No. 846,871. PATENTED MAR. 12, 1907.

F. M. STAMBAUGH.

METAL WORKING MACHINE.

APPLICATION FILED NOV. 9, 1905.

12 SHEETS—SHEET 1.

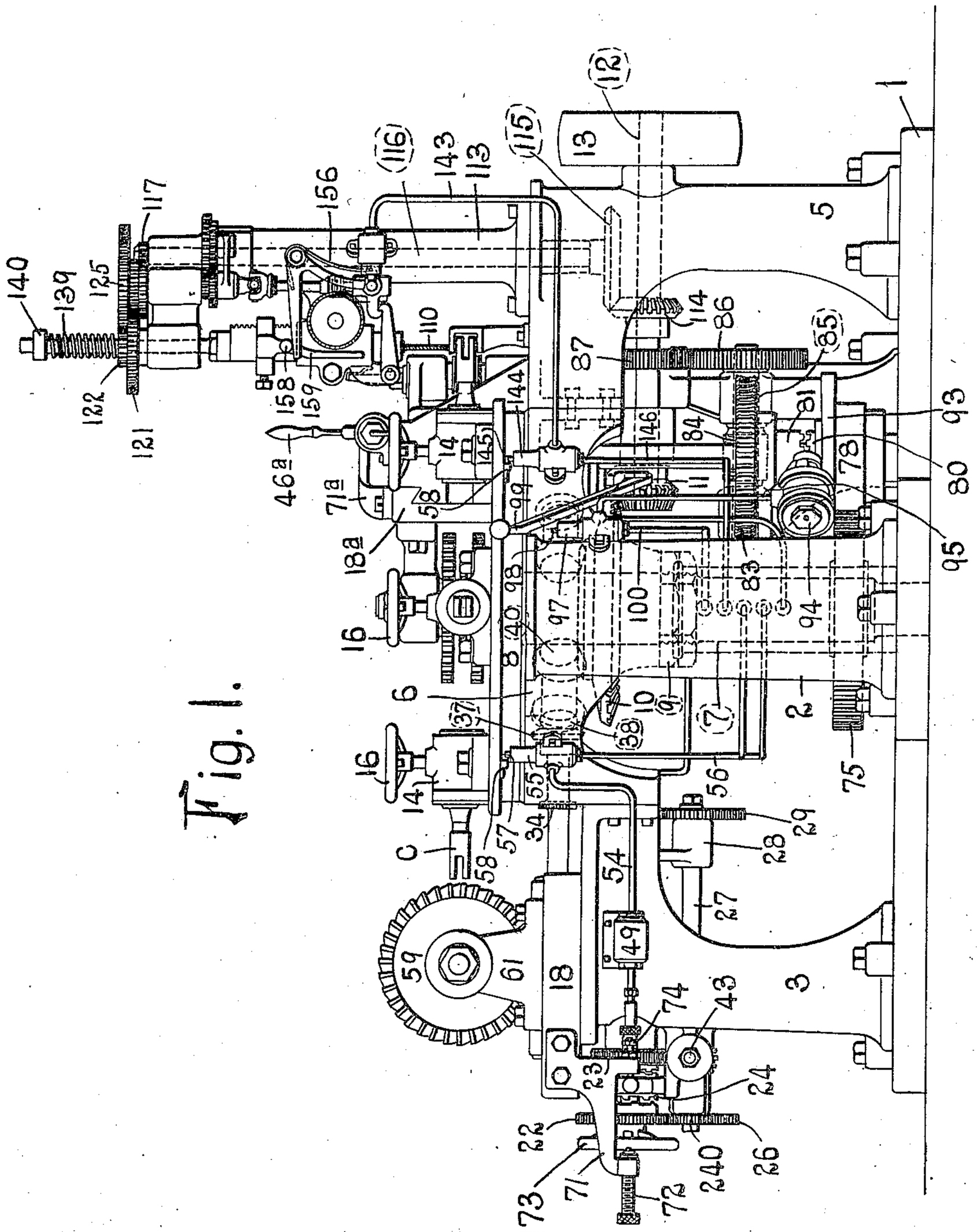

Fig. 1.

Witnesses

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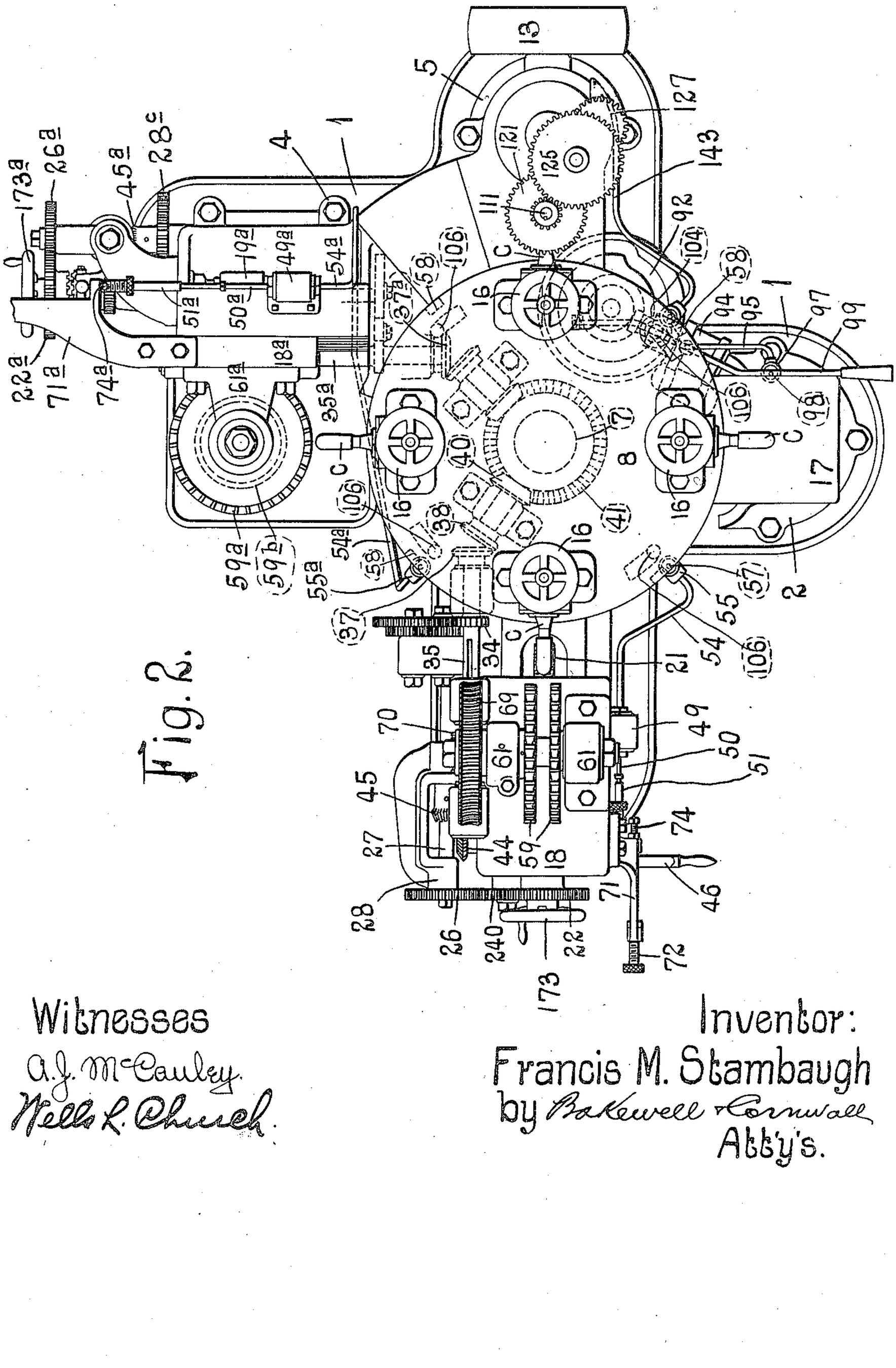

Fig. 2.

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12 SHEETS—SHEET 3.

Fig. 3.

