As previously stated, the lens is drilled first a little more than half-way through from one side and is then reversed and drilled the remaining distance from the other side. When the decentering-gage is used for drilling at one side of the major axis, it is placed on one of the spindles or pins 19. The lens is then placed upon the platens or pads 20 of the sliding heads 16 and 17, the pins 18 engaging the edge of the lens at one end at different points on opposite sides of its greater axis, and the pin and adjacent face of the gage 33 engage the opposite end edges of said lens, thereby firmly holding the lens in position during the process of drilling the same. After the lens has been drilled substantially half-way through or a little more the decentering-gage is removed and placed upon the other pin 19, and the lens is inverted and the operation repeated for drilling the lens through from the opposite side.

When desired to drill odd shapes or forms of lenses, we preferably remove the sliding heads 16 and 17 from the guide or way 7 and insert within the aperture 8 a suitable pin or stud 36, the upper end of which is formed of greater diameter than the lower end and adapted to rest upon the upper face of the guide or way 7, the upper extremity of the enlarged portion of said stud being conical or pointed for the purpose of facilitating the centering of the partially-drilled hole in the lens thereon. In this case it is necessary to previously mark the lens at the point where it is desired to drill, the lens being held by the operator and drilled partially through. The lens is then inverted and the drilled portion centered with the point of the stud 36 and the operation of drilling completed, it being understood, however, that even when drilling odd shapes or forms of lenses the micrometer attachment, as the screw 26 and gage 27, is employed for determining the distance from the edge of the lens to the drilling-point.

In order to properly set the micrometer for drilling lenses at standard or other distances from the edge of the lens, we preferably provide a gage 37, Fig. 13, which is formed with a series of graduations upon its face corresponding to the graduations upon the periphery of the gage 27 and numbered in either direction from a zero point or graduation, each graduation having an aperture or small circular opening, all of which are arranged at unequal distances from the edge or perimeter of the disk, the aperture at zero having its center at a distance from the perimeter or edge of the disk corresponding to the standard distance at which the lenses are usually drilled from the edge upon the major axis, so that if desired to set the micrometer-gage or, rather, the end face of the screw 26 adjacent to the drill the standard distance from the center of the drill it is only necessary to place the aperture at the zero graduation of the disk in alinement with the center of the drill, and then to move the micrometer-screw until its end face abuts against the edge of the disk, being careful at all times to have the radial line leading from said aperture in a line substantially coincident with the major axis of the lens. In like manner the stop-face of the micrometer-screw may be set at any desired distance from the center of the drill, or the accuracy of various adjustments, as indicated by the gage 27, may be tested by this apertured disk or gage 37. The special use, however, of this disk-gage 37 and pin 38 is to determine the distance of the screw-hole in a mounting which is to be fitted with a lens in order that the hole may be correctly drilled, said disk being, as previously stated, graduated in substantially the same manner as the graduated member on the adjustable stop-screw 26. It is used by inserting the disk between the clamps of an eyeglass or spectacle and revolving the same until one of the holes is directly between the holes provided in the clamp for the screw which goes through the lens. The center or zero hole is made at standard distances from the center of the hole to the point where the glass touches the clamp. Should the clamp not be regular, the

disk is used in connection with the pin to ascertain just how much the lens should be drilled nearer or farther from the edge of the standard drilling, and the figures, plus or minus, "1," "2," "3," "4" enable the operator to readily set the machine by means of the micrometer attachment, as the screw 26 and gage 27, so that the hole may be correctly drilled, whereby the drill-holes in the lens and mounting are the same distance from their contact edges or faces. Another use, however, of this disk-gage is to determine the distance of the drill-hole of any lens from its edge. This is readily done by inserting the pin 38 in the drill-hole of the lens and then moving or turning the disk or gage 37 upon the lens with its edge coincident with the end edge of the lens adjacent to the hole until one of the apertures in the disk 37 registers with the pin, and if it is then found that the edges adjacent to the drill-hole of the lens and the disk are in alinement with each other the operator will readily read upon the disk a number which corresponds to a certain distance known to those skilled in the art of the drill-hole from the edge of the lens.

