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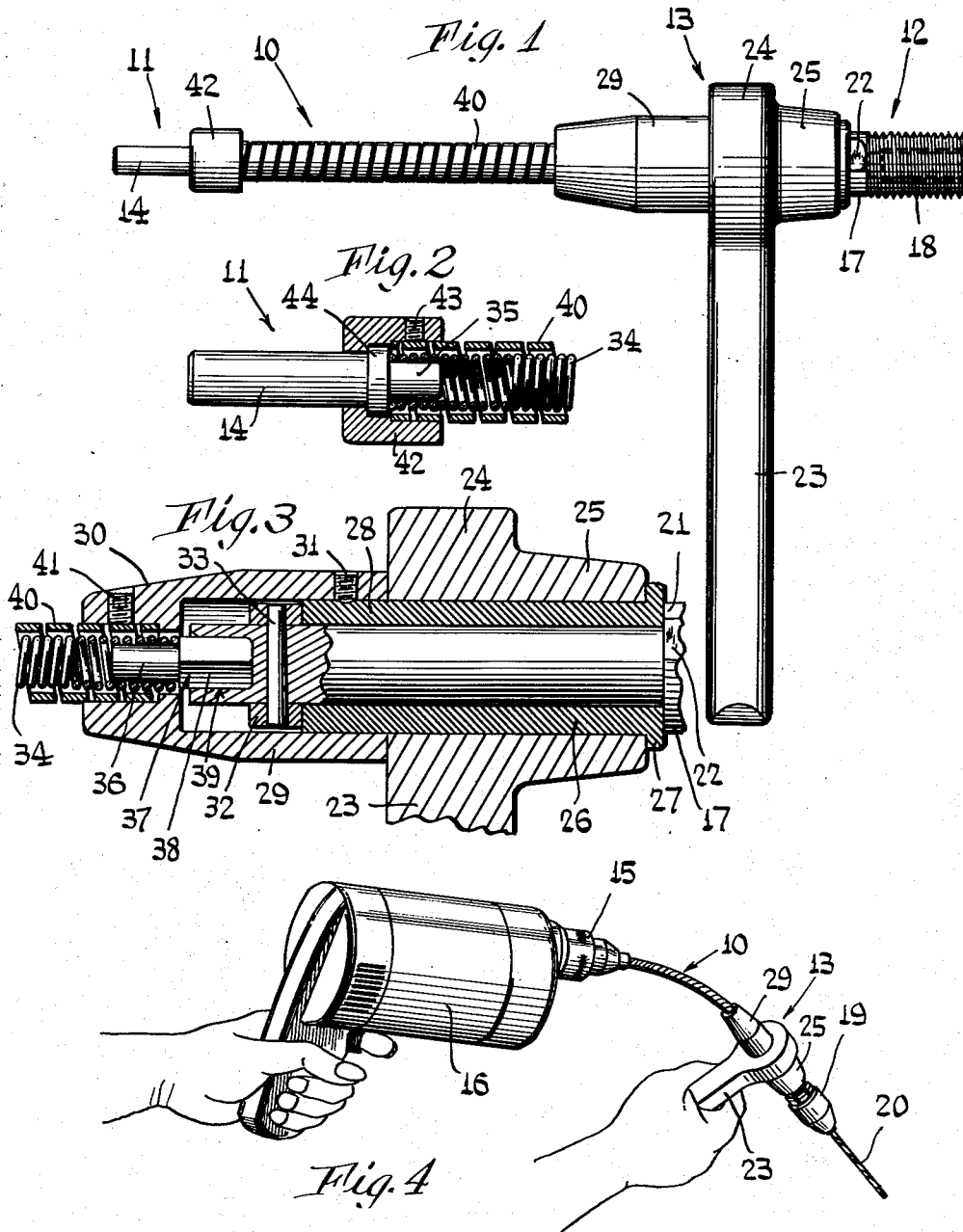
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FLEXIBLE EXTENSION ATTACHMENT FOR ELECTRIC DRILLS

