

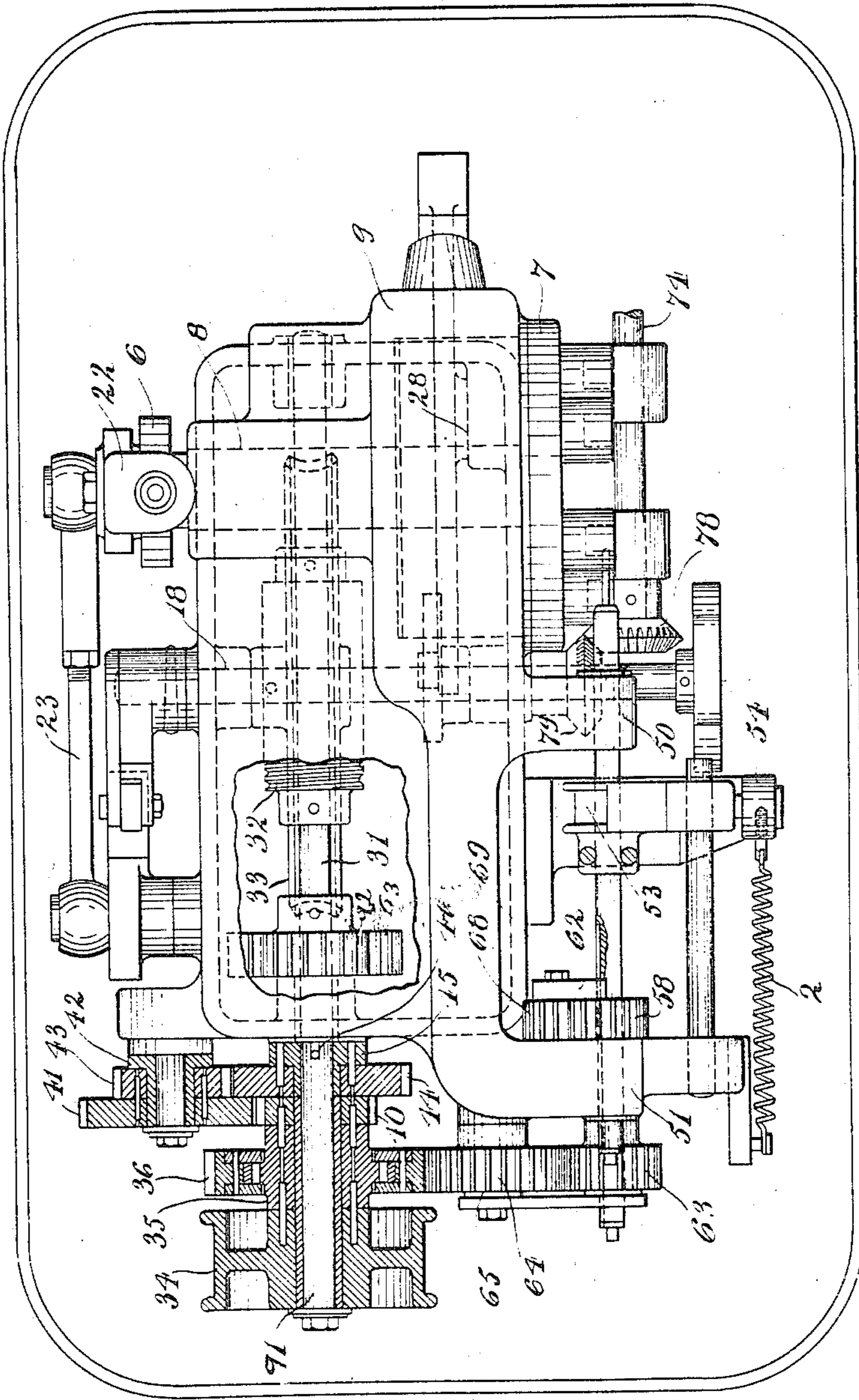
O. A. SMITH.
 MULTIPLE DRILLING MACHINE.
 APPLICATION FILED DEC. 15, 1909.

975,729.

Patented Nov. 15, 1910.

