

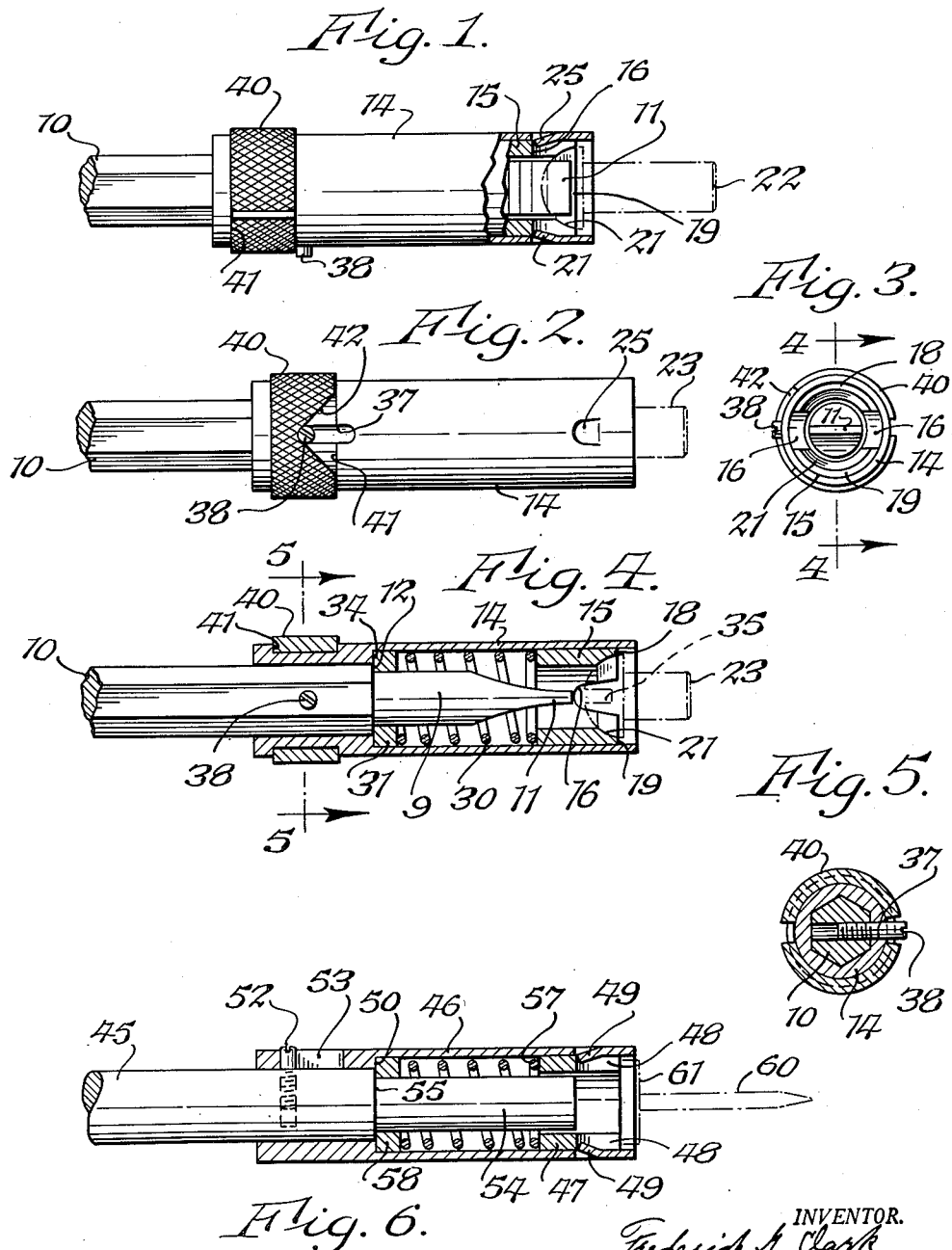
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F. G. CLARK
MAGNETIC TOOL

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Filed Nov. 18, 1948

2 Sheets-Sheet 1



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Fig. 7.

