May 31, 1966 G. B. STILLWAGON, JR., ETAL 3,253,626

MAGNETIC TOOL

Filed Aug. 3, 1964 2 Sheets-Sheet 1

FIG-1

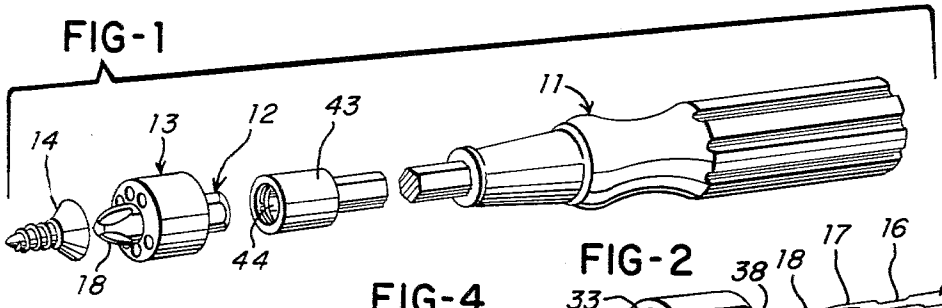


FIG-2

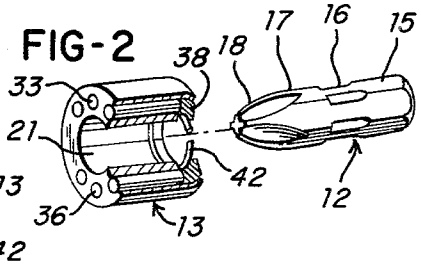


FIG-3

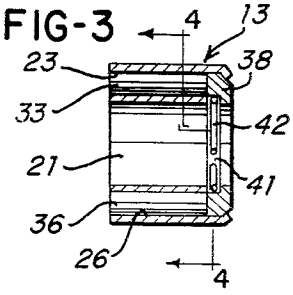


FIG-4

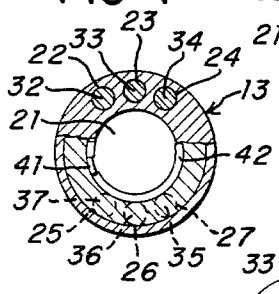


FIG-5

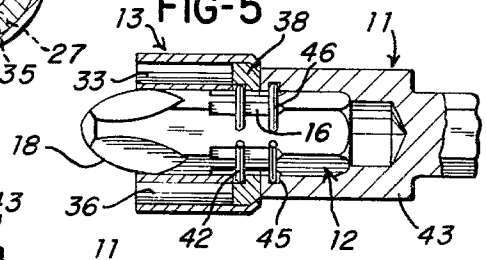


FIG-6

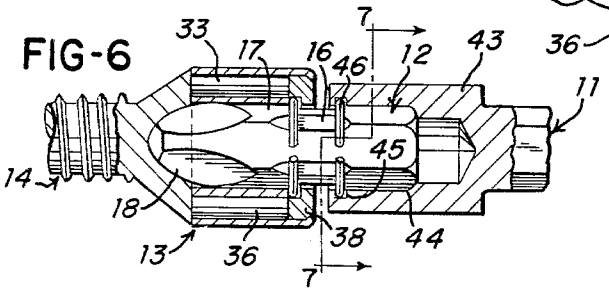


FIG-7

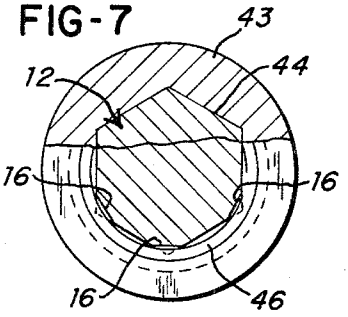


FIG-8

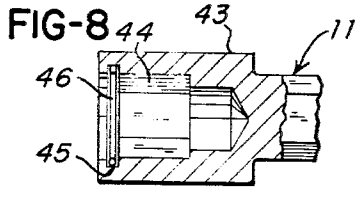


FIG-9

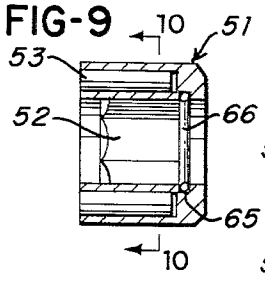
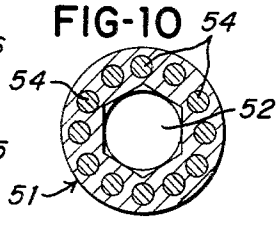


