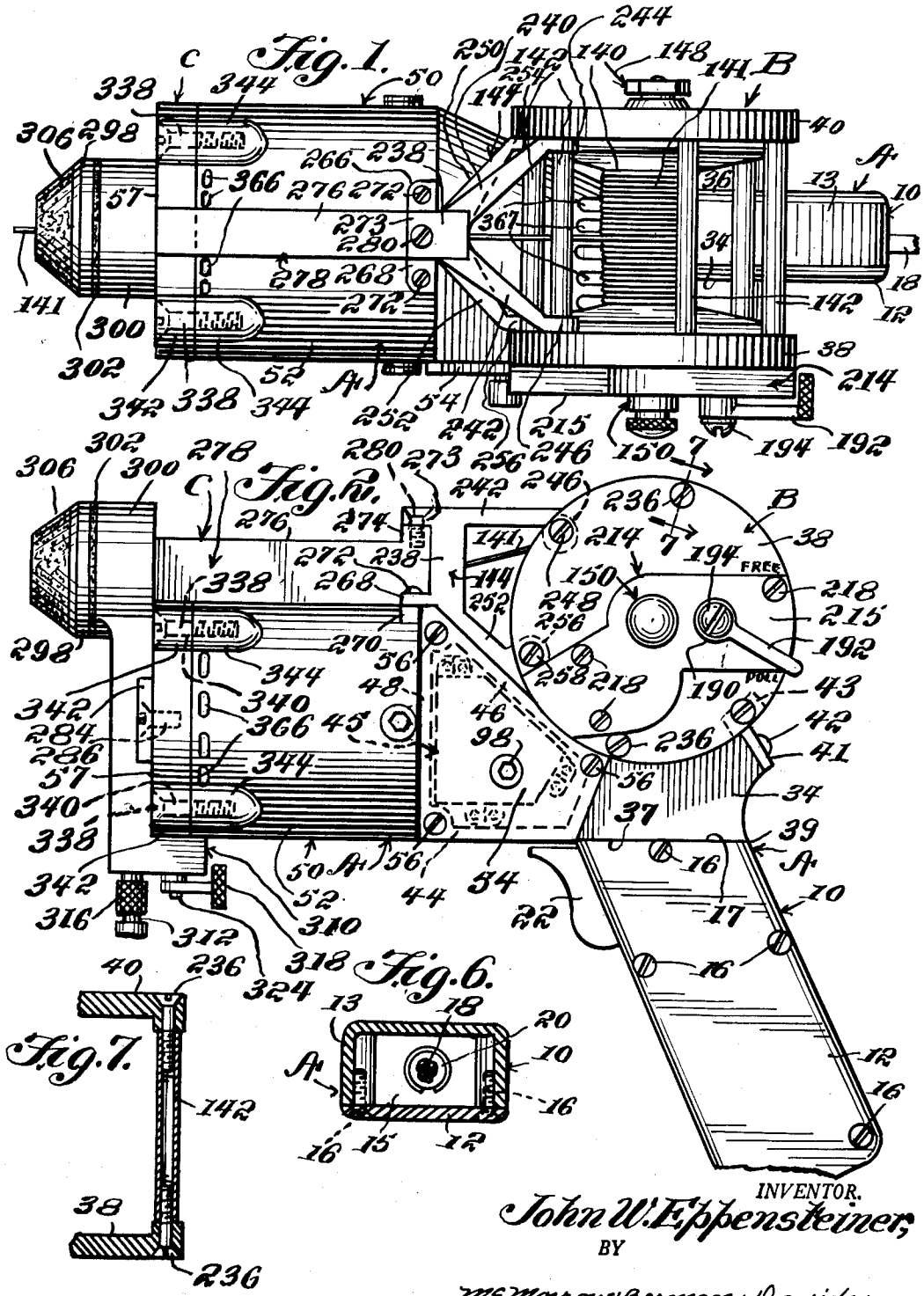
Jan. 3, 1956 J. W. EPPENSTEINER 2,729,424

