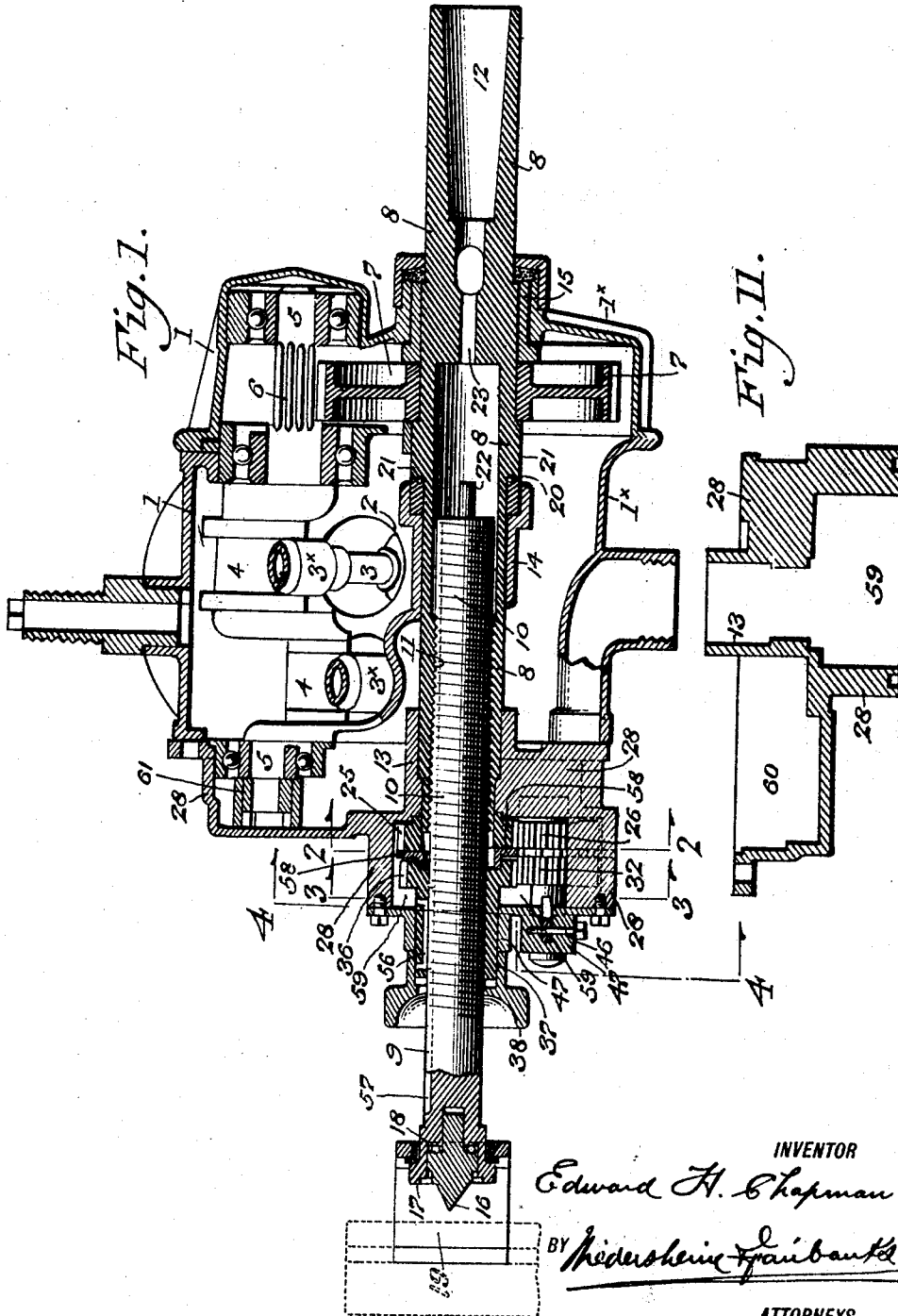


E. H. CHAPMAN.
 AUTOMATIC FEED FOR AN AIR DRILL.
 APPLICATION FILED DEC. 18, 1918.

1,366,716.

Patented Jan. 25, 1921.
 4 SHEETS—SHEET 1.



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Fig. 2.

ON 2-2, FIG. 1.
 ON 2-2, FIG. 5.