5 SHEETS—SHEET 1.

Fig. 1



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 H. E. Purney

Inventor:
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 By his Attorney, F. H. Richards

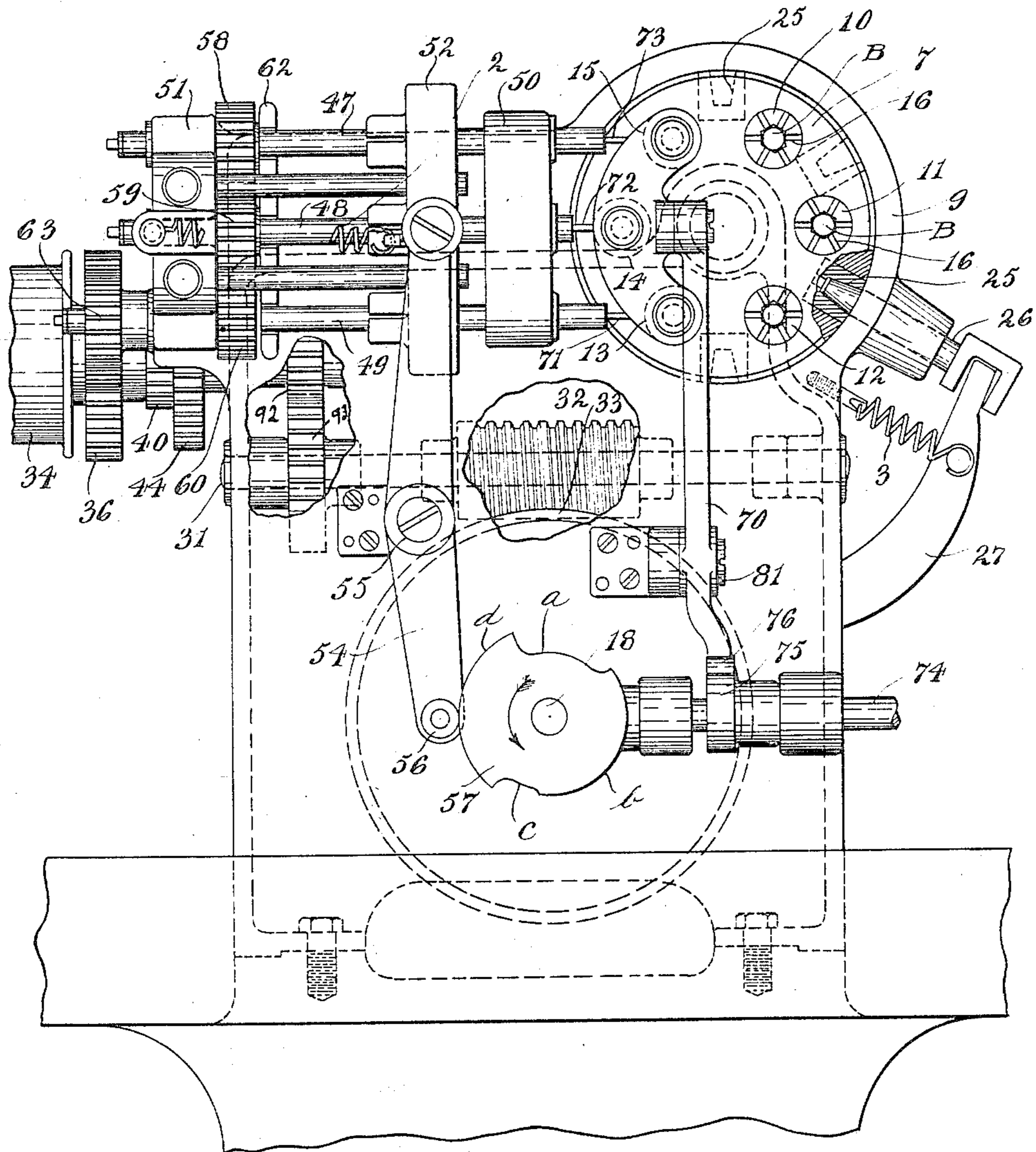
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5 SHEETS—SHEET 2.

FIG. 2.