PORTABLE HAND TOOL

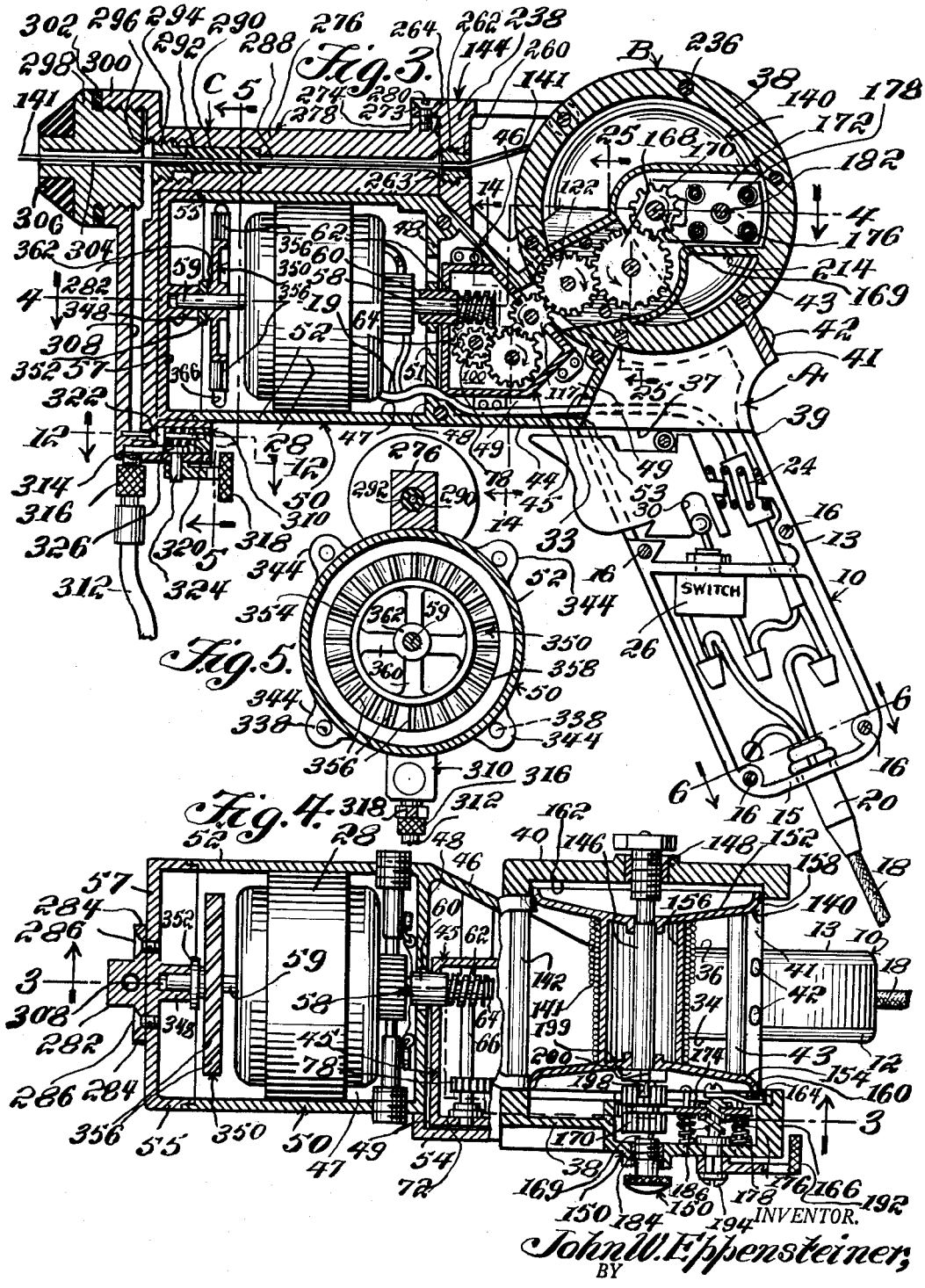
Filed April 2, 1954 5 Sheets-Sheet 1



Jan. 3, 1956 J. W. EPPENSTEINER 2,729,424

PORTABLE HAND TOOL

Filed April 2, 1954 5 Sheets-Sheet 2

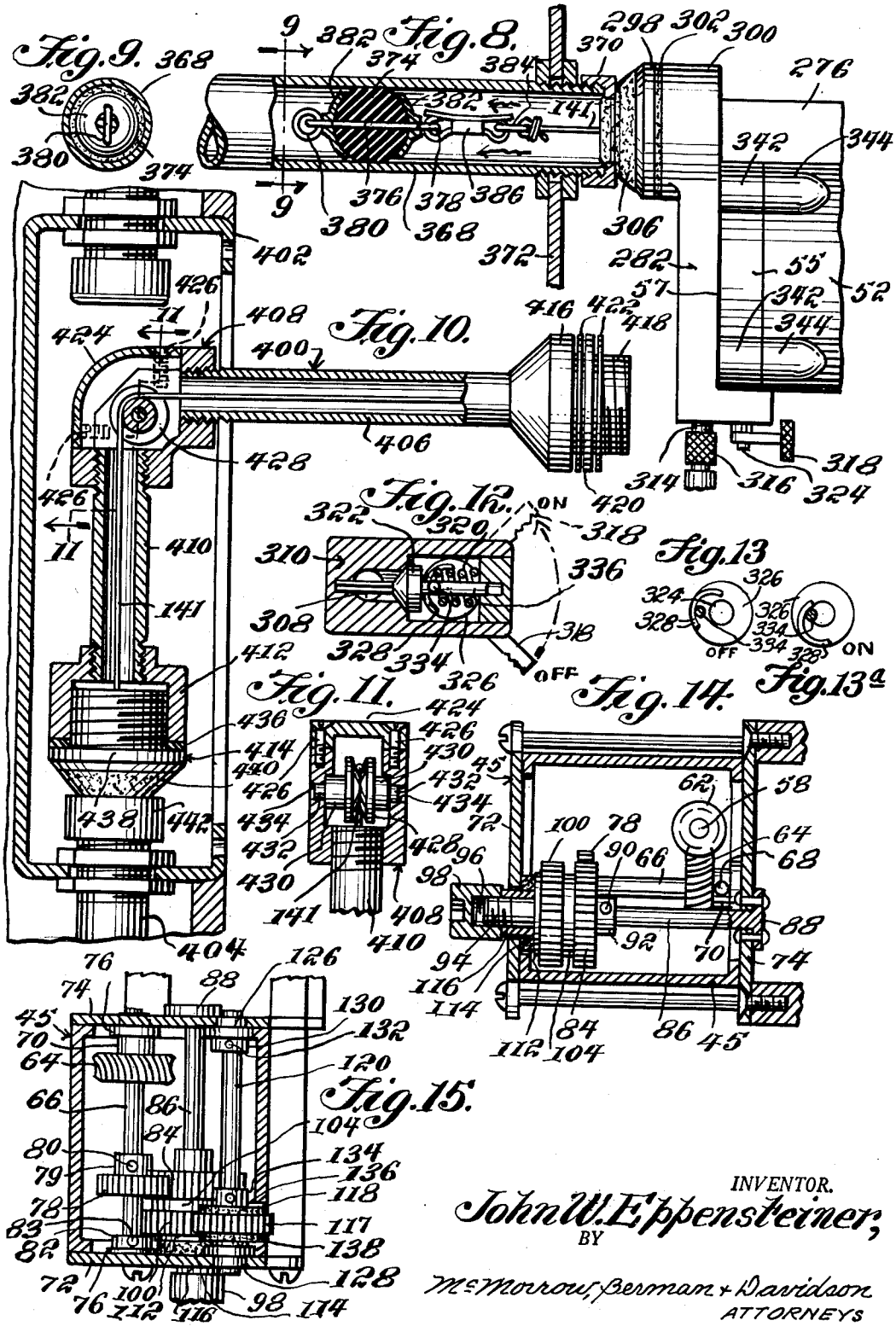


INVENTOR.
John W. Eppensteiner;
BY
McMorrow, Berman & Davidson
ATTORNEYS

Jan. 3, 1956 J. W. EPPENSTEINER 2,729,424

PORTABLE HAND TOOL

Filed April 2, 1954 5 Sheets-Sheet 3

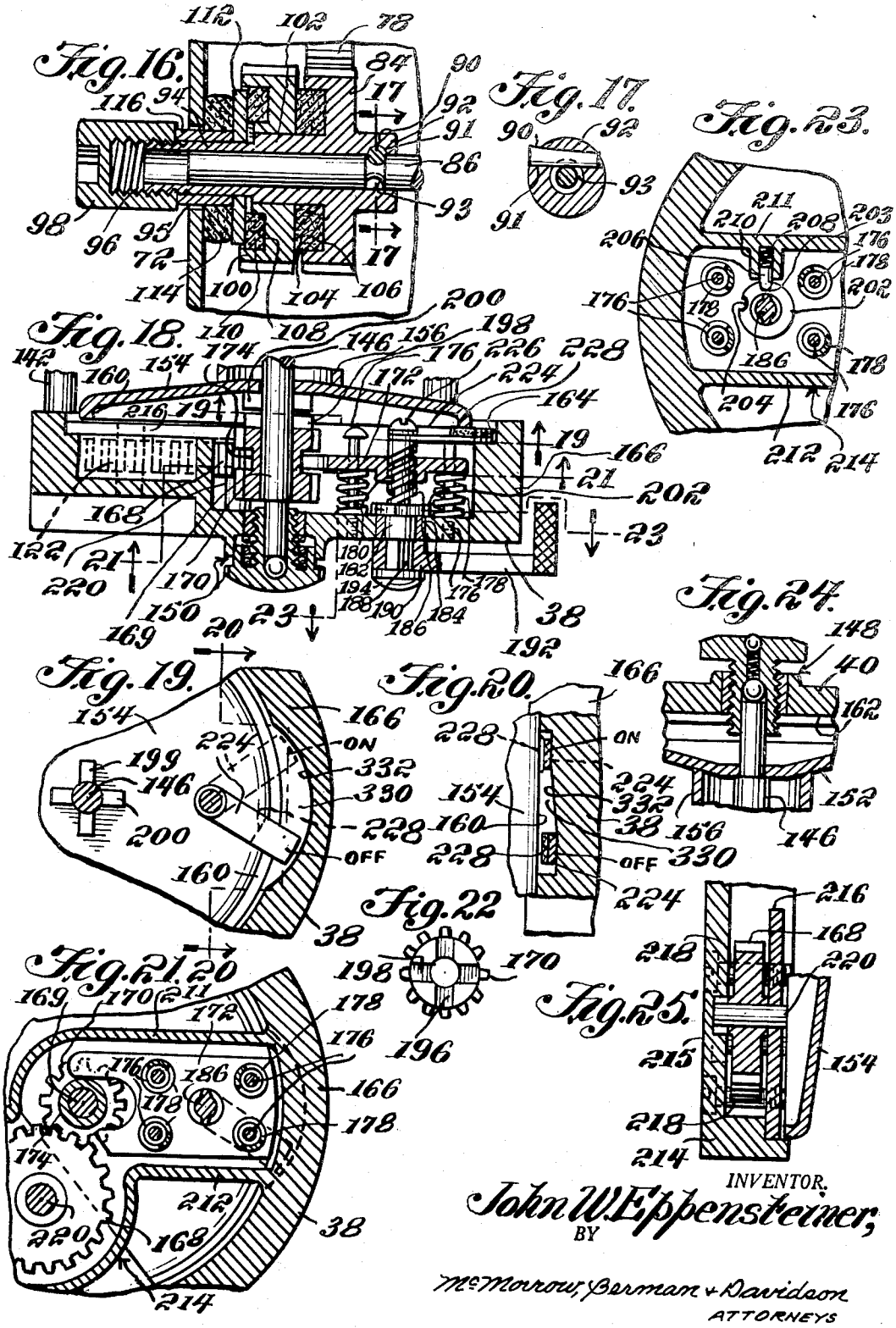


INVENTOR.
John W. Eppensteiner,
BY
McMorrow, Berman & Davidson
ATTORNEYS

Jan. 3, 1956 J. W. EPPENSTEINER 2,729,424

PORTABLE HAND TOOL

Filed April 2, 1954 5 Sheets-Sheet 4



Jan. 3, 1956 J. W. EPPENSTEINER 2,729,424

PORTABLE HAND TOOL

Filed April 2, 1954 5 Sheets-Sheet 5

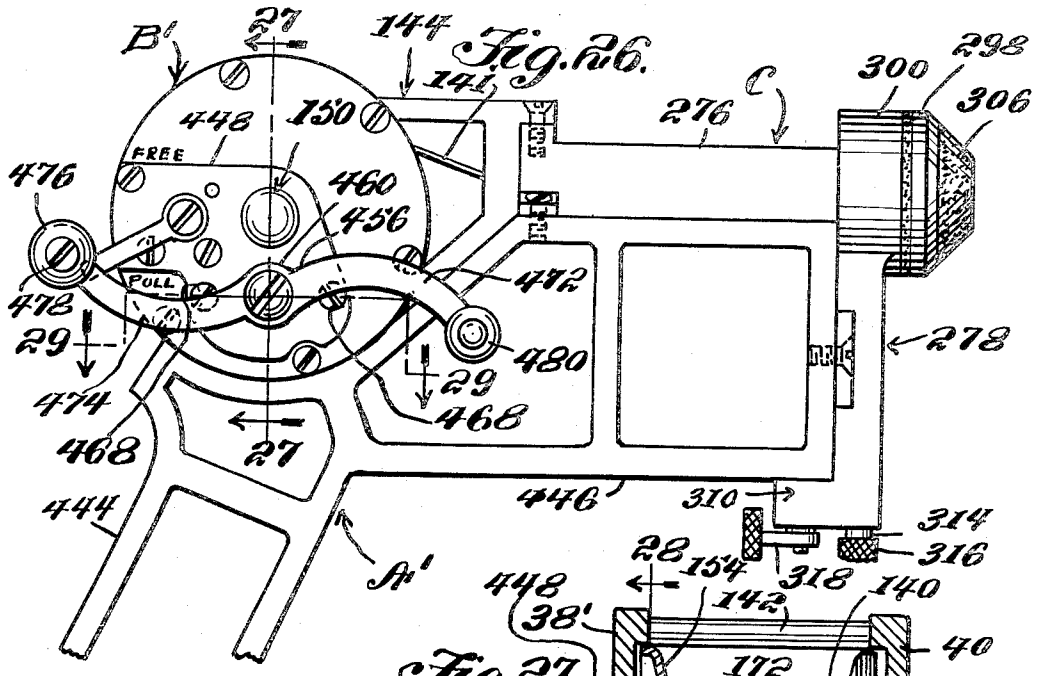


Fig. 26.

