R. A. NORLING.

PNEUMATIC DRILL.

APPLICATION FILED MAY 7, 1907.

969,394.

Patented Sept. 6, 1910.

3 SHEETS—SHEET 1.

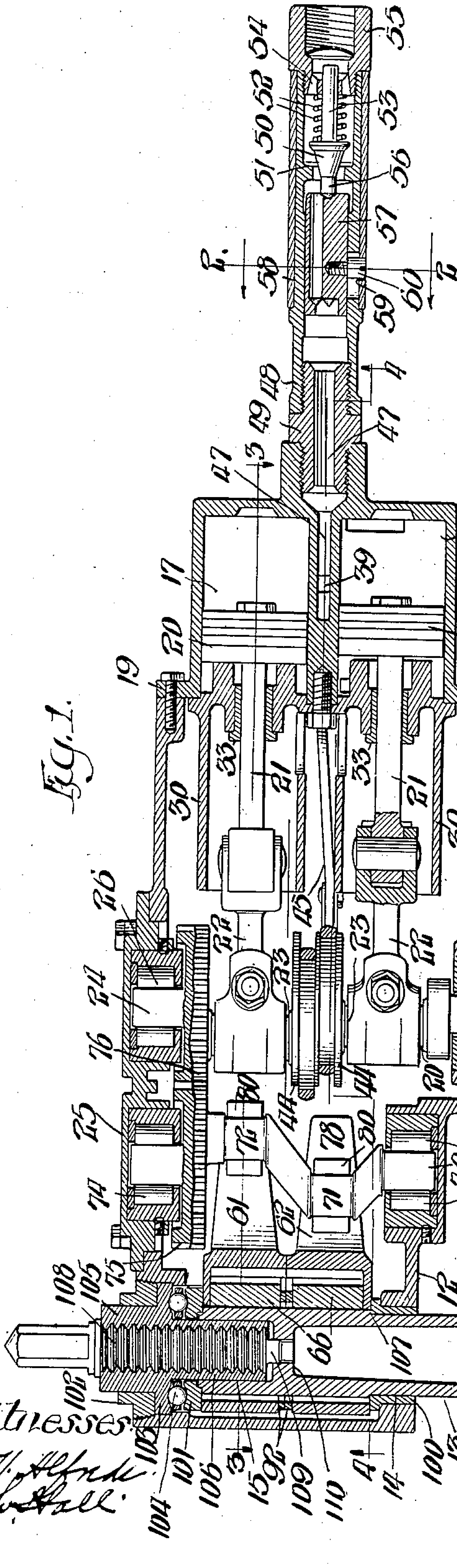


Fig. 1.

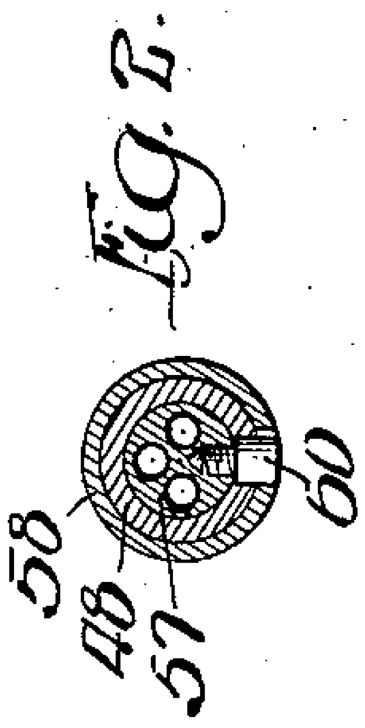


Fig. 2.

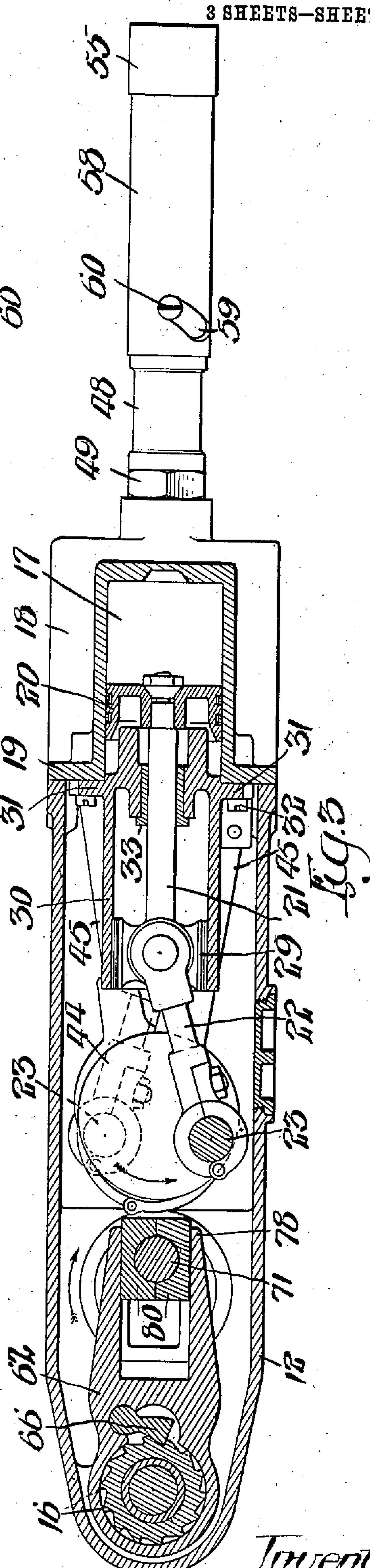


Fig. 3.