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2 Sheets-Sheet 1



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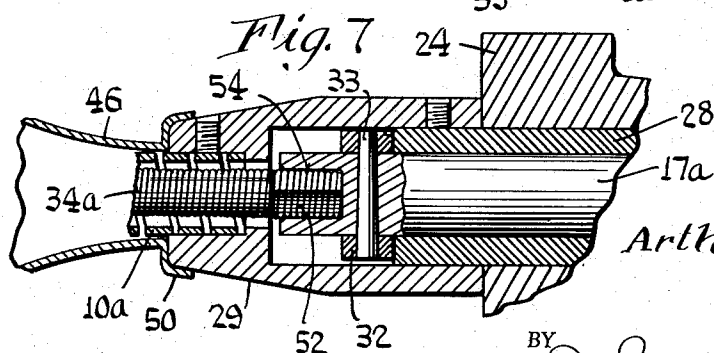
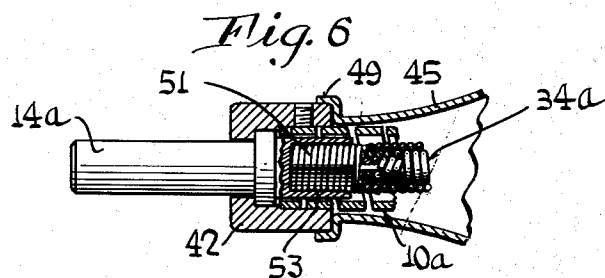
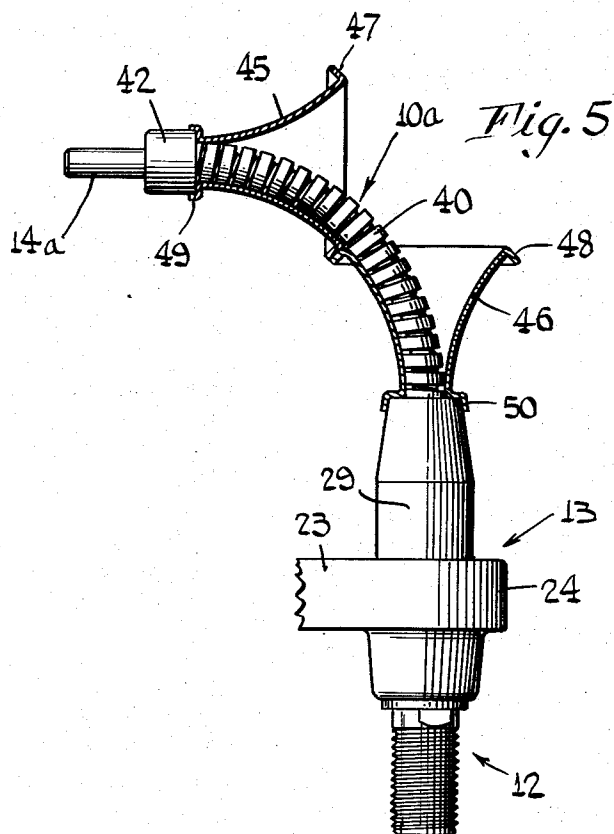
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FLEXIBLE EXTENSION ATTACHMENT FOR
ELECTRIC DRILLS

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4 Claims. (Cl. 64—2)

This invention relates to electric hand drills, more particularly small, lightweight drills intended to be held and manipulated by one hand.

An object of the invention is to provide an improved, flexible, extension attachment for a small electric hand drill by which the drill may be positioned further away from the work and in various locations and angular positions, the said attachment by its structure and arrangement of parts being extremely convenient and easy to use in conjunction with the drill, and enabling working force to be readily and effectively applied to the drill bit.

