J. A. L. PEALING.

PORTABLE DRILL.

APPLICATION FILED MAY 12, 1910.

983,083.

Patented Jan. 31, 1911.

3 SHEETS—SHEET 1

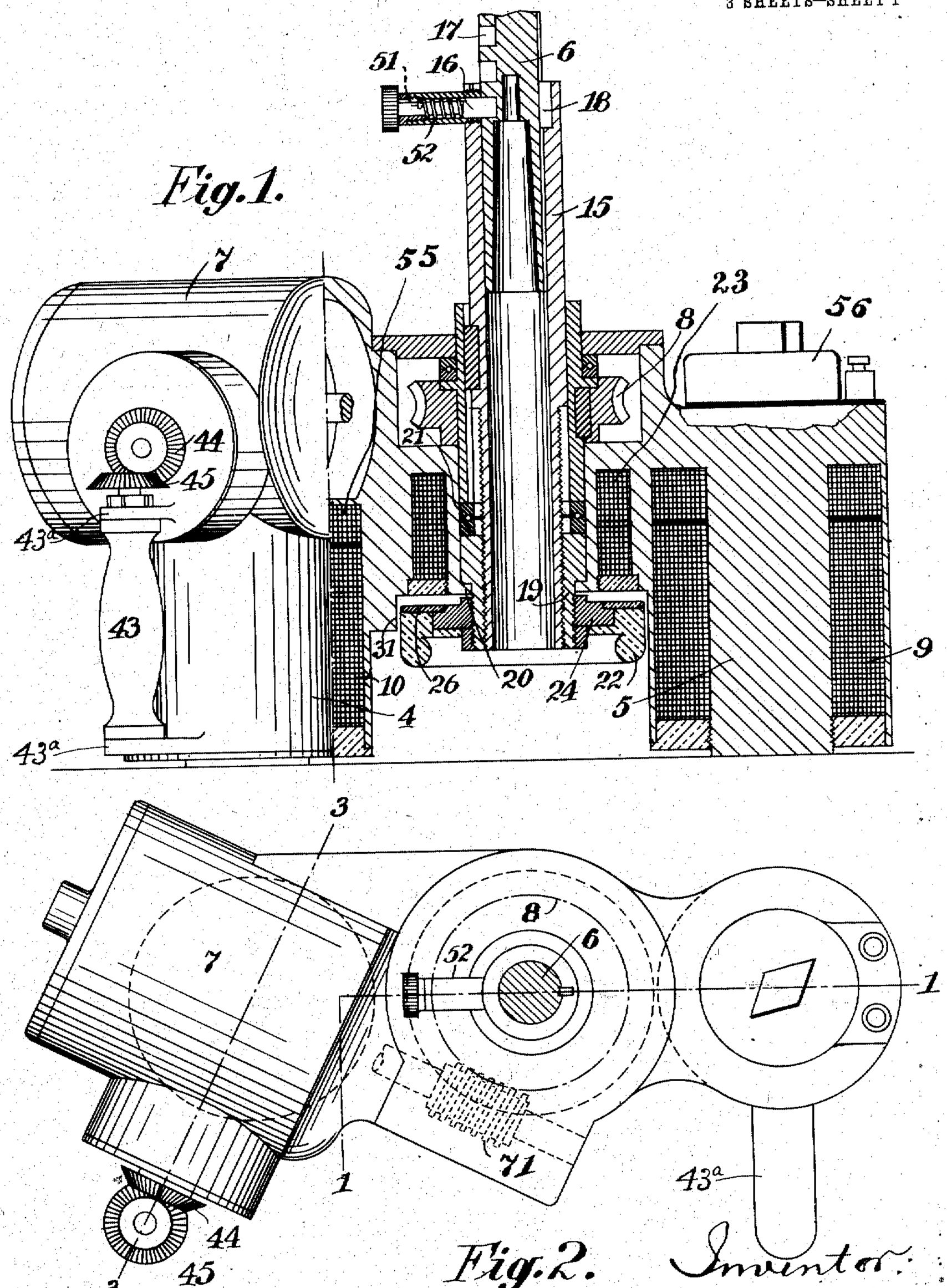

Fig. 1.

Fig. 2.

Witnesses:
James B. Mansfield
L. E. Witham.