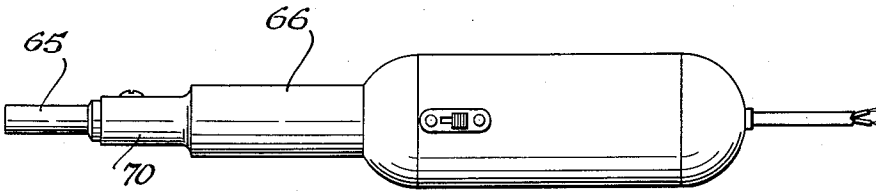
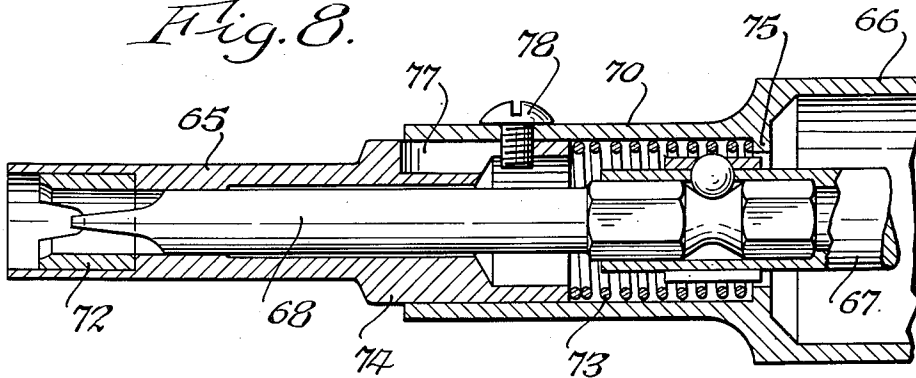


Fig. 8.



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MAGNETIC TOOL

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1 Claim. (Cl. 145—51)

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This invention relates to magnetic tools for applying fasteners such as screws, bolts, nails, rivets, or the like, and for holding such fasteners on the tool prior to and during the starting of the driving of the same into their operative positions.

One of the objects of this invention is to provide a tool of this kind of improved construction by means of which a fastener will be securely held prior to and during the preliminary driving of the same into its operative position. A further object of this invention is to provide a tool of this type in which a small horseshoe type of magnet of high magnetic force is incorporated in the tool and in which the driving implement is normally so positioned as to avoid bridging the poles of the magnet until the fastener has been arranged in position for driving. Another object is to provide a tool of this type in which conventional driving members or screwdriver bits made of magnetizable steel may be utilized. A further object is to provide a tool of this type in which the driving member may be readily replaced. Other objects and advantages will be apparent from the following description of certain embodiments of the invention and the novel features will be particularly pointed out hereinafter in connection with the appended claim.

In the accompanying drawings:

Fig. 1 is an elevation, partly in section, of a magnetic screwdriver embodying this invention.

Fig. 2 is a bottom plan view thereof, showing some of the parts in different positions.

Fig. 3 is an end view thereof.

Fig. 4 is a longitudinal central sectional view thereof, on line 4—4 Fig. 3.

Fig. 5 is a transverse sectional view thereof, on line 5—5, Fig. 4.

Fig. 6 is a central sectional elevation of a magnetic tool for driving nails, rivets, and the like.

Fig. 7 is an elevation of a power driven screwdriver embodying a modified form of my invention.

Fig. 8 is a fragmentary longitudinal central sectional view thereof, on an enlarged scale.

Referring to the particular embodiment of the invention shown in Figs. 1 to 5, 10 represents the shank of a screw driver. Only a portion of this shank is shown and the same may be rotated either manually or by power. This shank is provided at the outer end thereof with a portion 9 of reduced diameter which terminates at its outer end in a driving member, such for example as a screwdriver bit 11. The portion 9 of reduced diameter may be formed integral with the shank 10 and forms a shoulder 12 with the shank 10.

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The end 11 of the driving member may be of any other shape to cooperate with the heads of the fasteners with which the tool is to be used.

14 represents a sleeve or shell, one end of which is slidably mounted on the shank 10 to move to a limited extent lengthwise thereof and the other end of which supports a magnet 15. This magnet is preferably made of an alloy which may be highly magnetized and is of hollow cylindrical or tubular form. The outer end of the magnet is bifurcated by means of a slot or groove 16 extending diametrically of the magnet and dividing the outer end thereof into two projections 18 and 19 which form the two poles of the magnet. The outer end faces of the magnet poles 18 and 19 may be shaped in any desired manner to best cooperate with the head of a screw or bolt to hold the same substantially in axial alinement with the driving member or bit. For example, when the tool is to be used in connection with flat headed screws, the outer face of the magnet will extend perpendicular to the axis thereof. In the construction shown, the outer face of the magnet is concave or partly spherical, as shown at 21 to fit round-headed screws or bolts, such for example as the round-headed bolts or screws 22 and 23 shown in broken lines in Figs. 1, 2 and 4. It will be understood, however, that the outer face of the magnet may be of any suitable or desired shape to enable it to best hold the heads of the fasteners with which the tool is to cooperate. The sleeve 14 constitutes a magnet holder by means of which the magnet may be moved toward the shank 10 to permit the bit to move into engagement with the fastener. The magnet holder may be of other suitable form.