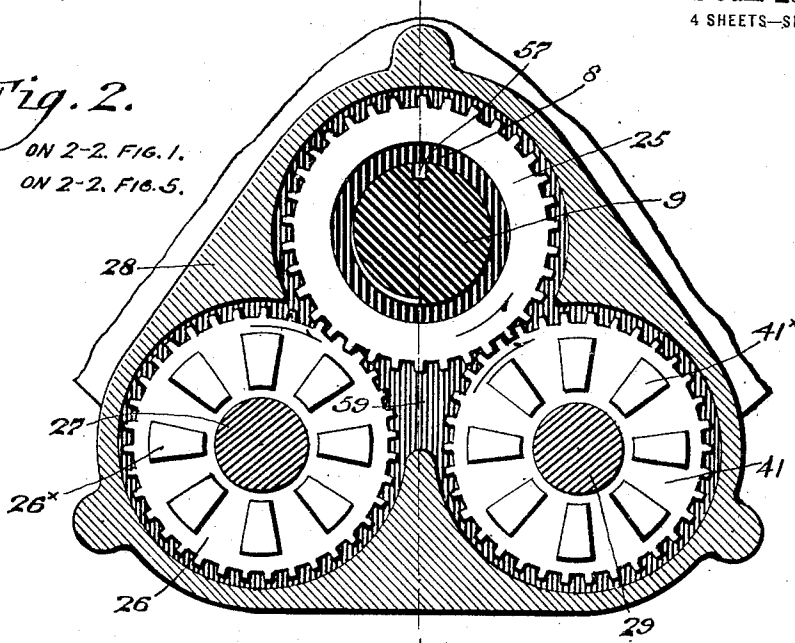
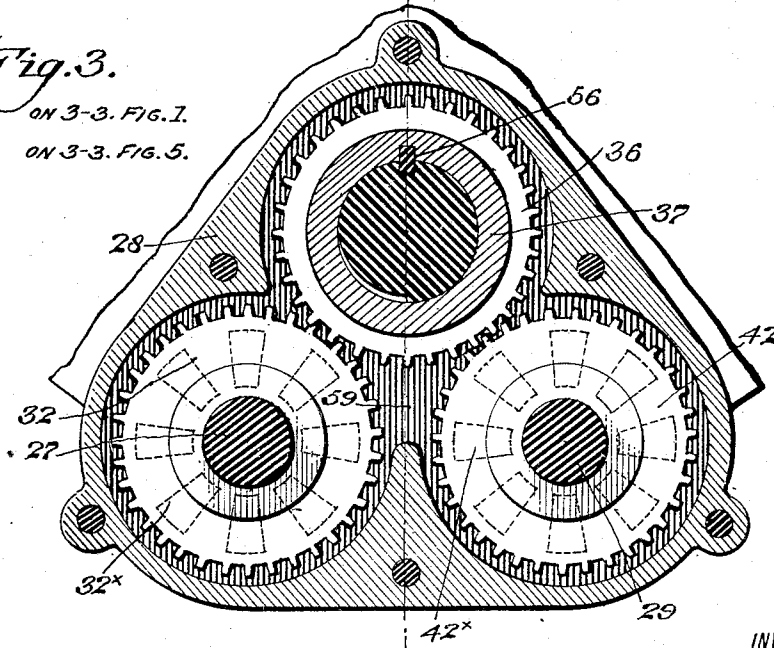


Fig. 3.

ON 3-3, FIG. 1.
 ON 3-3, FIG. 5.



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Fig. 4.
 ON 4-4, FIG. 1.