FIG-10



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MAGNETIC TOOL

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FIG-11

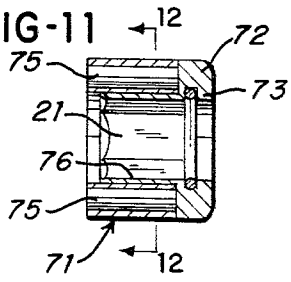


FIG-12

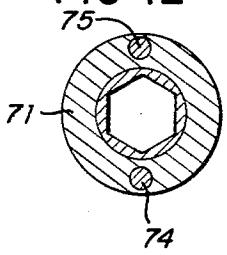


FIG-13

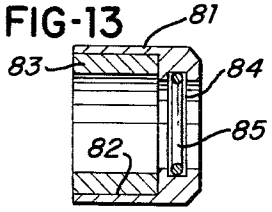


FIG-14

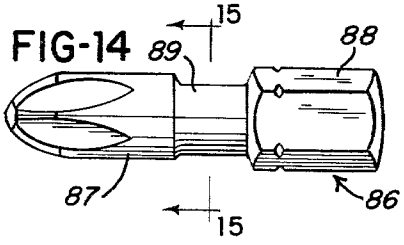


FIG-15

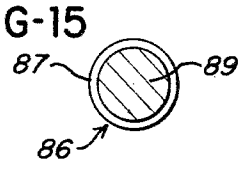


FIG-16

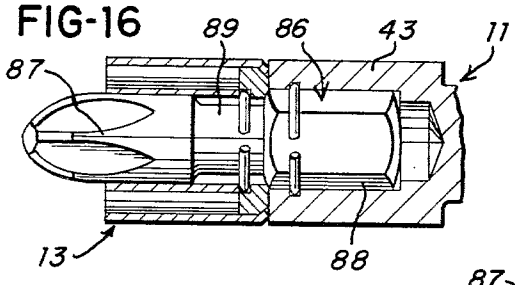


FIG-17

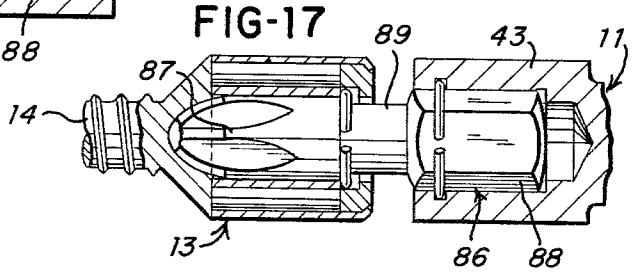
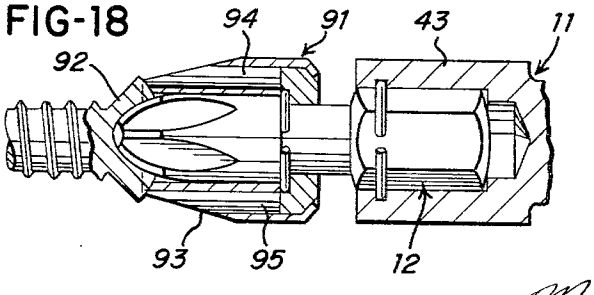


FIG-18



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3,253,626

MAGNETIC TOOL

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Filed Aug. 3, 1964, Ser. No. 386,992
5 Claims. (Cl. 145—50)

The inventions disclosed and claimed in this application relate to tools. More specifically they relate to magnetized sleeves which may be combined with any one of a plurality of bits for the purpose of holding small screws, bolts or similar fastening elements in driving engagement with the bit, while such elements are being driven or are about to be driven, and to combinations of such sleeves with such bits and/or with holders for such bits.

Magnetic tools for applying fasteners such as screws, bolts, and the like and for holding such fasteners on the tool prior to driving such fasteners have heretofore been proposed. In some of these, the magnet is secured within the bit holder and holds the bit within the bit holder by magnetic force. The magnetism passes through the bit so that the fastener is held on the end of the bit or driving implement by the magnetic force transmitted from the holder through the bit. The magnet as such in these prior art devices does not at any time contact the work piece.

In another type of magnetic tool for holding and applying fasteners, a bit may slide forward and rearwardly in a non-magnetic sleeve, the sleeve carrying a cylindrical magnet at its forward end. Therein a spring is provided to keep the bit normally with its tip rearward of the front face of the magnet in order to prevent magnetic force from passing from one pole of the magnet to the other pole through the bit itself. Such cylindrical magnets are expensive, and also have a dead area which extends across the cylinder approximately 90° to the north and south poles.

One of the objects of the inventions disclosed herein is the provision of an improved driving tool by means of which a screw or other similar fastener may be securely held by direct contact with a magnet prior to and during the driving operation.