Any desired drill may be used for drilling the lens, the form or quality of drill forming no part of our invention and being the quality ordinarily used in this class of work. In the drawings we have shown an ordinary drill 40, detachably secured in a socket 41 in the lower end of the rotary shaft 15 by a suitable set-screw 42. The shaft 15 is in addition to this rotary movement movable endwise, being mounted in the bearings 13 and 14 and secured at its upper end to a vertically-movable head-block or bracket 43. This bracket 43 is securely mounted on the upper end of a reciprocally-movable rod or bar 44, movable in the upright opening 4 and preferably guided in its vertical movement in suitable upper and lower bearings 45 and 46.

The upper end of the shaft 15 is preferably provided with a reduced portion 47, having a threaded end 48, the portion 47 being passed through a suitable aperture or opening in the front end of the bracket 43. The threaded portion of the spindle 15 is engaged by suitable nuts 49, one of which is adapted to lock the other in position, the inner one being engaged with or resting upon the upper face of the bracket 43. The intermediate portion of the bracket 43 is provided with a threaded aperture 50, in which is movable an adjusting-screw 51, the purpose of which is to stop or limit the downward movement of the drill-supporting spindle when desired to drill only a predetermined distance into the lens, this stop-screw having its lower face adapted to engage the upper face of the arm or bracket 5.

Any desired means may be employed for actuating the rod 44; but we preferably employ a suitable hand-lever 52, having its inner end pivoted to the base 1 at 54 and its intermediate portion loosely connected to a stud or pin 55, secured to the bar 44, so that when the hand-lever 52 is rocked in either direction the bar 44 will actuate the spindle 15 endwise. We preferably employ a spring 56 for returning the rod 44 and spindle 15 to their normal positions, although it is evident that any equivalent means may be employed for this purpose.

The spindle 15 is provided with a pulley 57, which is secured thereto by a set-screw 58 and serves as a driving-pulley for rotating the drill 40, this pulley being connected to any desired source of power by a suitable belt, not illustrated, but which is adapted to pass over the pulleys 12, one of which is secured to the spindle 11 and the other is loosely mounted thereon, this arrangement being necessary in order to permit the pulleys to rotate in opposite directions.

The spindle 10 is provided at one or both ends with suitable apertures for receiving a reaming or other finishing tool, as 59, in this instance consisting of a small rat-tail file adapted to ream or finish the walls of the drill-hole of the lens after coming from the drill.

In Fig. 15 we have shown a slightly-modified form of platen or pad for supporting the lens, consisting of a single disk of rubber or equivalent material, having apertures 19′, adapted to receive the pins 19, and slots 18′, arranged to receive the pins 18, said slots 18′ opening from the periphery of the disk or pad in order to permit the sliding head-block 17 to be moved toward and away from the block 16 during the operation of placing the lens on the pad between the pins 18 and 19.

In the operation of our invention the lens head-block 17 is withdrawn from the block 16 a sufficient distance to permit the lens to be readily placed between the pairs of pins of each head, with its major axis in a line between the centering-pins of each pair. The sliding block 17 is then moved toward the block 16, or both may be moved together toward each other, whereupon the pins of each pair or head engage the edge of the lens and center the same with its major axis in the line with the drill-point and parallel with the line of movement with the heads. The micrometer is then adjusted for drilling the hole the desired distance from the edge of the lens upon the major axis, and the heads are then moved together until the advance edge of the lens engages the end face of the micrometer-screw, whereupon the hand-screw 52 is then depressed for forcing the drill into engagement with the upper face of the lens, the drill being forced downwardly until the lower face of the adjusting-screw 51 engages the stop-face of the arm 5, the movement being sufficient to drill a little more than half-way through the lens. The pressure of the hand-lever is then relieved and the spring 56 returns the drill to its normal inoperative position, the sliding block 17 is then withdrawn again, and the lens is inverted and placed upside down in the manner before described upon

the pads 20, the blocks being then brought together for centering the lens, which is then engaged with the abutting face of the adjusting-screw, whereupon the hand-lever is again depressed for drilling the hole in the lens the remaining distance.

The operation of the decentering-gage having been previously described is thought to be sufficiently understood. The purposes and operations of the remaining parts are also believed to have been thoroughly described.

Having thus described our invention, what we claim, and desire to secure by Letters Patent, is—

1. A lens-centering device consisting of sliding supports each having a separate pair of contact-points arranged to engage the edges of the lens at different points for the purpose described.

2. A lens-centering device consisting of separate pairs of contact-points arranged to engage the lens at different perimetric points, each pair being mounted on an independent support adjustable toward and away from the other.