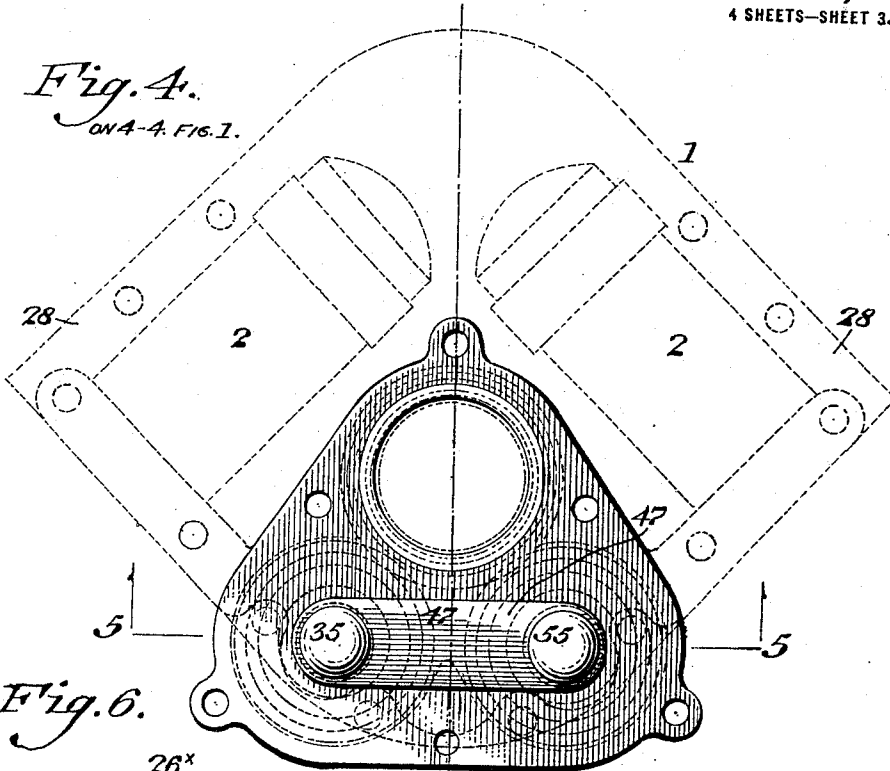


Fig. 6.

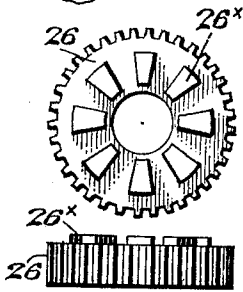
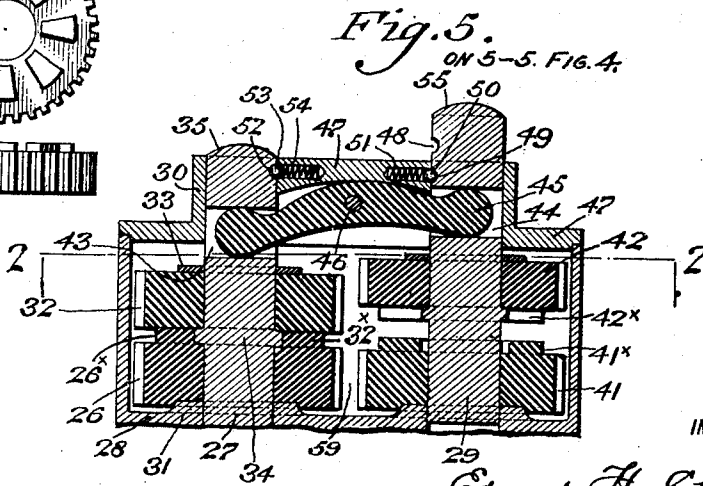


Fig. 7.



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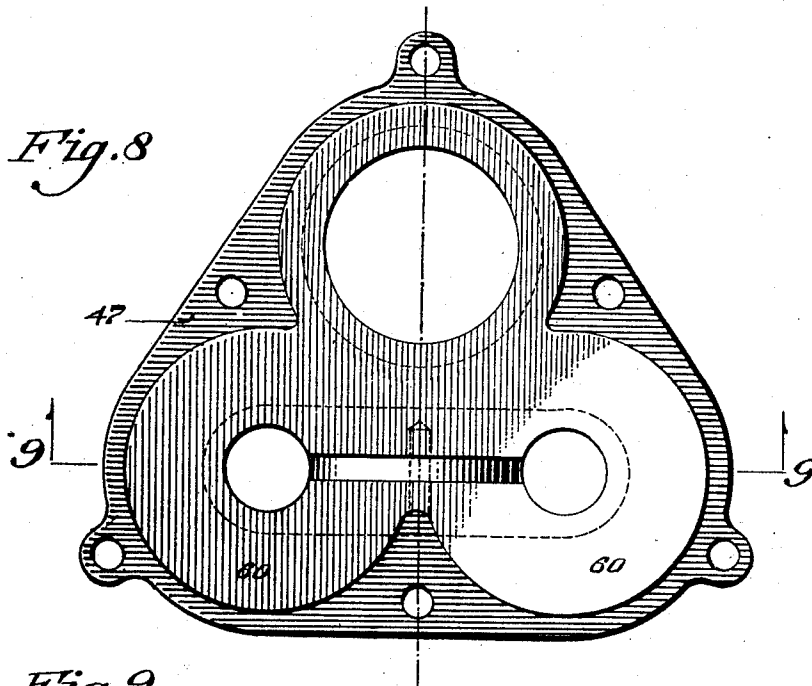


Fig. 9.
ON 3-3, FIG. 8.