Fig. 27.

Fig. 28.

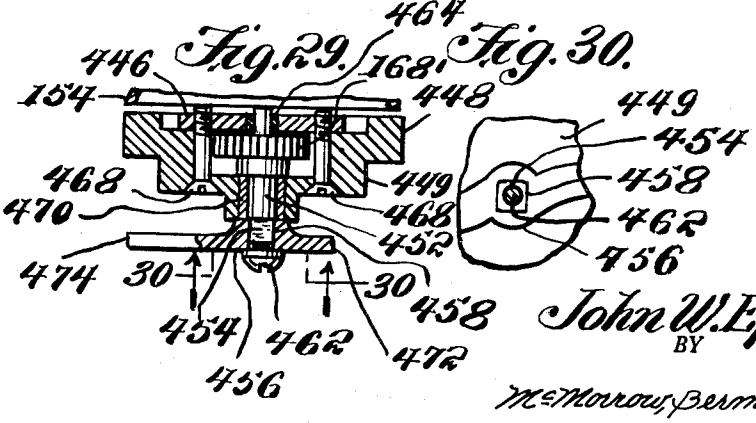


Fig. 29. Fig. 30.

INVENTOR.
John W. Eppensteiner;
BY
McMorrow, Berman & Davidson
ATTORNEYS

United States Patent Office 2,729,424 Patented Jan. 3, 1956

2,729,424

PORTABLE HAND TOOL

John W. Eppensteiner, Woodbridge, N. J.

Application April 2, 1954, Serial No. 420,580

2 Claims. (Cl. 254—134.3)

This invention relates to portable hand tools and more particularly to a hand tool for laying an electrical conductor in a conduit.

It has long been the practice to lay electrical conductors in conduits or pipes by means of a rod made in sections which were screwed together, one length of the rod being forced into the entrance end of the conduit and insertion of the rod continued by adding the required number of sections jointed to the preceding section, or by means of fish snake wires made of hardened spring steel inserted in the outlet end of the conduit and forced therethrough to the other end of the conduit. Both of these methods are not only slow and tedious, as well as being very laborious, but accident records show that a great number of injuries to the operators result from the use of the fish snake wires.

Various attempts have been made to solve this problem of laying an electrical conductor in a conduit, and aside from the jointed rods and snakes, which are still in use, there have been proposed various apparatus employing a projectile to which one end of a pilot wire is secured and paid out into the conduit as the projectile travels through the conduit, and various projecting means have been employed including air and hydraulic pressure. However, in all known instances where such apparatuses were proposed, the apparatus itself was large and bulky, relatively non-portable or would be so constructed as to be of exceedingly limited use, that is, its employment could only be effective in a limited number of given structural conditions. The principal disadvantages of the prior devices, besides those already mentioned, are that the guide wire was subject to breakage, that a conduit in which a number of angular bends were present could not be readily traversed by the device, and the device was incapable of universal application to electrical conductor containing conduits.

It is therefore an object of this invention to provide in a single, compact hand tool, the means whereby a guide wire may be projected through a conduit to the other end thereof, an electrical cable or wire then connected to the end of the guide wire now extending through the conduit and pulling the connected electrical cable or wire back through the conduit.

It is a further object of this invention to provide a portable hand tool which will quickly and efficiently complete the electrical conductor laying operation with a minimum of effort on the part of the operator, provide safer operation and eliminate the slow and laborious steps required with the use of previous devices used for this purpose.

Another and still further object of this invention is to provide a portable hand tool with which an angular adapter may be used to reach relatively inaccessible conduit outlet ends, such as the outlet end of a conduit of a typical wall outlet box.

Another and still further object of this invention is to fill a recognized need for a portable hand tool by which a cable or wire for conducting electricity may be laid in a conduit and in which the danger of breakage of the guide wire is minimized despite the number of angular bends in the conduit or despite the fact that the conduit sections may be out of alignment due to settling.

Other objects and advantages will become apparent from the following detailed description, forming the specification, and taken in conjunction with the accompanying drawings, in which:

Figure 1 is a top plan view of a motor powered hand tool embodying this invention;

Figure 2 is a side elevational view of the left side thereof as viewed from the rear of Figure 1;

Figure 3 is a vertical cross-sectional view taken on line 3—3 of Figure 4;

Figure 4 is a horizontal cross-sectional view taken on line 4—4 of Figure 3;

Figure 5 is a cross-sectional view taken on line 5—5 of Figure 3;

Figure 6 is a cross-sectional view of the handle or grip taken on line 6—6 of Figure 3;

Figure 7 is a sectional view of a portion of the reel taken on line 7—7 of Figure 2;

Figure 8 is a side elevational view showing the front or head portion of the tool as applied to a conduit, the conduit being partially broken away to show the structure of the free end of the guide wire and the movable piece and its manner of connection to the free end of the guide wire;

Figure 9 is a cross-sectional view taken on line 9—9 of Figure 8;

Figure 10 is a vertical cross-sectional view, partially in side elevation, showing the angle head adapter and its manner of application to a conduit which has its outlet end opening into a conduit box;

Figure 11 is a sectional view taken on line 11—11 of Figure 10;

Figure 12 is a sectional view showing the air inlet and switch therefor taken on line 12—12 of Figure 3;

Figure 13 is an elevational view showing the cams of the operating lever for the air inlet of Figure 12 in one position;

Figure 13*a* is an elevational view similar to Figure 13 but showing the cams in a different position;

Figure 14 is a sectional view of the gear box, taken on line 14—14 of Figure 3;

Figure 15 is a sectional view similar to Figure 14 but taken substantially from the rear thereof and rotated 90° from the position of the respective elements in Figure 14;

Figure 16 is a partial sectional view, on an enlarged scale, showing a portion of the gear box and particularly the clutch mechanism and the clutch tension adjusting screw;

Figure 17 is a sectional view taken on line 17—17 of Figure 16;

Figure 18 is a sectional view of a portion of the reel showing the clutch operating lever and the brake or drag means associated with the reel;

Figure 19 is a cross-sectional view taken on line 19—19 of Figure 18;

Figure 20 is a sectional view taken on line 20—20 of Figure 19;

Figure 21 is a sectional view taken on line 21—21 of Figure 18;

Figure 22 is an end elevational view of the laterally shiftable clutch gear on the reel drum extension shaft;

Figure 23 is a sectional view taken on line 23—23 of Figure 18;

Figure 24 is a sectional view of a bearing for the reel shaft;

Figure 25 is a sectional view taken on line 25—25 of Figure 3;

Figure 26 is a side elevational view of a modified form

of the tool in which the source of power for operation of the reel is provided manually;

Figure 27 is a sectional view taken on line 27—27 of Figure 26;

Figure 28 is a sectional view taken on line 28—28 of Figure 27;

Figure 29 is a sectional view taken on line 29—29 of Figure 26; and

Figure 30 is a partial end view of Figure 29 taken along the line 30—30 of Figure 29.

With continued reference to the drawings, the portable tool of this invention generally comprises the separable sections A, B and C which define the motor and handle section, reel section and air discharge or blowing section, respectively.

Considering first the handle and motor section A, defining the supporting frame for sections B and C, and specifically the structure of the handle, generally indicated at 10, the handle is of the pistol hand grip type normally found on quarter inch and half inch electric drills and is provided with a separable cover part 12 fastened to the U-shaped frame 13 by screws 16 to define a hollow housing within which is contained the usual electrical conductors leading from a power cable 18 having a reinforcing cover 20 adjacent the point of entrance of the cable into the handle 10. The cable 18 is adapted to be connected at its end remote from the tool to a source of electricity such as a convenience outlet. The handle grip 10 also has a spring biased trigger switch 22 which, when depressed against the bias of the spring 24, will cause operation of the toggle switch 26 whereby electrical current will be transmitted to the small electric motor 28 and may be maintained in the depressed operative position by engaging the notch 30 on the trigger 22 secured upon the annular projection 32 carried by the handle 10 and extending inwardly thereof. The pistol grip handle 10 employed with the portable hand tool of this invention, it will be seen, is a modified version of the typical pistol grip type handles redesigned so as to interfit with the sections B and C.