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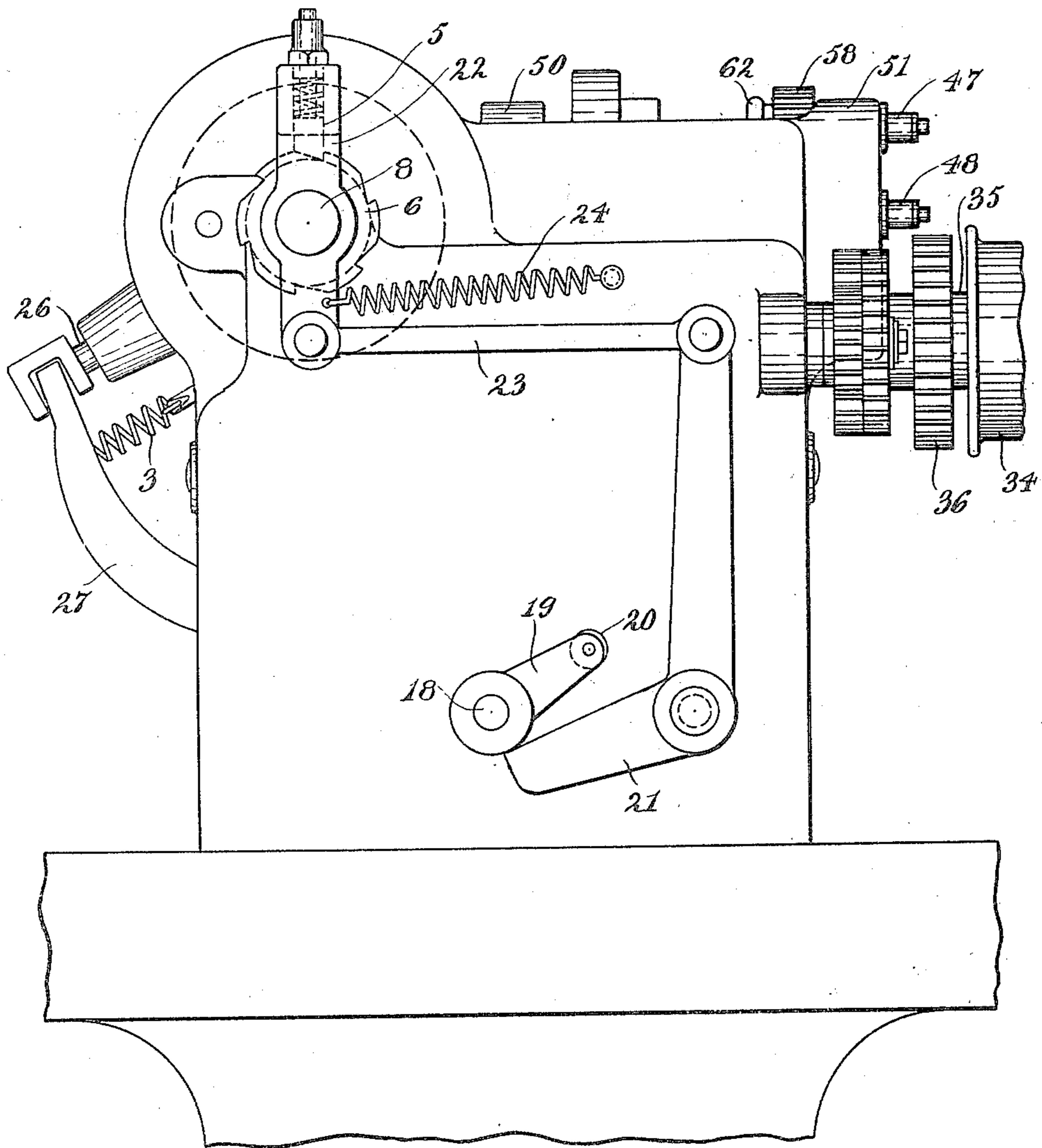
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5 SHEETS—SHEET 3.

Fig. 3.