Another object of the invention is to provide an improved, flexible, extension attachment for an electric drill as above set forth, which is very simple and yet sturdy in its construction, and also reliable in operation and economical to manufacture.

A further object of the invention is to provide an improved, flexible, extension attachment in accordance with the above, wherein the flexible shaft means is constituted and incorporated as a readily replaceable unit, thus eliminating the necessity for discarding other parts of the attachment if for some reason the flexible shaft means should become damaged or be rendered inoperative.

A feature of the invention resides in the provision of a flexible extension attachment as above characterized, which may be attached to the electric drill as easily and quickly, and in the same manner, as a drill bit is attached.

Other features and advantages will hereinafter appear.

In the accompanying drawings:

Figure 1 is a side elevational view of the improved, flexible, electric-drill extension attachment of the invention.

Fig. 2 is a fragmentary axial sectional view, enlarged, of the coupling means which is adapted to be secured to the electric drill.

Fig. 3 is a fragmentary axial sectional view, enlarged, of the handle-carried portion of the flexible extension.

Fig. 4 is a perspective view of the flexible extension attachment secured to an electric drill and in the process of being used.

Fig. 5 is a fragmentary elevational view of the flexible extension attachment of the invention, showing the flexible shaft bent through an angle of 90 degrees and showing means for restricting further bending of the shaft.

Fig. 6 is a fragmentary axial sectional view like Fig. 2 but showing a modified form of connection between the flexible shaft and the coupling means adapted to be secured to the electric drill.

Fig. 7 is a fragmentary axial sectional view somewhat like Fig. 3 but showing a modified connection means between one end of the flexible shaft and the handle-carried portion of the flexible extension.

Referring to Fig. 1 the present improved extension attachment comprises essentially an elongate, flexible shaft portion 10, a coupling portion 11 by which it is secured to the electric drill, a chuck-carrying spindle portion 12 and a handle portion 13 which carries the spindle portion

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12. The coupling portion 11 comprises a stub shaft 14 having a relatively small diameter, as for example $\frac{1}{4}$ ", by virtue of which it may be inserted in the standard chuck 15 (Fig. 4) of a small electric hand drill 16 so as to be secured to the output shaft of the drill, to be driven thereby.

The spindle portion 12 of the attachment comprises a relatively short spindle 17 having right-hand screw threads 18 on one end, by which it can accommodate a standard three-jaw chuck 19 adapted to hold a tool bit or twist drill 20 as shown in Fig. 4. The spindle 17 has a flange or shoulder portion 21 intended mainly to position it, said shoulder portion being also provided with a pair of oppositely-disposed flats 22 adapted to accommodate a wrench (not shown) by which tightening or loosening of the chuck 19 may be more conveniently accomplished.

In accordance with the present invention a novel handle structure is provided in conjunction with the spindle 17 whereby tool bits carried in the chuck 19 may be effectively manipulated and applied to the work, and whereby the desired working pressures may be transmitted to the tool bits easily and comfortably. This handle structure comprises an elongate handle member 23 having sufficient girth or cross-sectional dimension so that it may be comfortably held or gripped in one hand. At one end of the handle member 23 an enlargement 24 is provided, together with an integral boss 25, said enlargement and boss being bored to receive a bearing bushing 26 having an outwardly-extending flange 27 engaging the end of the boss 25. The flange 27 also engages the shoulder 21 of the spindle 17 to position the latter.

At its other end 28 the bushing 26 projects from the handle member 23 and carries a sleeve 29 provided with a tapering end portion 30. The sleeve 29 is secured to the projecting end 28 of the bushing 26 by means of a set screw 31, and by this organization the bushing is rigidly secured to the handle member 23. If desired, in addition to the above securement a slight press fit may be established between the bushing 26 and the handle enlargement 24 and boss 25.

The spindle 17 extends through the bushing 26 and projects beyond the end 28 of the bushing, carrying a ring 32 secured to the spindle by a tapered drive pin 33. It will be understood that the shaft 17 is easily rotatable in the bushing 26.