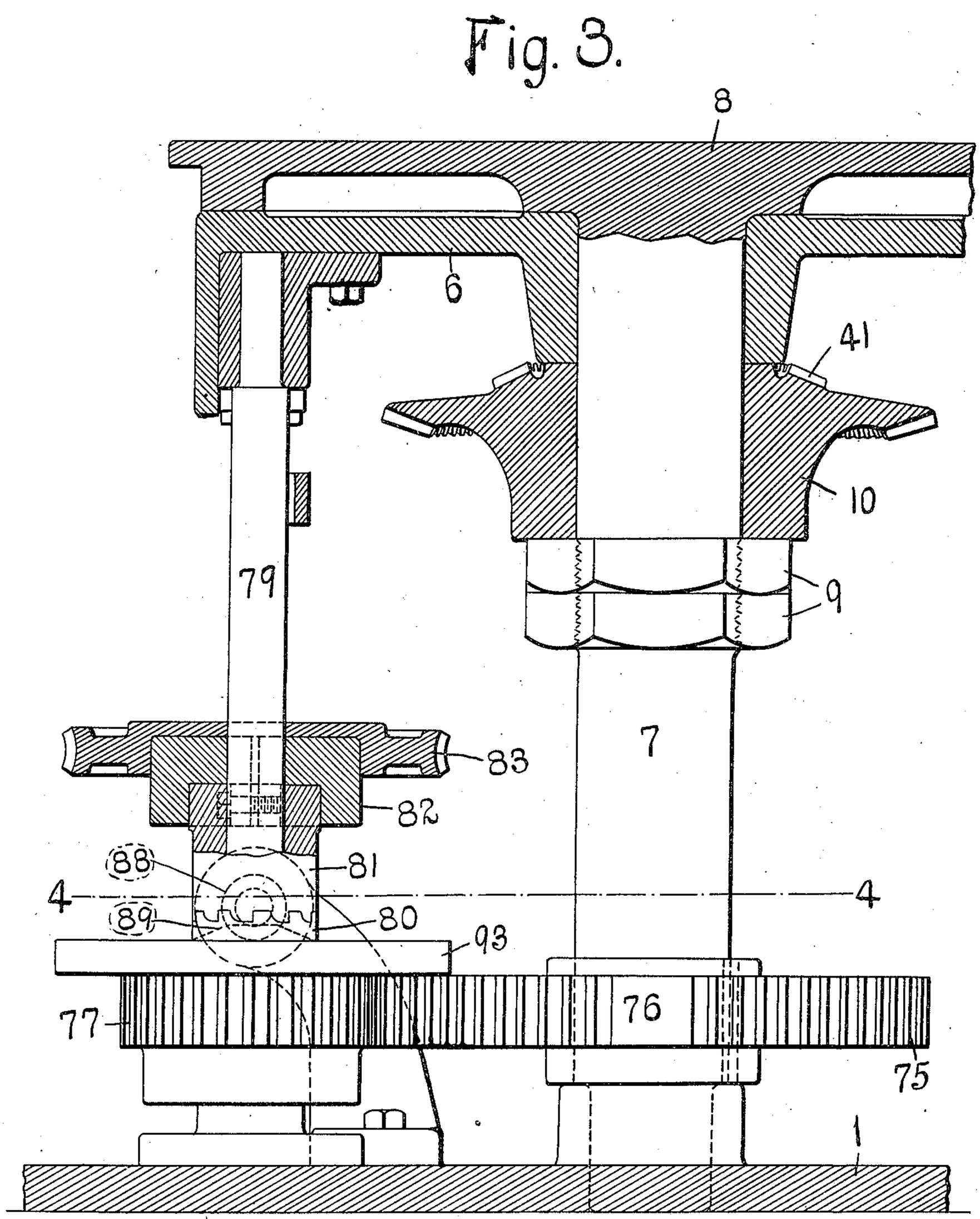

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Fig. 4.

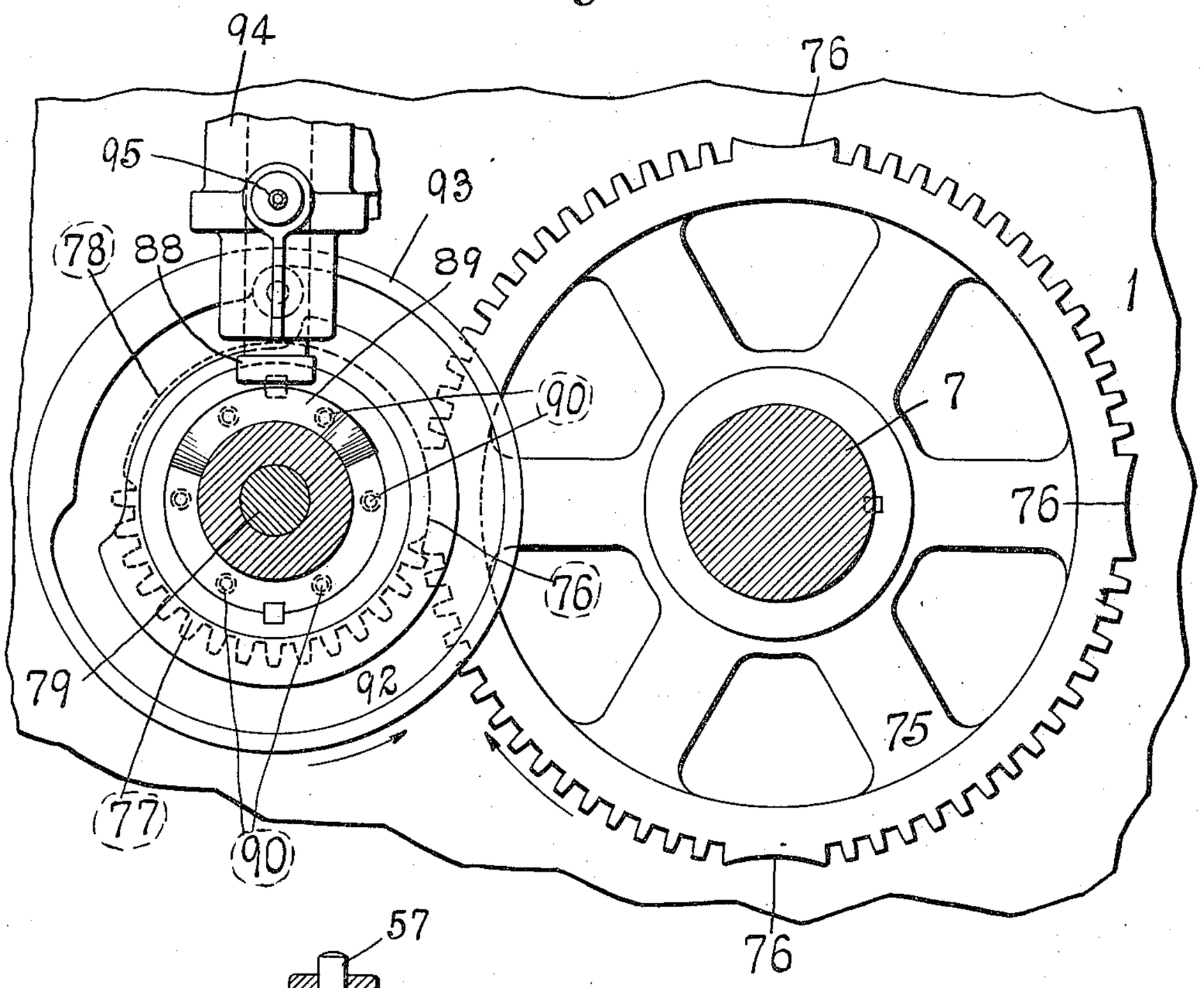


Fig. 4a.

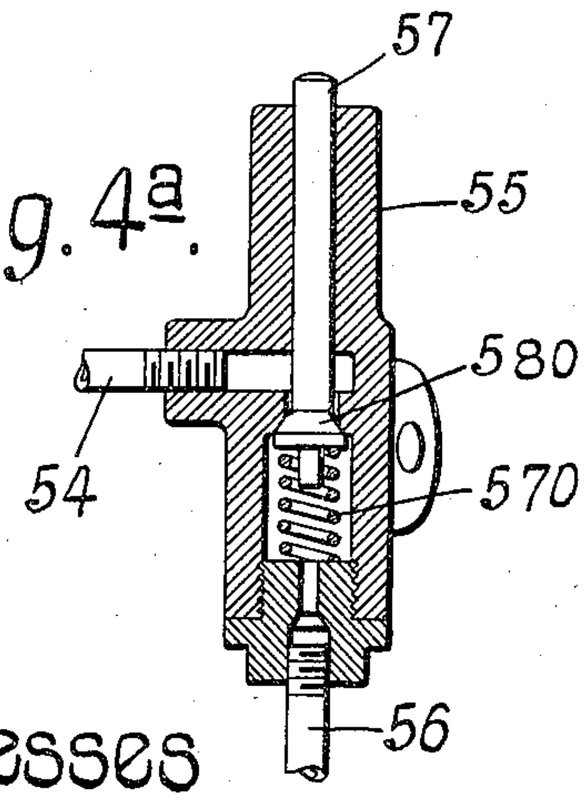
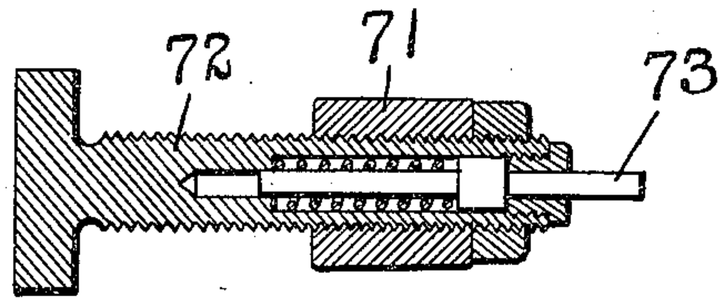


Fig. 4b.