Witnesses:
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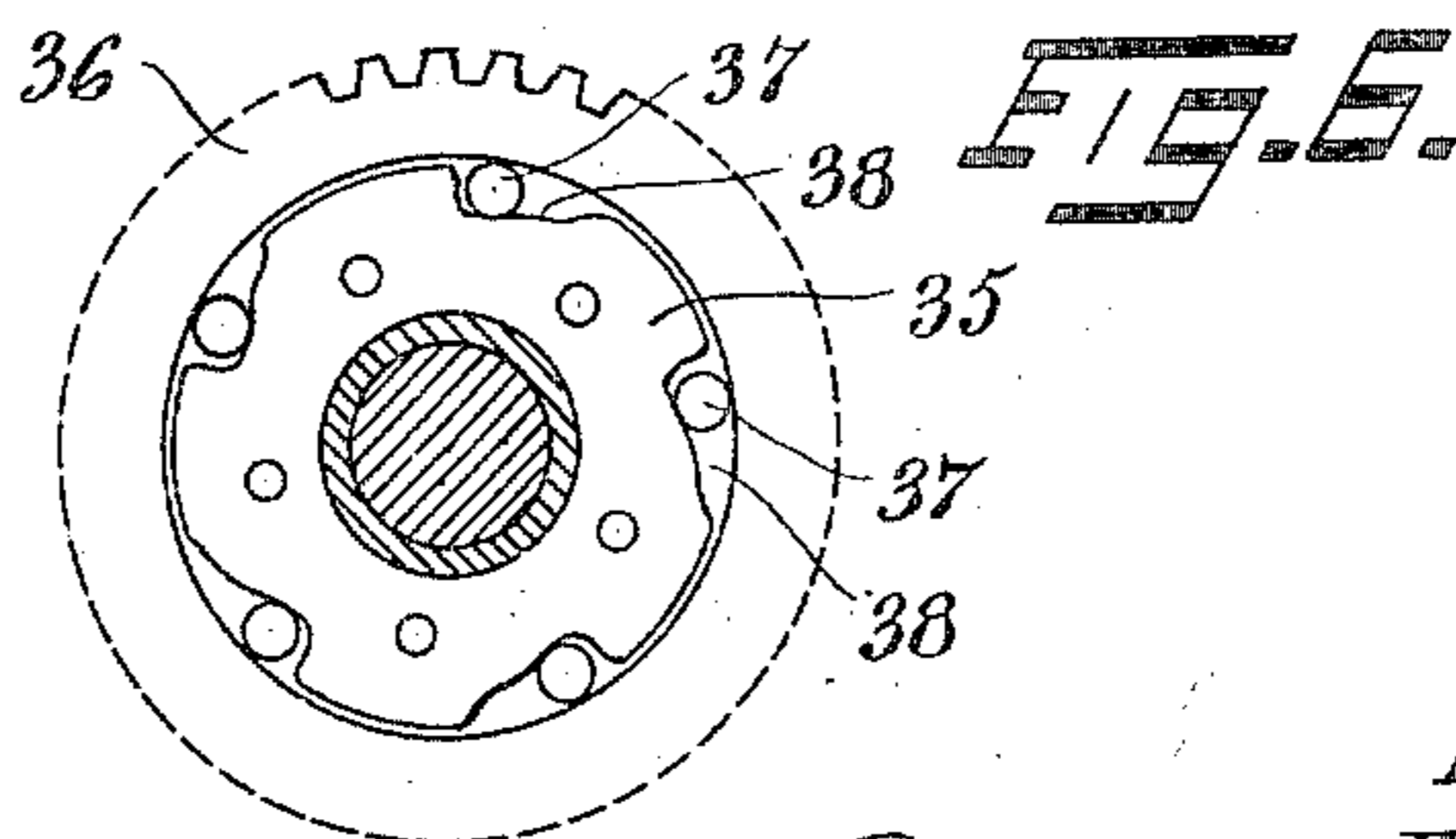
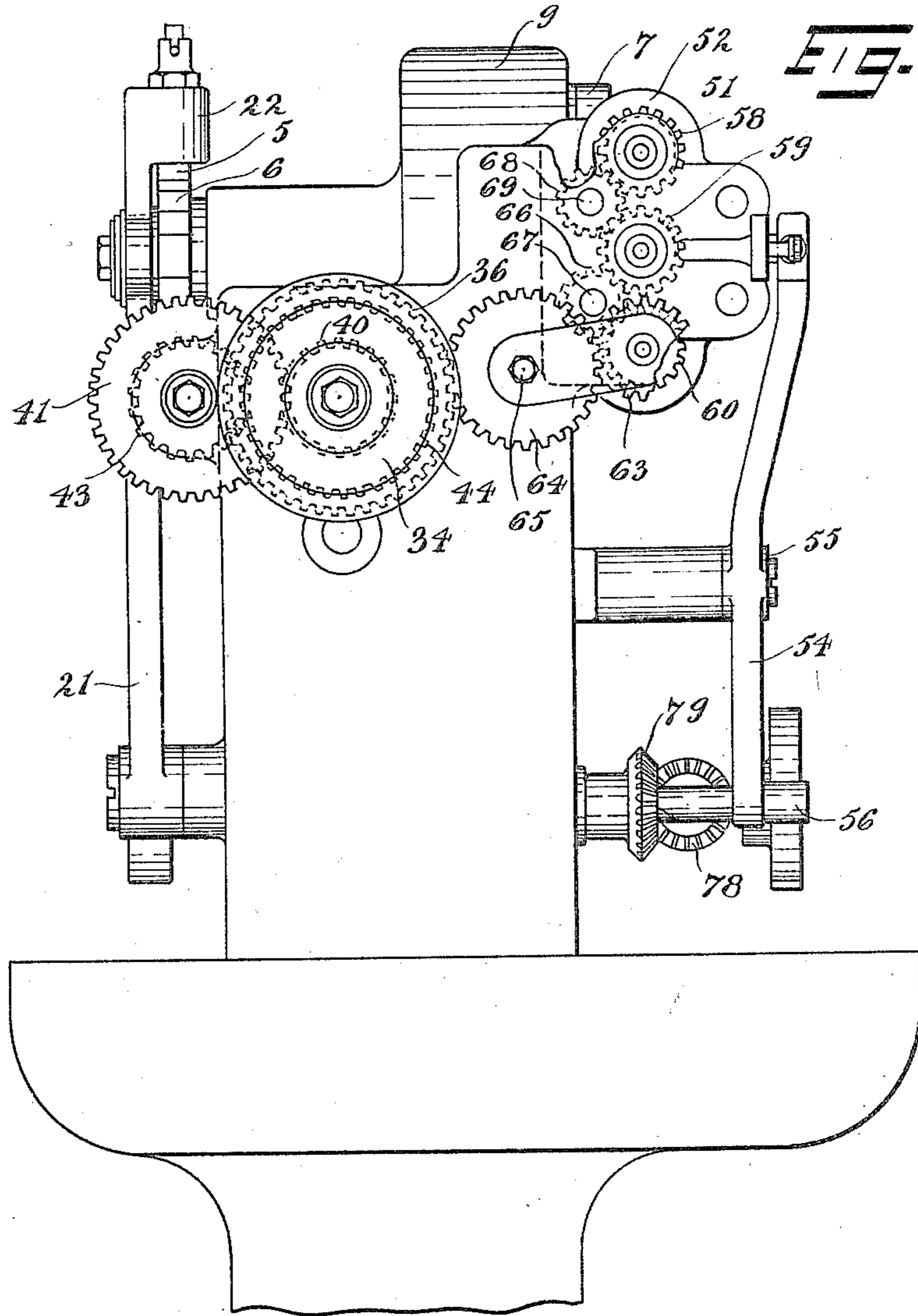
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5 SHEETS—SHEET 4.