Witnesses:
T. H. Alfreds
W. W. Hall

Inventor:
Reinhold A. Norling
by Poole & Brown
Attys

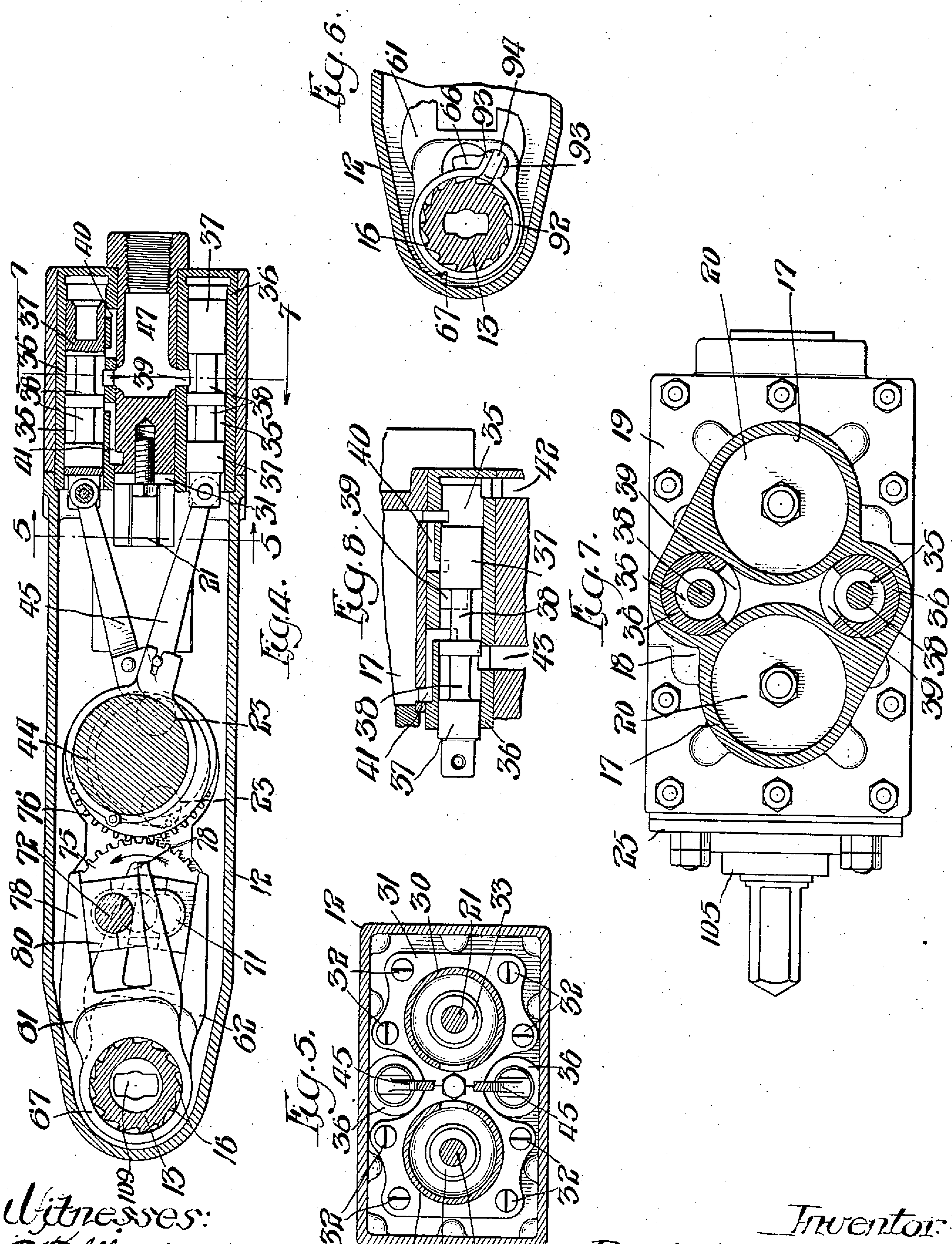
R. A. NORLING.

PNEUMATIC DRILL.

APPLICATION FILED MAY 7, 1907.

969,394. Patented Sept. 6, 1910.

3 SHEETS—SHEET 2.



Witnesses:
F. H. Alfreds
W. L. Hall.

Inventor:
Reinhold A. Norling
by Poole & Brown
Attys.

R. A. NORLING.

PNEUMATIC DRILL.

APPLICATION FILED MAY 7, 1907.

969,394.

Patented Sept. 6, 1910.

3 SHEETS—SHEET 3.

Fig. 11.

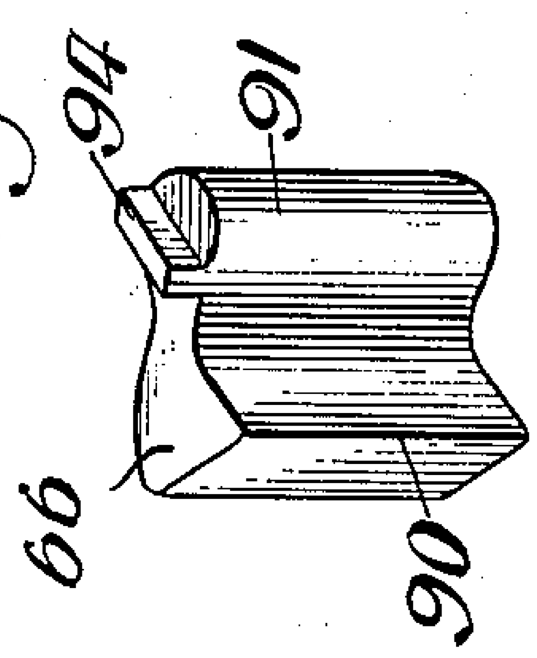


Fig. 9.