Inventor:
John A. L. Pealing.
By his Attorneys
Alexander & Sawell

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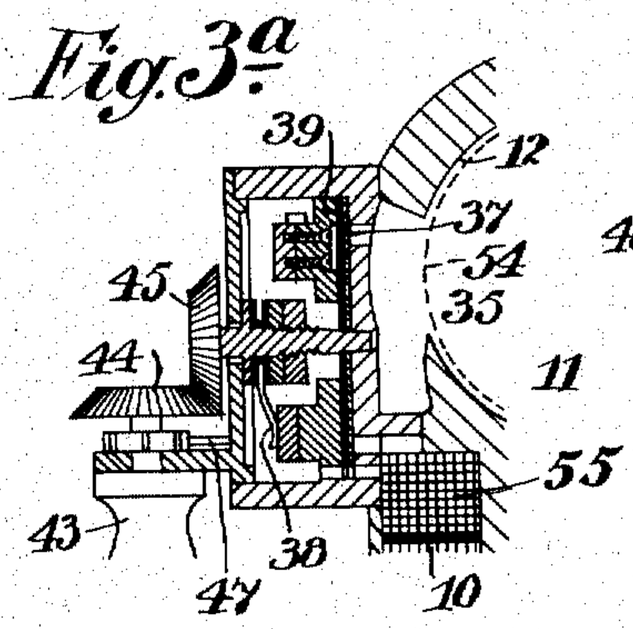
3 SHEETS—SHEET 2.

Fig. 3a



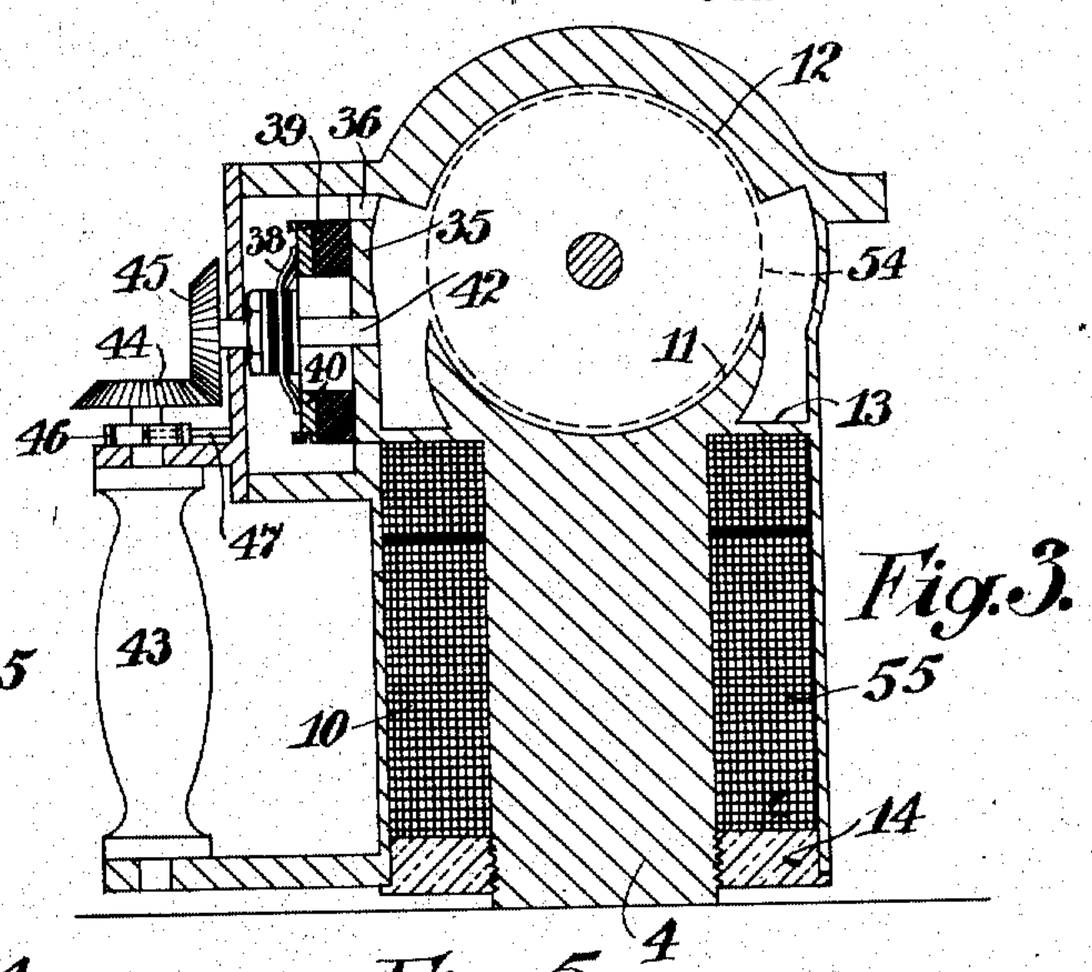


Fig. 3.