Witnesses:
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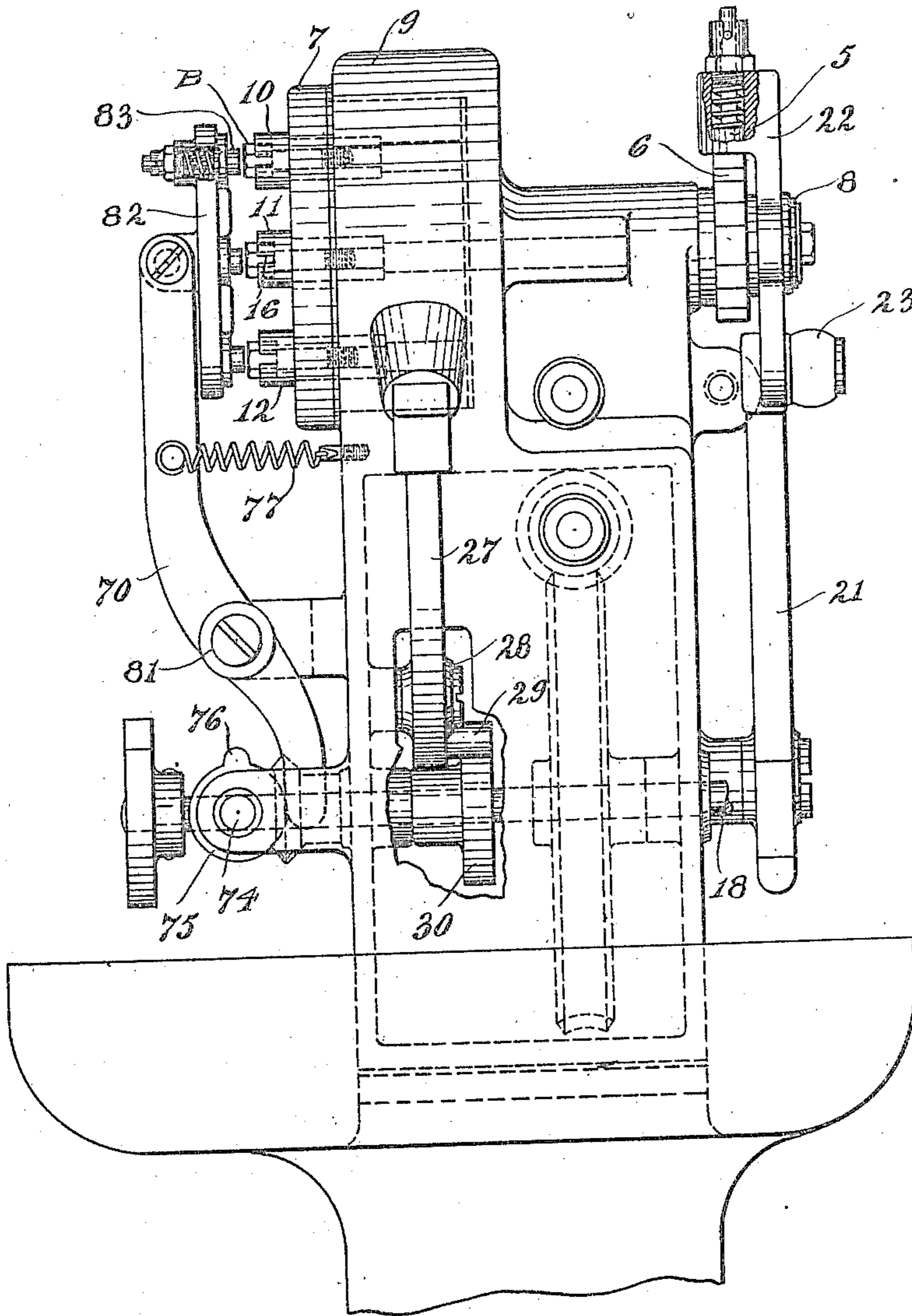
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5 SHEETS—SHEET 5.