A further object is to provide an improved driving tool including a driving bit and a magnetized sleeve axially floating on said bit between inner and outer limits so that full contact of the bit with the fastener is assured.

A further object is to provide an improved magnetized sleeve for use with a driving tool formed of a sleeve of non-magnetic material with which there are associated a plurality of bar magnets each having its north and south poles spaced longitudinally of the sleeve.

Another object of this invention is the provision of a magnetic fastener retainer which is carried wholly or entirely on the driving bit and which is preferably axially slidable on the bit.

Further objects, features and advantages will be apparent from the following specification, the accompanying drawings illustrating general embodiments of the invention and from the appended claims.

In the drawings:

FIG. 1 is an exploded or separated view in perspective of a tool constructed according to the invention and forming an embodiment thereof, a portion of the driving shank being broken away;

FIG. 2 is a fragmentary perspective view of the magnetic sleeve and bit of FIG. 1, the two units being separated and a portion of the sleeve being broken away and shown in section, it being apparent that the interior bore of the sleeve is circular in cross section while the exterior of the bit is hexagonal;

FIG. 3 is a longitudinal section through the magnetic sleeve of FIG. 2;

FIG. 4 is a view in vertical section taken on the line 4—4 of FIG. 3;

FIG. 5 is a view in longitudinal section taken through the combined sleeve, bit and driver or bit retainer of FIG. 1;

FIG. 6 is a view in section similar to FIG. 5 but showing the sleeve and bit in the relative position they assume when applied to a fastener of ferrous metal;

FIG. 7 is a view in vertical section taken on the line 7—7 of FIG. 6;

FIG. 8 is a view in longitudinal section through a portion of the holder of FIG. 1;

FIG. 9 is a view in section similar to FIG. 3 but of another embodiment of the invention, it being apparent that the interior bore of the sleeve is hexagonal in cross section;

FIG. 10 is a view in vertical taken on the line **10—10** of FIG. 9;

FIG. 11 is a view in longitudinal section through a sleeve forming another embodiment of the invention;

FIG. 12 is a view in vertical section taken on the line **12—12** of FIG. 11;

FIG. 13 is a view in longitudinal section through a sleeve forming another embodiment of the invention utilizing a circular magnet;

FIG. 14 is a view of another form of bit which may be used in the invention disclosed, the forward portion and the intermediate portion of this bit being circular in cross section;

FIG. 15 is a view in vertical section of the bit of FIG. 14 taken on the line **15—15** of FIG. 14;

FIG. 16 is a view in longitudinal section showing the bit of FIGS. 14 and 15 combined with a magnetic sleeve similar to the sleeve of FIGS. 1–6 inclusive;

FIG. 17 is a view in longitudinal section of the combined bit and sleeve of FIG. 16 being shown combined with a screw in operative relationship for driving the screw; and

FIG. 18 is a view similar to FIG. 17 but showing a modified magnetic sleeve which has been formed especially for use with very small head screws.

Detailed description

Referring to the drawings which show preferred embodiments of the invention and especially to FIGS. 1 through 8 inclusive, there is shown a tool consisting of a holder or handle **11**, a bit **12** and a magnetic sleeve **13**. In FIG. 1 the holder is shown separated from the bit and sleeve. A screw **14** is also shown associated with but slightly separated from the bit **12** and sleeve **13**.

As shown possibly more clearly in FIGS. 2, 5 and 6, the bit **12** is formed with a hexagonal rear head **15**, an intermediate portion **16**, a forward hexagonal portion or driving head **17**, and a driving tip **18**. The intermediate portion **16** is also generally of a hexagonal shape but has the corners removed so that it is in effect of smaller overall diameter than the rear head and the forward hexagonal portion.

The sleeve **13** is formed generally of a non-magnetic metal or other appropriate material. It may preferably be of brass. Though the sleeve **13** is preferably of brass it could be of any other appropriate non-magnetic material or appropriate plastic. Through the sleeve there is formed a main large diameter axial bore **21** which may be cylindrical or conforming to the shape of the bit. A plurality of smaller parallel bores **22**, **23**, **24**, **25**, **26** and **27** are also formed in the sleeve **13**, these extending in a direction parallel with the bore **21**. As stated there are shown six of the smaller bores but it is obvious that there may, if desired, be more of these bores or less.

Preferably, however, for reasons which will be obvious hereafter there should be an even number of these smaller bores, and pairs of these smaller bores should be arranged substantially diametrically opposite to each other. For example the bores 23 and 26, the bores 24 and 25, and the bores 22 and 27 form diametric opposites.