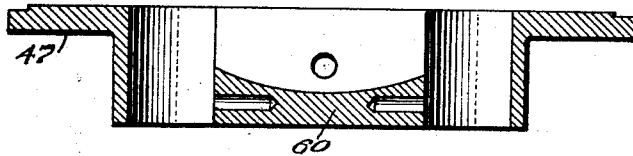
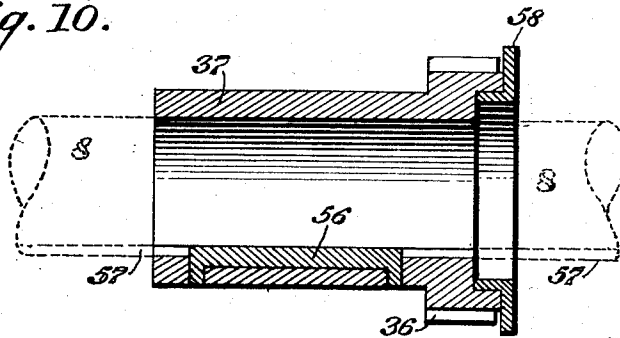


Fig. 10.



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UNITED STATES PATENT OFFICE.

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AUTOMATIC FEED FOR AN AIR-DRILL.

1,366,716.

Specification of Letters Patent.

Patented Jan. 25, 1921.

Application filed December 18, 1918. Serial No. 267,343.

To all whom it may concern:

Be it known that I, EDWARD H. CHAPMAN, a citizen of the United States, residing at Bethlehem, in the county of Northampton, State of Pennsylvania, have invented a new and useful Automatic Feed for Air-Drills, of which the following is a specification.

My invention relates in general to the class of automatic drill feed attachments for air and electric drills, or drill presses of various types, in which provision is made for automatically feeding the drill into the work and for disconnecting the feed mechanism without affecting the rotary movement of the drill.

More particularly my invention relates to an automatic portable feed for drills invented by me and forming the subject-matter of United States Letters Patent No. 1,202,030, granted to me October 24, 1916,—and, while possessing all of the advantages of my aforesaid feed, comprehends certain improvements in the organization and application to the drill-spindle and gearing which drives said spindle, of the motive mechanism which operates upon the gearing to effect the control of the drill-spindle relatively to the feed screw.

My invention possesses all of the advantages which inhere in the portable feed of my patent, and in addition includes a differently balanced and arranged casing for containing the motive mechanism and also the gears which control the operation of the drill-spindle and the feed screw, so that the assembly as such is better arranged for certain types of drills, and calculated to be more particularly applicable to a motor driven drill as contra-distinguished from one that is portable and operated by hand.

While all the advantages of my patented feed and the details of its construction, which my patent aforesaid comprehends and particularly claims, are present in this new and useful embodiment of them, I have in addition to the organization and balanced arrangement of the casing, devised certain improvements in the organization, application, control and form of the rocker arm which controls the movements of one of the idle gears relatively to one of the driving gears and also the movements of a second idle gear and a second driving gear which in this invention as well as in that of my patent, cooperate with the first named gears.

For the purpose of illustrating my inven-

tion, I have shown in the accompanying drawings certain types and embodiments of it which are at present preferred by me because in practice they have been found to give satisfactory and reliable results. It is to be understood, however, that the various instrumentalities in which my invention is embodied can be variously arranged and organized and that my invention is not therefore limited to the precise arrangement and organization of these instrumentalities which are typified in the constructions illustrated in the accompanying drawings and hereinafter described.

Referring to the drawings:—

Figure 1 represents a vertical, central, sectional elevation of a drill embodying my invention,—certain parts being represented in broken side elevation.

Fig. 2 represents a section on the line 2—2, Figs. 1 and 5.

Fig. 3 represents a section on the line 3—3, Figs. 1 and 5.

Fig. 4 represents a left-hand end elevation of the machine of Fig. 1, the casing of the motor being indicated in dotted lines.

Fig. 5 represents a section on the dotted line 5—5 of Fig. 4, showing two sets of feed gears and means for engaging and disengaging them, certain parts being omitted for the sake of clearness of illustration.

Fig. 6 represents a bottom plan view of one of the idle gears.

Fig. 7 represents an edge view of the gear of Fig. 6.

Fig. 8 represents an inside view of the casting which is used as a cap to inclose the motor casing as shown in Fig. 1.

Fig. 9 represents a section on line 9—9 of Fig. 8.

Fig. 10 represents the gear sleeve with a portion of the drill-spindle in broken outline.

Fig. 11 represents an inverted central section of the cap of the motor casing which is shown in Fig. 8, removed from the casing.

Similar numerals of reference indicate corresponding parts.

Referring to the drawings:—

1 represents a casing, being a housing of the form shown in full lines in Fig. 1 and in dotted lines in Fig. 4, the peculiar form, organization and application of this casing being described later on.

Within the casing are the cylinders 2 within which are the pistons 3, and also the

connecting rods 3* for the cranks 4 of the crank shaft 5, assembled and mounted in the manner usual in motors of this character and which are typical of motive mechanism 5 generically considered, and adapted through a pinion 6 on the right-hand crank shaft 5, to occasion the rotation of a gear or spur wheel 7 mounted on the hollow drill spindle 8.