In accordance with the invention a novel and simplified flexible drive shaft means is provided, connecting the stub shaft 14 of the attachment with the spindle 17. This flexible drive shaft means consists solely of a single helical coil spring 34 preferably having tightly wound convolutions, said spring being left-hand wound, that is, in such a manner that its convolutions are in the form of a left-hand thread. The length of the coil spring 34 is a large multiple of the diameter of the spring, and the wire size of the spring is large enough to impart sufficient strength to the spring for transmitting rotary motion within the normal operating range of the electric drill 16. Preferably the spring 34 is formed of hard steel spring wire, a suitable type being commonly known as music wire.

At one end the spring 34 extends over a reduced portion 35 of the stub shaft 14, and the spring may be suitably attached to the shaft as by welding or other means. At the other end of the spring 34 there is a separable clutch connection between the spring and the spindle 17, and in accomplishing this I extend the end of the spring over a round shank 36 of a connector member 37, the spring being welded or otherwise secured to the shank. The member 37 has a portion 38 of square cross section which is slidably received in a square socket 39 of the spindle 17 and is readily removable therefrom. Thus a strong and reliable yet readily separable driving connection is

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established between the coil spring 34 and the spindle 17, and this is an important feature of the invention.

To provide a guard for the coil spring 34 a flexible armored-type metal sheath 40 is provided around the spring, one end of the sheath 40 extending into the tapered end portion of the sleeve 29 and being secured thereto by a set screw 41. The other end of the sheath 40 extends into a collar 42 surrounding the stub shaft 14 and is secured to the collar by a set screw 43, the collar 42 providing a bearing for the shaft 14 and the latter having a shoulder 44 intermediate its ends to position it in the collar.

It will be observed that by the above construction the handle and spindle assembly of the attachment may be easily and quickly separated from the flexible shaft portion of the attachment, by merely loosening either one of the set screws 31 or 41. If the set screw 31 is loosened, the sleeve 29 will separate from the handle assembly and remain with the flexible shaft portion of the attachment. If the set screw 41 is loosened the sleeve 29 will remain with the handle assembly and be separated therewith from the flexible shaft portion of the attachment. This is of considerable advantage if it should become necessary at any time to replace the flexible shaft portion due to damage, or breakage from overloading, etc.

It will be observed further that by loosening the screw 43 of the collar 42 the latter may be removed from the stub shaft 14, and the said stub shaft together with the spring 34 may, without further loosening of screws or the like, be removed from the assembly comprising the handle 23, spindle 17, sleeve 29 and sheath 40. Thus removal of the stub shaft 14, coil spring 34 and connector member 37 may be readily effected at any time for replacement, by merely loosening the single screw 43. If damage to the flexible shaft portion includes the sheath 40, then this may be removed by loosening the set screw 41. I thus provide a very flexible assembly in which the parts susceptible to damage may be easily and quickly replaced without the necessity for discarding any of the other parts of the attachment. At the same time, the construction of the attachment has been kept simple, enabling it to be readily and economically manufactured.

I have found that by the provision of the coil spring 34 which constitutes the sole means for transmitting rotary motion from the stub shaft 14 to the spindle 17 a desirable economy in manufacture is effected while at the same time the spring has adequate strength to reliably transmit the required torque, and this is an important feature of the present invention.

The novel shape and the arrangement of the handle 23 closely adjacent the chuck 19 provides for ready manipulation of the tool bit 20 and for easy application of working pressures, and greatly facilitates the use of the attachment. The attachment, moreover, is safe to use inasmuch as, wherever possible, exposed parts have been made stationary. For example, the collar 42 and sleeve 29, the sheath 40, the handle 23 and the boss 25 are all stationary, and accordingly danger of a worker's clothing becoming caught in rotating parts is minimized.

