B. M. W. HANSON.

GRINDING MACHINE.

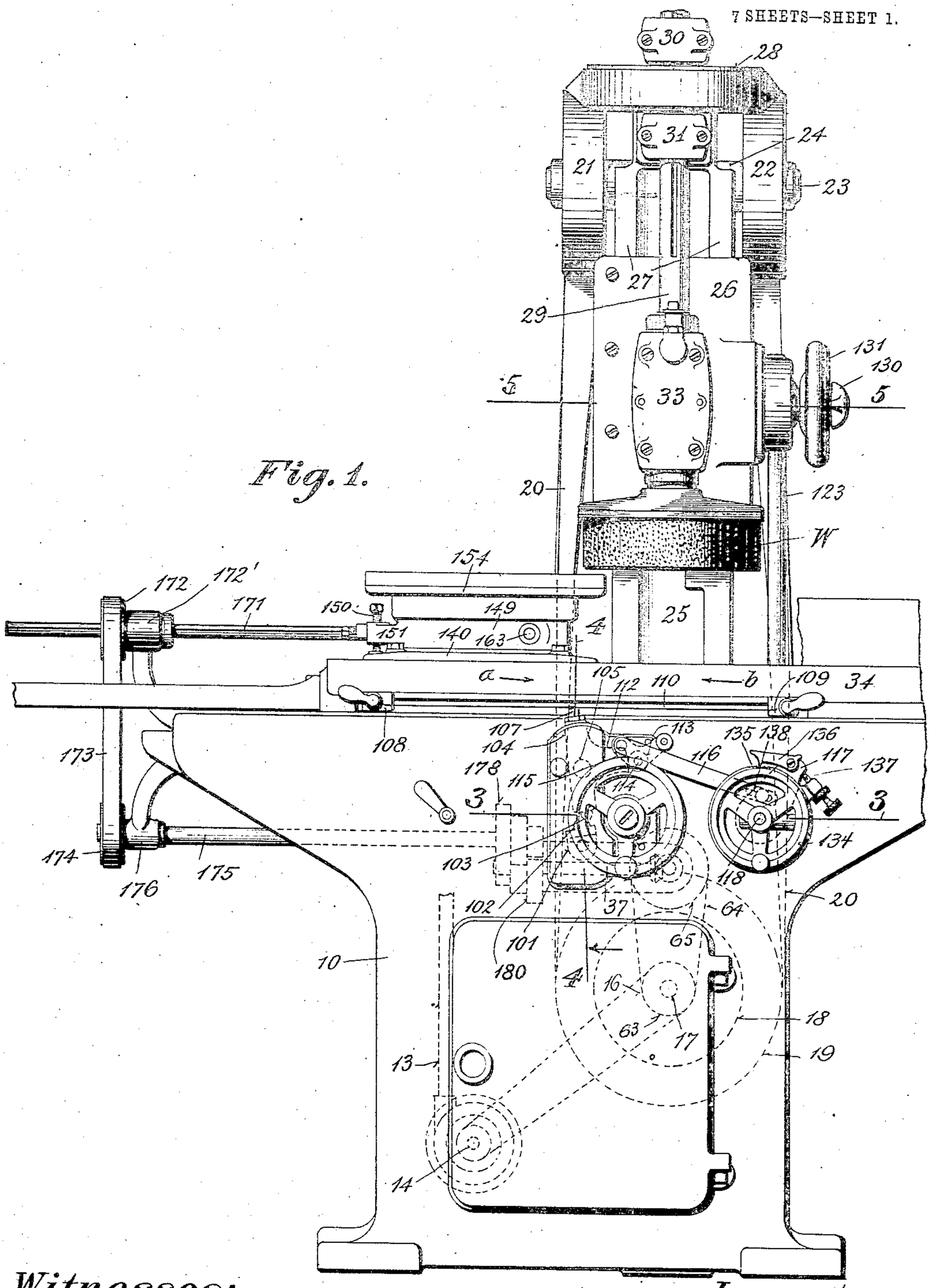
APPLICATION FILED OCT. 19, 1906.

915,174.

Patented Mar. 16, 1909.

7 SHEETS—SHEET 1.

Fig. 1.



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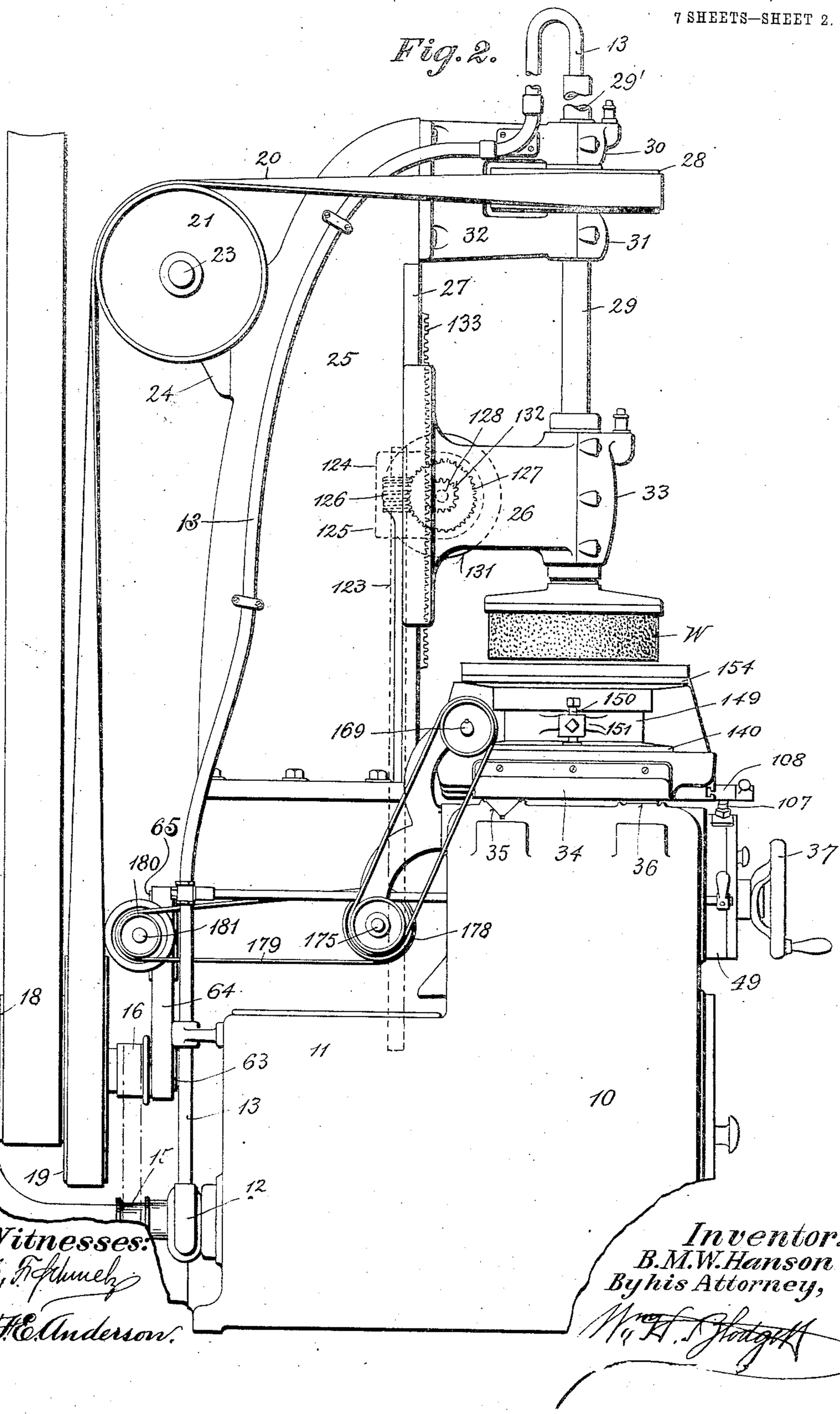
7 SHEETS—SHEET 2.