9 designates the cylindric upper or outer portion of a rotatable feed screw, the externally threaded portion of which is designated 10, and the threads of which may be of a predetermined number and pitch, engaging with internal threads 11 formed within the hollow drill spindle 8 which extends longitudinally of the casing within a cylindric bore thereof, the upper bearing surface of which bore is designated 13, the middle 14, and the lower 15.

The feed screw 9-10 at the end opposite to the drill socket 12 is provided with a conical center 16, retained by a cap 17 and provided with a ball race 18 intermediate the end of the feed screw and the tip, the latter being adapted to engage a suitable abutment or "old man" 19, Fig. 1, said center serving when held stationary, to permit of the free rotation of the feed screw.

The drill-spindle or drill-carrying member is rotatable within the bearing surfaces 13, 14 and 15, of the bore, and a ball race 20 intervenes between the shoulder 21 of said spindle and the middle bearing 14 of the bore.

The lower end of the feed screw is formed with a pintle 22 which in the downward or outward movement of the feed screw enters within a socket 23 formed within the drill-spindle, so as to stop the outward movement of the feed screw.

The outer or lower end of the drill-spindle terminates in the usual drill socket 12 within which the drill, bit, or other implement (not shown), engages.

The organization so far described is that embraced in the construction of Fig. 1 of my patent referred to, and the rotation of the drill-spindle 8, in the operation of the tool, is occasioned by the agency of compressed air, or other motive fluid, applied to a typical motor of the character illustrated in Figs. 1 and 4,—or by an electrically operated motor,—either operating through the spur wheel 7 and pinion 6 to effect the rotation of the crank shaft 5.

The rotation of said drill-spindle is transmitted to the feed screw by the following manually-actuated supplemental controlling gearing, which also is illustrated and particularly described in connection with the construction of Fig. 2 of my said patent, and also in a somewhat similar arrangement in connection with the construction of Fig. 1.

It is here to be explained that in the or-

ganization of my present drill, the casing as an entirety is of such a construction that the motive mechanism is disposed in opposition to the gearing, in contradistinction to a disposition in relative alinement therewith 70 as in the organization of Fig. 1 of my herebefore-mentioned patent. For this purpose the casing to be later described presents the disposition shown in Figs. 1 and 4.

Referring now to the feed-gearing organization which in the present instance I utilize for the operation of my drill, 25 is a feed-gear keyed to the drill spindle 8. This feed-gear 25 meshes with an idle gear 26, freely revoluble upon a gear stem 27, housed 80 in the cap member 28 of the casing 1, see Figs. 1 and 11, and in parallelism with the drill-spindle 8 and feed screw 9-10.

This gear stem 27, as hereinafter explained, is similar in construction to a second and parallel gear stem 29.

The gear stem 27 is susceptible of vertical movement within bearings 30 and 31 within the cap member 28, and above the idle gear 26 it carries a vertically movable, revoluble 90 driving gear 32, retained in place upon the stem by and between two collars 33 and 34.

The stem 27 extends above and beyond the cap member 28 and is provided with a head or push-button 35.

The driving gear 32 is adapted to engage with a driven gear 36, see particularly Figs. 1 and 10, formed on the inner end of a hollow, cylindric sleeve 37 terminating in a hand wheel 38, and adapted to turn freely 100 on the feed screw, as shown in Fig. 1.

This sleeve extends upwardly or outwardly beyond the cap member 28 of the casing, and while encompassing the smooth portion 9 of the feed screw, encompasses 105 also the upper threaded portion 10 of said feed screw, upon which it is revoluble, so as, at will, through the intervention of a feather 56 hereinafter referred to, to make it possible manually to turn the feed screw. 110

The driven gear 36 and the sleeve 37 are a unit, and the gear member 36 is in constant engagement or meshed with the driving gear 32.

Axially paralleling the gear stem 27 is 115 a similarly mounted second gear stem 29, upon which are mounted another idle gear 41, being a counterpart of the idle gear 26, and also another driving gear 42 above said idle gear 41, being a counterpart of the 120 driving gear 32.

Both the driving gears 32 and 42 have bottom clutching faces, respectively designated 32* and 42* and both of the idle gears 26 and 41 have upper clutching faces, respectively designated 26* and 41*, so that 125 according to the lifting and dropping movement of the gear stems 27 and 29, one or the other of the idle gears 26 or 41, both of which are in mesh with the feed gear 25 on 130

the drill-spindle 8, will be engaged with the driving gear 32 or 42 with which it coöperates.