A modification of the invention is shown in Figs. 5, 6 and 7. In these figures, parts which are similar to those shown in Figs. 1 through 4 have been given the same reference numerals.

In accordance with the present invention, as shown in Fig. 5, I provide means in association with the flexible shaft 10a for limiting the amount of bending which the shaft may have. This means comprises a pair of cone-shaped members 45 and 46, the member 45 being secured to the collar 42 and the member 46 being secured to the sleeve 29. Preferably the members 45 and 46 are formed of drawn sheet metal, having flared walls of curved cross section. The large-diameter ends of the members 45 and 46 have outturned flanges 47 and 48

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respectively, said flanges being adapted to engage each other when the flexible shaft 10a is bent through an angle of approximately 90 degrees, as shown. The small-diameter ends of the members 45 and 46 preferably have outwardly offset flanged portions 49 and 50 respectively, adapted to closely fit the collar 42 and sleeve 29. The flanged portions 49 and 50 may be secured to the collar and sleeve in any suitable manner, as by welding, soldering, etc.

By the provision of the flared members 45 and 46 I prevent the flexible shaft 10a from being bent beyond the maximum angle intended for normal operation, and accordingly I minimize the likelihood of the flexible shaft being damaged due to abuse.

In Figs. 6 and 7 there is shown a modified form of connection between the flexible shaft and the driving and driven members associated therewith. In these figures a flexible shaft 34a of reversely-coiled spring wire construction has its ends 51 and 52 formed to provide a square transverse cross section. The stub shaft 14a shown in Fig. 6 at its inner end has a square socket 53 accommodating the squared end 51 of the flexible shaft 34a. In Fig. 7 the spindle 17a has a square socket 54 accommodating the squared shank portion 52 of the flexible shaft 34a. By this construction readily separable connections are established between the flexible shaft 34a and the stub shaft 14a and spindle 17a. The stationary protecting sheath 40, in this construction, serves to retain the squared ends of the flexible shafts 34a in the square sockets provided for them, in a manner similar to that already described in connection with Figs. 1-4.

Variations and modifications may be made within the scope of the claims and portions of the improvements may be used without others.

I claim.

1. A flexible extension attachment for connection to the output shaft of a hand drill comprising a one-piece elongate handle having a gripping portion adapted to be held in one hand and having an enlarged head at one end provided with an enlarged boss projecting from one face thereof, said head and boss having a bore there-through normal to said gripping portion, a bearing bushing secured in the bore and having a portion projecting from the head in the direction opposite said boss, a spindle rotatably mounted in said bushing to project beyond the ends thereof, the end of said spindle projecting from the boss having a tool-receiving chuck thereon, and the end of the spindle projecting from the bushing having an out-of-round socket therein, a sleeve detachably secured to the projecting portion of the bushing and having one end of a flexible sheath detachably secured thereto, the other end of the sheath having a bearing collar detachably secured thereto, a flexible drive shaft disposed within the sheath and having a coupling portion at one end freely disposed in the out-of-round socket to form a drive connection therewith and having a stub shaft secured to the other end and rotatably mounted in the bearing collar and adapted to be connected to the output shaft of the electric hand drill, said stub shaft being provided with a flange cooperating with the collar to limit movement of the stub shaft outwardly of the collar and maintain the other end of the drive shaft in the socket in the spindle.

2. The invention as defined in claim 1 wherein the sleeve is connected to the bushing, the sheath is connected to the sleeve and the collar is connected to the sheath by means of releasable set screws whereby release of any one of said set screws releases the connection between the related parts and enables the drive shaft to be readily disconnected from the spindle.

3. The invention as defined in claim 1 in which there are means carried exteriorly of the flexible sheath, restricting the angle through which the shaft may be bent.

4. The invention as defined in claim 3 in which the means restricting the angle of the flexible sheath com-

prises a pair of cone-shaped members adapted to be brought into engagement with each other when the flexible sheath is bent through a pre-determined angle.

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