Fig. 4.

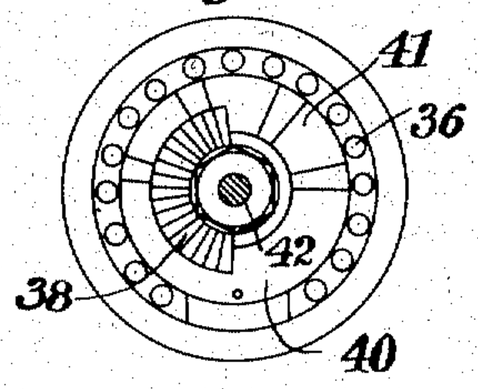


Fig. 5.

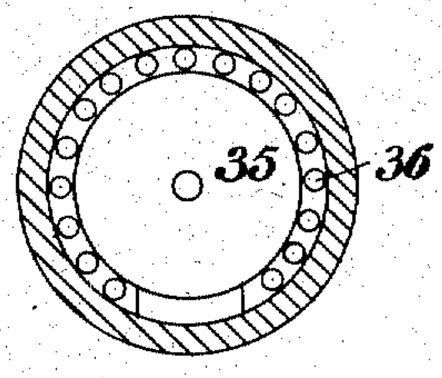


Fig. 6.

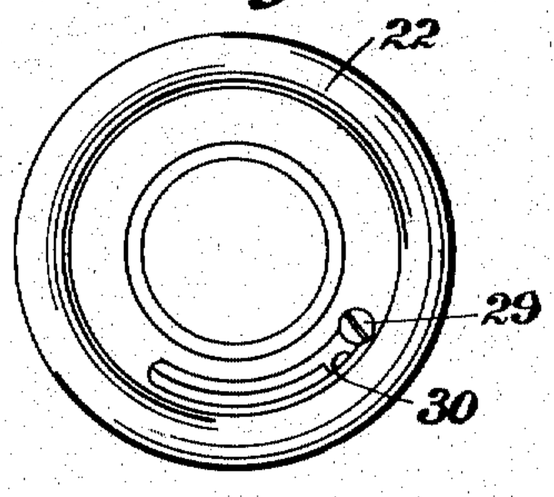


Fig. 7.

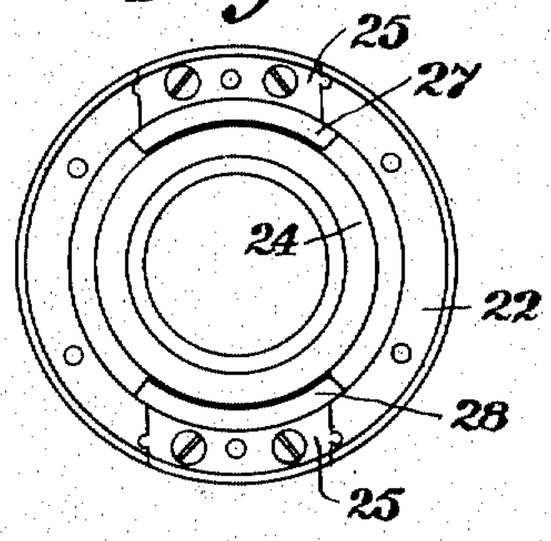
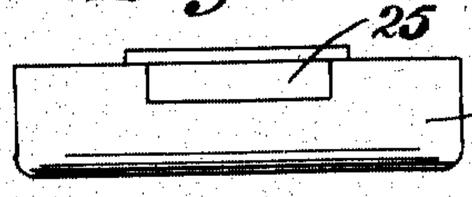


Fig. 8.



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3 SHEETS—SHEET 3.

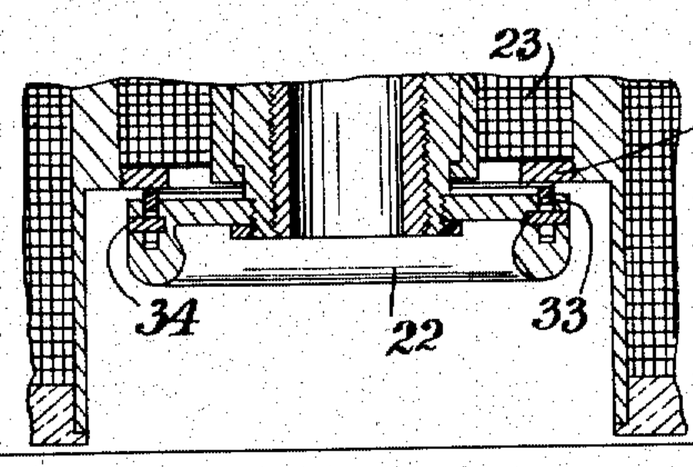

Fig. 9.