The remainder of the motor and handle casing includes a pair of oppositely disposed divergent sides 34 and 36 as extensions of the frame 13 and extending upwardly and outwardly from one end thereof remote from the end 15 which is provided with an opening to receive the cable 18. The top edge of each of the sides 34 and 36 is arcuately formed to match the radius of rims 38 and 40 of the reel section B which are secured to the frame 13 by the screws 42 passing through a central depending flange 41 on a reel cross bar 43 carried by the rims 38 and 40 and extending therebetween.

The sides 34 and 36 extend laterally from the handle 10 with their lower edges 37 coplanar with the line of separation 39 between the top edge 17 of the cover plate and the respective sides 34 and 36. The sides 34 and 36 are further provided with structural frame members 44 and 46 in spaced relation as extensions of the respective sides. The frame member 44 is shaped in the form of a right trapezium, the right angle of which is formed by a partition wall 48 extending transversely between the members 44 and 46, and the lower edge 37 of the respective members 44 and 46. The partition wall 48 separates the motor housing area 47 and the gear case area 49.

The remainder of the casing for the section A consists of a generally cylindrical housing 50 for the motor 28 and consists of a circular side wall 52 and a separately formed end wall or cap 57 remote from the partition wall 48 having an inwardly directed annular flange 55 which mates with the side wall 52, and which end wall or cap defines the other end wall of the motor housing 50. The frame 13, sides 34 and 36, frame members 44 and 46 and the motor housing 50 are cast or otherwise formed as a single piece and is preferably made of aluminum or some other light weight metal alloy.

A removable gear case cover 54 is secured on the frame member 44 by a plurality of screws 56 to provide access to the gears in the gear case defined by the casing member generally indicated at 45, of right trapezium form disposed within and transversely of the frame members 44, 46 and carried thereby to define a gear casing.

It should be observed that the partition wall 48 is provided with an opening 51 to permit the electrical cable 19 to pass therethrough after passing through a similar opening 53 provided in one leg 33 of a structural frame member 46 remote from the partition wall 48 to connect the motor 28 to the cable 18 with the toggle switch 26 interposed between the cable 18 and the motor 28 to effect selective operation of the motor.

The motor drive shaft 58 extends from opposite sides of the motor 28, thus the motor 28 is of the double-ended drive shaft type, and the shaft end projecting from the side of the motor adjacent to the partition wall 48 extends through a bronze bearing sleeve 60 protruding through the partition wall 48 and carried by the gear case 45 so that the drive shaft 58 extends within the gear case area 49 and carries on the end thereof within the gear case 45 a worm 62 to mesh with a worm gear 64 which is fastened upon a shaft 66 by a set screw 68 carried in a hub 70 of the worm gear 64. As clearly shown in Figures 14 and 15, the worm gear shaft 66 is journaled at its opposite ends in the gear case front cover 72 and the gear case back cover 74 respectively in similar brass bearings 76 carried by the respective front and back covers. The worm gear 64 is preferably made of brass.

An idler gear, preferably made of brass, is indicated by the reference numeral 78, and is provided with a hub 79 in which a set screw 80 is carried so that the idler gear 79 may be secured upon the worm gear shaft 66 in spaced relation to the worm gear 64 and will rotate with the shaft 66 as rotation is imparted to the worm gear 64 by the worm 62 on the end of the motor drive shaft 58. A collar 82 is carried by the shaft 66 adjacent the bearing 76 carried by the front cover 72 and is secured on the shaft 66 by a set screw 83 to limit end play of the shaft 66. (See Figs. 3, 14, 15 and 16.)

The idler gear 78 meshes with and is adapted to rotate the gear 84 which is secured on a shaft 86 which remains stationary as it is riveted to the rear cover 74 through its outer flange or hub 88. Shaft 86 is in spaced parallel relation to the worm wheel shaft 66 and is laterally offset therefrom.

Gear 84 is held in place on the shaft 86 by means of a small tapered pin 90 (Figure 17) which fits into a hole 91 in the hub 92 of the gear 84 and the shaft 86 has a slight concave recess 93 about its circumference at the point where the tapered pin 90 fits into the hole 91 so that the pin 90 fits in the recess 93 when inserted into the hub 92 to prevent the gear 84 from moving on the shaft 86. The gear 84 may be termed the main clutch gear for a reason which will subsequently appear.

The main clutch gear 84 is provided with an elongated hub 94 formed integrally therewith and carried on the shaft 86, the hub 94 extending from the main clutch gear 84 in a direction away from the hub 92, or from the side of the main clutch gear 84 adjacent the gear case front cover 72. The hub 94 extends through the front cover 72, an opening 95 being provided in the cover 72 for this purpose, and extends outwardly beyond the outer face of the cover 72 or the side thereof remote from the gear 84. The end of the hub 94 is provided with external threading 96 to receive a steel adjusting screw nut 98. A brass clutch slipping gear 100 is mounted for rotation upon an enlarged portion 102 of the elongated hub 94 adjacent the main clutch gear 84 and is spaced from the gear 84 by a friction disc plate 104 also carried on the raised or enlarged portion of the hub 94 and fitting within an annular recess 106 and being of such thickness as to prevent gears 84 and 100 from contacting each other. The slipping gear 100 is also provided with an annular

recess 108 in the face thereof remote from the main clutch gear 84. A composition, anti-burning friction clutch disc 110 similar to the disc plate 104, the clutch discs 104 and 110 preferably being made of asbestos or some similar material possessing equivalent properties, is carried on the shaft 86 and is received in the recess 108. The recesses 106 and 108 for the friction discs 104 and 110 respectively are so made as to prevent the flattening out or spreading of these composition parts under pressure exerted by the adjusting screw nut 98 when it is tightened, thus giving much longer life to the clutch friction discs. A brass clutch pressure disc or plate 112 is carried by the elongated hub 94 adjacent the face of the friction clutch disc 110 remote from the slipping gear 100 and of a slightly lesser diameter than the diameter of the clutch disc 110. Interposed between the pressure plate 112 and the gear case front cover 72 is a felt washer 114 carried on a brass collar or sleeve 116 circumposed about the hub 94 and interposed between the adjusting screw nut 98 and the pressure plate 112. The purpose of the felt washer 114 is to prevent lubrication leakage around the slight clearances through the side of the gear case front cover 72 occasioned by the opening 95 therethrough.

It will be noted that the sleeve 116 fits on the hub 94 of the gear 84 between the brass pressure plate 112 and the nut 98 so that when the nut 98 is turned clockwise on the hub 94, pressure is transmitted through the collar 116 to the pressure plate 112 and thence to the remainder of the clutch parts so as to have the friction disc 104 engage adjoining faces of the gears 84 and 100 as the friction disc 110 is moved by the action of the nut 98 against the collar 116 and the pressure plate 112. With the friction clutch discs tightened against the respective faces of the gears 84 and 100, rotation imparted to the idler gear 78 will be transmitted to the main clutch gear 84 and to the slip gear 100. The gear 117 extends partially through an opening 118 in the gear case 45 and is adapted to mesh with the gear 100. The gear 117 is carried on a shaft 120 journaled at its opposite ends in the respective front and rear casing covers 72 and 74 and is adapted to mesh with a larger gear 122 of the reel section B to impart turning or rotating motion to the reel.

In order to transmit rotational movement to the reel, adjusting screw nut 98, which is provided with an external hex socket of the Allen type, is tightened or rotated in a clockwise direction to have the clutch friction discs engage the respective adjoining faces of the gears 84 and 100, so that whenever the electric motor 28 is operating, motion from the motor drive shaft 58 will be transmitted through the gear train in the gear case housing and thence to the reel section B.

The adjusting screw nut 98 is adapted to fit through a hole 124 in the gear case cover 54 so that it can be externally operated at all times to make the necessary clutch slippage adjustment. In other words, in order for the reel section B to rotate in response to motor operation, the adjusting screw nut 98 must first be tightened so that the clutch arrangement will insure transmission of the power from the motor 28 to the gear 122 of the reel section B.

Referring again to the gear 117 mounted on the shaft 120 which extends in spaced parallel relation to the clutch gear shaft 86 and on the side thereof remote from the worm gear shaft 66, it will be noted that the shaft 120 is laterally offset with respect to the shafts 66 and 86 and has bearings 126 and 128 carried by the front and rear covers, 72 and 74 respectively, to receive the opposite ends of the shaft 120. Also, a collar 130 is carried by the shaft 120 in abutting relation with the bearing 126 and is locked on the shaft 120 by a set screw 132. A similar collar 134 is also provided on the shaft 120 adjacent the gear 117 and is secured thereon by a set screw. A pair of similar felt washers 136 and 138 is carried on the shaft 120 and disposed, one at either side of the gear 117, with the felt washer 136 interposed between the collar 134 and the gear 117 while the felt washer 138 is disposed between the bearing 128 and the gear 117 to keep lubrication losses from the gear box to a minimum.