Each of the gear stems 27 and 29 is formed with a transverse slot, respectively designated 43 and 44, whose walls are engaged by the ends of a rocker arm 45 pivoted at 46 within the cover top 47 of the cap member 28.

In order to hold the gear stems in their relative opposite positions, when, for instance the gear stem 29,—shown in Fig. 5 in its elevated position,—is raised, I provide said gear stem 29 with two notches, an upper designated 48, and a lower designated 49, into one or the other of which a locking ball or device 50 is adapted under the pressure of a confined spiral spring 51, to be entered.

The first gear stem 27 is shown as provided with but a single notch 52, into which a locking ball or device 53 controlled by a spring 54 is adapted to be entered. Obviously, a pressure upon the head or push button 35 of the stem 27 will force down said stem, and through the rocker arm 45 force up the stem 29 into the position shown in Fig. 5, while a depression upon the push button 55 will occasion a reversal of position of the parts. Thus the locking and temporary holding together of either idle gear 26 and driving gear 32, or of idle gear 41 and driving gear 42, is effected.

Inasmuch as, according to the desired direction of rotation of the drill-spindle 8, either the driving gear 32 or the driving gear 42 is, through the clutch of its idle gear, operatively engaged with the driven gear 36 on the thumb sleeve 37; and inasmuch, further, as both of the idle gears 26 and 41 are always in engagement with the feed gear 25 on the drill spindle 8, it is obvious, broadly stated, that the right-hand or left-hand rotation of the drill spindle and drill, will be accomplished by the manual movement or pushing in of one of the gear stems to effect the clutching of the driving gear and the idle gear with which it operates.

56 is a feather or spline in the sleeve 37 and sliding in a featherway 57 longitudinally recessed partly in the exterior of the feed screw 9—10 and partly in the interior of the sleeve 37, so that in the rotation of the driven gear 36 and sleeve 37, in one or the other directions, the feed screw will be correspondingly rotated.

58 is a bearing washer and spacer encircling the feed screw and separating the driven gear 36 and the driving gears 32 and 42.

Referring now to the casing 1, its organization, so far as it comprehends a casing as such for a motive mechanism and as it appears in Fig. 1, is a matter of large

importance, and while the details of construction shown in Fig. 1 are well suited for for the purpose, I do not necessarily confine myself to them. It is, however, of the essence of my present construction that such portion of the casing as embraces the motive mechanism should be upon a given side of the drill spindle and feed-screw and that the other portion of said casing within which is confined the manually-controlled supplemental driving gearing should be upon another side, so as to make a double-compartment and, so to speak, balanced, casing.

The entire casing and the component members of it, in which the motive mechanism is contained is designated by the number 1 and its details of construction are apparent from Fig. 1.

That portion of the casing, however, which is upon the opposite side of the drill-spindle and feed screw I have designated as 1', and its details of construction also will be understood from Fig. 1.

The casing as an entirety is however, at the end opposite the drill-holding end 12 of the drill spindle 8, confined and inclosed by a cap member 28 which is shown in both Figs. 1 and 11, in Fig. 11 removed from the casing proper.

This cap member 28 is preferably a casting embodying a chamber 59 of cylindric form, within which are assembled the driving gears 32 and 42, the idle gears 26 and 41, the gear stems 27 and 29, the feed gear 25 on the inner end of the drill-spindle 8, and the driven gear 36 on the sleeve 37.

A cover or top 47 incloses the outer end of the chamber 59, and the bearing 13 for the sleeve 37, and also the slide bearings 30—31, Fig. 5, for the gear stems 27 and 29, are formed in the cap member.

A cap extension 60 extends radially of the axis of the feed screw beyond that portion of the cap member 28 which contains the chamber 59, to inclose the upper left hand end portion of the casing proper which confines the motor, and this extension has formed within it a bearing 61 for the left hand end of the crank shaft 5.

In the formation of the cap member 28 and its components as just described, I do not of course confine myself to the exact detail of the shapes or contours described but have found them in practice to be advantageous features of construction.

The operation is as follows:—The object being, as in all drills of this class, to advance and retract the drill-carrying member or drill-spindle against the resistance of the "old man" or other abutment, the advance and retraction are accomplished by the rotation in one or the other direction of the feed screw. The rotation of the drill-spindle through the motor geared to it by the

pinion 6 and the spur wheel 7 on said drill spindle will, of course, be understood.

By reason of the internal threaded engagement between the feed screw and the drill-spindle, it is obvious that the rotation of the feed screw will occasion the advance or retraction of the drill-spindle and drill.