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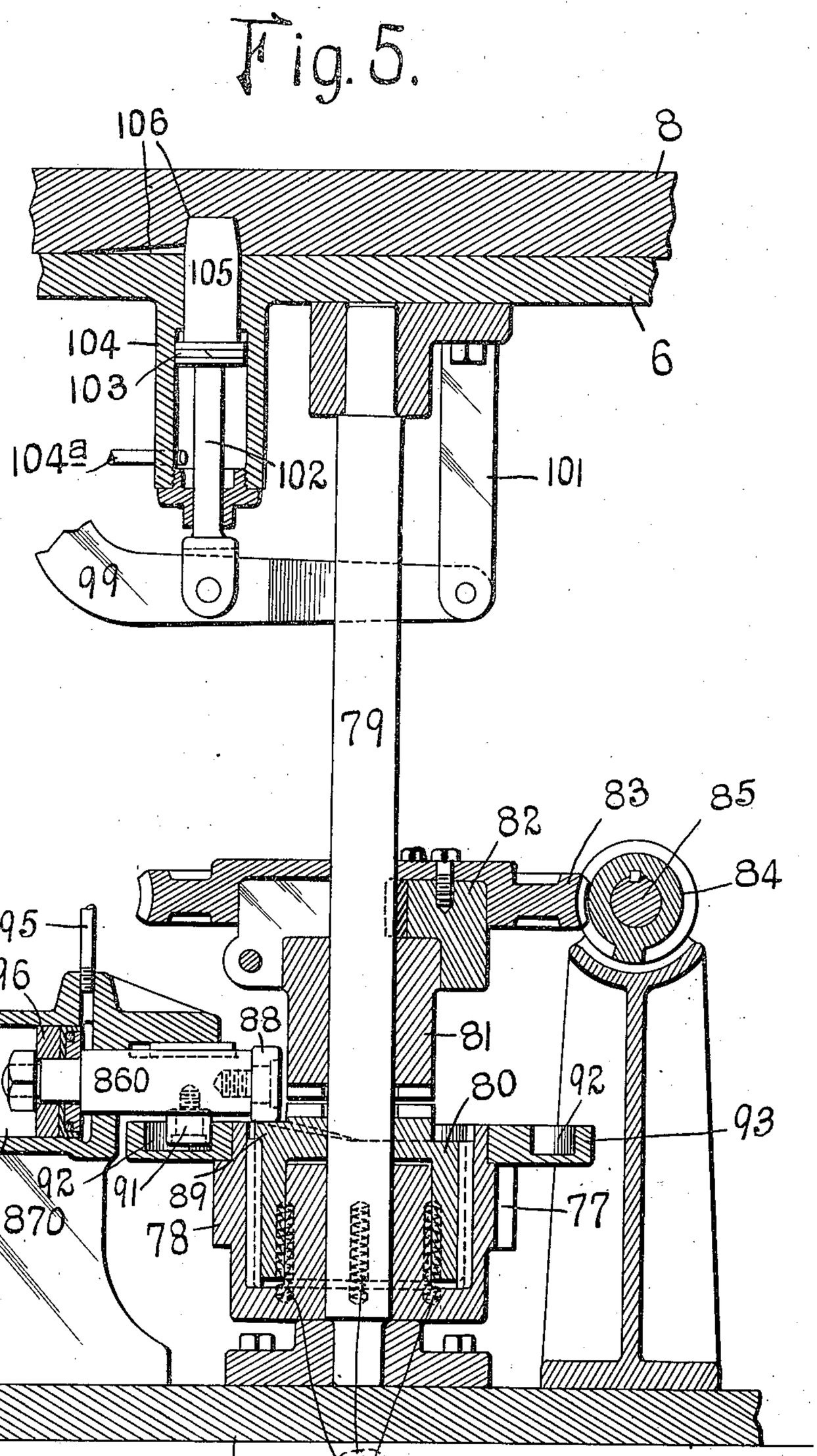
12 SHEETS—SHEET 5.

Fig. 5.



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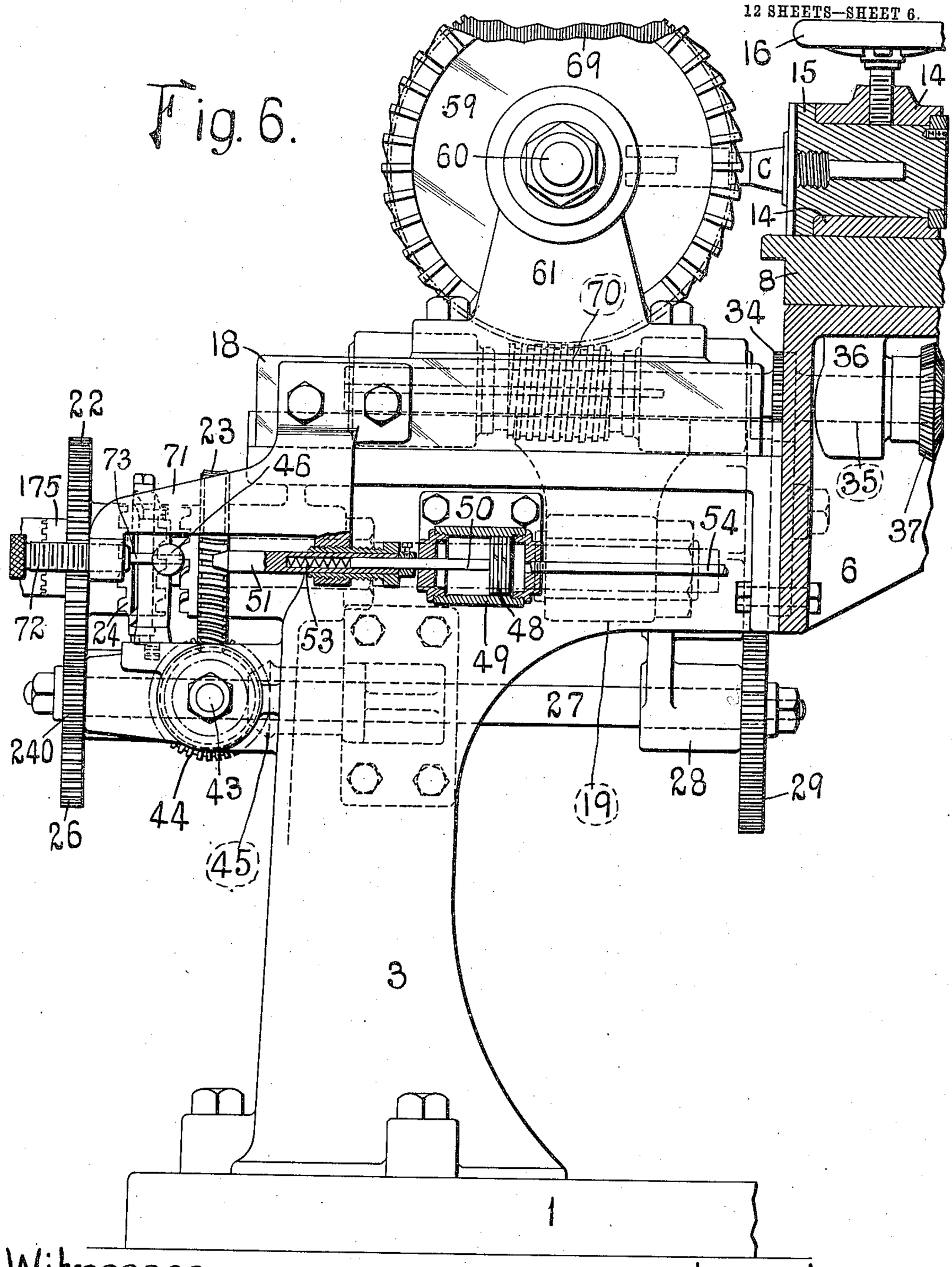
12 SHEETS—SHEET 6.

Fig. 6.



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12 SHEETS—SHEET 7.

Fig. 8.

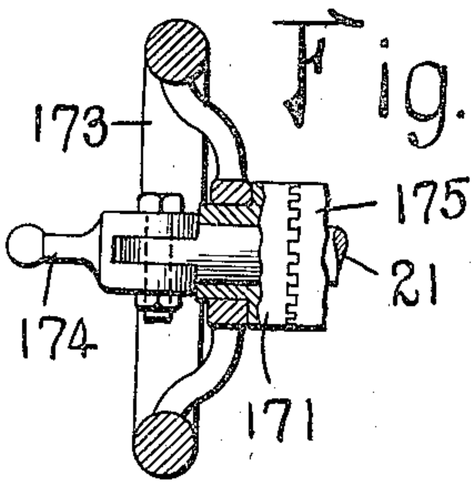

Fig. 7.