The reel section B generally comprises the pair of circular side housings or rims 38 and 40 which are preferably of aluminum or magnesium or similar light weight metal or alloy, a cable drum 140 upon which is wound a guide cable or wire 141, a plurality of spreader or spacer bars 142 extending between the side housings and secured thereto at their opposite ends at spaced locations about the respective housings 38 and 40 adjacent the periphery thereof, and a front cable guide piece 144 secured at one end upon the respective housings 38 and 40 and extending outwardly therefrom toward the air discharge section C and secured to the section C. The cable guide is preferably made of chrome plated steel to withstand the pulling force of the guide cable or wire 141 as well as to resist breaking due to dropping of the tool or rough usage thereof.

The cable or reel drum 140 is mounted on a shaft 146 journaled at one end centrally in the housing 40 in a bearing assembly, generally indicated at 148 and at its other end in a bearing assembly, generally indicated at 150, carried centrally in the side housing 38.

The cable drum 140 is cast as a one-piece steel unit and machined to the shape shown in the drawings and includes a pair of spaced parallel side walls 152 and 154 secured on the shaft 146 and has a hub 156 extending therebetween with shaft 146 disposed centrally of the hub 156. The guide cable or wire 141 is wound upon the hub 156 and contained thereon between the side walls 152 and 154 since the hub 156 is of considerably smaller diameter than the diameter of the side walls between which it extends in coaxial relation thereto. Side walls 152 and 154 are of a narrow width, are circular in form and diverge outwardly from their centers to their circumference. The peripheries of each of the side walls are turned outwardly, that is away from the hub 156 and toward the side housings 38 and 40 to define annular laterally projecting lips 158 and 160 respectively. The annular lip 158 extends partially within an annular recess 162, as clearly seen in Figure 4. A similar recess 164 is formed in an inwardly directed flange 166 formed integrally with the side housing 38.

The shaft 146 extends beyond the side walls 152 and 154 to be journaled in the bearing assemblies 148 and 150 respectively. That portion of the drum shaft 146 which extends beyond side wall 154 to one side of the tool, which may be termed the left side of the tool as viewed when looking from the handle end toward the air discharge section C, may be considered as a shaft extension 169. As best seen in Figures 4 and 18, the gear 170 is mounted for rotation upon the drum shaft extension 169 and is laterally shiftable therealong by means of a forked actuating plate 172, the forked end of which fits in a groove 174 cut in the gear 170. The other end of the actuating plate 172 is secured to the side housing 38 by a plurality of screws 176 and has a spring 178 circumposed about each of the screws 176 and interposed between the actuating plate 172 and the side housing 38 which tends to hold the plate in a rigid position. Intermediate the ends of the actuating plate 172 and closely adjacent to the end thereof but remote from the gear 170, there is provided an integrally formed hub 180 having an internally cut female spiral gear thread into which is screwed the control lever shaft 182 journaled for rotation in a brass insert bushing 184 in the side housing 38. The end of the control lever shaft 182 which is received in the internally cut female spiral gearing of the hub 180 is formed with external male spiral gearing 186 so as to mate with the internal gear threading into which it is screwed. The end of the control lever shaft 182 remote from the hub 180 and extending exteriorly of the side housing 38 is provided with splines 188 onto which is received the lower hubbed end 190 of a control lever 192.

The hubbed end 190 is provided with a splined opening therein so as to be received on the splined end 188 of the shaft 182 and is secured with the respective splines in their mating position by a screw 194 extending into a suitable tapped hole provided in the end of the shaft 182. The gear pitch of the spiral gearing threads 186 on the shaft 182 and matching the internal spiral gearing threads in the hub 180 on the actuating plate 172 should be great enough to give sufficient movement to the actuating plate when the operating handle 192 moves approximately 45° along the outer reel rim or housing 38 from "free" position to the "pull" position to move the actuating plate toward and away from the side housing 38 and thereby cause movement of the gear 170 longitudinally of the shaft extension 169 so that in the "pull" position the actuating plate will be moved away from the side housing 38 carrying the gear 170 therewith in the same direction and to the same extent to cause coupling means to be presently described to engage and thereby impart rotational movement to the drum shaft 146. Movement of the handle from the "pull" to the "free" position will cause the gear 170 to move in the opposite direction and uncouple the coupling means so that the drum shaft 146 will be free to rotate in its bearing assemblies 148 and 150.

Defining the coupling means, one end of the gear 170 is provided with a pair of perpendicularly crossed notches 196 and 198 (Figure 22) to match with mating perpendicularly crossed ridges 199 and 200 on the face of the side wall 154 of the cable drum 140 so that upon movement of the control lever 192 from the "free" to the "pull" position, the ridges or projections 199 and 200 will mate with the respective notches 196 and 198, so that rotational movement imparted to the gear 170 may be transmitted through this coupling arrangement to the reel drum 140. See Figures 18, 19 and 22.

To aid in keeping the operating handle or control lever 192 in either position, an inner collar 202 (see Figure 23) carried on the control lever shaft extension 182 adjacent the inner face of the side housing 38 is provided with notches 203 and 204 in the periphery thereof for each of the positions of the operating lever, and into which notches slips a bluntly rounded pin 206 under the pressure of a spring 208 housed in a depending boss 210 on a rib 211. This arrangement will prevent the control lever from moving once it has been placed in either of the "free" or "pull" positions until such time as the operator desires to change the control lever position by manually moving it from one position to the other.

Rib 211 extends generally transversely of the side housing or rim 38 and projects outwardly therefrom to generally follow the contour of the gears 122, 168 and 170 and along with a complementarily formed rib 212 defines a gear housing 214 which not only includes the gears 122, 168 and 170 therein but also encloses the forked actuating plate 172 and its shaft 182 and associated parts. The inner side of the gear housing 214 is enclosed by a gear cover plate 216 and is secured to the gear housing 214 by screws 218, as shown in Figure 2. The heads of the screws 218 being received in countersunk recesses provided in the outer face of the gear housing 214 so that the outer surface of the gear housing will present a smooth surface without projections due to the bolt heads extending therefrom.

The gear 168 is secured on a stub shaft 220 within the gear housing 214, the shaft 220 being journaled at one end in the outer wall 215 of the gear housing in a suitable bronze or brass bushing and at its other end in the gear cover plate 216. This gear mounting is clearly shown in Figure 25. The gear 122 is similarly mounted upon a short shaft 222 journaled at one end in the outer wall 215 and at the other end in the gear cover plate 216 so as to be interposed between the gears 117 and gear 168 and in mesh with both of these gears.

In order to provide a slight drag on the reel or cable drum 140 when the control lever 192 is in the "free" position so as to prevent backlash during the paying out of the guide cable or wire 141, there is provided a brake mechanism which consists of a brass spring arm 224 secured at one end on the terminal end of the control arm shaft 182 remote from the control lever 192, screw 226 passing through a suitable opening in the arm 224 and received in a threaded hole in the end face of the control lever shaft so that the spring arm 224 will be mounted to move with the shaft 182 in response to manual movement of the control lever 192. The other end of the spring arm 224 is provided with a rubber tip 228 received in a recess 330 in the flange 166. The rear wall 332 is angularly disposed with respect to the plane of the rear face 234 of the flange 166 so as to define a cam surface against which the rubber tip 228 may be moved so as to rub thereagainst when moved into the position shown in broken lines in Figure 19 in response to the movement of the control lever to the "free" position. This contacting position of the tip 228 upon the camming surface 332 is clearly shown in Figure 20. Thus, it will be seen that when the control lever is moved to the "free" position, the braking means in the form of the spring arm 224 and the rubber tip 228 carried thereby will contact the outer face of the cable drum side wall 154 by riding on the cam surface 332 and actually being in contact with the annular lip 160 of the side wall 154. When the control lever 192 is moved to the "pull" position, the spring arm 224 will move therewith and since the inherent resilience of the spring arm is so biased as to bear against the camming surface 332, the rubber tip 228 carried by the spring arm 224 will move along the camming surface to a position where it no longer contacts the annular lip 160 under the spring bias of the arm 224, as clearly shown at the lower end of the recess 330 in Figures 19 and 20. From the foregoing, it will be apparent that there has been provided a brake means which will move with the control lever so as to exert a slight braking pressure against the reel or cable drum 140 when the drum 140 is in its freely rotatable position, that is with the coupling means provided by the notches 196 and 198 and the ridges 199 and 200 being disconnected. And when the control lever 192 is moved to the "pull" position, the brake means will move therewith so as to be out of contact with the cable or reel drum 140, hence there will be no braking action when the coupling means is moved to its connected position whereby the rotational movement imparted to the gear 170 will be transmitted to the cable drum 140 through the train of gears from the worm 62 at the end of the motor drive shaft 58 to the gear 170 laterally shiftable upon the shaft extension 169 by the control means, lever 192 and actuating plate 172.