It being, as in the case of the construction of the drill of my Patent No. 1,202,030, already referred to, my present intention to control the rotation of the feed screw in one or the other direction by connected and manually operated gearing, it will be apparent that because of the constant engagement of the feed gear 25 with both of the idle gears 26 and 41, one or the other of said idle gears,—and whichever one it is that for the time being is engaged with either the driving gear 32 or 42,—will occasion the rotation of the driven gear 36 upon the sleeve 37, which as explained is in feathered engagement with the feed screw and is therefore capable of turning said feed screw in either direction according to the direction of its own rotation.

From the foregoing association of gears, it will be obvious that through pressure upon either the push-button 35 or the push-button 55, one or the other of the driving gears 32 or 42 will be locked with its idle gear 26 or 41, and the rotation of either the drill spindle 8 or the feed screw 9—10 will, in consequence, be accomplished through the connection between the aforesaid driving gears and idle gears with the driven gear 36 feathered through its sleeve 37 to the feed screw, and also with the feed gear 25 on the drill-spindle.

The revolutions of the drill-spindle are therefore the same as those of the feed screw and drill and reduction in their relative speeds is effected by the difference in the number of teeth in the gear 36 and those of either 32 or 42. When the reduction is made either through the gear 36 and either 32 or 42 or through the gear 25 and either 26 or 41, the feed screw is right-handed, with the result that either the gear 36 or the gear 25 will have one or several more teeth respectively than those of the gears 32 and 42 or 26 and 41,—the relative numerical difference being calculated for the required speed of revolution.

Assuming, upon the other hand, the feed screw to be left-handed, then the gears 32 and 26 and 42 and 41, will have a greater number of teeth than the gears 36 or 25.

Obviously, also the feed per revolution will vary according to the number of threads per inch upon the feed screw, relatively and correspondently, of course, to the number of the internal threads of the drill-spindle.

The operation of returning the drill to its original position after the hole has been bored, is accomplished through the manual

operation of one or the other of the gear stems 27 or 29, occasioning the locking of the driving gears and idle gears with which said gear stems respectively operate.

In case of a right-handed-screw the return is accomplished through the instrumentality of the feather 56 and featherway 57 acting in the manner already fully explained, whereas in the case of a left-handed screw its return to its original position can be accomplished by the power of the drill itself, a release of the clutched gears therefore in action being first accomplished and the thumb sleeve 37 being manually held against rotation.

In practice I prefer to employ a left-handed screw which can be returned by the power of the instrument.

It will be obvious that by employing gears with relatively different numbers of teeth and by calculating the numbers of threads per inch of the feed screw, any desired revolution of the drill may be obtained.

As already explained, the drill spindle may be rotated by any suitable medium, as my invention in its broad aspects is applicable to either a rotary piston drill or a reciprocating piston drill, or the rotation of the gear spindle may be effected by electricity or any other source of power.

It will now be apparent that I have devised a novel and useful construction of automatic drill which embodies the features of advantage enumerated as desirable in the statement of the invention and the above description, and that while I have, in the present instance, shown and described a preferred embodiment which has been found in practice to give satisfactory and reliable results, it is to be understood that such embodiment is susceptible of modification in various particulars without departing from the spirit or scope of the invention or sacrificing any of its advantages.

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

1. A drill comprising in combination,—a rotatable drill-carrying member,—a casing for supporting said drill-carrying-member,—means for rotating said drill-carrying-member, located within said casing upon a given side of said drill-carrying-member,—and manually-controlled supplemental gearing for operating upon said drill-carrying-member, located within said casing upon another side of said drill-carrying member.

2. An automatic drill comprising in combination:—a drill-carrying-member,—a feed screw, located axially within said drill-carrying-member,—a casing for supporting said drill-carrying-member and said feed screw,—means for rotating said drill-carrying-member, located within said casing upon a given side of said drill-carrying-member,—

ber,—and manually-controlled supplemental gearing for operating upon said feed screw, located within said casing upon another side of said drill-carrying-member and said feed screw.

3. An automatic drill comprising in combination:—a rotatable drill-carrying-member having at its inner end a feed gear,—a feed screw located axially within said drill-carrying-member and having a driven gear feathered to it and to said member,—a casing for supporting said drill-carrying-member and said feed-screw,—means for rotating said drill-carrying member located within said casing upon one side of said drill-carrying-member,—and manually-controlled gearing located within said casing upon another side of said drill-carrying member and said feed screw, which comprises balanced driving gears in engagement with the feathered driven gear on the feed screw, and idle gears in engagement with the feed gear on the drill-carrying-member, either one of which is adapted to be clutched to the driving gear with which it coacts.