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FIG. 5.



Witnesses:

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UNITED STATES PATENT OFFICE.

OSCAR A. SMITH, OF CLEVELAND, OHIO, ASSIGNOR TO THE NATIONAL-ACME MANUFACTURING COMPANY, OF CLEVELAND, OHIO, A CORPORATION OF OHIO.

MULTIPLE-DRILLING MACHINE.

975,729.

Specification of Letters Patent. Patented Nov. 15, 1910.

Application filed December 15, 1909. Serial No. 533,157.

To all whom it may concern:

Be it known that I, OSCAR A. SMITH, a citizen of the United States, residing in Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Multiple-Drilling Machines, of which the following is a specification.

This invention has for its object to provide a machine for drilling a plurality of radial or diametral holes in an article from different positions, whereby the articles, such as bolt heads, are successively and continuously operated upon automatically by a series of drills, and one article is finished at each cycle of operation of the drills.

In the accompanying drawing representing an embodiment of my invention, Figure 1 shows the machine in plan, partly in section. Fig. 2 is a front elevation of the machine. Fig. 3 shows a rear elevation. Fig. 4 is an elevation from the driving belt side; Fig. 5 is an elevation from the opposite side; and Fig. 6 shows the clutch.

In the frame is suitably mounted a head 7 rotatable on a shaft 8 in a casing 9, which head carries a series of bushings, six being shown, 10, 11, 12, 13, 14 and 15, that are arranged in a circle and equidistant. These bushings are so designed as to engage the article desired to be operated upon, that may consist of bolts B, having hexagon heads inserted into similar sockets to prevent turning of the bolts. The bushings 10 etc. may have slots 16 formed radially, making three diameters, for admission of the drills into and through the heads of the bolts. Suitable means are provided for indexing the head around so that each of the bolts is brought successively to a given position, that is, it is advanced one-sixth of a revolution. A cross shaft 18 is mounted in suitable bearings and continuously driven from the main driving member of the machine, by means described hereinafter. This shaft 18 carries an arm 19 having a roller 20 that will engage a bent lever 21 and swing it once for each revolution of the shaft. An arm 22 is mounted to swing on the shaft 8 of the head freely, and is connected by link 23 with the bent lever 21. A spring 24 having one end secured to the frame and the other end fastened to the arm 22, serves to retract the arm and the

bent lever 21 when the latter is disengaged from the arm 19. The arm 22 carries a spring pawl 5 that engages a ratchet wheel 6 fast on the shaft 8. Each time the said arm is swung by engagement with the arm 19, the spring pawl engaging the ratchet wheel will advance the head one-sixth of a revolution. The return movement of the arm 22 will cause the pawl to ride freely on the ratchet wheel backward until it engages another notch. By this means for each revolution of the shaft 18 there will be one advance of the head.