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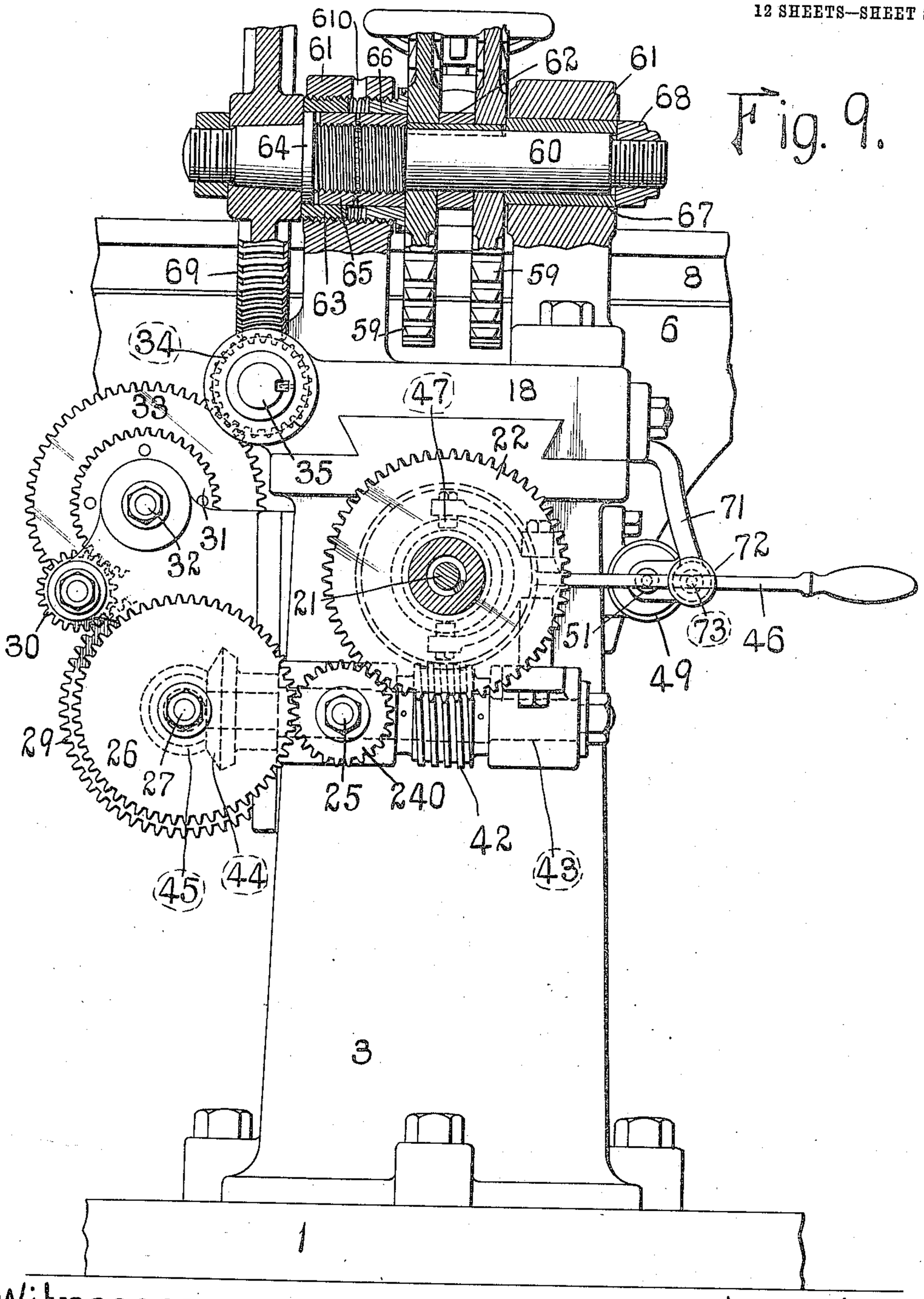
12 SHEETS—SHEET 8.

Fig. 9.



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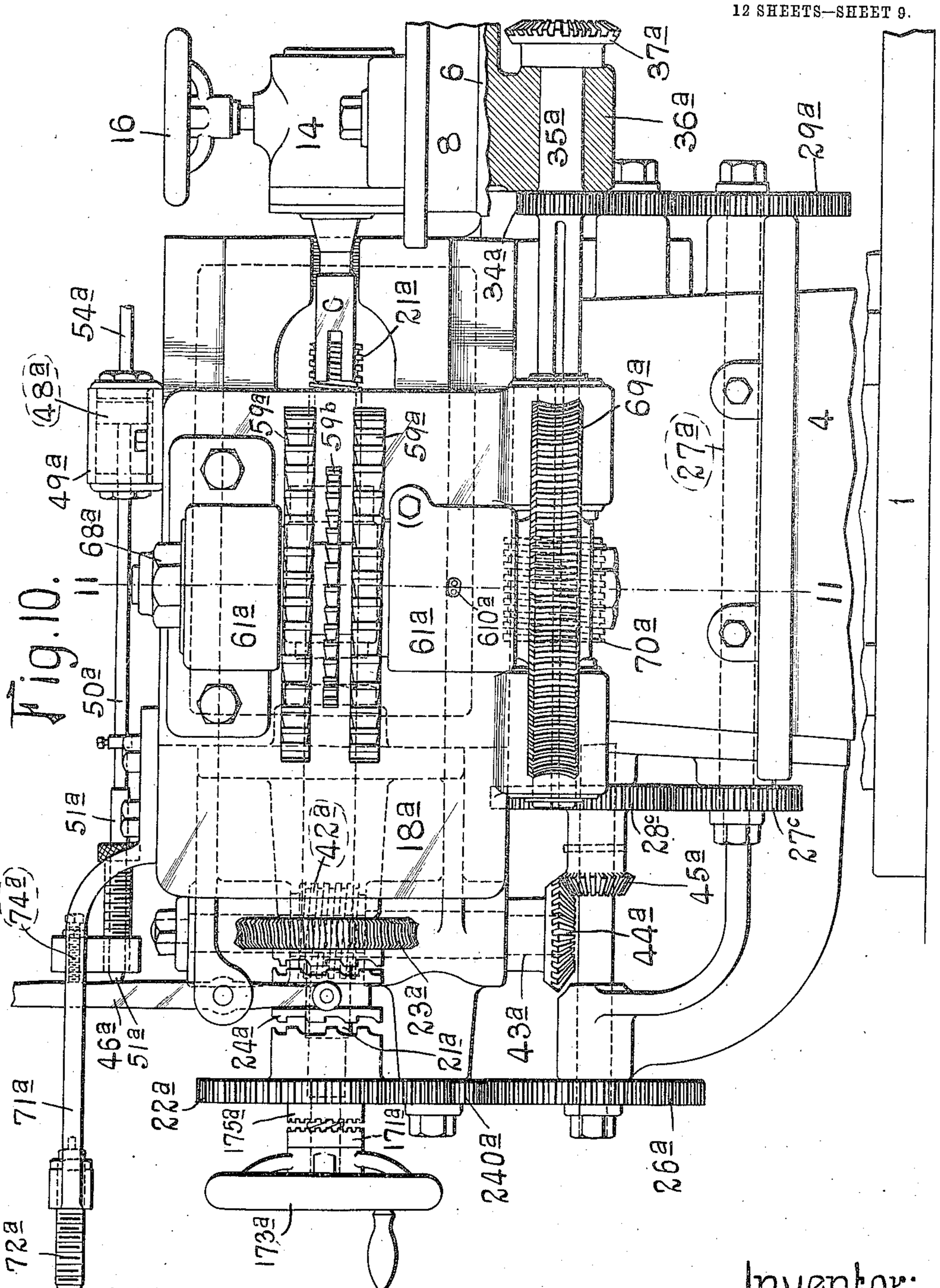

Fig. 10.

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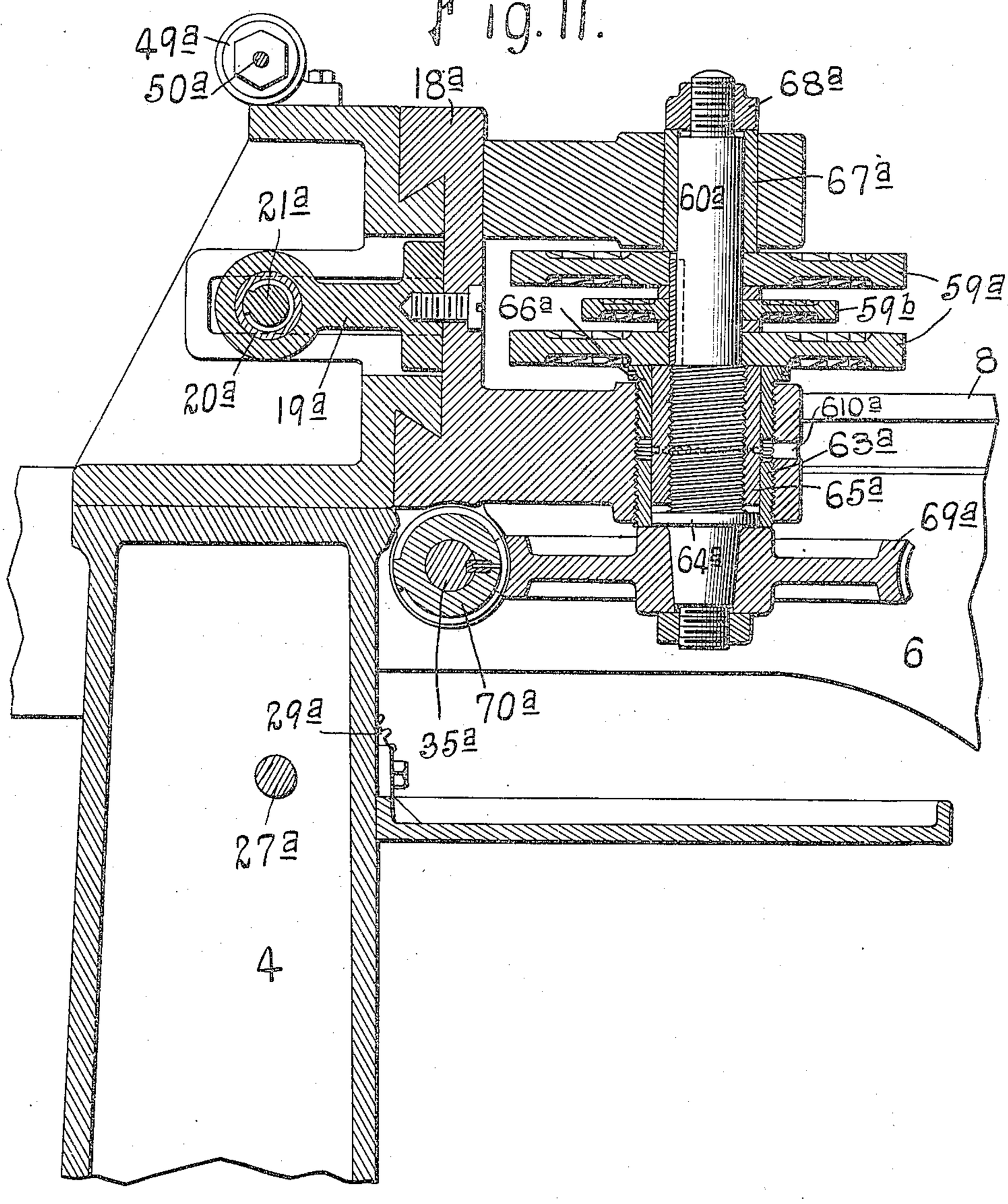
Fig. 11.