As stated above the bore 21 is circular in cross section and the outer periphery of the driving head 17 of the bit 12 is hexagonal. The diameter of the bore 21 is however preferably substantially equal to the diameter of the high points of the driving head 17 (i.e., to the diameter of the driving head 17 when taken through a pair of opposite high points of the hexagon).

The smaller bores 22 to 27 inclusive are also preferably circular in cross section and receive respectively the bar magnets 32–37. These magnets are secured in the bores 22 to 27 by a drive fit or held in place with a suitable adhesive. These magnets each have a north pole at one end and a south pole at the opposite end. It is preferred that half of the magnets be arranged with the north pole at one end and half be arranged at the south pole of the sleeve 13. Thus for example the magnets 35, 36 and 37 may have the north pole at the forward end of the sleeve and the south pole at the rear end of the sleeve. In such case the magnets 32, 33 and 34 may have their south pole at the forward end of the sleeve and the north pole at the rearward end of the sleeve. The magnets are preferably magnetized after assembly with the sleeve 13.

At the rear end of the sleeve 13 there is provided a washer 38 of magnetic flux carrying metal such as, for example, steel. The washer 38 completes the path of magnetic force from the forward end of the sleeve 13 through three of the bar magnets as for example through magnets 32, 33, and 34, through the washer 38 and then back to the forward end of the sleeve 13 through the other three bar magnets 35, 36 and 37, thus providing a six prong horseshoe magnet of very high efficiency. The washer 38 is secured in a depression in the rear of the sleeve 13 by peening or crimping the rear of the sleeve after the washer 38 has been inserted in the depression. This holds the washer 38 firmly against the rear ends of the magnets 32 to 37 inclusive.

The washer 38 is formed with an annular internal groove 41. In this groove there is positioned a split snap ring 42. The holder 11 is provided at its forward end with a head 43 having a hexagonal socket 44. This socket 44 is similarly formed with an annular groove 45 and in this groove 45 there is similarly positioned a split snap ring similar to the split snap ring 42. As shown in FIG. 5 when the hexagonal rear head 15 of the bit 12 is assembled in the socket 44 the ring 46 is positioned around the reduced portion 16 of the bit 12, thus holding the bit 12 releasably in the head 43 of the holder 11. Because of its resiliency the split ring 46 in its normal condition has an inside diameter smaller than the outside diameter of the hexagonal rear head 15 and an external diameter which maintains it normally in the groove 45 although normally it is not in contact with the inner wall of the groove. However, when sufficient force is exerted the resilient split snap ring 46 is spread slightly farther into the groove 45 (possibly into contact with the inner wall) so that the hexagonal rear head 15 may pass through the internal diameter of the ring 46.

The split snap ring 42 similarly cooperates with the groove 41 in the washer 38 and with the driving head 17 to releasably hold the bit 12 in the desired sliding relationship with the sleeve 13. However, because the reduced portion 16 is longer than the minimum possible distance between the two split rings 42 and 46 (i.e., the distance shown in FIG. 5), the magnetic sleeve 13 is free to move backward and forward axially on the bit 12. As shown in FIG. 6 when a fastener such as a screw 14 is associated with the forward ends of the sleeve 13 and of the bit 12, the magnet retains the fastener firmly for driving by the tip of the bit 12. This may cause the sleeve 13 to move forward a greater or less amount relative to the bit 12 and that the spacing between the head 43 of the holder 11 and the sleeve 13 be greater or less. For example, in FIG. 6, the sleeve 13 has moved forward substantially to its greatest extent inasmuch as the split rings 42 and 46 are at substantially the forward end and the rearward end of the reduced portion 16 of the bit 12.

In FIGS. 9 and 10, the sleeve 51 is again shown as being formed of a non-magnet. The sleeve 51 is provided with a main central radial bore 52 and with a plurality of parallel magnet bores of smaller diameter within which are received a plurality of bar magnets 54, again preferably forming opposite pairs of magnets. This sleeve 51 is also provided with a groove 65 in which there is a split snap ring 66. In this embodiment, there is no flux return member, such as the ring 38, and the sleeve operates substantially in the manner described above, but the magnets have correspondingly lower efficiency. This embodiment may be preferred where the simplicity of manufacture is of prime importance.

In FIGS. 11 and 12 a different form of magnet carrying sleeve is shown. Therein, the brass sleeve 71 is associated with and carried on a steel sleeve 72. The steel sleeve 72 has a rear ring portion 73 contacting the rear ends of the magnets 74 and 75 which are held in boxes in the brass sleeve 71 and forming the flux return path for the magnets. The sleeve 72 also has a forward extending tubular projection 76 which telescopes into the sleeve 71 and forms the central opening 21. Thus, the sleeve 71 may be a press fit on the tubular projection 76 of the sleeve 72.