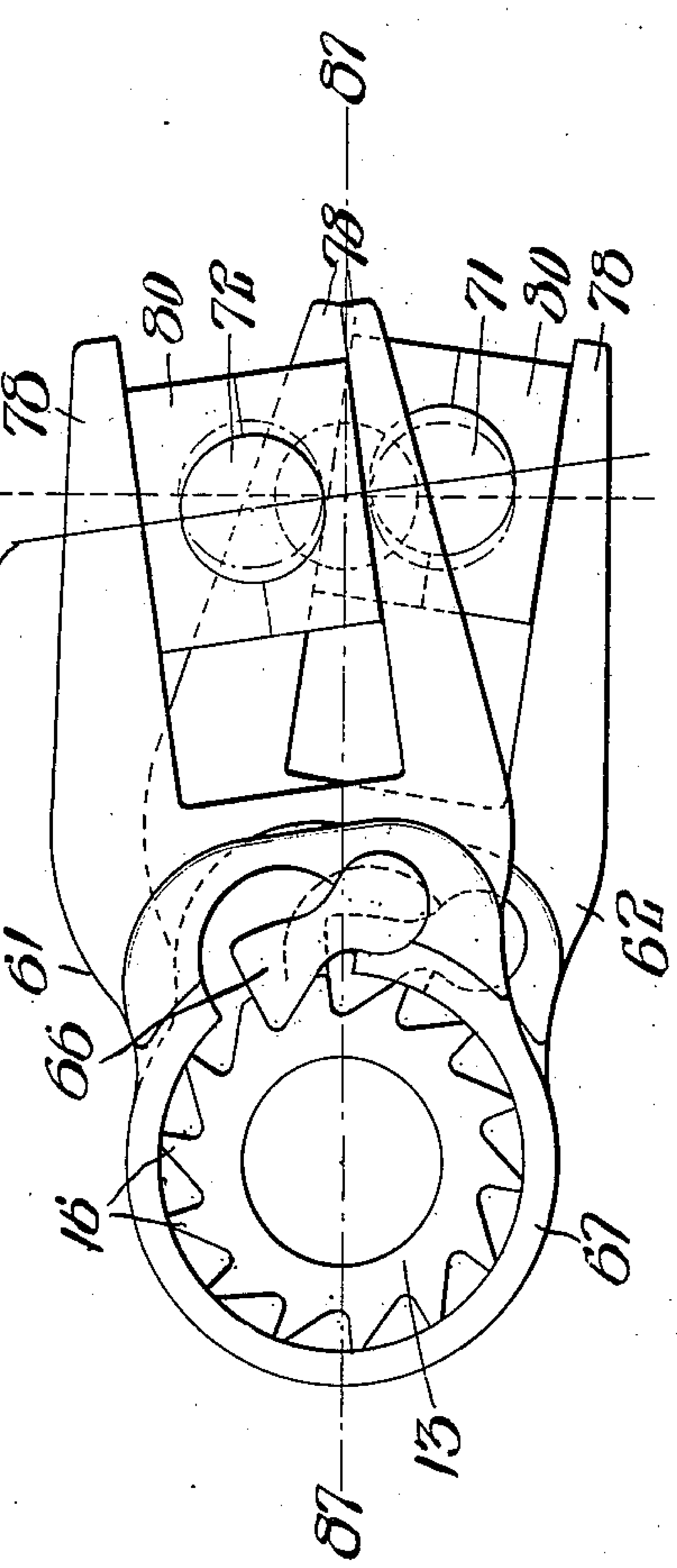


Fig. 10.