4. An automatic drill comprising in combination:—a rotatable drill-carrying-member having at its inner end a feed gear rotatable with it,—a feed screw located axially within said drill-carrying-member and having a driven gear feathered to it and to said member,—a casing for supporting said drill-carrying-member and said feed screw,—motive mechanism for rotating said drill-carrying-member located within said casing upon one side of said member,—manually-controlled gearing located within said casing relatively oppositely to said motive mechanism, and comprising a pair of gear stems upon each of which is mounted a driving gear and an idle gear having respectively opposing clutching faces,—and means for connecting said gear stems so that when one is depressed the other will be elevated to effect the relative clutching and unclutching of each pair of gears upon each stem.

5. An automatic drill comprising in combination:—a rotatable drill carrying member having at its inner end a feed gear rotatable with it,—a feed screw located axially within said drill-carrying member and a driven gear feathered to it and to said member,—a casing for supporting said drill-carrying member and said feed-screw,—motive mechanism for rotating said drill-carrying member, located within said casing upon one side of said member,—manually-controlled gearing located within said casing relatively oppositely to said motive mechanism, and comprising a pair of gear stems upon each of which is mounted a driving gear and an idle gear having respectively opposing clutching faces,—means for connecting said gear stems so that when one

is depressed the other will be elevated to effect the relative clutching and unclutching of each pair of gears upon each stem,—and automatic means for retaining the gear stems in predetermined different positions.

6. An automatic drill of the character described, which comprises in combination:—a longitudinally-extending drill-carrying member,—a feed screw located axially within said drill-carrying member,—a casing encompassing said drill-carrying member and said feed screw in such manner that their common axis is approximately longitudinally central of said casing,—means for rotating said drill-carrying member, located within said casing to one side of but so as to partly encompass the drill-carrying member and the feed-screw,—and manually-controlled supplemental gearing for operating upon said feed-screw, oppositely disposed within the casing with relation to the means for rotating the drill-carrying member.

7. In an automatic drill of the character described, the combination of,—a drill-carrying member,—a feed screw within said member,—a motive mechanism to rotate said member,—a manually-controlled gearing for operating upon said feed screw,—and a casing encompassing both the motive mechanism and the manually-controlled gearing and of such form as to support the motive mechanism upon one side of the drill-carrying member and the gearing upon the other.

8. In an automatic drill of the character described, the combination of:—a drill-carrying member,—a feed screw within said member,—a motive mechanism to rotate the drill carrying-member,—a manually-controlled gearing for operating upon said feed-screw,—and a casing encompassing both the motive mechanism and the manually-controlled gearing and formed with a cap member which incloses the manually-actuated gearing.

9. In an automatic drill of the character described, the combination of,—a drill-carrying member,—a feed screw within said member,—a motive mechanism to rotate said drill-carrying member,—a manually-controlled gearing for operating upon said feed-screw,—and a casing encompassing both the motive mechanism and the manually-controlled gearing but upon opposite sides of the drill-carrying member, and formed with a cap member which incloses the manually-actuated gearing and embodies a bearing for the outer end of the drill-carrying member.

10. In an automatic drill of the character described,—a casing formed to contain upon one side of its longitudinal center a motive mechanism and upon the other side of said center a gearing,—in combination with a drill spindle extending longitudinally

through said casing,—a feed screw within said drill spindle,—a motive mechanism for said spindle,—and a gearing operative upon said feed screw.

- 5 11. In an automatic drill of the character described,—a casing formed to contain upon one side of its longitudinal center a motive mechanism and upon the other side of said center a gearing,—in combination with a
10 drill-spindle extending longitudinally through said casing,—a feed screw within said drill-spindle,—a motive mechanism for said spindle,—a gearing operative upon said feed screw,—and means for manually controlling said gearing.

- 15 12. In an automatic drill of the character described,—a casing formed to contain upon one side of its longitudinal center a motive mechanism and upon the other side of said
20 center a gearing,—in combination with a drill-spindle extending longitudinally through said casing,—a feed screw within said drill-spindle,—a motive mechanism for said spindle,—a gearing operative upon

said feed screw,—means for manually controlling said gearing,—and means for automatically locking said gearing-controlling means.

13. In an automatic drill of the character described,—a casing formed to contain upon
30 one side of its longitudinal center a motive mechanism and upon the other side of said center a gearing,—in combination with a drill-spindle extending longitudinally through said casing,—a feed screw within
35 said drill-spindle,—a motive mechanism for said spindle,—a gearing operative upon said feed screw,—means for manually controlling said gearing,—means for automatically locking said gearing-controlling
40 means,—and automatic means for retaining the gear stems of said gearing in predetermined different positions.

EDWARD H. CHAPMAN.

Witnesses:

E. HAYWARD FAIRBANKS,
C. D. McVAY.