Suitable means are provided for locking the head in its indexed positions. The head is provided with a series of sockets 25, six in number according to the number of bushings and equally spaced. But one of these is shown at Fig. 2, and a plunger 26 is slidable to cause its tapered end to enter these tapered sockets and accurately position the head. The plunger is withdrawn by a lever 27 pivoted at 28 and carrying a roller 29 engaged by a cam 30 on the shaft 18. Since the head is indexed at each revolution of the shaft 18, this cam is so timed that the lever 27 is shifted just before the head is indexed, and the plunger 26 is withdrawn and held out by this cam until the head has been indexed, when the lever 27 is released and returned to advance the plunger into the socket, by a spring 3 between the arm 27 and the frame.

A driving shaft 31 is mounted in suitable bearings in the frame and carries a worm 32 meshing with a worm wheel 33 fast on the said shaft 18 by which the latter is rotated at a comparatively slow speed. A pulley 34 is mounted loose on a shaft 91 and is suitably secured to the hub 35 of a gear 36. The hub and gear are connected by a suitable clutch device causing the hub to drive the gear upon rotation of the pulley in one direction, but permitting reverse movement of the pulley without causing the reverse movement of the gear. Such a construction is shown in Fig. 6 in section, and comprises a series of rollers 37 lying in inclined slots 38 in the gear, and engaging the periphery of the hub 35. The said hub is secured to a gear 40 loose on the shaft 91 meshing with a gear 41 mounted loosely on a stud 42. A pinion 43 is secured to the gear 41 and meshes with a gear 44 secured

to a sleeve 45. The latter sleeve is locked to shaft 91 by a pin 46. By this means the shaft 31 is driven from the belt pulley 34 through the reduction gearing, and through the worm and worm-wheel shaft 18 is operated, by means of gear 92 on shaft 91 that meshes with gear 93 on shaft 31.

Three spindles 47, 48 and 49 are mounted to rotate in bearing members 50 and 51 of the frame, and are also slidable therein. These spindles are reciprocated by means of a yoke 52 engaging spools 53 on the three spindles, only one being shown. This yoke is reciprocated by a lever 54 pivoted at 55 on the frame and carrying a roller 56 that engages a cam member 57 fast on the shaft 18. This cam has a concentric portion *a*, against which the roller is pressed by means of a spring 2, to hold the spindles in retracted position. As the cam member is advanced in the direction of the arrow the roller is brought to bear on an eccentric portion *b*, that will cause advance of the yoke and spindles. There is another concentric peripheral portion *c*, during the engagement of which with the roller, the spindles will not be advanced; while another eccentric peripheral portion *d* causes a further advance of the yoke and spindles. Then the spindles are retracted by the spring 2 as the roller passes down to the reduced portion *a* of the cam.

The three spindles 47, 48 and 49 each carry gears 58, 59 and 60 that are keyed thereon to rotate the spindles, but endwise movable thereon, permitting advance of the spindles, while the gears are held against endwise movement between the bearing member 51 and a plate 62. The lower spindle 49 also carries a gear 63 meshing with a gear 64 mounted on a stud 65 on the machine. Gear 64 meshes with the said gear 35 that is driven from the belt pulley 34 through the clutch member as described. By this means the lower spindle 57 is driven, and a gear 66 mounted on a spindle 67 connects with the gear of the next spindle. A gear 68 mounted on spindle 69 connects the gear 58 with the gear 59 on the upper spindle. By this means the three spindles are continuously driven from the belt pulley all in the same direction, upon rotation of the pulley. But the reverse movement of the pulley will cause the clutch to release and none of the drill spindles will be rotated. Thus it will be seen that the three spindles are continuously driven notwithstanding their endwise reciprocation by means of the yoke and lever. Suitable drills 71, 72 and 73 may be mounted in the respective spindles, and so adjusted that upon the first advance of the drill spindles, by engagement of the lever with the eccentric portion *b*, the drills will simultaneously engage three blanks in the head, and

begin to cut. When the lever roller reaches the depression *c*, the drills will be backed off, by retraction of the lever through the spring 73 connecting the yoke 52 with the bearing member 51. The further advance of the cam will bring the second eccentric surface *d*, to engage the lever roller, and the drills will be again simultaneously advanced, whereby they can be caused to pass through the blanks. After the roller leaves this surface *d*, the lever is retracted by the spring and the drills withdrawn. Thereupon the head is indexed one-sixth of a revolution, and the same operation of the drills repeated. It will thus be seen that as each blank is successively advanced three times from engagement with the first drill, it will have three diametral holes drilled, and that they will be at an angle of sixty degrees. After receiving the three operations each blank is removed, and a fresh blank is inserted before the first drilling operation is reached.