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12 SHEETS—SHEET 11.

Fig. 12.

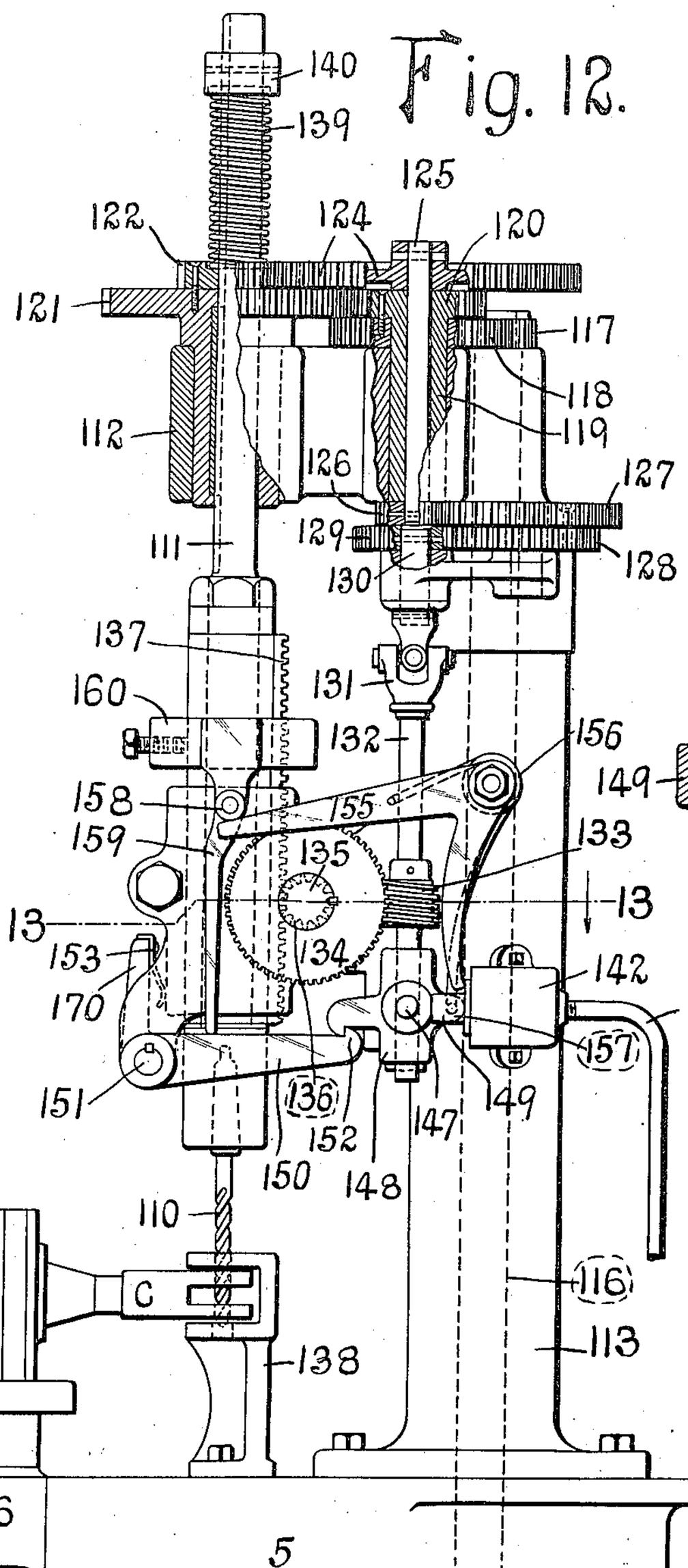
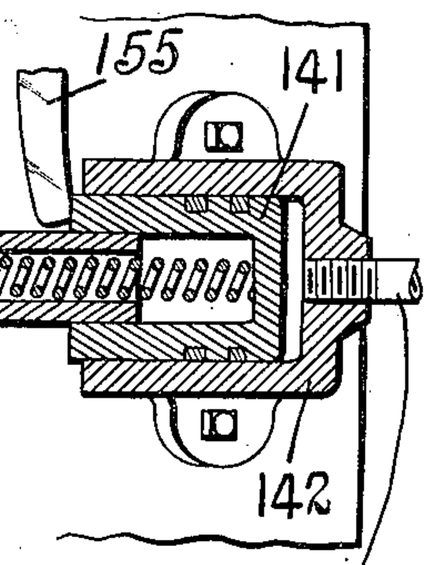


Fig. 12a.



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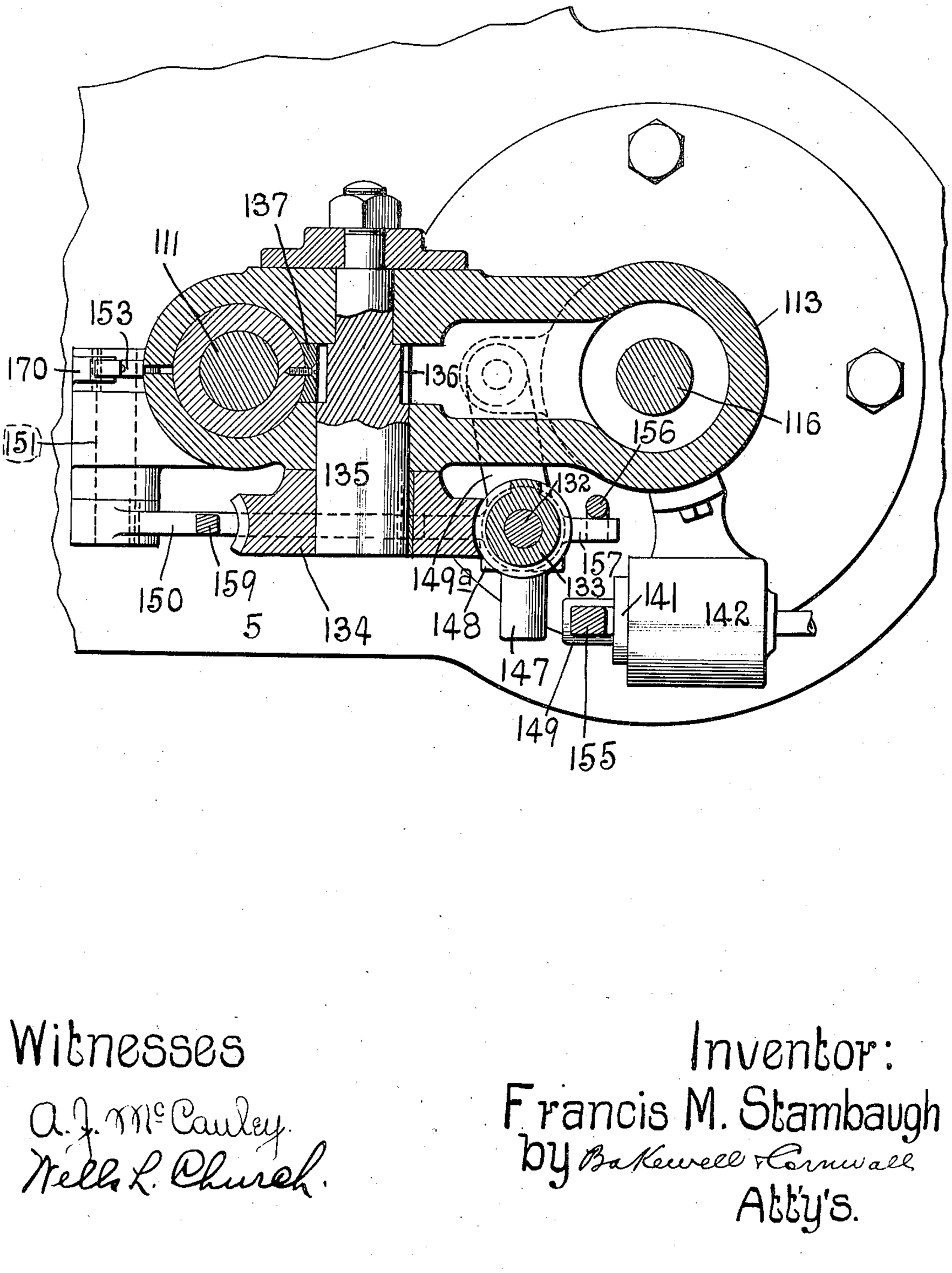
12 SHEETS—SHEET 12.