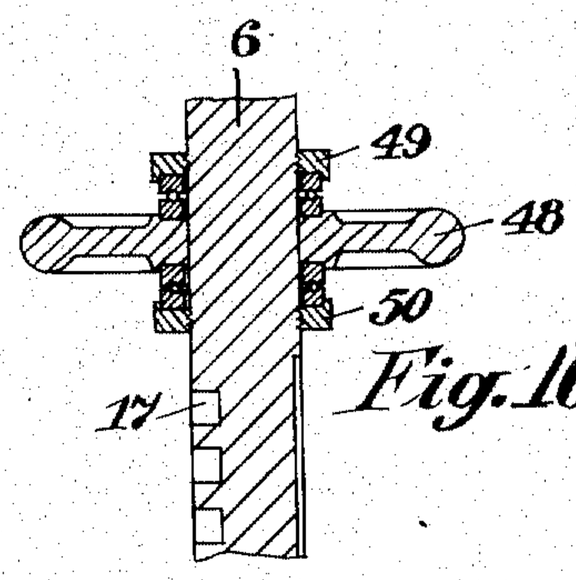

Fig. 10.

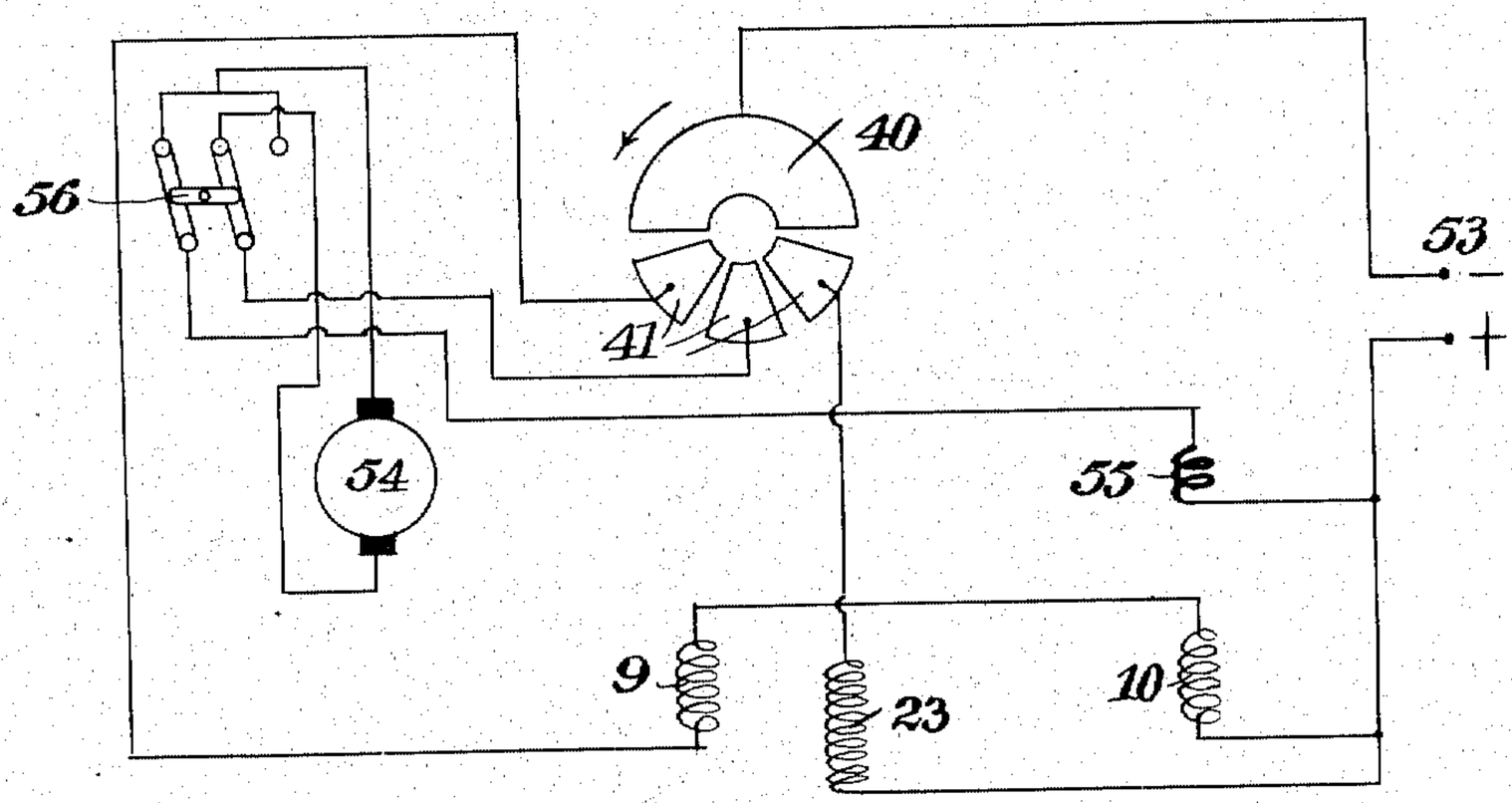

Fig. 11.

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UNITED STATES PATENT OFFICE.

JOHN ALFRED LAWRENCE PEALING, OF SEACOMBE, ENGLAND.

PORTABLE DRILL.

983,083. Specification of Letters Patent. Patented Jan. 31, 1911.

Application filed May 12, 1910. Serial No. 560,957.

To all whom it may concern:

Be it known that I, JOHN ALFRED LAWRENCE PEALING, a subject of the King of Great Britain, residing at Seacombe, in the county of Chester, in the Kingdom of England, have invented certain new and useful Improvements in Portable Drills, of which the following is a specification.

This invention relates to improvements in portable drills for use in drilling holes in metal, for instance, ships' plates, boilers and the like, of the kind having an electro-magnetic holding-on device and an electric driving motor, the magnetic fields of which are produced by the same set of coils so that the flux due to these coils traverses both the motor and the holding-on magnets.

The invention has for its object to provide an improved construction of such a drill which shall be simple to manufacture and shall form a strong structure and shall be simple to use and control.

The invention will be described with reference to the accompanying drawings.

In these drawings;—Figure 1, is an elevation of the complete drill partly in section on line 1—1, Fig. 2; Fig. 2, a plan view; Fig. 3, a vertical section on line 3—3, Fig. 2; Fig. 3ª, a corresponding view showing a modified form of the switch device shown in Fig. 3; Fig. 4, a view of the controlling switch with the cover plate removed; Fig. 5, a view of the base plate or pole piece on which the controlling switch is mounted; Fig. 6, a view from below of part of the drill feeding device; Fig. 7, a view from above of this part, a covering ring being removed; Fig. 8, a side view of this part; Fig. 9, a vertical section showing a modified form of feeding device; Fig. 10, a vertical section showing the method of mounting a hand wheel on the drill holder for use when tapping, and Fig. 11, a diagram of the electrical connections of the apparatus.