With reference to Figure 7, it will be seen that the spacer or spreader bars 142 are of hollow tubular construction and are provided with internal threads at the opposite ends thereof to receive screws 236 passing through the respective side rims or housings 38 and 40 in countersunk holes so as to secure the bars 142 between the side rims or housings 38 and 40.

The front cable guide piece 144, as shown in Figures 1, 2 and 3, includes a front wall 238 disposed centrally of the tool or along its longitudinal center line and upon the wall 46 of the gear case 45 at its juncture with the partition wall 48. Extending rearwardly in divergent relation are a pair of upper arms 240 and 242 which terminate in spaced parallel fingers 244 and 246 respectively. The fingers 244 and 246 are provided with aligned openings therethrough which are in register with openings in the side housings 38 and 40 so as to receive screws 248 whereby the front cable guide piece 144 is secured upon the reel section B. Also, the front wall 238 has integrally formed therewith spaced downwardly and rearwardly extending arms 250 and 252 which are in divergent relation to each other and generally inclined downwardly along the top of the wall member 46 of the gear case

45, and the arms 250 and 252 are provided with laterally extending fingers 254 and 256 respectively, each of which are provided with suitable apertures therethrough in register with threaded holes in the respective side housings 38 and 40 so as to receive screws 258 to further secure the front cable guide piece 144 to the reel section B.

With particular reference to Figure 3, it will be seen that the front wall 238 is provided with an opening 260 which leads into an annular recess 262 provided in the face of the front wall 238 remote from the reel section B and identified by the reference numeral 264. The annular recess 262 is internally threaded to receive a hardened steel insert screw 263 which has an opening centrally longitudinally therethrough to permit passage of the pulling cable 141. The end of this screw facing reel drum 140 is rounded off to permit easier winding up of the cable 141 and to prevent excessive wear at this point.

The upper leg 276 of the body, generally indicated at 278, of the air discharge section C has a pair of spaced, parallel laterally extending ears 266 and 268 extending perpendicularly thereto and abutting the front face 264 of the front wall 238. Each of these ears is provided with an opening therethrough to register with respective tapped openings in similar spaced, external bosses 270 on the side wall 52 of the motor housing 50 to receive countersunk steel machine screws 272 to further secure the front cable guide piece 144 in place on the tool. It should be noted, that the ears 266 and 268 are disposed along the lower edge of the leg 276 and at the lower end of the front wall 238 or adjacent the end from which the lower arms 250 and 252 diverge. At the upper end of the front wall 238 and projecting laterally therefrom is a central plate-like flange or reel cable guide piece extending perpendicularly from the front face 264 to overlap leg 276 at a boss 274, the plate-like flange being identified by the reference numeral 273, formed on the upper leg 276 of the body, generally indicated at 278. A machine screw 280 secures the upper leg 276 to the flange 273 of the front cable guide piece 144 by passing through a suitable countersunk hole in the flange 273 and into a registering tapped opening in the top of the boss 274. This is the only fastening of the reel guide frame to the tool body.

The body 278 is generally L-shaped and overlies the motor housing 50 with the upper leg 276 disposed centrally along the top thereof, as clearly seen in Figure 1, to define a guide tube through which the free end of the guide cable 141 can pass the front leg 282 centrally overlying the end wall 57 of the motor housing 50. The front leg 282 is provided with a pair of laterally extending plates 284 and 286 which overlie the end wall 57 and extend from opposite sides of the front leg 282. Each of the plates 284 and 286 are provided with suitable countersunk openings therethrough to register with tapped openings 285 in the end wall 57 to receive screws 287 in the registering openings to secure the body 278 on the end wall 57 of the motor housing 50. The upper leg 276 is provided with a central bore 288 longitudinally therethrough in communication with the recess 262 at its inlet end so that the guide cable or wire 141 may be received therein. The outlet end portion of the bore 288 remote from the end which opens into the recess 262 is somewhat enlarged as at 290. A packing gland 292, preferably made of neoprene rubber, fits tightly into the enlarged portion 290 of the guide wire bore or passage 288 and is held in place and its fitting around the guide wire or cable 141 is adjusted by a packing gland screw 294 which is preferably slotted across its head to provide easy adjustment and removal and is received and threadingly carried at the end of the enlarged portion 292 of the bore 288 in internal threads provided at this end. The packing gland screw 294 is provided with an opening 296 longitudinally therethrough to permit the guide wire 141 to pass therethrough and into the nose piece 298 removably threaded into a socket 300 formed at the forward end of the body 278 and at the juncture of the upper and front legs 276 and 282 respectively thereof. The packing gland 292 and its adjusting screw 294 provide an airtight seal about the guide wire or cable 141 to prevent air pressure loss and blowback through the bore 288 during the blowing or air discharge operation and yet will not offer too much resistance to hinder the rewind operation of the reel section B.

It will be noted that a sealing washer 302 is interposed between the nose piece 298 in the outer end of the socket 300 so as to prevent or at least minimize the escape of air at this point. The nose piece 298 is provided with a central bore 304 longitudinally therethrough so as to be in communication with the bore 288 through the upper leg 276 of the body 278 in order to permit the guide cable or wire 141 to have a continuous passage through the tool from the cable or reel drum 140 on which it is wound to the end of the bore 304 in the nose piece 298 remote from the cable drum 140. In addition, the nose piece 298 is provided with a frusto-conical ring 306 of comparatively soft rubber composition about its front end and is secured thereon in a recess 308 provided in the nose piece at its end remote from the socket 300.

The front leg 282 defines an air conduit and is provided with a longitudinal air passage 308 which intersects and is in communication at its upper end with the bore 304 at the end of the bore 288 in the upper leg 276 adjacent the nose piece 298 and forming an air chamber adjacent the connecting ends of the legs. The lower end of the air passage 308 is in communication with a source of compressed air, not shown, supplying air under pressure to the air chamber through a finger operated air valve, generally indicated at 310, and an air hose 312 which is detachably connectible upon a threaded nipple 314 by a quick snap-on type safety air hose connector 316, as best shown in Figure 3. Thus, there is provided an effective air propulsion means connected in communication with the guide tube 276 adjacent the outlet end thereof for forcibly propelling the free end of the guide cable 141 out of the outlet end of the guide tube and into a conduit.

With reference to the air valve 312, as shown in Figures 3, 12, 13 and 13*a*, there is shown the type of air valve in which a finger operated air valve lever 318 is normally spring urged, by the spring 320, into an off position wherein the valve body 322 is seated in the end of the air passage 308 so as to prevent air under pressure from entering into the passage 308. The air valve lever 318 is secured upon a shaft or pin 324 rotatably journaled in the side of the valve 310. Also mounted on the shaft 324 and rotatable therewith in response to the movement of the lever 318 is a flat circular cam wheel or plate 326 which extends within the valve 310. The cam plate 326 is a raised arcuate cam ridge 328, against the inner surface of which a pin 334 bears, and the pin 334 projects laterally from the valve stem 336.

As clearly shown in Figures 12 and 13, as the air valve lever 318 is moved from the "off" to the "on" position, the cam ridge against which the pin 334 bears will cause the valve body 322 to move away from the seat against the pressure of the spring 320 thus permitting air under pressure to flow from the source of air pressure through the hose 312 and through the valve 310 into the air passage 308 and be discharged from the tool through the bore 304 in the nose piece 298.

The end wall 57 of the motor housing 50 is secured to the side wall 52 by a plurality of screws 338 which pass through openings 340 in laterally projecting, circumferentially spaced lugs or ears 342 formed on the end wall or cover 57, as clearly shown in Figure 5. A plurality of external bosses 344 are formed on the side wall 52 in circumferentially spaced relation and are provided with central tapped openings which register with the openings 340 in the lugs 342 to receive the threaded portion of the

screws 338 thereby securing the end wall or plate 57 to the side wall 52 of the motor housing 50.

As previously mentioned, the drive shaft 58 extends from both sides of the motor 28. That portion of the motor drive shaft which extends from the left hand side of the motor as viewed in Figure 3, or towards the end wall 57, will be identified by the reference numeral 59 and is journaled in a bearing 348 carried by the end wall or plate 57 at its end remote from the motor 28. Mounted on the motor drive shaft 59 for rotation therewith is a vane wheel 350 spaced from the end of the bearing 348 by a collar 352. The vane wheel 350 carries a plurality of circumferentially spaced, angularly disposed vanes 356 carried in a circular cage 358 which in turn is carried by spokes 360 radiating from the hub 362 which is secured upon the motor drive shaft 59. The vane wheel 350, in effect, defines an exhaust fan which will operate when the motor 28 is energized to cause rotation of the reel section B in the rewinding operation so as to provide an air cooling means for the gears which transmit the rotational power from the motor 28 to the reel or cable drum 140. In order for the exhaust fan to be effective, the partition wall 48 is provided with a plurality of openings 364 therethrough and exhaust vent ports 366 are provided in side wall 52 adjacent the flange 55 of the end wall 57 so that a flow of air will be continuous from the intake ports 367 in the gear case wall 46 and from gear case 45 and the gear housing 214 so that the gears contained in these housings will not become unduly heated during the rewinding operation.