Fig. 13.



Witnesses

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UNITED STATES PATENT OFFICE.

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METAL-WORKING MACHINE.

No. 846,871. Specification of Letters Patent. Patented March 12, 1907.

Application filed November 9, 1905. Serial No. 286,563.

To all whom it may concern:

Be it known that I, FRANCIS M. STAMBAUGH, a citizen of the United States, residing at St. Louis, Missouri, have invented a certain new and useful Improvement in Metal-Working Machines, of which the following is a full, clear, and exact description, such as will enable others, skilled in the art to which it appertain to make and use the same, reference being had to the accompanying drawings, forming a part of this specification, in which—

Figure 1 is a front elevation of a machine embodying the features of my invention. Fig. 2 is a top plan view of the machine shown in Fig. 1. Fig. 3 is a detail elevation, partly in section, showing a portion of the mechanism for actuating the work-table. Fig. 4 is a horizontal sectional view taken on the line 4 4 of Fig. 3. Fig. 4[a] is a detail sectional view of one of the valve-casings. Fig. 4[b] is a detail sectional view of the spring-pressed plunger mounted in one of the tool-carrying slides for actuating the clutch-shifting lever. Fig. 5 is a detail elevation, partly in section, showing the mechanism for locking the work-table and the mechanism for actuating said table. Fig. 6 is a side elevation, partly in section, of the tool which first operates on the casting, showing the mechanism for actuating the slide on which the tool is mounted, the slide being in its inward position. Fig. 7 is a vertical sectional view of the parts shown in Fig. 6. Fig. 8 is a detail view of the clutch mounted on the end of the screw-shaft. Fig. 9 is an end view of the parts shown in Fig. 6 and shows in section the means for adjusting the cutters longitudinally of the shaft upon which they are mounted. Fig. 10 is a side elevation of the tool which performs the second operation on the casting, the slide which carries said tool, and the mechanism for actuating the slide. Fig. 11 is a transverse sectional view taken on the line 11 11 of Fig. 10. Fig. 12 is a side elevation of the drill and its operating mechanism. Fig. 12[a] is a detail sectional view of the air-controlled piston comprising part of the mechanism for causing a reciprocating movement to be imparted to the drill, and Fig. 13 is a horizontal sectional view on the line 13 13 of Fig. 12.

This invention relates to metal-working machines, and particularly to machines for planing or smoothing a casting or article.

The object of my invention is to provide an automatic machine having a movable work-table for carrying castings or pieces of work into position to be operated on progressively by tools located adjacent to said work-table. The tools are moved automatically into and out of position for operating upon the work, and in the preferred form of my invention as herein shown the means for effecting the movement of the tools into operative position comprises air-controlled apparatus.

The machine herein illustrated as embodying my invention is provided with a set of tools for finishing a casting that is to be used as a piston for a slack-adjuster; but it should be understood that various other tools might be substituted for those shown and described without departing from the scope of my invention and, furthermore, that the number of tools located adjacent to the work-table could be varied.

Briefly stated, the machine comprises a work-table having means for supporting a number of castings, and located around the work-table are a plurality of milling-tools and a drilling-tool, which tools operate progressively upon each casting. The operator standing at the front of the machine removes the casting which has just been finished, places a rough casting in position, and then operates a lever which unlocks the work-table and also puts in operation air-controlled mechanism which causes the table to be moved one-quarter of a revolution. The last portion of the movement of the table just before it stops operates air-controlled apparatus which effects an endwise movement of a milling-tool that finishes two faces of the casting, said tool being thereafter returned automatically to its normal position. The operator again removes a finished casting from the work-table and inserts a rough one and operates the starting-lever, so that the table is caused to make another quarter of a revolution, carrying the casting, which has just been operated on by the first milling-tool, into position to be operated on by a second milling-tool, which finishes two other faces of the casting and also the bifurcated end of the casting, said tool also being moved auto-

matically into and out of operative position. At the next quarter-revolution of the table the casting is brought into alinement with the drill, which is automatically moved into and out of position for boring a hole in the casting, and the last quarter-revolution of the table brings the finished casting into position to be removed by the operator.

Referring to the drawings, 1 designates a base provided with a plurality of standards 2, 3, 4, and 5, which support the tools employed for operating upon the castings. Revolubly mounted in said base and in a top plate 6, parallel to the base and connected to said standards, is a vertical shaft 7, having connected to its upper end a table 8, rotating on the top plate and provided with a plurality of chucks adapted to hold the castings being operated on. Loosely mounted on said shaft and held in position by means of locknuts 9, as shown in Fig. 3, is a multiple beveled gear 10, having in its lower face teeth which coöperate with the gear 11 on the drive-shaft 12, mounted in the standard 5 and provided with a pulley 13, that is driven by a belt, (not shown,) said shaft being driven continuously, so that the multiple gear will rotate continuously.

The table is provided with four chucks, one of which is shown in section in Fig. 6 and comprises a sleeve 14, having revolubly mounted therein a chuck-block 15, into which the casting C is screwed, the chuck-block being held in adjusted position in the sleeve by a set-bolt, provided at its upper end with a hand-operating wheel 16.

The standard 2 at the front of the machine carries a table 17, at which the operator stands when removing a finished casting from the chuck and placing an unfinished casting in position, and on the standard 3 at the left-hand side of the machine a tool-carrying slide 18 is reciprocatingly mounted, which slide is clearly shown in the enlarged detail views in Figs. 6, 7, and 9.

Fastened to the slide 18 and projecting downwardly into an opening in the standard 3 is a block 19, carrying an interiorly-screw-threaded sleeve or nut 20, adapted to receive the actuating screw-shaft 21, rotatably mounted in the standard 3 and having mounted loosely thereon a gear 22 and a worm-gear 23, provided with clutch-engaging faces. A clutch 24 is splined to said screw-shaft and is adapted to be moved longitudinally thereof into and out of engagement with the gear 22 and worm-gear 23. The gear 22 meshes with a pinion 240 on a stud-shaft 25, carried by the standard 3, and said pinion meshes with a gear 26, fastened to the outer end of a horizontal shaft 27, mounted in bearings 28 on the standard and having fastened to its inner end a gear 29, that meshes with a pinion 30, cooperating with a gear 31, mounted on the stud-shaft 32 and having connected thereto a gear 33. This latter gear meshes with the pinion 34 on a shaft 35, supported in a bearing 36, projecting downwardly from the top plate, as shown in Fig. 6, said shaft having at its inner end a beveled gear 37 in mesh with a coöperating beveled gear 38 on a shaft that is rotatably mounted in a bearing on the underneath side of the top plate and being provided with a beveled gear 40, that meshes with gear-teeth 41, formed on the upper face of the multiple gear 10, loosely mounted on the table-supporting shaft 7, as shown in dotted lines in Fig. 2. Accordingly by means of these various gears and pinions continuous movement is imparted to the gear 22, loosely mounted on the screw-shaft 21. Continuous rotative movement in the direction opposite to that of the gear 22 is imparted to the worm-gear 23 by means of a worm 42, meshing therewith, which worm is carried by a shaft 43, having a beveled gear 44, that meshes with a beveled gear 45 on the shaft 27.

For moving the clutch 24 into engagement with the worm-gear 23 to cause the tool-carrying slide to be moved inwardly I have provided a lever 46, pivotally connected to the standard 3 and having a forked end provided with rollers 47, which enter a circular groove in the clutch. Said lever is actuated automatically at a predetermined time in the cycle of operations of the machine by means of apparatus operated by compressed air and consisting of a piston 48 in a cylinder 49, carried by the standard and having a piston-rod 50 slidingly mounted in a plunger 51, that is adapted to engage the lever 46 and move it toward the left of the machine for throwing the clutch into engagement with the worm-gear. Interposed between the end of said piston-rod and the end of the recess in the plunger is a coiled spring 53, which effects a yielding movement of the lever 46, so that the engaging face on the clutch can accomodate itself to the clutch-engaging face of the worm-gear in case said faces do not register perfectly when the clutch is thrown in.

The piston is operated by means of compressed air, that enters the cylinder through a pipe 54, connected to a valve-casing 55, carried by the top plate, (shown in detail in Fig. 4ª,) the air entering said valve-casing through a pipe 56, connected to a suitable source of supply of compressed air. If desired, the air can be furnished by a pump which is automatically actuated. A valve-stem 57 projects above the end of the casing and normally occupies a position to be engaged by one of a plurality of lugs 58, carried by the rotating table, as shown in Fig. 1. Consequently as said table rotates the valve-stem will be depressed by one of the lugs at each quarter-revolution of the table to permit the compressed air to pass from the pipe 56 into the pipe. 54, thereby actuating the

pistcn to move the clutch into engagement with the worm-gear 23 and cause the screw-shaft to be rotated in a direction to move the slide 18 inwardly toward the center of the machine. After the valve-stem has been actuated as described said stem is returned to normal position by means of a coiled spring 570, the valve 580 when in its normal position preventing the entrance of air into the pipe 54.