The improved drill comprises a pair of holding-on electromagnets 4 and 5, a drill holder 6 and feed device located between these magnets and an electric motor 7 for rotating the drill arranged at the outer end of the holding-on magnet 4 and driving the drill holder through worm gearing 7 and 8, the whole apparatus being so arranged that the same coils 9 and 10 serve for energizing the holding-on magnets and for providing the field of the motor 7, the outer end of the core of the holding-on magnet 4 forming one field pole 11 of the motor, (see Fig. 3), while the other pole 12 is connected to the holding-on magnet 5 through the parts which support the drill holder.

The core of the magnet 4 is separated, as completely as is structurally convenient from the surrounding magnetic parts of the apparatus. This may be effected by removing all magnetic connecting pieces between this core and the rest of the apparatus and supporting it in position by means of non-magnetic material, for instance, rings of brass inserted between it and the casing. Instead, however, of entirely separating this core, it is in some cases found preferable for constructional reasons to leave a thin connecting ring between the core and the casing as shown in Figs. 1 and 3. This part may then be so dimensioned that it very quickly becomes magnetically saturated. To effect this it may be either perforated with a number of holes or machined down to a sufficiently small thickness.

In the arrangement shown in the drawings the core of the electromagnet 4 is attached to the adjacent parts by a thin ring 13 which may be perforated at a number of points, and the core is supported from the casing at its other end by a ring 14 of brass or other non-magnetic material.