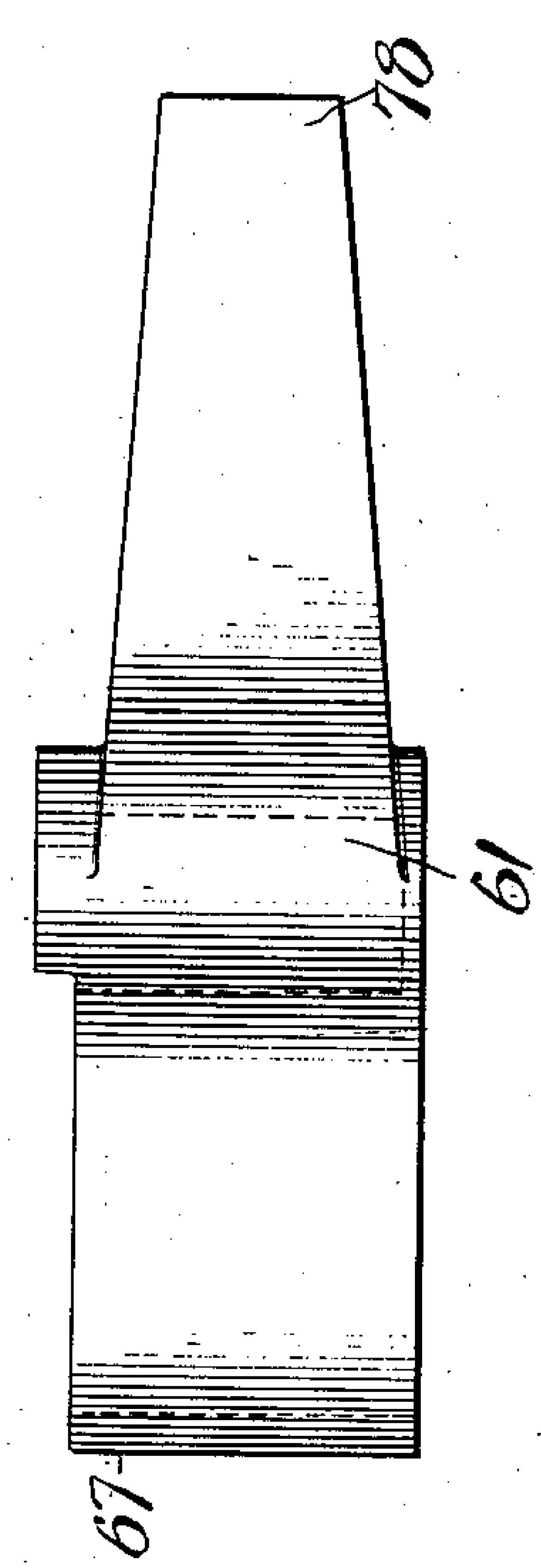
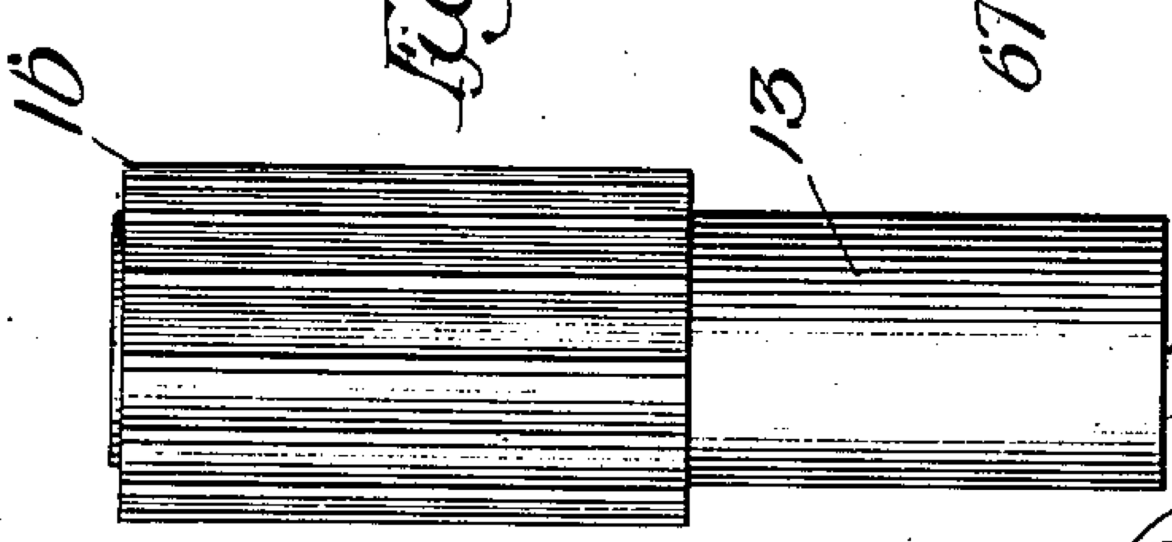


Fig. 12.



Witnesses
T. H. Alfreds
W. Hall.

Inventor
Reinhold A. Norling
by
Poole & Brown
Attys.

UNITED STATES PATENT OFFICE.

REINHOLD A. NORLING, OF AURORA, ILLINOIS, ASSIGNOR TO AURORA AUTOMATIC MACHINERY COMPANY, OF AURORA, ILLINOIS, A CORPORATION OF ILLINOIS.

PNEUMATIC DRILL.

969,394. Specification of Letters Patent. **Patented Sept. 6, 1910.**

Application filed May 7, 1907. Serial No. 372,407.

To all whom it may concern:

Be it known that I, REINHOLD A. NORLING, a citizen of the United States, and a resident of Aurora, in the county of Kane and State of Illinois, have invented certain new and useful Improvements in Pneumatic Drills; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention relates to improvements in motor actuated drilling tools or machines and the invention consists in the matters hereinafter set forth and more particularly pointed out in the appended claims.

A drilling machine embracing the features constituting my invention is constructed and arranged to drill holes located in close proximity to a wall or object, in a corner formed by two walls or surfaces located at right angles with each other or between two walls or objects located closely adjacent to each other, as is often required in structural iron work, engine building, ship building and the like. Said machine includes an improved means for driving or rotating a tool spindle, embracing a pawl and ratchet mechanism or analogous devices so arranged as to impart a continuous rotary motion to the tool spindle, and also an improved driving connection between a double motor driven crank-shaft having two crank-pins and a tool spindle, whereby both crank-pins may exert their most efficient power, through the intermediate mechanism, to drive the drill spindle at a time when said intermediate mechanism is in position to most effectively transmit power to rotate the drill spindle, together with other features as hereinafter set forth.