Fig. 2.



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7 SHEETS—SHEET 3.

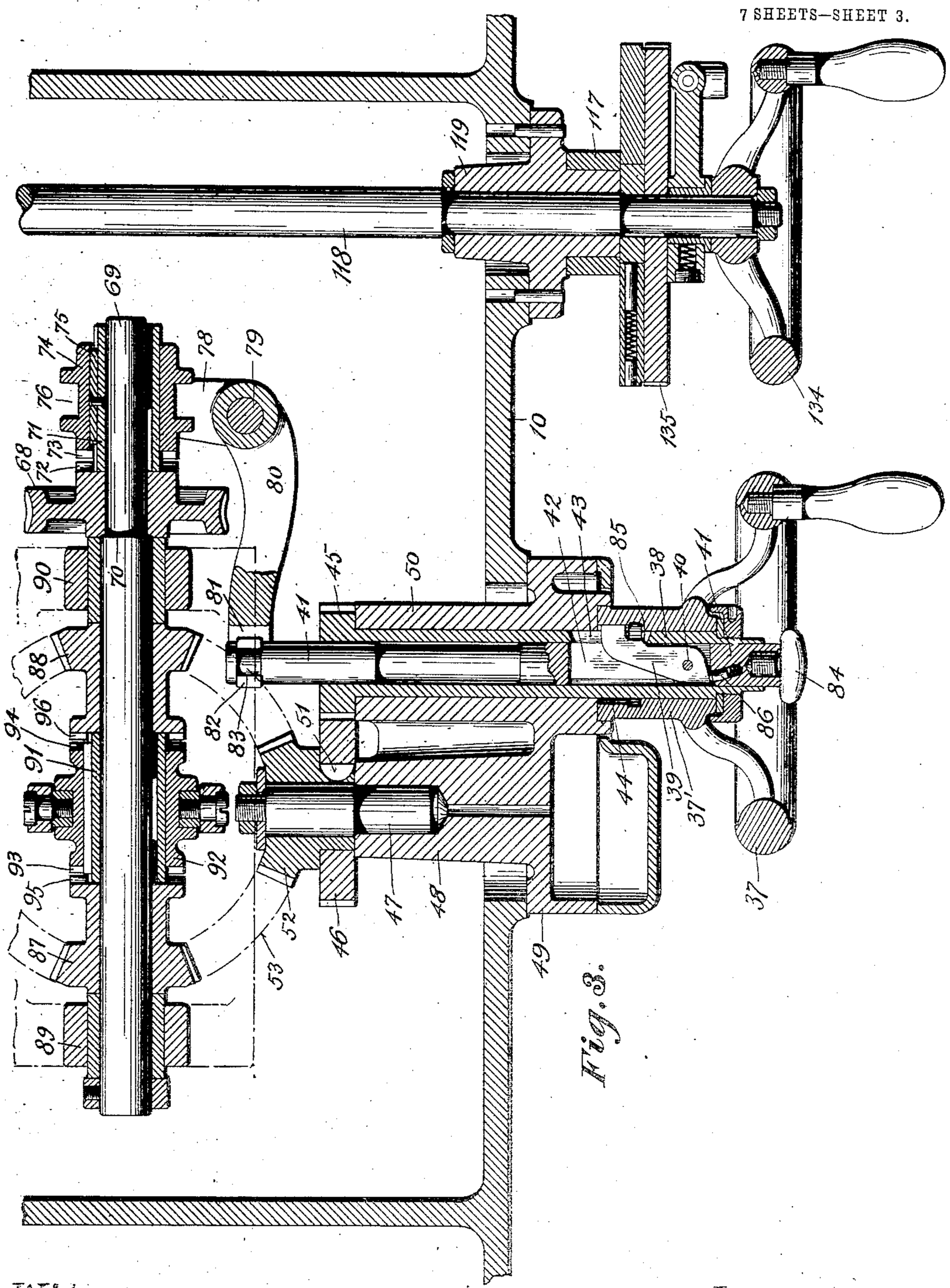

Fig. 3.