The drill holder 6 is adapted to slide axially in a sleeve 15 and to be fixed at various positions therein by a spring pin 16 engaging in holes 17 in the drill holder spindle, the sleeve 15 being also connected with the drill holder by means of a groove and feather 18 and being similarly engaged with the worm wheel 8 by means of which it is rotated. The sleeve 15 is provided at its lower end with an external screw thread which is engaged by an internally threaded collar 19 which is held between thrust bearings 20 and 21 so that it is free to rotate but is held against axial movement. On this collar 19 is mounted a hand wheel 22. It will be obvious that if while the drill is in operation this hand wheel 22 be either held stationary or retarded by means of a brake the sleeve 15 will be caused to move axially through the collar 19 and so feed forward the tool. The retarding of the wheel 22 is effected by means of a brake or equivalent device. In the preferred form of construction a magnetically operated retarding device is used. For this purpose a winding 23 is arranged around the part in which the

drill-feeding sleeve 15 works. This winding 23 provides the flux by means of which the brake is operated. In the form of brake shown in Figs. 1, 6, 7 and 8 of the drawings the hand wheel 22 is formed with a center part 24 of magnetic material and the greater part of its rim of non-magnetic material.

An annular cover plate 26 of non-magnetic material is placed over the rim of the wheel as shown in Fig. 1.

The center part 24 is in direct connection with the collar 19 and so forms part of the path for the flux due to the coil 23. Two pieces 25 (see Figs. 7 and 8) of magnetic material are arranged so as to extend radially through apertures in the rim and are attached to the rim. The above mentioned parts are shown in Figs. 1, 6, 7 and 8, Fig. 6 showing the under side of the hand wheel, Fig. 7 the upper side with the non-magnetic cover plate 26 (Fig. 1) removed, and Fig. 8 a side view of the wheel. From Fig. 7 it will be seen that the magnetic central part 24 has two recesses in its periphery at 27 and 28. The rim carrying the pieces 25 may be angularly adjusted relative to the center part so as to vary the reluctance of the magnetic path to the projections 25 (which act as pole pieces) by bringing these pieces to lie to a greater or less extent in front of the recesses 27 and 28, in the periphery of the part 24. In the position shown the path has the greatest reluctance to which it can be adjusted, since the recesses are entirely in front of the parts 24. The adjustment may be fixed by means of a screw 29 working in a slot 30 in the under part of the hand wheel (see Fig. 6). It will be obvious that I may if desired use any equivalent fastening device.

The casing which lies outside the coils 23 and forms part of the frame of the apparatus is of iron and may be at one or both sides, as shown at 31 on the left hand side in Fig. 1, made considerably thicker than at the other parts so that the greater part of the return flux is concentrated at said thickened part or parts. Accordingly as the projections or pole pieces 25 on the hand wheel pass these parts they experience a pull tending to prevent their forward movement. It will thus be seen that as the sleeve 15 is rotated the wheel 22 is at frequent intervals retarded so as to cause relative movement between the threaded sleeve 15 and the collar 19 and give the necessary feed to the tool. It will further be seen that the adjustment of the reluctance of the magnetic path to the pole pieces 25 will vary the strength of the pulls exerted on the hand wheel 22 and accordingly the rate of feed of the tool.

An alternative method of producing the feeding forward of the drill (see Fig. 9) is by forming the hand wheel 22 entirely of magnetic material and arranging between this wheel and an end flange 32 of the casing of the winding 23 a ring 33 of magnetic material which is mounted in a groove in the wheel so that there may be relative axial movement between it and the parts between which it lies and relative rotary movement between it and the flange 8 while it is caused to rotate with the wheel by means of pins 34 which engage slots or recesses in the ring 33, so that it may be drawn into engagement with flange 32 and serve as a continuous friction brake to retard the movement of the wheel.