In the accompanying drawings:—Figure 1 is a central vertical section of a drilling machine embodying my invention, said section being taken axially through the drill spindle. Fig. 2 is a cross-section, taken on line 2—2 of Fig. 1. Fig. 3 is a longitudinal section, taken on line 3—3 of Fig. 1. Fig. 4 is a longitudinal section, taken on the indirect line 4—4 of Fig. 1. Fig. 5 is a transverse section, taken on line 5—5 of Fig. 4. Fig. 6 is a detail section illustrating the pawl and ratchet mechanism for rotating the tool spindle. Fig. 7 is a cross-section, taken on line 7—7 of Fig. 4. Fig. 8 is a detail section illustrating the valve for controlling the admission of the motive fluid to the motor cylinders. Fig. 9 is a view illustrating the two pawl bearing levers and pawls carried thereby and the ratchet teeth of the drill spindle. Fig. 10 is a side elevation of one of the pawl levers. Fig. 11 is a perspective view of one of the pawls. Fig. 12 is a side elevation of the drill spindle separate from its coacting parts.

As shown in said drawings, 12 designates an elongated hollow frame or casing in one end of which is mounted a drill-spindle 13 and to the opposite end of which is attached the power cylinder of an engine or motor. Said casing constitutes the principal part of a crank-case for the motor, and also an inclosure and support for the bearings of the drill spindle 13 and the mechanism by which the drill spindle is operated from the motor. At one end the drill spindle 13 is provided with a socket to receive the shank of the drill, and extends through the wall of the casing, turning in a bearing 14 in said wall. At its opposite end said spindle engages a bearing member 15 affixed to the adjacent wall of the casing, as hereinafter described. Said spindle is also provided, within the casing or frame, with a series of elongated ratchet teeth 16 arranged parallel with the axis of the spindle and constituting part of the mechanism for driving or rotating said spindle.

The motor as herein shown has the form of a two cylinder pneumatic engine, and embraces two parallel power cylinders 17, 17 located side by side and formed in a single casting 18 having at its inner end a flange 19 by which it is bolted or otherwise secured to the adjacent end of the casing or frame 12, as clearly shown in Figs. 1 and 7. The pistons 20, 20 of said motor are connected by piston rods 21, 21 and connecting rods 22, 22 with the two cranks 23, 23 of the crank-shaft 24, which latter is mounted at its ends in the side walls of the frame 12. A portion of one side wall of the casing is removable and constitutes a cap or closure 25, the removal of which permits access to the interior of the casing for the insertion and removal of the crank-shaft and its associated parts, as well as the mechanism for communicating motion from the crank-shaft to the drill spindle. The crank-shaft 24 engages at its ends antifriction roller bearings 26 mounted in one side wall of the frame and in the opposing removable cap 25. The said piston rods have cross-heads 29 which slide in cross-head guides 30 shown in the drawings as of cylindric form. The cross-head guides are formed on plates 31 which constitute the inner cylinder heads and are attached by bolts to the flange 19 on the inner end of the cylinder casting, said plates 31 and the flange 19 constituting an end wall for the end of the casing 12 adjacent to the cylinders. Said inner cylinder heads are equipped with bushings 33 through which the piston rods slide.

35, 35 designate valve chambers, formed in the cylinder casting and located at the opposite sides and between said cylinders. In said cylinder casting are formed the various ports leading to the cylinders and the supply passage for the motive fluid, as will hereinafter appear. Said valve chambers are open at their inner ends and closed at their outer ends by the end walls of the bushings. Reciprocating in said valve chambers are piston valves, each designated as a whole by 37. Each of said piston valves is provided with two reduced parts 38, 38 which form three longitudinally separated, cylindric enlargements, by means of which, during the reciprocation of each valve, communication is afforded alternately between the inlet port 39 of said valve chamber, and ports 40, 41 communicating with the valve chamber and the opposite ends of the cylinders, as shown most clearly in Figs. 4 and 8.

42, 43 designate exhaust ports opening into the atmosphere, one at each end of the valve chamber, and which are brought alternately into communication with the cylinder ports 40, 41 through reciprocation of the piston valves, as will be clear from an inspection of Fig. 8. Said valves 37 are reciprocated from eccentrics 44 on the main crank-shaft 24 through the medium of eccentric rods 45 connected at their ends respectively with eccentric straps surrounding said eccentrics 44 and with the piston valves, (Fig. 4). The inlet ports 39 of the valve chambers communicate with a centrally located supply passage 47 formed in the cylinder casting connected at its outer end with a tube 48 which is connected with the cylinder casting by means of a screw-threaded nipple, as shown in Figs. 1, 3 and 4, and through which the motive fluid is supplied to the motor cylinders.

A throttle valve is located within the tube 48 for controlling the flow of the motive agent therethrough. Said valve embraces a conical valve or plug 50 adapted to engage a correspondingly shaped seat 51 formed on an annular flange within said tube. The valve member is held normally against its seat by a spring 52 surrounding the stem 53 of the valve member and interposed between the valve member and an inwardly facing shoulder of a nipple 55 which has screw-threaded engagement with the outer end of said tube. The said valve member is provided with an inward axial extension or stud 56, which engages at its inner end the outer end of a hollow plug 57 located within and having endwise sliding engagement with the tube 48. The valve member 50 is lifted from its seat through the medium of a sleeve 58 surrounding and having rotative movement on the tube 48 and confined between the inner end of the nipple 55 and an annular exterior shoulder on said tube. Said sleeve is provided with an inclined slot 59, (Fig. 3) through which extends a screw-stud 60 which has screw-threaded engagement with the hollow plug 57 before referred to. The tube 48 and its surrounding sleeve constitute a handle which is grasped by one hand of the operator in using the tool. Rotation of said sleeve in one direction operates through the action of said inclined slot on the stud 60 to slide the hollow plug 57 and throttle valve 50 outwardly and thereby open the valve. Said inclined slot 59 is provided at its outer end with a transverse end portion adapted to be engaged by the stud to hold the valve closure in its open position. The valve and mechanism for operating the same constitute no part of the present invention and the construction and operation thereof need not be further herein described.