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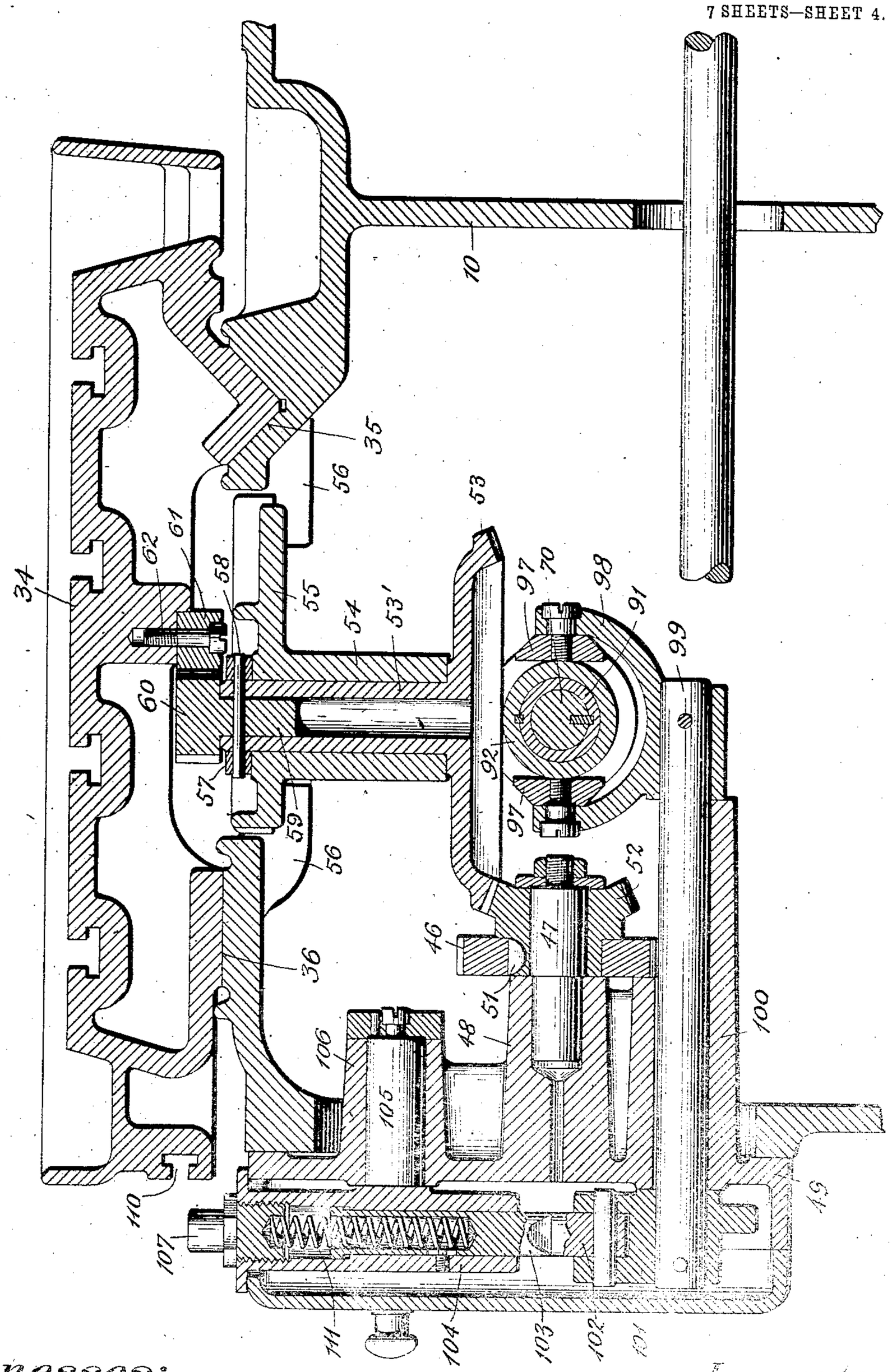
7 SHEETS—SHEET 4.

Fig. 4.



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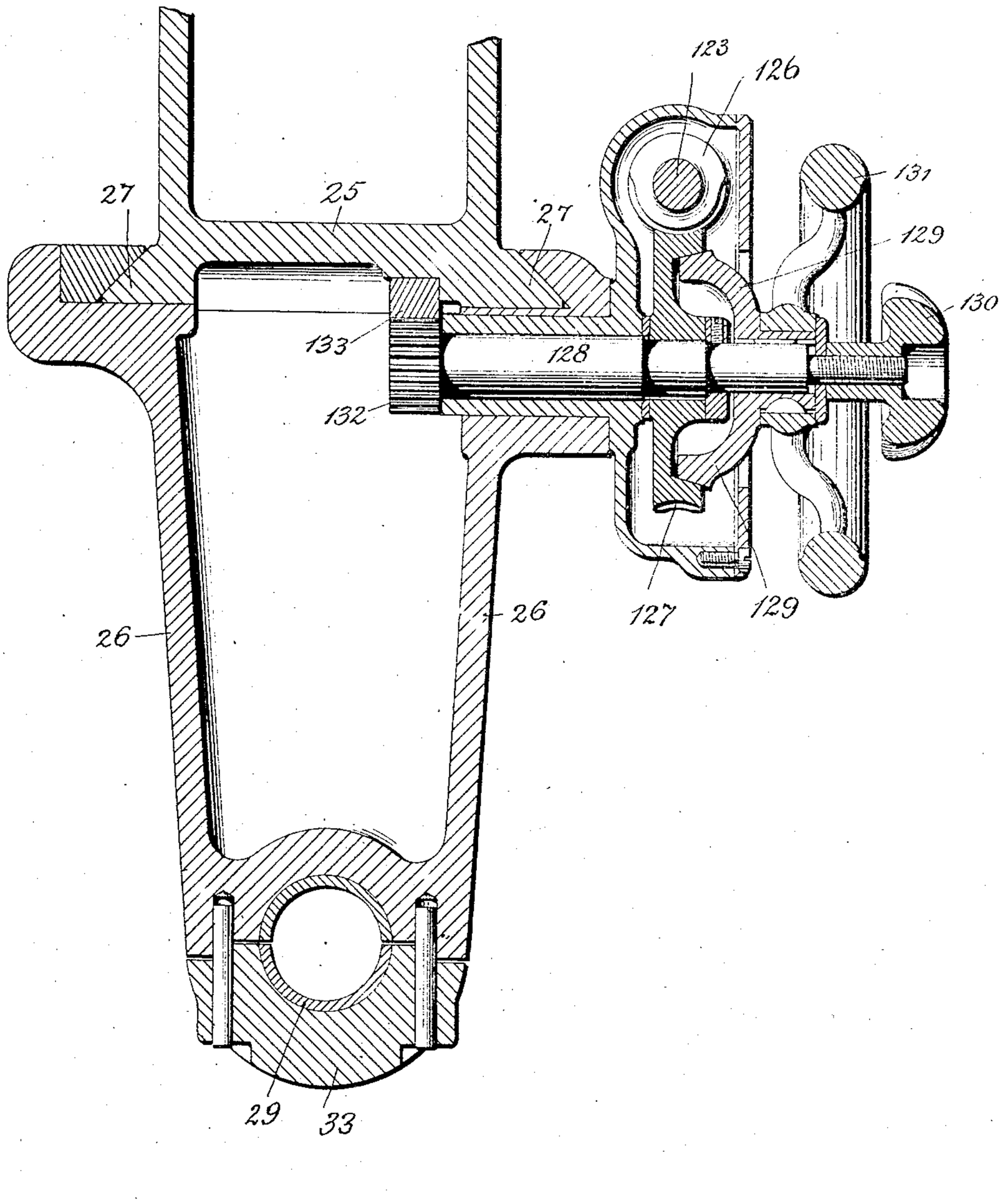
7 SHEETS—SHEET 5.