The winding 23 by means of which the feed is actuated, the coils 9 and 10 of the holding-on magnets and the armature of the motor are controlled by a contact member which works in a magnetic field forming part of that of the motor. This switch is a rotary device (see Figs. 3, 3ª, 4 and 5) and accordingly a circular pole piece 35 is provided to give the blow-out flux therefor. This pole piece is connected to the pole 11 of the motor and is formed as part of the casing of the motor being in the form shown in Figs. 3, 4 and 5, separated from the surrounding parts by drilling a number of holes 36 so as to leave a comparatively small amount of magnetic material which quickly becomes saturated. The same result is obtained in the form illustrated in Fig. 3ª, by cutting away the iron around the pole piece 35 and mounting this latter on a plate 37 of brass or other non-magnetic material. The other pole for the blow out flux is formed by the casing of the switch which is connected to the other pole 12 of the motor field. The switch blade is in the form of a semi-circular piece of metal 38 slit radially at intervals so as to be capable of bearing evenly on the various contacts mounted on the insulating bed 39. These contacts comprise a main contact 40 connected with the supply and occupying a large part of the circle so that the switch member 38 is always in contact therewith. The other contacts 41 are in the form of radial strips insulated from each other and arranged so as to occupy the remainder of the circle (see Fig. 4). The operating member 42 of the switch extends through the casing and is adapted to be rotated so as to make the successive changes of connection. This rotation is effected by turning one of the two handles 43 by which the drill may be held. These handles are carried between parts 43ª projecting from the casings of the two holding-on magnets 4 and 5, so that by forming one of the handles rotatable and prolonging its spindle beyond the outer bracket a bevel wheel 44 may be mounted thereon so as to engage with a corresponding wheel 45 on the switch spindle 42. A notched ring 46 may be provided on

the handle spindle (or the switch spindle) adapted to act in conjunction with a spring detent 47, the notches being arranged to correspond with the different positions of the switch.

To enable the drill to be used for tapping holes the ordinary feed may be arranged so as to be thrown out of action and a hand wheel 48 (see Fig. 10) provided on the outer end of the drill holder spindle 6, this wheel being loose on the spindle but mounted between collars 49 and 50 so that pressure may be applied by the operator by this hand wheel to bring the tap into engagement with the hole. The ordinary feed is rendered inoperative by taking out of action the pin 16 which limits the axial movement of the drill holding spindle 6 in its sleeve 15. In order to effect this the pin may be provided with a projection 51 (see Fig. 1) which engages in a bayonet slot in its support 52 so that on withdrawing the pin and turning it slightly it will be held out of action. The winding 23 is preferably disconnected from the source of current at the same time.

The electrical connections of the apparatus and the manner in which they are controlled by the switch are shown in Fig. 11. One of the terminals 53 for the supply is connected as previously mentioned to the main contact 40. To complete the circuit through the various parts of the apparatus the switch member 38 is turned in the direction of the arrow shown in Fig. 11 so as to connect in succession the contacts 41 with the contact 40. The first of these contacts 41 is connected with the coils 9 and 10 of the holding-on magnets so that the flux through these magnets and through the motor field is established first. Then by means of a second contact 41 the armature 54 of the motor is put in circuit and the motor started. The third of the contacts 41 completes the circuit through the winding 23 which actuates the feed device. It will be seen that by this arrangement of contacts the motor may be caused to operate without the winding 23 being energized this being desirable in some cases as above indicated. In addition to the shunt coils 9 and 10 of the holding-on magnets a series coil 55 is arranged on one of the holding-on magnets. The effect of this is to strengthen the field as the resistance opposed to the tool increases. A reversing switch 56 is also preferably provided so that the direction of rotation of the motor may be changed.

Although the apparatus has been above described in considerable detail it will be understood that such description is given for purposes of illustration rather than with a view to limiting the invention to the specific arrangement given.

It will be obvious that considerable alterations may be made within the scope of the appended claims without departing from the invention.

I declare that what I claim is:—

1. A portable electric drill comprising a pair of holding-on electro-magnets, a yoke connecting said magnets, a motor, the field of which is energized by the holding-on magnets, a sliding sleeve mounted in said yoke, means for rotating said sleeve from said motor, a tool holder mounted in said sleeve and driven thereby, a screw-threaded collar on said sleeve held against axial motion and normally rotating with said sleeve, and means for producing relative rotary motion between said sleeve and said collar by retarding the movement of said collar and effecting the forward feed of the tool thereby.

2. A portable electric drill comprising a pair of holding-on electro-magnets, a yoke connecting said magnets, a motor, the field of which is energized by the holding-on magnets, a sliding sleeve mounted in said yoke, means for rotating said sleeve from said motor, a tool holder mounted in said sleeve, a screw threaded collar on said sleeve held against axial motion, and electro-magnetic means for producing relative motion between said sleeve and said collar and effecting the forward feed of the tool thereby.

3. A portable electric drill comprising a pair of holding-on electro-magnets, a yoke connecting said magnets, a motor, the field of which is energized by the holding-on magnets, a sliding sleeve mounted in said yoke, means for rotating said sleeve from said motor, a tool holder mounted in said sleeve, a screw threaded collar on said sleeve held against axial motion, and electro-magnetic means for producing relative motion between said sleeve and said collar and effecting the forward feed of the tool thereby, said means comprising a winding located around said sleeve, a wheel on said sleeve, parts on said wheel forming portions of the magnetic circuit for the flux due to said coil.