Referring now to the mechanism for transmitting motion from the crank-shaft 24 to the drill spindle, said mechanism embraces two swinging levers 61, 62 disposed one over or at the side of the other and arranged to turn or rotate about the axis of the drill spindle, and provided each with a pawl 66 adapted to engage the ratchet teeth 16 on the drill spindle and turn the latter, when the lever is swung or moved in one direction, and to pass over said teeth when the lever is swung in a reverse or backward direction. Said levers are arranged to swing or oscillate reversely in such manner that when one of the levers is swung in a direction to rotate the drill spindle forwardly the other lever is swung or moved backwardly or retracted; each lever being moved or swung forwardly, or in a direction to rotate the spindle while the other lever is being restored to its starting point. The said reversely swinging levers are so connected with the mechanism which operates the same that the retracted lever is reversed and engages the drill spindle in a manner to turn the same forwardly before the lever which is then completing its forward swing is released from the drill spindle, whereby the rotation of the drill is made continuous.

The said pawl carrying levers may be pivotally supported or mounted in any suitable way in the machine frame or casing, but, as shown in the accompanying drawings, they are provided at their outer or forward ends with hubs 67 having smooth cylindric apertures which fit over and have bearing on the toothed part of the drill spindle.

The levers are swung or vibrated through the medium of a secondary crank-shaft 70, parallel with the main crank-shaft 24, and provided with two crank-pins 71, 72 corresponding with the cranks of the main crank-shaft. The secondary crank-shaft is rotatively mounted at its ends in antifriction roller bearings 73, 74 mounted, one set in one side wall of the frame, and the other set in the cap or closure 25. The said secondary crank-shaft is rotated from the main crank-shaft through the medium of intermeshing gear-wheels 75 and 76 on the secondary and main crank-shafts, respectively, said gear wheels being arranged to drive the secondary shaft at the same speed that the primary crank-shaft is driven. The said levers are provided at their inner or swinging ends with laterally separated arms 78 between which the crank-pins 71, 72 of the secondary crank-shaft operate. Said fork-arms 78 of the pawl bearing levers have smooth inner parallel bearing surfaces, and the crank-pins 71, 72 of the secondary crank-shaft are provided with bearing blocks 80, 80, (each made of two halves or parts to facilitate the fitting thereof over the crank-pins) which have smooth side or lateral faces for engagement with the inner faces of the fork arms of said pawl-bearing levers. It is obvious that the enlargement of the crank-pins of the secondary crank-shaft will produce the same effect as the bearing blocks described, but, for convenience of manufacture and to increase durability, the separate bearing blocks are preferred.

The operation of the secondary crank-shaft, acting through the pawl bearing levers and their pawls to continuously rotate the drill spindle will be apparent from a consideration of the following, in connection with Fig. 9 of the drawings. It will be observed that the crank-pins 71 and 72 of said secondary crank-shaft are located 180 degrees from each other and each crank-pin turns, in giving the power stroke to its associated lever, in the arc farthest away from the drill spindle. It will be also observed that, by reason of the angularity of the bearing surfaces of the arms of each lever to a line passing through the axis of oscillation of the levers and the axis of the secondary crank-shaft, as indicated at 87 in Fig. 9, when the lever is at the extreme limit of its vibratory movement in each direction, the center of the crank-pin is not on a line at right angles with the line 87, such as is indicated by the dotted line 85 in Fig. 9, but its said center is on a line at right angles to the bearing faces of the lever, and passing through the axis of the crank-shaft, such as is indicated at 86, in said Fig. 9. In other words, the movement of the said crank-pin in giving the power stroke to the lever, is measured by the angular distance between the line 86 and a line similarly drawn through the axis of the crank-shaft at right angles to the straight bearing faces of the other lever, and is greater than 180 degrees by an amount equal to twice the angular distance between the lines 85 and 86. That is to say, in the power stroke from the lower position of the lever to its upper position, the crank-pin will swing not only through 180 degrees, but through an additional angle equal to the angle between the two positions of the levers. As a consequence the crank-pin of said secondary shaft has a movement through an arc of more than 180 degrees, when, during the power stroke of the lever, the said crank-pin carries said lever from the extreme limit of its backward stroke to the extreme limit of its forward stroke. It follows, also, that the crank-pin, acting on the lever which is making its forward stroke advances said lever to a point at which the bearing faces of the lever are perpendicular to a line passing through the axes of said crank-pin and the crank-shaft, and this point is at an angular distance from the location of the crank-pin in the mid-position of the lever, equal to ninety degrees plus the angle between the lines 85 and 86 on Fig. 9. On the other hand, it will be observed that the crank-pin, when operating to retract the pawl bearing lever, reverses the direction of movement thereof at a point on a line passing through the axis of said crank-pin perpendicular to the bearing faces of said lever, so that the said lever begins its forward movement before the other lever has completed its advance or power stroke, both levers therefore moving forward during the period of rotation of the crank-pin represented by the angle between the lines 85 and 86. Said crank-pins are shown in dotted lines in Fig. 9 as occupying positions on the dotted line 85, and in full lines as occupying positions on the full line 86. Thus it will be observed that during the time the crank-pin, acting upon the pawl bearing lever 61 which is completing its advance or power stroke, is passing from the position indicated by the line 85 to the line 86, the said lever 61 continues to advance. During the same time the crank-pin 71, which has just retracted the pawl bearing lever 62, is passing from the position indicated by the line 85 to the position indicated by the line 86 and during this part of the rotation of the crank-pin 71, the said pawl bearing lever 62 begins its forward swing to rotate the drill spindle.