As shown in Figures 8 and 9, the tool of this invention is adapted to be applied to one end of a conduit 368 normally provided with an end flange 370, the end of the conduit 368 to which the tool is to be applied normally passing through a wall or similar structure 372.

The soft rubber nose or ring 306 is inserted into the opening in the flange 370 and is pressed therein so as to form an effective air seal at this point. The guide cable or wire had been first placed in the conduit 368 with the rubber ball 374 attached to the free end thereof. The diameter of the rubber ball 374 is of approximately the same diameter as the interior diameter of the conduit in which it is placed, and it will be appreciated that the diameter of the rubber ball or blowing ball 374 will be made smaller or larger in accordance with the diameter of the conduit to which it is to be applied. Passing centrally through the ball 374 is a wire 376 provided at the ends thereof with eyes 378 and 380 exteriorly of the ball 374. A pair of curved metal washers 382 are carried by the wire 376 so as to be placed between the ball 374 and the eyes 378 and 380 respectively and conforming to the curvature of the ball at this point and closely overlying the ball to prevent the rubber ball 374 from losing its shape and also to prevent either of the eye hooks 378 and 380 from pulling through the ball 374 during the blowing or air discharge operation. The free end of the wire 141 extending within the conduit 368 is provided with an eye hook 384 so that the eye hook connecting piece or connector 386 will define a securing means between the free end of the guide cable or wire 141 and the blowing ball 374. It will be appreciated that ball 374 could have wire 376 formed at one end with a safety type hook or connector to replace the eye hook 378 so that the blowing ball 374 could be snapped directly onto the eye 384, and thereby eliminate the necessity for the connector 386.

With the tool in the position shown in Figure 8 with the blowing ball 374 disposed within the conduit 368 and secured to the free end of the guide wire 141, the control lever 192 is moved to the "free" position and the air valve lever 318 is moved from the "off" to the "on" position to permit air pressure to pass from the hose 312 into the air passage 308 and into the air chamber formed in the air discharge section adjacent the connected ends of the legs 276 and 282 to be discharged out of the bore 304 in the nose piece 298. This builds a pressure behind the ball 374 to thereby project the ball 374 through the conduit 368. As the ball 374 is projected by the pressure of the air behind it through the conduit, the guide wire 141 secured thereto will be payed out in the conduit since the reel drum 140 is free to rotate. When the ball 374 emerges from the other end of the conduit, not shown, remote from the end to which the tool has been applied, the blowing ball 374 will be disengaged from the guide wire 141 and an electrical conductor, which may be an electric wire or cable, is secured to the eye hook 384 at the end of the wire or cable 141. The removal of the ball 374 prior to the rewinding of wire 141 will reduce friction during the rewinding operation.

The tool is now ready to reel in the guide wire or cable 141. In order to set the tool for this reeling in or rewinding operation, finger pressure is released from the air valve lever 318 thereby shutting off the flow of air pressure to the tool, the control lever 192 is moved from the "free" to the "pull" position, and the clutch adjusting screw 98 is tightened or rotated in a clockwise direction to have the clutch friction discs 104 and 110 engage the respective faces of the gears 84 and 100 so that rotational movement from the motor 28 may be transmitted to the reel drum 140. The trigger switch 22 is then moved so as to cause energizing of the motor 28 which will drive the reel drum 140 in the manner hereinbefore described and at the same time will cause operation of the exhaust fan 350. Thus, the reel drum 140 will be rewound so as to reel in the guide wire or cable 141 which will carry the electrical conductor secured to the free end thereof to be laid in the conduit 368 and the operation will, of course, cease when the free end of the guide wire or cable 141 is again adjacent the nose piece 298, at which time the tool may be removed from the end of the conduit and the electrical cable pulled through at this end for connection to a switch or other electrical part after it has been detached from the hook eye 384.

The source of compressed air to which the hose 312 is connected may be a small tank which would contain a sufficient supply required for the short air blasts necessary to blow the ball 374 from one end of the conduit to the other. The type of compressed air tank used for this tool is the readily available commercial type, easily portable and readily refilled at any filling station which has an air supply hose, or may be attached to an air compressor mounted on a truck if such is available by the contractor installing the electrical wiring of the structure.

It will be realized that the size of the tool and the power of the electric motor 28 will be increased where electrical conductors are to be laid in large size conduits.

With reference to Figures 10 and 11, there is shown an angle head, generally indicated at 400 designed for use in small outlet boxes, such as the outlet box 402 where the end of a conduit 404 could not be reached by the nose piece 298. The angle head 400 comprises a straight tubular section 406, an elbow 408 threadedly secured to one end of the tubular section 406; the other end of the elbow 408 threadingly receives a tubular section 410 disposed in a plane normal to the plane of the tubular section 406, and the end of the tube 410 remote from the elbow 408 has threaded thereon a socket 412 into which may be screwed a nose piece 414 similar to the nose piece 298.

The end of the straight tube 406 remote from the elbow 408 is in the form of an enlarged head 416 having an externally threaded nipple 418 extending therefrom at the side thereof remote from the tube 406. The nipple 418 is adapted to be received in the socket 300 after the nose piece 298 has been removed therefrom. A heavy washer 420 made of tough rubber is held between a pair of similar captive washers 422 on the nipple 418 and is interposed between the outer edge of the socket 300 and the head 416 to permit the turning of the angle head 400 into any position for easier use with hard-to-get-at con-

duits in outlet boxes and still prevent loss of air and not weaken the tool during the rewinding operation.

The elbow **408** is provided with a removable center cap **424** secured on the elbow **408** by screws **426**. The purpose of the removable center cap **424** is to allow for rapid threading of the guide cable or wire **141** over the concave roller **428** having a hub **430** extending from either side thereof to act as spacer washers so as to maintain the grooved roller **428** centrally within the opening in the elbow **408** since the hubs **430** extend from the opposite sides of the roller and bear against the interior of the wall of the elbow **408** and each of the hubs **430** have pins **432** extending centrally therefrom to be received in openings **434** so as to journal the roller **428** in the side wall of the elbow **408**. The openings **434** in the side wall of the elbow **408** are axially aligned and are provided in diametrically opposite portions of the side wall so that the roller **428** will run true and rotate about an axis perpendicular to the longitudinal axes of the tubular sections **406** and **410**.

The nose piece **414** has a sealing washer **436** interposed between the end of the socket **412** remote from the tube **410** and the head **438** of the nose piece **414**. As in the case of the nose piece **298**, there is also provided on the nose piece **414** a frusto-conical ring or nose **440** which is adapted to fit into the flange **442** provided on the end of the conduit **404** terminating within the conduit box **402** so as to form an airtight seal therewith as in the case of the nose piece **298** and the flange **370** of the conduit **368**.

The guide cable or wire **141** will be threaded through the straight tubular section **406** and around the concave roller **428** journaled in the elbow **408** and thence through the straight tubular section **410** and through the nose piece **414** so that its free end terminates within the conduit **404**. As in the previous case, and as shown in Figure 8, the rubber blowing ball **374** will be secured to the free end of the guide cable or wire **141** and the blowing and rewinding operations will proceed as described with reference to the tool operation when the angle head or adapter **400** is not used.

It should be noted in connection with the rewinding operation that the braking means defined by the spring arm **224** and the rubber tip **228** carried thereby will be moved to its non-operative position when the control lever **192** is correspondingly moved so that the drag placed on the reel drum **140** during the air discharge or blowing operation to prevent backlash will be relieved.

In the modified form of the invention shown in Figures 26 through 30, the air discharge section C is exactly the same as the previously described section C and the same reference numerals that were used to identify its component parts used in connection with the form shown in Figures 1 through 25 will be duplicated in the modified form to identify the same parts.

The reel section B' is similar in many respects to the reel section B of the form shown in Figures 1 through 25 and the component parts thereof which are exactly duplicated in the reel section B' will be identified by the same reference numerals as those employed in connection with the prior described form of the invention.

The modified form of the invention is a hand powered model in which the rewinding operation is accomplished manually thereby eliminating the necessity for a motor and the parts and transmitting mechanism associated therewith. Thus in the modified form, the handle and support section A' is merely an open framework which includes a rearwardly extending handle **444** and a support frame, generally indicated at **446** integrally formed therewith and adapted to carry the air discharge or blowing section C and the reel section B' thereon in the same relation between the sections as in the motorized form of the invention.

Aside from the elimination of the motor and its associated parts and the redesigning of the section A', the principal differences will reside in the structure of the reel section B'.