Fig. 5.



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GRINDING MACHINE.

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7 SHEETS—SHEET 6.

Fig. 7.

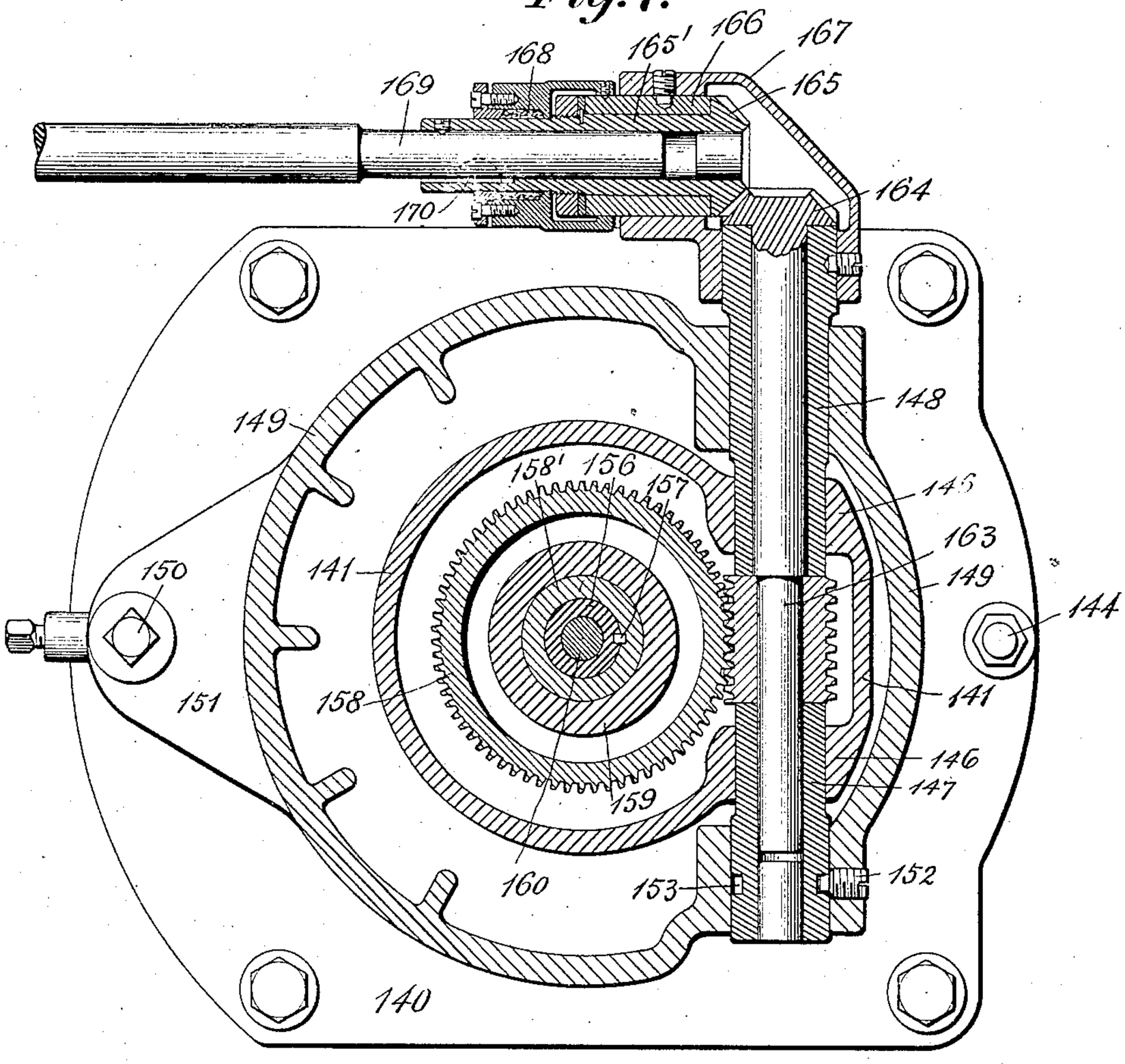
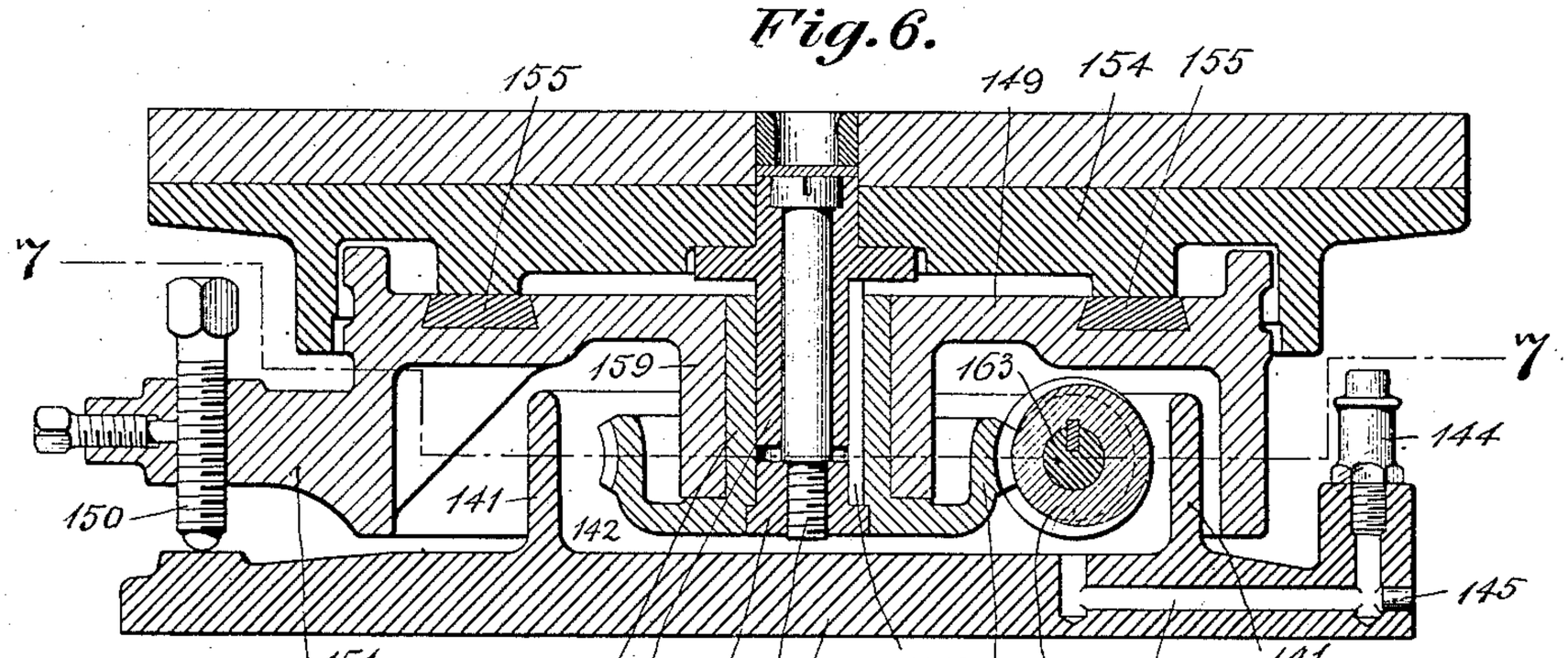