It follows that the effective action of the crank-pins of the secondary crank-shaft upon each of said pawl bearing levers is 180 degrees plus twice the angle between the lines 85 and 86. It will therefore be seen that the action of the secondary crank-shaft through said pawl bearing levers 78 and 79 in rotating the tool spindle is a continuous one, the speed of rotation of the spindle being, of course, somewhat reduced when the levers are near the opposite limits of their vibrating movement. Inasmuch as each of said levers is being retracted during the greater part of the period of the power stroke of the other lever the total movement of the pawls from one extreme position to the other is but slightly greater than one-half of the angular distance between adjacent ratchet teeth, and the teeth may, therefore, be made of relatively large size and with ample bearing surfaces.

The employment of a pawl and ratchet driving connection between the vibrating levers and the drill spindle, made as hereinbefore set forth, affords a simple and effective driving connection between said parts, but it is to be understood that the same general effect in the operation of the drill may be obtained when, in place of such pawl and ratchet connection is employed some other well known or preferred form of connecting means, analogous in character to a pawl and ratchet, adapted to transmit to the drill spindle, from the vibrating levers, turning movement in one direction.

Inasmuch as the secondary crank-shaft 70 rotates in the direction indicated by the arrow in Fig. 3 and each crank-pin thereof rotates, during its power stroke, in the arc farthest away from the drill spindle, it will be seen that the greatest force of the pawl bearing devices is exerted in mid-position as shown in Fig. 3, and the greatest power is required to turn the drill spindle, as it is then moving at its maximum speed. The lever is, however, at this time exerting its greatest leverage because its associated crank-pin of the second secondary crank-shaft is at the same time operating on the part of the lever farthest from the spindle. So far as the coöperation of the pawl bearing levers with the crank-shaft 70 is concerned, said crank-shaft may be rotated from any suitable source of power.

As a further and separate improvement in a drill of this character, wherein vibrating pawl bearing levers or analogous devices are arranged to be operated from a secondary crank-shaft geared to the main crank-shaft, I arrange the crank-pins on said main crank-shaft at such angular distances apart that said crank-shaft exerts its greatest power to reciprocate the pawl bearing levers at a time when most needed, or at a time when the advancing pawl bearing lever is in its mid-position, as shown in Fig. 3.

It will be understood that a double acting engine having parallel cylinders and arranged with the crank-pins of the crank-shaft at right angles to each other gives substantially uniform power throughout the full rotation of the crank-shaft and further that if the crank-pins be placed at 180 degrees apart, the power of the two pistons will be exerted simultaneously with the result, however, that both crank-pins will be simultaneously on a dead center at the end of each stroke. In order to more effectively transmit power from the two pistons to the vibrating levers I arrange the crank-pins of the main crank-shaft so that the pistons act on both of said crank-pins when the latter are in position requiring the greatest power to turn the same, to wit,—when the crank-pins of the secondary crank-shaft are passing through that part of their circular path farthest from the axis of oscillation of the levers.

As shown in the accompanying drawings, the crank-pins of the main crank-shaft are placed at approximately 135 degrees apart, as indicated in Figs. 3 and 4, and as a result, when the pawl bearing lever, which is making its driving or power stroke, is at mid-position, one of the crank-pins of the main crank-shaft is in position to receive maximum power from the piston acting thereon. As shown in Fig. 4, the pawl bearing levers are at the limits of their vibratory movement. In this position one of the crank-pins of the main crank-shaft has just passed the dead center while the other crank-pin is approaching its dead center. When, however, the parts are in the position shown in Fig. 3, and one of the vibratory levers is in the middle of its advance or power stroke and the other is being retracted, one of the crank-pins of the main crank-shaft will be approaching the point in its path at which the crank-shaft receives maximum power from its associated piston, while the other crank-pin will have passed such point. It follows that both crank-pins of the main crank-shaft will be in position to give maximum power when each lever is making its advance or power stroke.

The pawl 66 illustrated more clearly in Fig. 11 has at its free end an edge 90 for engagement with the spaces between the ratchet teeth of the drill spindle, and at its opposite end a rounded or hinge portion 91, made integral with the body of the pawl. The two pawls are made of a combined width approximately equal to the length of the ratchet teeth. The said pawl bearing levers are provided with sockets which receive the rounded or hinge portions 91 of the pawls. The pawls are spring-pressed toward the ratchet teeth by means of a form of spring made as follows: Each spring comprises an incomplete or split ring 92 surrounding the ratchet teeth of the drill spindle (Fig. 6). The terminals 93 of said springs are bent outwardly from the ring-like body of the spring in parallel relation to each other and grip between them flat faced lugs 94 on the ends of the pawl. The pressure exerted by said springs serve to hold the pawls yieldingly in position to engage with the ratchet teeth, while permitting the pawls to spring outwardly to ride backwardly over said teeth. As illustrated, said springs 92, 92 are located between the hubs of the two pawl bearing levers, in contact with each other.