The tool which the slide 18 carries consists of two cutters 59, spaced apart and carried by a shaft 60, rotatably mounted in split bearings 61 on the slide. The purpose of spacing the cutters apart is to enable each cutter to act upon one of the outer side faces of the casting and trim said faces down to a perfectly-smooth surface. The cutters 59 are splined to the shaft 60 and are spaced apart by a ring 62. Adjustably secured to the shaft 60 is a collar 65, having its inner end bearing against one of the cutters 59 to provide a means for moving the cutter longitudinally of the shaft. The shaft has an integral collar 64, and mounted on said shaft is a worm-gear 69, that is clamped against said collar by a nut threaded on the end of the shaft, as shown in Fig. 9. Adjustably mounted in one of the split bearings 61 and bearing against the gear 69 is a bushing 63, which may be adjusted for moving the shaft longitudinally of its bearing for causing the gear thereon to register exactly with an actuating-worm, and at the other end of said bearing is a flanged bushing 66, which at its outer end bears against one of the cutters 59, the inner ends of said bushings being spaced apart.

The collar 65 is provided with a plurality of recesses, as shown in Fig. 9, and the split bearing is provided with a slot 610, through which an instrument may be inserted to engage one of the recesses in the sleeve 65 for turning it to move the cutter 59 longitudinally of the shaft into snug engagement with the spacing-ring 62. In operation the collar 65 rotates with the shaft; but rotative movement of the bushings is prevented, as they are clamped securely in the split bearing 61. In the coöperating bearing a bushing 67 is loosely mounted and engages the other cutter 59, the end of said bushing being engaged by a nut 68 on the shaft 60 and operating to lock the two cutters in position. By substituting rings 62 of different width the distance which the cutters are spaced apart may be varied. The worm-gear 69 on the cutter-carrying shaft 60 meshes with a worm 70, splined to the shaft 35 and longitudinally-movable thereon to provide for the movements of the tool-carrying slide 18. After the slide has moved inwardly to cause the cutters to trim down the side faces of the casting said slide is moved outwardly back to its normal position by the following apparatus: Secured to said slide is a bracket 71, having mounted thereon an adjustable screw 72, carrying a spring-pressed plunger 73. (Shown in detail in Fig. 4b.) As the slide reaches its inward position, as shown in Fig. 6, the spring-pressed plunger will engage the lever 46 and move it toward the right for withdrawing the clutch out of engagement with the worm-gear 23 and moving it into engagement with the gear 22, which, as has been previously described, rotates in a direction opposite to that of the worm-gear, whereby the screw-shaft is actuated for moving the slide 18 back to normal position. When the slide arrives in its normal position, a set-screw 74, mounted in the bracket 71, will engage the lever 46 and move it to cause the clutch to be withdrawn from the gear-wheel 22 and moved into position midway of said gear-wheel and said worm-gear. After the table has made a quarter of a revolution it is stopped automatically to bring the next casting into position to be operated on by the cutters 59, the movement of the table being effected by the following mechanism:

Fastened to the table-carrying shaft 7 is a gear 75, having four sets of teeth and four plane portions 76, and coöperating with this gear is a partially-toothed gear 77, having a plane portion 78. The gear 77 is carried by a vertical shaft 79, journaled in the base-plate and top plate, as shown in Figs. 3 and 5. Movably mounted in said gear is a clutch-block 80, adapted to coöperate with a clutch-block 81, connected to the hub 82 of a worm-gear 83, said hub being split, as shown in Fig. 5, to permit it to frictionally clamp the clutch-block 81. The gear 83 meshes with a worm 84 on a horizontal shaft 85, having at its outer end a gear 86 in engagement with an idler that meshes with a gear 87, carried by the drive-shaft 12, whereby the worm-gear 83 is caused to rotate continuously. For controlling the movements of the clutch-block 80, carried by the gear 77, I have provided a plunger 860, movably mounted in a bearing 870 on the base-plate and provided at one end with a roller 88, which is adapted to engage a cam-lug 89 on the upper end of said block, and thereby depress said block out of engagement with the clutch-block carried by the continuously-rotating gear 83. When said roller is out of engagement with said cam-lug, the clutch-block is moved into engagement with the one carried by the gear 83 by means of a plurality of expansion-springs 90. The plunger carries a roller 91, which enters a gloove 92 in a block 93, fastened to the gear 77, whereby said plunger is actuated for moving its roller 88 into engagement with the clutch-block 80 for moving it into an inoperative position. Said plunger is moved in the opposite direction to permit said clutch-block to

reëngage the one carried by the gear 83 by means of compressed air, which enters the cylinder 94 on the bearing 870 through a pipe 95 and actuates the piston 96, attached to said plunger, said pipe leading from a valve-casing 97, fastened to the standard 2, and having projecting from its end a valve-stem 98, that is adapted to be actuated by a manually-operated starting-lever 99 to permit the compressed air to enter said pipe 95 through a supply-pipe 100, leading to the casing, the construction of the valve and casing being similar to the one shown and described in Fig. 4ª.

As shown in Fig. 5, the starting-lever is pivoted at its inner end to a downwardly-projecting link 101 on the top plate and has connected thereto a piston-rod 102, fastened to a piston 103 in a cylinder 104, attached to the top plate, said piston having projecting upwardly from its opposite face a locking-plunger 105, that engages one of the series of four recesses 106 in the underneath face of the rotating table 8.

After the operator has placed a casting in the chuck he depresses the lever 99 to unlock the table and also actuate the valve-stem 98 to permit the compressed air to enter the cylinder 94 for withdrawing the plunger from engagement with the clutch-block 80 and permit said block to move into engagement with the clutch-block on the continuously-rotating gear 83. The starting-lever is returned to its elevated position by means of compressed air, which enters the cylinder 104 from a suitable supply-pipe 104ª. The gear 77 will now start to rotate. and the teeth thereon will coöperate with one set of teeth on the gear 75 to move the table 8 one-quarter of a revolution, the plane portions of said gears then coming into engagement with each other and the cam-groove in the block 93 operating to move the plunger 88 inwardly to separate the clutch-blocks 80 and 81 and cause the gear 77 and also the gear on the table-carrying shaft to come to rest.

After a casting has been operated on by the cutter-wheels 59 the rotating movement of the table carries it into position to be operated on by the rotating cutters 59ª, carried by a slide 18ª, that is reciprocatingly mounted on the standard 4 at the rear of the machine. The construction and operation of these cutters and also the slide on which they are mounted is similar to the cutters 59 on the slide 18, except that the cutters 59ª rotate in a horizontal plane for finishing the top and bottom faces of the casting, as shown in Fig. 10. The vertical shaft 60ª, on which the cutters are mounted, is provided with an additional cutter 59ᵇ for milling out the interior of the bifurcated end of the casting. Said cutter-carrying slide is vertically disposed, as shown in Figs. 11, instead of being horizontally disposed, as is the cutter-carrying slide 18. The mechanism for actuating these cutters and the slide 18, however, is substantially the same as that used for actuating the cutters 59 and the slide 18, and to avoid prolixity this mechanism is not herein specifically described otherwise than by stating that the parts designated by reference characters to which an "a" has been added are substantially the same as the parts designated by corresponding reference characters without an "a." There is this slight difference, however, in the construction of these two sets of mechanism. The shaft 27ª, instead of carrying the beveled gear 45ª, is provided with a gear 27ᶜ, which drives a gear 28ᶜ on a stud-shaft on which the gear 45ª is mounted, as shown in Fig. 10. From the cutters 59ª the casting is carried into position to have a hole drilled in its bifurcated end, the mechanism for performing this operation being located at the right-hand side of the machine and comprising a drill 110, carried by a stock 111, which is reciprocatingly and rotatably mounted in the arm 112 of a bearing 113, carried by the standard 5. The drill-stock is continuously rotated by means of a beveled gear 114 on the drive-shaft 12, which meshes with a gear 115 on a vertical shaft 116, supported in the bearing 113 and having secured to its upper end a pinion 117, meshing with a gear 118 on a shaft 119, mounted in the arm 112, said gear having connected thereto a gear 120, which meshes with a gear 121, splined to the drill-stock, as shown in Fig. 12. Fastened to the gear 121 is a pinion 122, which meshes with a gear 124, keyed to a shaft 125, that is rotatably mounted in the shaft 119, said shaft 125 carrying at its lower end a pinion 126, that meshes with a gear 127, having fastened thereto a gear 128 in engagement with a pinion 129, secured to a short shaft 130. Connected to said short shaft by means of a universal coupling 131 is a shaft 132, having a worm 133, that meshes with a gear 134 on a shaft 135, that has fastened thereto a pinion 136 in engagement with a rack-bar 137, connected to the drill-stock, said shaft 135 being journaled in a portion of the bearing 113.