Fig. 6.



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7 SHEETS—SHEET 7.

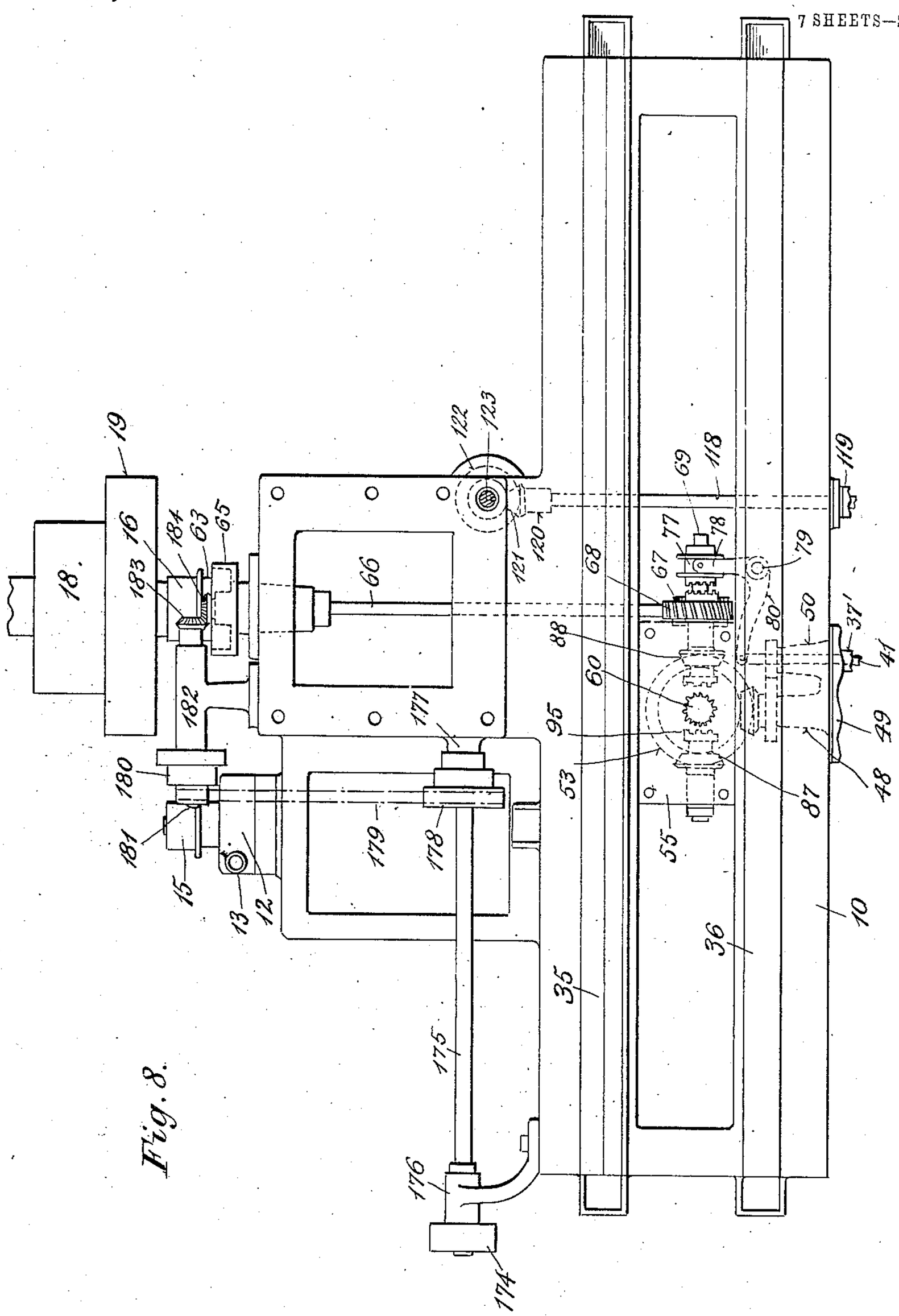

Fig. 8.

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By his Attorney
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UNITED STATES PATENT OFFICE.

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GRINDING-MACHINE.

No. 915,174. Specification of Letters Patent. Patented March 16, 1909.

Application filed October 19, 1906. Serial No. 339,643.

To all whom it may concern:

Be it known that I, BENGT M. W. HANSON, a citizen of Sweden, having declared my intention of becoming a citizen of the United States, residing at Hartford, in the county of Hartford and State of Connecticut, have invented certain new and useful Improvements in Grinding-Machines, of which the following is a specification.

This invention relates to grinding machines and more particularly to that class thereof in which the work to be ground is held on a platen or table which is movable relatively to the reducing or grinding wheel, and which are generally known as "surface grinding machines", and it has for one of its objects the provision of a machine of this character which is especially adapted to grind the surface of work generally and also of circular saws in addition to the usual work performed by the machine.

My invention has furthermore for its object, the provision of a table which is mounted for rotation around a normally stationary vertical axis, and which may be slightly tilted so as to permit the grinding-wheel to produce work the central portion of which is somewhat thinner than the peripheral portion thereof.

A further object of the invention is the provision of means whereby the table may be continuously rotated and advanced during the grinding operation to thus bring every part of the side of the work into contact with the grinding-wheel.

The invention has furthermore for its object the provision of an automatic feed-mechanism for causing the grinding-wheel gradually to advance toward the work for a predetermined amount, thus precisionizing the work performed by the machine.

Other objects of the invention will be hereinafter set forth.