The construction of the tool spindle and the manner of mounting the same in the frame or casing will now be described. One wall of the casing or frame is provided with a bushing 100 which constitutes the bearing for the lower cylindric portion of the spindle. On the upper or inner end of the said drill spindle is mounted a ring or collar, constituting the rotative member of a thrust bearing, the non-rotative member of which consists of an annular flange 103, formed on a tubular bearing member 105, which is secured in the top wall of the casing in axial alinement with the drill spindle by means of a locking ring 102 which has screw-threaded engagement with the surrounding casing wall and clamps the flange 103 against an upwardly facing shoulder on said wall. Antifriction balls 104 are interposed between the rotative ring 101 and the flange 103. The hubs of the levers 61 and 62 are confined between and held from movement endwise of the drill spindle by contact with the bushing 100, and the ring 101. The sleeve 105 is extended downwardly or inwardly to form an externally cylindric bearing member 106 which fits within a cylindric bearing recess formed in the upper end of the drill spindle. The bearings for holding the spindle laterally in place thus comprise the exterior bushing 100 at its lower end and the interior extension 106 of the fixed sleeve 105 at its upper end. The upward end thrust of the tool spindle is resisted by the thrust-bearing formed by the ring 101, the flange 103, and the balls 104. The said tool spindle is held from downward endwise movement by an annular shoulder 107 thereon, which bears against the upper or inner end of the bushing 100.

The upper sleeve 105 is made hollow and interiorly screw-threaded to receive a feed-screw 108 by which the drill is fed to its work, in a familiar manner. The said feed-screw is provided at its inner end with an axial projection 109 that extends through an aperture in a transverse diaphragm or wall 110 that constitutes the stop for the drill shank, said extension 109 being adapted to engage the drill shank in a manner to eject the same from the tool holder.

A general advantage of the arrangement of parts illustrated wherein the drill spindle is actuated by two vibrating levers extending from one side thereof and a crank-shaft having crank-pins engaging said levers is that this construction permits of the location of the drill spindle closely adjacent one end of the frame or casing which carries said spindle and the levers and other operating mechanism for the spindle and thereby renders possible the drilling of a hole in a wall or like part closely adjacent to a wall located at right angles thereto, in a corner, or in other analogous situation, such as often occurs in structural iron work, in engine building, ship building and the like, it being evident that a hole may be drilled by the device described in a wall or like part, the center of which is as near an adjacent part or object as the distance between the center of the drill and the adjacent end of the casing or frame.

Another advantage of the construction shown, is the compactness of structure in the drill actuating devices and casing and consequent short distance between the end of the drill and the end of the feed-screw, making it practicable to drill a hole through a plate or wall located closely adjacent to and parallel with another plate or wall where it is necessary that the drill be introduced between the walls. Such compactness of structure is gained by providing an interior bearing for the upper end of the drill spindle, enabling the same to be made very short, and by locating the vibrating levers closely adjacent to each other with their parts or hubs which engage or surround the drill spindle filling substantially the entire length of the spindle between the walls of the casing and arranging the pawl and ratchet connections between the said levers and the drill spindle in such manner that they occupy substantially no greater space, lengthwise of the spindle, than is occupied by the said hubs of the levers.

I claim as my invention:—

1. A drilling machine comprising a frame, a drill spindle mounted in said frame, said spindle having at one end a bearing recess and the frame having a fixed bearing member which extends into said bearing recess.

2. A drilling machine comprising a frame, a drill spindle mounted in the frame, said spindle having at one end a bearing recess, and the frame having a fixed bearing member which extends into said recess, and a thrust bearing interposed between said end of the spindle which engages said bearing member and the frame.

3. A drilling machine comprising a frame, a drill spindle mounted in the frame, said spindle having in one end a bearing recess, and the frame having a fixed bearing member which extends into said recess and a thrust bearing embracing an annular flange on said bearing member, and a ring on the adjacent end of the spindle.

4. In a drilling machine, the combination of a drill spindle provided with ratchet teeth, a lever provided with an apertured hub which fits and turns upon said ratchet teeth, a pawl pivoted in said hub, and an actuating spring for said pawl consisting of a split-ring which surrounds the drill spindle, said pawl having a flat-sided projection which is engaged by the ends of said ring.

5. A drilling machine comprising a frame, a drill spindle mounted in said frame, said spindle being provided at one end with a bearing recess and having ratchet teeth surrounding its part which contains said bearing recess, and the frame being provided with a fixed bearing member which extends into said bearing recess, a lever provided with an apertured hub which fits and turns on said ratchet teeth, and a pawl mounted on said hub.

6. A drilling machine comprising a frame, a drill spindle mounted in said frame, said spindle being provided at its upper end with a bearing recess and the frame having a fixed bearing member which extends into said recess and being provided also with a fixed bearing for the lower end of the spindle through which extends said lower end of the spindle and said spindle having ratchet teeth occupying substantially the entire length of the same between its said upper end and its lower bearing, and two levers provided with apertured hubs which fit and turn on said ratchet teeth and occupy substantially the entire length of the said teeth, and pawls mounted on said hubs.

7. A drilling machine comprising a frame, a drill spindle mounted in the frame, said spindle having at its upper end a bearing recess and the frame being provided with a fixed bearing member which extends into said recess and being provided also with a fixed bearing for the lower end of the spindle through which extends the said lower end of the spindle, a thrust bearing interposed between said upper end of the spindle and the frame, said spindle being provided also with ratchet teeth occupying substantially its entire length between said thrust bearing and its lower bearing, two levers provided with apertured hubs which fit and turn on said ratchet teeth and which occupy substantially the entire length of the said ratchet teeth, and pawls mounted on said hubs.

In testimony, that I claim the foregoing as my invention I affix my signature in the presence of two witnesses, this 3rd day of May A. D. 1907.

REINHOLD A. NORLING.

Witnesses:
W. L. HALL,
A. M. BUNN.