The magnet may be secured in its operative relation to the sleeve or magnet holder in any suitable or desired manner, and in the construction shown, the shell is provided with integral lips 25 which extend inwardly into engagement with the inner ends of the grooves or recesses 16 in the magnet. If it is desired to remove the magnet, the lips may be bent or sprung outwardly to permit the magnet to pass through the outer end of the sleeve, so that the magnet may be replaced by another magnet. The shell 14 is made of a non-magnetic material, such as stainless steel, bronze, or the like, which will not form a low resistance path for the lines of force from one pole of the magnet to the other, and which will therefore not detract from the strength or force of the magnet.

In order to avoid short-circuiting the lines of force from one magnetic pole to the other and

thus have most of these lines of force available to pass through the head of the fastener to more securely hold the same while the fastener is being positioned in correct relation to the hole in the work into which the fastener is to be driven, I preferably provide means for normally holding the sleeve 14 and the magnet arranged thereon in such position that the end of the bit 11 will not be located between the end portions of the poles of the magnet and will be located normally within said magnet and spaced from the outer end thereof. Any suitable or desired means may be provided for this purpose, and which also permit the bit to pass further into the hollow cylindrical magnet and projects to a point beyond the innermost limit of the face of the magnet and into engagement with the slot or recess in the fastener after the same has been correctly positioned on the work. In the construction, shown by way of example, I provide a coil spring 30, one end of which engages the inner end of the magnet 15 and the other end of which may exert a pressure against the shank 10. This may be accomplished, for example, by providing on the reduced shank portion 9 a ring or washer 31 bearing against the shoulder 12 of the shank and against which the spring 30 may press. The ring or washer 31 may, consequently, slide lengthwise of the shank portion 9 into engagement with the shoulder 12. The portion of the sleeve 14 slidably engaging the shank 10 is preferably of somewhat smaller internal diameter than the remaining portion of the sleeve, thus forming a shoulder 34 which may abut against the ring or washer 31 to limit the extent to which the spring 30 may expand.

Suitable means are provided for retaining the sleeve in operative relation to the shank 10 and the bit 11 and for permitting limited sliding of the sleeve or magnet holder 14 on the shank. For this purpose the sleeve is provided with a slot 37 and the shank 10 has a pin or set screw 38 secured thereto and extending outwardly therefrom into the slot 37. Consequently, the spring 30 will normally hold the magnet holder or sleeve in its outer position as shown in Figs. 2 and 4, in which the end of the bit will be spaced from the projections or poles 18 and 19. Consequently, it will be obvious that by means of this construction, the driving member may be made of a grade of steel, such as heretofore used for driving members of various types and which is magnetic, and more durable than non-magnetic materials which are at present available. By making the pin or set screw 38 removable, the sleeve or magnet holder 14 and the magnet mounted thereon may be released from the driving member so that the driving member may be replaced when worn out or broken.

When the screwdriver bit is of the type commonly used for screws or bolts with slotted heads, it is desirable to position the bit relatively to the poles of the magnet in such a manner that the flat end of the bit will extend substantially parallel with the transverse groove or recess 16 in the magnet as clearly shown in Figs. 1 to 4 so that the fastener engaging end of the screwdriver bit will be spaced from the poles of the magnet by the maximum air gap. When arranged in this position, the screwdriver bit will have very little effect in reducing the magnetic force available to hold the screw or other fastener on the tool. This positioning of the bit relatively to the magnet poles can readily be effected by means

of the construction described by arranging the slot 37 and pin or set screw 38 in such relation to the shank 10 so that the flat sides of the screwdriver bit 11 will face the poles of the magnet.

In the particular construction shown, the shank 10 is of hexagonal cross section and the bore in the portion of the shell 14 which engages the shank is of similar hexagonal form so that rotation of the shell and shank relatively to each other is prevented, thus supplementing the action of the pin or set screw 38 and slot 37, which also serve to prevent turning of the sleeve relatively to the shank. The shank may, however, be of circular cross section, if desired. Any other means for preventing relative rotation of the shell and shank may, of course, be provided if desired.

When the parts are in their normal positions, the spring 30 will hold the sleeve or magnet holder 14 in its outer position, as clearly shown in Fig. 4, so that the end of the bit 11 is spaced from the poles 18 and 19 of the magnet. When the parts are in this position, a screw or bolt having a slotted head will be rigidly held by the magnet in such a manner that the screw or bolt may be moved into correct relation to the hole into which it is to be screwed, whereupon pressure may be exerted on the shank 10 in a direction toward the fastener and by simultaneously turning the shank, the bit 11 will seat itself in the slot 35 or other recess in the head of the screw or bolt. When this driving connection has been established, further rotation of the shank 10 will cause the screw or bolt to be screwed into its operative position. Once the screw or bolt is started, the holding force of the magnet is no longer required and when the screw or bolt enters the work approximately into its final position, the head of the same may be withdrawn from the magnet as the end of the sleeve 14 contacts with the work.