In the accompanying drawings Figure 1 is a front view of a grinding machine embodying my invention; Fig. 2 is a left hand view thereof; Fig. 3 represents a horizontal section on line 3—3 of Fig. 1, on an enlarged scale; Fig. 4 shows a fractional vertical section on line 4—4 of Fig. 1; Fig. 5 is a section on line 5—5 of Fig. 1; Fig. 6 is a central vertical section of the work-supporting table; Fig. 7 represents a horizontal section on line 7—7 of Fig. 6, and Fig. 8 is a plan view of the machine bed, all superstructures being left off, to show the driving connections.

Like characters designate similar parts throughout the several views.

Referring to the drawings, the numeral 10 denotes the bed of the machine, comprising a lubricant tank 11, from which lubricant, for instance water, may be conveyed by a pump 12 through a pipe 13 to the reducing or grinding-wheel W. The pump-shaft 14 has a pulley 15 which is driven from a pulley 16 mounted on the main shaft 17 of the machine, which also has a main pulley 18 to which power may be transmitted from any convenient source.

The mechanism for rotating the grinding-wheel consists, in the present instance, of a band-wheel 19 secured upon the shaft 17, and a belt 20 running over idlers 21 and 22 loosely mounted on a spindle 23, which is held in a bracket 24, secured to a post 25, upon which the grinding-wheel is adapted to be moved vertically, (see Figs. 1 and 2), through the intervention of a carriage 26 which is guided on ways 27. The belt 20 passes around a pulley 28 having a sliding key-connection with the vertical grinding-wheel arbor 29, and disposed between a pair of bearings 30, 31 which project from a bracket 32 attached to the upper end of the post 25, and in which said arbor 29 is journaled, while at the same time the latter may be vertically shifted or moved through said bearings.

The lower end of the arbor 29 is journaled in a bearing 33 constituting a part of the vertically-slidable carriage 26, and it carries the grinding-wheel W preferably formed in the shape of an annular ring the lower edge-surface of which is adapted to be brought into contact with, and to grind the upper surface of the work.

Inasmuch as it is desirable to carry a plentiful supply of lubricant to the grinding-wheel, and also to avoid complexity in piping, I deem it advantageous to make the arbor 29 tubular, as indicated at 29′ in Fig. 2, and to connect the pipe 13 with the interior hollow channel thus formed, in this manner not only throwing a portion of the lubricant directly upon the work-surface, but also permitting a major portion of the lubricant to be thrown by centrifugal force against the inner wall surface of the grinding-wheel, from which it will of course drop and therefore

cover the lower edge or grinding-surface of the wheel.

As above stated, my improved grinding-machine is adapted for performing the usual class of work pertaining to what is known as "surface grinders", and in the present instance the work may be secured in any suitable manner on a table or platen 34 movable on ways 35, 36 on top of the bed 10.

Means are provided to enable the operator to impart to the table a reciprocatory movement by hand, these means consisting of a hand-wheel 37, (see Figs. 1 and 3), normally loose on a tubular shaft 38, but connected therewith for hand manipulation by a dog 39, pivoted at 40 on a longitudinally shiftable rod 41, which is recessed or slotted at 42 to receive said dog. The free end of the dog passes through a slot 43 in the tubular shaft 38 and is adapted to engage any one of a series of notches 44 provided in the interior surface of the hub 37′ of the hand-wheel 37 thus causing both hand-wheel 37 and tubular shaft to rotate simultaneously.

The rear end of the shaft 38 has a pinion head 45 in engagement with a gear 46 indirectly mounted for free rotation on a stud 47 which is rigidly held in a lug 48 projecting inwardly from a plate 49, which is secured to the front of the bed 10 and which has also a bearing 50 for supporting the tubular shaft 38. In its preferred form shown, the gear 46 is rotatably connected by a key 51 with a bevel pinion 52 which is in constant engagement with a bevel gear 53 (see also Fig. 4), the hub 53′ of which is vertically disposed and journaled in a bearing 54 attached to, or constituting a part of, a plate 55, firmly held on lugs 56 of the bed 10. At its upper end the hub or trunnion 53′ carries a collar 57, secured thereto by a pin 58, which at the same time passes through a pintle 59 formed on a pinion 60 and entering the tubular bore of the trunnion 53′, so that the pinion 60 will be rotated with the bevel-gear 53 as will be readily understood. This pinion 60 is in engagement with a rack 61 secured to the under side of the table 34, by screws 62, and hence it will be seen that when the hand-wheel 37 is rotated, the table 34 will be correspondingly moved on its ways, and beneath the grinding-wheel W.

In addition to the hand-operable mechanism just described, for reciprocating the table 34, means are provided whereby such movement may be obtained automatically and for a predetermined amount as required by the operator, this means being actuated from the main shaft 17 which carries a pulley 63, (see Figs. 2 and 8), connected by a belt 64 with a pulley 65 on a transversely-disposed shaft 66 journaled in suitable bearings in the bed 10 and having near its front end a worm 67, (see Fig. 8), in constant engagement with a worm-gear 68, (see Fig. 3). This gear is loosely mounted on a shaft 69, and rests with one side of its hub against a shoulder 70, while the other end of the hub rests against a collar 71 and is provided with clutch-teeth 72 adapted to be engaged by similar teeth 73 formed on a spool 74 shiftable on the collar 71, so that when the teeth 72, 73 are in engagement, the movement of the worm-gear 68 will be transmitted to the shaft 69. The spool 74 has a circumferential-groove 76 to receive the shoes 77, (see Fig. 8), pivotally supported by a shipper-fork 78, which is pivoted on a stud 79 rigidly held on the underside of the top web-plate of the bed 10, and which has an arm 80 the free end of which is bifurcated at 81 to receive a yoke collar 82 engaging a groove 83 provided therefor near the rear end of the shiftable rod 41, above mentioned, said rod having a hand-knob 84 for its manipulation.

When the rod 41 is pulled forward, the dog 39 will be caused, (by virtue of an inclined cam-face 85 engaging the end wall of the slot 43), to swing round its pivot 40 and against the action of a spring-actuated plunger 86, thus withdrawing the clutch end of the dog from the notches 44 of the hand-wheel hub 37′, while at the same time the spool 74 is shifted to bring the clutch teeth 72, 73 into engagement, so that in this manner the shaft 69 will be connected with the worm-gear 68 and thus be driven by power, and the hand-wheel 37 will be left free from the mechanism normally operated thereby.