From the foregoing description it will be understood that the drill-stock rotates continuously, and when the worm 133 is in engagement with the gear 134 the drill-stock will be moved downwardly to cause the drill to form a hole in the bifurcated end of the casting, as shown in Fig. 12, a guide 138 being fastened to the standard 5 in alinement with the end of the drill. Said worm and gear are in engagement only at certain predetermined times in the cycle of operations of the machine, however, and after they have been disengaged the coiled spring 139, which surrounds the drill-stock between the collar 140 and the gear 122, will operate to move said drill-stock upwardly to withdraw the

drill from the casting. The worm 133 is moved into engagement with the gear 134 by means of an air-controlled apparatus comprising a piston 141, mounted in a cylinder 142, fastened to the support 113 and supplied with air by a pipe 143, leading to the valve-casing 144, secured to the top plate, as shown in Fig. 1, and provided with a valve-stem 145, that normally occupies a position to be engaged by one of the blocks 58, carried by the rotating table. As said valve-stem is depressed the compressed air which enters the valve-casing from the supply-pipe 146 passes through the pipe 143 to the cylinder 142 and actuates the piston 141, the forward movement of said piston engaging a lug 147, projecting laterally from a block 148, in which the end of the shaft 132 is rotatably mounted, and moving the worm 133 into engagement with the gear 134. Preferably the piston is provided with a yielding plunger 149, which permits the worm to yield as it engages the gear, and thus cause said gear and worm to mesh properly. The block 148 has an arm 149ª, which is pivotally connected to the bearing 113, as shown in dotted lines in Fig. 13, this construction controlling positively the swinging movement of the shaft 132. For holding the worm and gear in engagement for a predetermined time I provide a locking-dog in the form of a rock-arm 150, fastened to the shaft 151, mounted in the support 113 and provided with a second arm 170. The arm 150 is provided with a hook 152, which engages a coöperating hook formed on the block 148, and the arm 170 carries a leaf-spring 153, which bears against the support and holds the hooked end of the arm 150 normally elevated. Pivotally mounted on the support is a second bell-crank lever 155, and surrounding the pivot of said lever and connected to one arm thereof is a spring 156, which at its other end is connected to a lug 157 on the block 148, said spring operating to withdraw the worm 133 from engagement with the gear 134 when the locking-dog is disengaged from the block 148. One arm of the bell-crank lever bears against the piston 141 and its other arm projects into alinement with a roller 158, carried by an arm 159, depending from a collar 160, removably fastened to the drill-stock. As the drill-stock descends the end of said arm engages and rocks the locking-dog 150 to release the block 148, and the roller on said arm being in contact with the arm of the lever 155 will actuate said lever for forcing the piston back into the cylinder 142, the spring 156 operating simultaneously to disengage the worm and gear, the drill-stock being thereafter moved upwardly by the spring 139, as previously described.

The time at which the worm 133 and gear 134 are disengaged may be varied to provide for the different thicknesses of the material being operated on by changing the positions of the collar 160 on the drill-stock.

I have not herein claimed the specific construction of the drill and its actuating mechanism, as it forms the subject of a separate application filed by me August 1, 1906, and given Serial No. 328,758.

To enable the screw-shafts 21 and 21ª to be rotated manually, I have provided each with a rigid clutch member 175 and a coöperating movable clutch member 171, that are held normally out of engagement with each other by a coiled spring 172, as shown in Fig. 7. The movable clutch member is provided with a manually-operated wheel 173, and pivoted to the end of the shaft 21 is a lever 174, adapted to engage the movable clutch member 171 and force it into engagement with the rigid clutch member 175.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a machine of the class described, a work-table, mechanism for imparting an intermittent movement to said table, a plurality of tools carried by members which are arranged adjacent to the table, means cooperating with each tool-carrying member for actuating the same to bring the tool into and out of engagement with the work on the work-table, devices for causing each of said means to become operative, air-controlled apparatus for moving said devices in one direction, whereby the tools are caused to move into engagement with the work, conduits for supplying compressed air to said apparatus, valves for controlling the passage of air through said conduits, a plurality of devices on the work-table for actuating said valves intermittently, and means on the tool-carrying members for actuating said devices in the opposite directions whereby the tools are moved out of engagement with the work; substantially as described.

2. In a machine of the class described, a work-table supported by a rotatable shaft provided with a gear, a gear coöperating with the gear on the table-shaft and provided with a clutch-block, a continuously-rotating gear provided with a coöperating clutch-block, yielding means for forcing said clutch-blocks into engagement with each other, positively-actuated means for disengaging said clutch-blocks for permitting the table to come to rest, and air-controlled apparatus for moving said means into an inoperative position to permit said clutch-blocks to reëngage for causing movement to be imparted to the table; substantially as described.

3. In a machine of the class described, a work-table mounted on a rotatable shaft provided with a gear, a coöperating gear meshing therewith and provided with a movable clutch-block, a continuously-rotating gear

having a coöperating clutch-block, a plunger for holding said clutch-blocks disengaged, air-controlled apparatus for actuating said plunger to permit the clutch-blocks to move into engagement with each other for imparting rotary movement to the table-carrying shaft, and cam-operated means for moving said plunger into engagement with the movable clutch-block after the table has been moved for a certain distance thereby causing said clutch-block to move into an inoperative position and cause the table to come to rest; substantially as described.

4. In a machine of the class described, a work-table carried by a rotatable shaft provided with a gear having a plurality of sets of teeth, a partially-toothed gear coöperating therewith, a block connected to said last-named gear and provided with a cam-groove, a movable clutch-block carried by said gear, a continuously-rotating gear provided with a coöperating clutch-block, a plunger mounted in a stationary support and adapted to engage the movable clutch-block for holding it normally in an inoperative position, air-controlled apparatus for causing said plunger to be moved out of engagement with said movable clutch-block, a starting-lever for actuating said air-controlled apparatus, a connection between the plunger and the cam-groove in said block whereby said plunger is moved into engagement with the movable clutch-block after the work-table has moved for a certain distance, and means for locking said table; substantially as described.

5. In a machine of the class described, a work-table carried by a rotatable shaft provided with a gear, a gear coöperating therewith and provided with a movable clutch-block, a continuously-rotating gear having a coöperating clutch-block, a device for holding the movable clutch-block in an inoperative position, air-controlled apparatus for actuating said device to permit the clutch-block to move into engagement with the block carried by the continuously-rotating gear whereby movement is imparted to the table-carrying shaft, means for locking the table, a starting-lever for simultaneously actuating the air-controlled apparatus and unlocking the table, and automatic means for moving the device into engagement with the movable clutch-block after the table has moved for a certain distance; substantially as described.

6. In a machine of the class described, a rotatable work-table, a slide carrying a tool for operating upon work carried by the table, a screw-shaft for imparting a reciprocating movement to said slide, gears loosely mounted on said shaft and rotating continuously in opposite directions, a clutch splined to said shaft and movable into and out of engagement with said gears for causing the shaft to be rotated in opposite directions, a shifting-lever connected to said clutch, a piston provided with means for engaging said shifting-lever, a valve-casing located adjacent to the work-table and having connected thereto a pipe for supplying compressed air and a pipe for conducting the air to said piston, and a valve mounted in said casing and provided with a stem projecting into position to be engaged by said work-table whereby said valve is actuated automatically to permit the compressed air to pass from the supply-pipe into the conducting-pipe; substantially as described.

7. In a machine of the class described, a work-table mounted on a rotatable shaft, mechanism for imparting an intermittent movement to said table, air-controlled apparatus for causing said mechanism to become operative, a plurality of tool-carrying slides mounted adjacent to said table, screw-shafts for imparting reciprocating movements to said slides, a plurality of gears loosely mounted on each screw-shaft and rotating in opposite directions, a continuously-rotating gear loosely mounted on the table-carrying shaft, connections between said gear and the gears on the screw-shafts for actuating said gears, a clutch splined to each screw-shaft between the gears thereon, and means for moving said clutches automatically into and out of engagement with said gears for actuating the screw-shafts to move the slides first in one direction and then in an opposite direction; substantially as described.

8. In a machine of the class described, a table for carrying work, a tool-carrying slide, a screw-shaft for actuating said slide, gears loosely mounted on said shaft and rotating in opposite directions, a clutch splined to said shaft between said gears, a shifting-lever connected to said clutch, air-controlled apparatus for shifting said lever in one direction to cause said clutch to engage with one of the gears whereby the screw-shaft will be actuated for moving the slide toward the work-table, means carried by said slide for shifting said lever into engagement with the other gear as the slide reaches its inward position, thereby causing the screw-shaft to be rotated in the opposite direction for moving the slide outwardly, and means carried by said slide for actuating said shifting-lever to cause the clutch to be moved midway of said gears as said slide reaches its outward position; substantially as described.

9. A machine of the class described, comprising an intermittently-actuated work-carrying member, a plurality of tools arranged adjacent said work-carrying member, mechanism coöperating with each tool for moving it toward and from the work-carrying member, devices for controlling said mechanism, a plurality of valve-casings arranged adjacent the work-carrying member, connections leading from said valve-casings

to pistons which actuate said devices, valve-stems projecting outwardly from said valve-casings, devices on the work-carrying member for actuating said valve-stems automatically whereby the said pistons will be supplied with compressed air for actuating said devices in one direction to cause the tools to be moved toward the work-table, and independent means for actuating said devices in the opposite direction to cause the tools to return to normal position; substantially as described.

In testimony whereof I hereunto affix my signature, in the presence of two witnesses, this 7th day of November, 1905.

FRANCIS M. STAMBAUGH.

Witnesses:
F. R. CORNWALL,
GEORGE BAKEWELL.