In FIG. 13 there is shown another embodiment of the invention wherein the sleeve 81 is formed of brass. It has a recess 82 formed in the front end. A ring magnet 83 is secured by reducing the outer diameter, such as, by swaging and consequently reducing the inner diameter to retain the magnet. An axially extending groove 84 in which there is a split snap ring 85 the axial freedom of movement of the sleeve relatively to the bit may thus be provided by the groove 84 in the sleeve.

In FIGS. 14 and 15, a modified form of bit 86 having a forward head 87, a rearward hexagonal head 88 and an intermediate reduced portion 89 is shown. The forward head 87 and the reduced portion 89 are both circular in cross section. In FIGS. 16 and 17, the bit 86 is shown combined with the head 43 of the holder 11, with the sleeve 13, and in FIG. 17 with the screw 14.

In FIG. 18 there is shown a sleeve 91 combined with the bit 12 and thus with the head 43 of holder 11. This combination is shown operatively connected with a screw 92 which has a head appreciable smaller than the head of the screw 14. The sleeve 91 is tapered as at 93 by grinding the front end thereof. In the process of grinding the sleeve 91, the bore magnets thereof such as for instance the bore magnets 94 and 95 are ground to a taper so that the forward end of the sleeve 91 is substantially of the same size as the head of the screw 92.

It will therefore be seen that in each of the embodiments, the magnetic retaining force is applied directly to the fastener, and the magnetic lines of force pass through the fastener between the opposite magnets forming the opposite poles on the front face of the fastener. The driving bit forms the means by which the magnet sleeve is carried on the tool, but is not relied upon for providing a flux return path, this being provided across the diameter of the sleeve through the attached fastener. Thus, the highest efficiency is obtained by the direct contact of the magnet or magnets with the fastener, providing a lightweight and highly compact structure.

The provision for limited axial movement of the sleeve relative to the bit provides a means for compensating for variations of the depth of the recesses in the fasteners, and for the wear of the bit, while assuring the direct con-

tact with the fasteners. The employment of releasable connection means in the form of a snap ring 42 permits the magnetic sleeves of this invention to be applied to new bits as the old ones are worn out or broken, or as it is otherwise desired to change the bits. Furthermore, the magnetic sleeve does not interfere with the driver, being axially aligned therewith. It is understood that the driver may frequently take the form of a tool holder or adaptor for attachment to a power tool and accordingly the sleeves of this invention are adapted for use with existing bit holders.

While several specific forms of tools have been described herein and while these specific forms constitute preferred embodiments of the invention, it is to be understood that the invention is not limited to these precise forms and that changes may be made therein without departing from the scope of the invention which is defined in the appended claims.

What is claimed is:

1. A magnetic pick-up fastener driver comprising a driving bit having a shank portion and a plurality of driving wings formed on one end thereof for receiving a fastener thereon, a fastener-retaining magnet assembly removably received on the said shank of said bit including a generally sleeve-shaped body received in telescoping relation over said shank and having an axial length less than that of said shank, means in said magnet assembly forming opposite magnetic poles at one end thereof adjacent said driving wings, and means retaining said assembly on said bit shank with said wings being positioned outwardly of said assembly one end providing for limited, substantially unrestricted, axial self-aligning movement of said body on said shank with direct contact of said assembly with the head of a fastener retained in driving relation on said bit wings.

2. The magnetic device of claim **1** in which said retaining means includes a snap ring on said assembly body, and in which one of said bit and assembly body is provided with an axially extending portion configured with respect to said snap ring to provide axial aligning movement relative to said snap ring.

3. The driver of claim **2** in which a portion of said bit shank is of reduced diameter at said snap ring providing said relative axial movement of said ring with respect to said bit shank.

4. The driver of claim **2** further comprising means in said assembly body defining an inwardly opening recess, said snap ring being received within said recess, and said recess having an axial length substantially greater than the width of said snap ring providing for said axial aligning movement by axial movement of said ring in said recess.

5. A magnetic screw driver bit for driving fasteners having cruciform slotted recesses therein comprising a bit having a shanklike body and having cruciform driving wings formed on one end of said body, a sleeve formed in surrounding relation to said body and having an axial length less than that of said body with said driving wings extending axially outwardly of one end of said sleeve, means mounting said sleeve on said body for limited axial aligning movement thereon with said one end being proportioned directly to engage fasteners which are in driving engagement with said wings over variations in the depth of such fastener recesses, and magnet means in said sleeve forming opposite magnetic poles at at least said one end for retaining such fasteners in said driving relation.

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