Referring to Figs. 3 and 8, it will be seen that the bevel-gear 53 is in constant engagement with a pair of diametrically oppositely disposed bevel-pinions 87, 88, normally loose upon the shaft 69 and positioned thereon by the bearings 89, 90 for said shaft, and also by a spacing sleeve 91, which is keyed to the shaft and supports on its outer surface a clutch-member 92 adapted to be shifted thereon in opposite directions, and having at its opposite ends clutch-teeth 93, 94, respectively, for engaging correspondingly-formed teeth 95, 96 of the bevel-pinions 87, 88, respectively.

From the foregoing description it will be understood, that when the shaft 69 is being rotated, through the intervention of the worm-gear 68, the bevel-gear 53 may be rotated in one direction or the other, as controlled by the engagement between the clutch-member 92 and either the bevel-pinion 87 or 88, so that consequently the table 34 may be moved in opposite directions.

In Fig. 3 the clutch-member 92 is shown in its central position, neither of the pinions 87, 88 being in engagement, the position being only transitory, however, inasmuch as the mechanism for moving said clutch member is such that either one side or the other thereof will be in clutch. This mechanism

is illustrated in Figs. 1 and 4 of the drawings, and comprises a pair of shoes 97 in engagement with the clutch member 92, and carried by the shipper-fork 98 secured upon a rock-shaft 99, which is journaled in a bearing 100 projecting from the front plate 49, above referred to. At its forward end the shaft 99 has secured thereto an arm or lever 101 which carries a hardened abutment-member 102 the upper end of which is double-beveled, (see Fig. 1), and coöperates with a similarly-beveled end of a spring plunger 103, slidably supported in a barrel 104 which has a trunnion 105 journaled in the bearing 106 of the front-plate 49 and may consequently be rocked thereon. The upper end of the barrel 104 has an abutment-stud 107 adapted to be engaged by a pair of dogs 108, 109 screwed to the front edge of the table 34, which is provided with a T-slot 110 to enable the operator to adjust the position of the dogs 108, 109 to any point longitudinally thereof.

It will be seen that when the table is being moved in the direction of the arrow *a*, (Fig. 1), the dog 108 will ultimately engage the abutment-stud 107, and gradually rock the barrel 104 on its trunnion 105, which action will result in forcing the lower beveled end of the spring-plunger 103 past the beveled end of the abutment 102, so that the plunger will be caused to rise against the tension of the spring 111, which then becomes effective in propelling said plunger downward as soon as the apexes of the double-beveled abutments have passed each other and thus throw the arm 101 to the right, consequently rocking the shaft 100 to move the clutch member 92 out of engagement with the bevel pinion 87, and into engagement with the pinion 88, and therefore reversing the movement of the bevel gear 53 and, with it, the movement of the table 34, which will then travel in the direction of arrow *b*, Fig. 1. As the dog 109 will then ultimately engage the abutment stud 107, the barrel 104 will be reversed in the manner above described and the table will consequently be caused again to travel in the direction of arrow *a;* the change of direction being effected at the end of the table stroke in either direction, the length of which is directly subject to the distance between the dogs 108, 109.

In order to render the machine entirely automatic in its function, and to produce precisionized work, means are provided for feeding the grinding wheel toward the work at the completion of each table movement in one direction, the mechanism employed in connection therewith being operatively connected with the reversible barrel 104, above described, and preferably as illustrated in Figs. 1, 5 and 8.

Referring first to Fig. 1, it will be seen that the barrel 104 has a lateral projection 112 for actuating a pinion 113 journaled in a stud 114 and carrying a crank arm 115 which is connected by a link 116 with an arm 117 pivotally supported on a shaft 118 (see also Fig. 3). This shaft 118 constitutes the primary device of the feed mechanism for the grinding wheel, and is journaled in bearings 119, 120 (see Fig. 8) of the bed 10. At its rear end said shaft carries a bevel pinion 121 in engagement with a bevel gear 122 in sliding key connection with a vertical shaft 123, which is journaled at its upper end in bearings 124, 125 (see Fig. 2) between which is disposed a worm 126 rigidly secured to the shaft 123 and in engagement with a work-gear 127. The latter is normally loose upon a horizontal shaft 128 journaled in the slide 26, previously mentioned, and may be cooperatively connected therewith by a cup-friction device, as shown in Fig. 5, and which comprises a clutch member 129 keyed to the shaft 128 but adapted to slight longitudinal movement thereon, to connect or disconnect said shaft with or from the worm gear 127, as controlled by a hand nut 130, in one direction, and the hand wheel 131 in the other direction. At its inner end the shaft 128 is provided with a pinion 132 in engagement with a rack 133 disposed in parallelism with the movement of the slide way, and secured to the front of the post 25. The primary shaft 118 carries at its front end a hand-wheel 134 (see Fig. 3) and also a ratchet 135 the teeth of which are adapted to be engaged by a dog or pawl 136 (see Fig. 1) pivotally held on the arm or pawl-carrier 117, which has an oscillatory movement imparted thereto in the manner previously described. From the foregoing explanation it will be understood that the oscillation of the pawl-carrier 117 will, acting as the pawl is permitted to engage the teeth of the ratchet 135, result in advancing the grinding wheel slide 26, and with it the grinding wheel W, toward the work, step by step, the actual feeding distance being naturally subject to the number of ratchet teeth carried forward by the pawl; and, in order to reduce this number of teeth so as to feed the wheel only one tooth at a time, I prefer to employ an adjustable stop 137, against which the pawl carrier will come to a rest during its backward movement, a fact which is permissible by virtue of the link 116 being slotted as indicated at 138.

The entire mechanism thus far described constitutes a surface grinding machine, in which the grinding or reducing wheel is disposed on a vertically-shiftable spindle, a feature which is desirable in grinding flat surfaces inasmuch as the surface is subjected to the wheel twice, viz., at diametrically opposite points thereof, so that consequently the work can be done in a correspondingly shorter time.

As above stated the present invention has

for one of its objects the provision of a machine which is especially adapted to grind the side faces of circular saws, in addition to the regular class of work, and hence I deem it expedient to combine with the table of the machine, a special support adapted to receive the saw-disks and to present them to the action of the grinding wheel in such a way as to cause the latter gradually to reduce the thickness of the disks toward the center, thus establishing in a natural way the clearance requisite for the proper operation of the saw teeth and to prevent all frictional contact or drag on the sides of the saw. In order to accomplish this result without resorting to a multiplicity of mechanical expediencies, and without necessitating any changes in the organization and operation of the several elements of the machine hereinbefore described, the special support just mentioned constitutes in reality a special fixture which may be installed on or removed from, the machine table at pleasure; and in order to minimize the trouble of adapting the machine to the ordinary plain-face work, I prefer to secure the saw-holding fixture near one end of the table, consequently leaving the major portion of the latter to be used otherwise.