3. A machine for centering and drilling lenses comprising a lens-support composed of independently-movable sections, a drill, and an adjustable lens-stop adapted to engage the edge of the lens said sections being movable toward and away from the stop for the purpose described.

4. A machine for centering and drilling lenses comprising a lens-support, a drill and an adjusting-screw having a stop-face adapted to engage the edge of the lens, said support being movable independently of the adjusting-screw.

5. A machine for centering and drilling lenses comprising a lens-support, a drill and an adjusting-screw having a stop-face adapted to engage the edge of the lens, said screw being provided with a graduated member adjustably secured thereto and coacting with a fixed indicator for indicating the position of the stop-face relative to the drilling-point.

6. A machine for centering and drilling lenses comprising a lens-support composed of sliding heads each having a pair of centering-pins, a drill, and an adjustable lens-stop adapted to engage the edge of the lens and having a member adjustable thereon and provided with a plurality of series of graduations, one series for each reverse movement of the stop.

7. A movable lens-support comprising sliding heads having lens-centering means, in combination with a drill, and an adjustable lens-stop for engaging the edge of the lens.

8. A movable lens-support, in combination with a drill, and an adjustable lens-stop having a graduated member adjustable relative thereto for the purpose described.

9. A movable lens-support having means for centering the lens thereon, in combination with a drill, and an adjusting-screw having a stop-face to engage the edge of the lens, and a collar adjustably secured to the screw and provided with separate series of graduations coacting with a fixed indicator for the purpose specified.

10. A lens-drill comprising a lens-support having sliding heads provided with lens-centering means, a drill-support having rotary and reciprocal movements, and adjustable means for limiting the movement of the drill-support toward the lens.

11. The combination with a lens-support consisting of sliding heads having means for centering the lens thereon, of a drill having rotary and reciprocal movements, and adjustable means for limiting the movement of the drill into the lens.

12. The combination with a movable lens-support consisting of independently-slidable heads having means for centering the lens thereon, of a drill having rotary and reciprocal movements, means for limiting the movement of the drill into the lens, and a lens-stop for regulating the position of the lens relative to the drill.

13. A lens drill and centering device comprising a frame, a movable lens-support having independently-slidable heads provided with means for centering the lens thereon, a drill having rotary and endwise movements, adjustable means for limiting the endwise movement of the drill into the lens, and additional adjustable means for regulating the position of the lens relative to the axis of the drill.

14. A lens drill and centering device comprising a frame, a movable lens-support, means for centering the lens, a rotary drill having endwise movement, an adjustable lens-stop having a graduated surface coöperating with a fixed indicator to indicate the position of the lens relative to the drill-point, an adjustable drill-stop for limiting the endwise movement of the drill into the lens, means for moving the drill endwise, additional means for rotating the drill, and a rotary chuck actuated by the latter means and adapted to carry a reamer or other lens-finishing tool.

15. The combination with a frame, of independent sliding heads or blocks each having a pair of pins or studs adapted to engage the edges of the lens for centering the lens, and a rotary drill for drilling the lens.

16. The combination with a frame, of sliding heads or blocks having removable platens or rests for the lens, each of the blocks or heads having a pair of pins for centering the lens, a rotary drill having an endwise movement for the purpose described, and means for regulating the position of the lens relative to the axis of the drilling-point.

17. A rotary drill having an endwise movement, combined with movable means for centering the major axis of the lens so that the lens may be moved parallel with its axis and the axis will always aline with the drill-point, and additional means for decentering the

lens to drill the lens at one side of its major axis.

18. A lens-support having a plurality of shoulders adapted to engage the edge of the lens, and an invertible member mounted on the support and provided with contact-faces of unequal projection for varying the position of the major axis of the lens.

19. The combination with a series of lens-centering pins adapted to engage the edges of the lens at opposite sides of its major and minor axes, of a decentering-gage detachably mounted on one of the pins and provided with annular faces of unequal diameters.

In witness whereof we have hereunto set our hands this 17th day of July, 1901.

his
WILLIAM × BOWKER.
mark
ELI M. LONG.
CHAUNCY W. HOWLAND.

Witnesses to William Bowker's mark:
FRED B. FETHERSTONHAUGH,
WILLIAM W. ESSICK.

Witnesses as to Eli M. Long and Chauncy W. Howland:
LEWIS W. KEYES,
CHARLES BEVIER.