Since the motion transmission gear **122** is no longer required, the gear **168'** will be slightly relocated so as to be placed directly under the center line of the reel drum **140** to mesh with the gear **170** journaled on the cable drum shaft extension **169**. The coupling arrangement by which the rotational motion is imparted to the cable drum **140** by action of the control lever **192** is exactly the same as that described in connection with the motor driven model except that the bearing assemlies **148** and **150** are reversed so as to be on opposite sides of the cable drum shaft from that shown in the form of the invention in Figures 1 through 25. The side rim or housing **38'** is similar to the side housing **38** but the raised portion **448** thereon defining the gear housing is shaped to roughly correspond to the gears **168'** and **170** and includes the control lever shaft and the elements associated therewith. The gear housing **448** is provided with an outwardly projecting boss **449** provided with a central bore **450** therethrough to house a stub shaft **452** therein which has a reduced end portion **454** extending beyond the outer surface of the boss **449** so as to receive the handle **456** thereon. The reduced portion **454** of the shaft **452** is square in cross section so as to mate with the square opening **458** in the central hub portion **460** of the handle **456**. The handle **456** is secured on the square end **454** of the stub shaft **452** by a screw **462**, as clearly shown in Figure 29. The other end of the stub shaft **452** remote from the end **454** is journaled in a sleeve bearing **464** carried in the brass gear holding plate **466** which is carried in spaced parallel relation to the boss **449** and secured thereto by a plurality of screws **468**, the heads of which are countersunk in the front face of the gear housing boss **449**. That portion of the stub shaft **452** adjacent the squared end **454** is carried in a cast in brass bushing **470** carried by the boss **449**. Thus the stub shaft **452** upon which is secured the driving gear **168'** is journaled for rotation in the boss **449** adjacent one end and journaled in the gear holding plate **466** at its other end.

The handle **456** is provided with a pair of substantially diametrically oppositely extending arms **472** and **474**. The end of the arm **474** remote from the handle hub **460** has secured thereto a wind-up knob **476** which is rotatably mounted on the screw **478** which secures the knob to the handle arm **474**. The end of the handle arm **472** remote from the hub **460** has riveted thereto a counterweight **480** to increase the ease with which the handle **456** may be rotated in a clockwise direction, as indicated by the arrow in Figure 26, to impart rotation to the driving gear **168'**.

A gear cover plate **482** is provided to form the inner side wall of the gear housing **448** and generally conforms to the shape of the gear housing or raised portion **448** being secured thereto by a plurality of countersunk screws **484** similar to screws **218** shown in Figure 2.

The control lever **192** will be maintained in either of the "free" or "pull" positions until moved by the operator by the same position retaining or locking arrangement employed with the motor driven model as shown in Figure 23 and previously described in connection with the latter.

With the control lever **192** in the "pull" position, the coupling means defined by the notches **196** and **198** in the end face of the gear **170** and the ridges **199** and **200** on the side wall **154** of the drum **140** which mates therewith in the manner previously described, will become engaged so that upon rotation of the handle **456** in a clockwise direction, the driving gear **168** will mesh with the gear **170** causing rotation thereof and as a consequence, rotation of the drum reel **140**. The application of the modified form of the invention shown in Figures 26 to 30, is essentially the same as that of the motor driven model, that is, the nose piece **298** will be placed against

the end of a conduit so that the rubber nose or ring **306** will form an air seal therewith. The control lever **192** will be placed in the "free" position so that the drum **140** will rotate freely except for the drag of the brake means, previously described in connection with the motor driven model, and the air valve lever **318** will be manually pressed to the "on" position permitting compressed air to be discharged through the nose piece **298** and into the conduit so that the rubber ball **374** which has been inserted into the conduit will be projected therethrough to pay out the guide wire or cable **141** into the conduit to which the tool has been applied. In the rewinding operation, that is after the free end of the guide wire **141** has emerged from the other end of the conduit and has had an electrical conductor secured thereto, the control lever handle **192** will be moved to the "pull" position. With the control lever **192** in the "pull" position, the drag preventing backlash in the paying out of the guide wire is released and the coupling means is engaged so that upon rotation of the handle **456** by the right hand of the user while his left hand grips the handle **444**, will impart rotation to the drum **140** so as to rewind the guide cable or wire **141** to pull the electrical conductor back through the conduit thereby laying the electrical conductor, which may be an electrical wire or cable, in the conduit.

The principle of operation in both forms is essentially the same, the hand or manually operated model being considerably simpler in construction and, of course, capable of more economical manufacture.

In both forms of the invention, there is provided a portable hand tool for laying an electrical conductor in a conduit which includes a reel having a flexible line wound thereon, a source of power which may be either motor driven or manual and which will be operatively connected to the reel and an air discharge section carried by the tool causing said line to pay out from the reel and into a conduit with the source of power operative to rotate the reel or cable drum to rewind the line thereon after it has been payed out into the conduit.

Basically, the portable hand tool of this invention comprises three detachably secured together sections, in the case of the motor driven model, a handle and motor section A, a reel section B and an air discharge section C. The reel section B is detachably carried by the motor and handle section A and includes a cable drum **140** which has a flexible line **141** wound thereon, the cable drum **140** defining a winding means which will pay out the flexible line **141** in response to the operation of the air discharge section, and the motor **52** carried in the motor and handle section is operatively connected to the winding means **140** so that rewinding the flexible line **141** thereon may be accomplished by the motor which is operatively connected to the winding means **140** through the gear train hereinbefore described. In the manually operated model, the tool comprises a frame and handle section A', a reel section B' and an air discharge section C. The reel section is detachably secured to and carried by the section A' and includes the cable drum **140** mounted for rotation therein having the flexible line **141** wound thereon and section B' also includes the source of rotational power, handle **456**, and a motion transmission means in the form of gears **168'** and **170** operatively connecting the winding means **140** to the handle **456** through its shaft **452** to the winding means **140**. The air discharge section C is detachably secured to the sections A' and B' and detachably carried by section A'.

In the broad sense, in both forms of the invention, there are means provided which are operatively connected to the winding means **140** to rewind the flexible line thereon after the line has been laid in the conduit by the action of the air discharge section C. In the case of the motor driven form, this means includes the electric motor **52**, the train of gears which define a motion transmission means operatively connecting the motor to the winding means, and in the case of the manually operated form shown in Figures 25 through 30, this means includes the handle **456** which is manually rotated and the gears **168'** and **170** constitute the motion transmission means whereby the rotation of the handle may be imparted to the winding means or cable drum **140** so that the flexible line **141** may be rewound upon the winding means **140** after it has been laid in the conduit by action of the air discharge section C to thereby thread an electrical conductor in the conduit as it is being rewound upon the winding means **140**.

Within the concept of this invention is included the use of a compressed air motor section to replace the electric motor section **47** to provide means operatively connected to the reel drum **140** to impart rotation thereto for rewinding the guide cable **141** payed out during the blowing operation. The use of a compressed air motor would involve no essential change in the design of the motor area or any of the frame or motion transmission parts with the possible exception of the gear ratios evolved and gives a purchaser the choice of a motor type best suited to his purposes. The principal advantage of the compressed air motor over the electric motor would be its ready acceptance for use in places where the use of electric motors would be hazardous, such as paint plants, oil refineries, or other places where highly combustible and easily inflammable materials are used. The use of an explosive-proof electric motor would prohibitively increase the cost of the tool in comparison with the compressed air motored tool.

While there are shown and described the preferred embodiments of the invention, it is to be understood that the structure is susceptible to change and modification within the practicability of the invention and therefore should be limited only by the scope of the claims appended hereto.

What is claimed is:

1. A portable hand tool for laying an electrical cable in a conduit, comprising a frame, a hand grip projecting from one end of said frame, a reel drum supported on said frame for unwinding movement in one direction, said reel drum having a guide cable wound thereon with a free end portion, a guide tube carried by said frame and having an inlet end positioned adjacent said reel drum and an outlet end positioned adjacent the other end of said frame for receiving and guiding said guide cable end portion therethrough, air propulsion means carried by said frame and connected in communication with said guide tube adjacent the outlet end thereof for forcibly propelling said guided cable end portion out of the outlet end of said tube, and positively driven means operatively connected to said reel drum for effecting winding movement of the latter in the other direction.

2. A portable hand tool for laying an electrical cable in a conduit, comprising a frame, a hand grip projecting from one end of said frame, a reel drum supported on said frame for unwinding movement in one direction, said reel drum having a guide cable wound thereon with a free end portion, a guide tube carried by said frame and having an inlet end positioned adjacent said reel drum and an outlet end positioned adjacent the other end of said frame for receiving and guiding said guide cable end portion therethrough, air propulsion means carried by said frame and connected in communication with said guide tube adjacent the outlet end thereof for forcibly propelling said guided cable end portion out of the outlet end of said tube, and positively driven means operatively connected to said reel drum for effecting winding movement of the latter in the other direction, and means on said hand grip operatively connected to said driven means and selectively actuable by the hand of the operator for causing said winding movement.

References Cited in the file of this patent

FOREIGN PATENTS

10,705 Great Britain ---------- of 1910