The saw support is clearly shown in Figs. 1, 2, 6 and 7, in which the table 34 carries at one end thereof a bed plate 140, having at its upper face a substantially annular flange 141 which forms an open chamber 142 for receiving some portions of the operating mechanism, and which may be filled with oil for lubricating the latter. An oil channel 143 is in communication with the bottom of the chamber 142 and may serve either to supply lubricant through the filter cup 144 or to withdraw the oil from the chamber, upon the removal of the plug 145, (see Fig. 6).

The flange 141 has a pair of reinforced portions 146 (see Fig. 7) bored to receive tubular bushings 147, 148, which are driven into place to prevent leakage of oil from the chamber 142. These bushings serve as trunnions for supporting one side of a frame 149 which is adapted to be tilted vertically around the axis of the trunnions, and which may be maintained in its tilted position by an adjusting screw 150 in screw threaded engagement with an ear 151 of said frame, and resting with its lower end against the upper face of the bed plate 140, while said frame may be held against longitudinal movement on the trunnion bushings, as for instance by a check screw 152 entering a groove 153 in the bushing 147.

From the foregoing it will be understood that, in as much as the axis of the trunnions is disposed at a right angle relatively to the movement of table 34, a flat plate may readily be ground so as to have its opposite (right and left) edges of different thicknesses; and in order to adapt the present fixture for grinding the saw-disks evenly and concentrically all around, I provide in connection with the frame, a saw-supporting table 154 which is rotatable around a vertical axis the position of which is subject to the inclination or tilt of the frame 149, which is provided with an annular wearing strip 155 upon which the table rests. Rotary movement is imparted to the table 154, through the intervention of a centrally-disposed trunnion stud 156 having a key connection 157 with the hub 158′ of a worm gear 158, journaled in a bearing-lug 159 projecting from the lower face of the frame 149, a screw 160 and nut 161 serving to retain the several elements in coöperative relation.

The center line of the worm gear 158 intersects the axis of the trunnion bushings 147, 148, so as to permit the frame 149 to be tilted without causing any cramping action between said gear and a worm 162 which is interposed between said bushings, and secured upon a shaft 163, journaled in said bushings and having at its rear end a bevel pinion 164, which is in mesh with a similar pinion 165 the hub 165′ of which is journaled in a bushing 166 secured in a casing 167 which is tightly held on the bushing 148, above referred to, and serves as an oil well for maintaining the gears 164, 165 constantly lubricated, leakage being prevented by a stuffing box 168. The hub 165′ is tubular to receive a shaft 169 and has a key connection 170 therewith, and which also has a longitudinal groove 171 (see Fig. 1) for a key carried by the hub of a pulley 172 journaled in a bearing 172′ which is attached to the machine bed 10. By virtue of the groove 171 the table 34 may be moved along the ways 35, 36 without interfering with the driving qualifications of the pulley 172, which obtains its power by a belt 173, from a pulley 174 which is secured upon a shaft 175 journaled in bearings 176, 177 of the bed 10 (see Fig. 8).

Means are provided for operating the shaft 175 at different speeds to correspond with the size of the work and also to regulate the rapidity of presenting a fresh work surface to the action of the grinding wheel, these means consisting preferably of a cone pulley 178, secured to the shaft 175 and driven by a belt 179 from a corresponding pulley 180 held upon a spindle 181 which is journaled in a bearing 282 attached to the bed, and which carries at its other end a bevel pinion 183 in mesh with a similar pinion 184 attached to the pulley 65, previously referred to, and which receives its power from the main shaft of the machine as above fully explained.

The organization of several coöperating elements just described, is therefore, such that the saw-supporting table is continuously rotated, as long as the main shaft 17 is run-

ning, and it is entirely immaterial in what particular position the table or platen 34 may be longitudinally of the bed. The especial purpose of the saw-supporting device being to present all portions of the saw-disk to the action of the grinding wheel, it is self evident that the table 34 should be moved so as to permit the grinding wheel to contact with the saw surface for the required amount. This movement may be a reciprocatory one and controlled by the dogs 108, 109 properly positioned on the platen, or if preferred the table 34 may be disconnected from its reciprocating mechanism, thus leaving it stationary, when the saw table 154 will be rotated without changing its position relatively to the grinding wheel, in which case the latter must needs be fed toward the work by hand.

In connection with the tilting mechanism of the saw-supporting table, it may be stated that, if the left side of said table should be slightly lowered, the work will be ground to have a thinner peripheral edge than its central portion, and also that when the table surface is in parallelism with the ways 35, 36 of the bed, the work will naturally be ground to a uniform thickness throughout, provided of course, that the underside of the work is in contact with the table surface in every instance. I might also state that in the present instance the spindle or shaft for the grinding tool rotates about an axis transverse or substantially perpendicular to that work-support; that is to say while said axis is transverse to said work-support it is not necessary that it be at right angles thereto.

Having described my invention, I claim:

1. The combination, with a grinding wheel, a platen movable relatively thereto, and a tiltable work-support carried by said platen, and feed mechanism for the grinding wheel and controlled by the platen movement, of the work-support carried on said platen, and means for rotating said work-support.

2. The combination, with a grinding wheel, a platen movable relatively thereto, and feed mechanism for the grinding wheel and controlled by the platen movement, of a work-support carried by said platen, and comprising a lubricant chamber, and means for rotating said work-support and disposed within said chamber.

3. The combination, with a grinding wheel, a platen movable relatively thereto, and feed mechanism for the grinding wheel and controlled by the platen movement, of a work-support carried by said platen, and comprising a lubricant chamber, and a worm-gear and worm disposed within said chamber, and for rotating said work-support.

4. The combination, with a carriage and with a rotary-work-support mounted thereon, of a vertically-disposed reducing-tool; means for feeding said reducing-tool toward the work-support; and means for reciprocating the carriage.

5. The combination, with a rotary work-support, of a reducing-tool, means for moving one of said elements toward and from the other; a reciprocatory carriage; and means for arresting the movement of said carriage at a predetermined point.

6. The combination, with a rotary work-support, of a reducing-tool, means for moving one of said elements toward and from the other; a reciprocatory carriage; means for arresting the movement of said carriage at a predetermined point, and reversing mechanism for said carriage.

7. The combination with a rotary work-support and a vertically-disposed reducing-tool of means whereby said work-support may be tilted; and mechanism for feeding the reducing-tool.

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

BENGT M. W. HANSON.

Witnesses:

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LOUIS F. N. WHITMAN.