Means are provided for retaining the bolts and other articles in the sleeves 10—15. A lever 70 is mounted to swing on a bearing at 81 and carries a plate 82 having three spring plungers 73. When the lever is rocked the plate will advance the plungers to each engage one of the bolts *B* in the three bushings, positioned for engagement with the drills upon advancement of the spindles. Means are provided for retracting the lever and plungers permitting the indexing of the head. A shaft 74 is mounted in suitable bearings and carries a disk 70 having a lug 76 that will engage the lever once during the rotation of the shaft and swing the lever to shift the spring plungers away from the articles; the lever being retained in its normal position by spring 77. The shaft 74 has a miter gear 78 engaging a miter gear 79 on the said shaft 18. By this means the lever 75 is rocked once for each rotation of the shaft 18; and the operation is so timed that the spring plungers are drawn away from the head and held in this position during the indexing of the head.

The object of having a roller clutch or other means for causing a driving means of the drills to be actuated in one direction but preventing their reverse movement, is that when a drill breaks, the machine can be reversed or backed off of the lead cam and the drills not broken withdrawn from the blanks without the drills being rotated backward, that would tend to loosen the drills in their chucks or holding means.

The irregular cam 57 having a rise and then a small fall and then another rise, has the effect of advancing the drill part-way through the blank, thereupon withdrawing the drill for the purpose of clearing the hole of chips or cuttings whereupon the drill is quickly advanced to its former position for

cutting and then by a regular movement is advanced to cut the hole entirely through the blank.

Having thus described my invention, I claim:

1. The combination with a frame, a head rotatable in the frame and carrying a circular series of bushings parallel to the axis of the head, and means for indexing the head around, of a plurality of spindles arranged with their axes parallel in a plane perpendicular to the axis of the head and organized to advance the tools to each engage one of the articles in the bushings respectively whereby upon indexing the head around each article in the bushing will thereby be successively engaged by one of the tools.

2. The combination with a frame, a head rotatable in the frame and carrying a circular series of bushings parallel to the axis of the head, means for indexing the head around, of a plurality of spindles arranged with their axes parallel in a plane perpendicular to the axis of the head and organized to advance the tools to each engage one of the articles in the bushings respectively, whereby upon indexing the head around each article in the bushing will thereby be successively engaged by one of the tools, means for simultaneously moving the tools to and from the articles held in the bushings, and means for causing the continuous operation of the tool spindles during said reciprocation, said latter means being operatively connected with the head indexing means and organized to permit a reverse movement of the tool advancing means without causing a reverse movement of the tool spindles.

3. The combination with a frame, a head rotatable in the frame and carrying a circular series of bushings parallel to the axis of the head, a driving member, means connected with the driving member for indexing the head around, a series of spindles rotatably supported in a plane transverse to the axis of the head whereby advance of the spindles in their axes will cause them to engage articles in the bushings respectively,

means connected with the driving member for causing a reciprocation of the spindles to engage the articles between each index movement of the head, means connecting said driving member with the spindles for causing continuous rotation of the spindles throughout their said reciprocation by said means, said latter means including a clutch permitting reverse movement of the driving member without causing reverse movement of the spindles.

4. The combination with a frame, a head rotatable in the frame and carrying a circular series of bushings parallel to the axis of the head, of a driving member, means connected with the driving member for indexing the head, a plurality of tool spindles arranged in a plane perpendicular to the axis of the head with their axes parallel, the spindles being endwise movable, means connected with the driving member for simultaneously moving the spindles endwise, means connected with the driving member for rotating the spindles between each indexing of the head including a clutch device permitting reverse movement of the driving member without causing reverse movement of the spindles.

5. The combination with a frame, a head rotatable in the frame and carrying a circular series of bushings parallel to the axis of the head, and means for indexing the head around, of a plurality of spindles arranged with their axes parallel in a plane perpendicular to the axis of the head and organized to advance the tools to each engage one of the articles in the bushings respectively whereby upon indexing the head around each article in the bushing will thereby be successively engaged by one of the tools, said tool advancing means being arranged to advance the tool part-way of its path of travel thereupon retract the tool a short distance, and then further advance the tool to complete the operation.

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Witnesses:

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