4. A portable electric drill comprising a pair of holding-on electro-magnets, a yoke connecting said magnets, a motor, the field of which is energized by the holding-on magnets, a sliding sleeve mounted in said yoke, means for rotating said sleeve from said motor, a tool holder mounted in said sleeve, a screw threaded collar on said sleeve held against axial motion and electromagnetic means for producing relative motion between said sleeve and said collar and effecting the forward feed of the tool thereby, said means comprising a winding located around said sleeve, a wheel on said sleeve, parts on said wheel forming portions of the magnetic circuit for the flux due to said coil, and means for varying the magnetic re-

luctance of this part of the magnetic circuit so as to vary the rate of feed.

5. A portable electric drill comprising a pair of holding-on electro-magnets, a yoke connecting said magnets, a motor, the field of which is energized by the holding-on magnets, a sliding sleeve mounted in said yoke, means for rotating said sleeve from said motor, a tool holder mounted in said sleeve and driven thereby, a screw threaded collar on said sleeve held against axial motion, a winding located around said sleeve, a casing of magnetic material around said coil, a wheel on said sleeve, projecting pole pieces on said wheel and a thickened part on the casing of the winding adjacent the path of said pole pieces, whereby a retarding pull is exerted on the pole pieces as they pass this thickened part.

6. A portable electric drill comprising a pair of holding-on electro-magnets, a yoke connecting said magnets, a motor, the field of which is energized by the holding-on magnets, a sliding sleeve mounted in said yoke, means for rotating said sleeve from said motor, a tool holder mounted in said sleeve and driven thereby, a screw-threaded collar on said sleeve held against axial motion, electro-magnetic means for producing relative rotary motion between said sleeve and said collar and effecting the forward feed of the tool thereby, means for putting said last mentioned means out of action and a member mounted on the tool holder so as to be free as regards rotary movement and adapted to be engaged by hand for the purpose of applying pressure to the tool when the apparatus is used for tapping.

7. A portable electric drill comprising a pair of holding-on electro-magnets, a yoke connecting said magnets, a motor, the field of which is energized by the coils of the holding-on magnets, a tool holder mounted in the yoke, means for driving said tool holder from said motor, means for feeding forward said tool holder, a coil controlling said last mentioned means, a rotary switch controlling the electrical connections of the coils and the motor, a circular pole piece attached to one part of the motor field structure and disposed adjacent to the switch, a casing of magnetic material surrounding the switch and attached to the other part of the motor field structure whereby a blow out flux is caused to pass through the interior of the switch casing.

8. A portable electric drill comprising a pair of holding-on magnets, a yoke connecting said magnets, a motor, the field of which is energized by the coils of the holding-on magnets, a tool holder mounted in the yoke, means for driving said tool holder from said motor, means for feeding forward said tool holder, a coil controlling said last mentioned means, a rotary switch controlling the electrical connections of the coils and the motor, a circular pole piece attached to one part of the motor field structure and forming the base on which the switch is mounted, a casing of magnetic material surrounding the switch and attached to the other part of the motor field structure, a ring of poorly magnetically conducting material between the pole pieces and the casing whereby a blow-out flux is caused to pass through the interior of the switch casing.

9. A portable electric drill comprising a pair of holding-on electro-magnets, a yoke connecting said magnets, a motor, the field of which is energized by the coils of the holding-on magnets, a tool holder mounted in the yoke, means for driving said tool holder from said motor, means for feeding forward said tool holder, a coil controlling said last-mentioned means, a rotary switch controlling the electrical connections of the coils and the motor, a circular pole piece attached to one part of the motor field structure and disposed adjacent to the switch, a casing of magnetic material surrounding the switch and attached to the other part of the motor field structure whereby a blow-out flux is caused to pass through the interior of the switch casing, handles for supporting and steadying the drill and means for operating the rotary switch from one of said handles.

10. A portable electric drill comprising a pair of holding-on magnets, a yoke connecting said magnets, a motor arranged on the top of one of said magnets the field of said motor being energized by the coils of said magnets, a rotary switch mounted at the side of said motor, a handle attached to the side of said magnet and gearing connecting said handle and said switch.

In witness whereof I have hereunto signed my name this 4 day of May 1910, in the presence of two subscribing witnesses.

J. A. LAWRENCE PEALING.

Witnesses:
RICHD. L. CLEAVER,
R. W. WILLIAMS.