It may at times be desired to provide additional means for holding the screw or bolt in axial alignment with the shank 10 in order to facilitate starting the bolt or screw in the hole into which it is to be screwed, and this can be accomplished by so positioning the screwdriver bit relatively to the magnet that the bit will enter the slot or other recess in the head of the fastener while the same is held by the magnet. For this purpose, I have shown a cam member in the form of a split ring 40 rotatably arranged in an annular recess 41 in the outer surface of the sleeve 14. The cam ring is provided at one edge thereof with a slot or recess 42 into which the pin or set screw 38 may enter. Consequently, when the pin is in the inner end portion of the slot or recess 42, as shown in Fig. 2, the sleeve 14 will be held by the spring 30 in its outer position so that the driving member or bit 11 will be spaced from the poles of the magnet. By moving the sleeve 14 to the left from the position shown in Figs. 2 and 4 and turning the split ring 40 relatively to the pin 38 so that the pin rests on the outer edge portion of the ring 40, as shown in Fig. 1, the sleeve is so positioned that the bit 11 will project between the poles of the magnet to enter the slot in the fastener while the same is held by the magnet. Under these conditions, the fastener will be held substantially coaxial with the shank 10 and sleeve 14 and can, consequently, be readily inserted into the hole into which it is to be screwed even while the shank is rotating. Since the flat faces of the bit will extend

parallel to the groove or space 16 between the pole pieces, it will not reduce the magnetic force acting on the fastener to any material extent. Any other means for holding the sleeve in retarded position against the action of the spring 30 may be provided, if desired. By making the sides 42 of the slot so that they diverge as shown in Fig. 2, these sides may serve as cams, so that by merely turning the ring 40, the sleeve 14 will be drawn to the left from the positions shown in Figs. 2 and 4.

By means of this construction, if a long fastener such as the screw or bolt 22 shown in Fig. 1 is to be handled by means of the screwdriver, the sleeve 14 can be moved into the position shown in Fig. 1, whereupon the fastener 22 will be held not only by the magnetic force, but will also be correctly positioned and held in substantially axial alinement with the shank 10 by means of the bit 11.

In Fig. 6, I have illustrated my invention adapted to a tool for driving nails, tacks, rivets, or the like. In this construction, 45 represents a portion of the shank of the tool 46 and magnet holder which may be in the form of a sleeve or shell, one end of which is slidably mounted on the shaft 45 and in the other end of which a hollow cylindrical horseshoe magnet 47 is mounted. The sleeve 46 is made of non-magnetic material. This magnet also has a diametrically extending groove or recess 48 dividing the outer end of the magnet into two projections which form the poles of the magnet, and the sleeve may be provided at opposite sides thereof with lips 49 extending into the groove or slot 48 to prevent outward movement of the magnet through the open end of sleeve 46. The portion of the sleeve 46 which engages the shank 45 is also made of greater thickness as described in Figs. 1 to 5, thus forming a shoulder 50. The sleeve 46 may be suitably limited in its motion relatively to the shank, for example, by means of a pin or set screw 52 secured to the shank and extending into a slot 53 in the sleeve 46. A shank 45 has an end portion 54 of reduced diameter which also forms a shoulder 55 at its juncture with the main portion of the shank 45, and this reduced portion 54, which corresponds to the bit 11 shown in Figs. 1 to 5, constitutes the driving member of the tool. The sleeve 46 is also made of non-magnetic material, but the driving part 54 of the shank may be of hardened steel. Means are, therefore, provided for normally supporting the magnet 47 in such relation to the driving part 54 that the driving part will not form a short path for the magnetic flux from one pole to the other, and for this purpose, a spring 57 is provided within the sleeve 45, one end of the spring engaging the inner end of the magnet 47 and the other end engaging the ring or washer 58 which engages the shoulder 55 of the shank and which also engages the shoulder 50 of the sleeve when the same is in its outer position in which the poles of the magnet are spaced from the driving member 54.

In the operation of this device a nail, rivet or like fastener 60 having a head 61 may be held on the tool by causing the head 61 to contact with the poles of the magnet 47 so that the fastening member may be held in substantially axial alinement with the shank or shaft 45 by means of the magnet. When force is applied through the shank 45 in the direction toward the fastening member, the driving member 54

will engage the head of the nail or rivet and thus drive the same into its operative position. Force may be applied to the shank 45 in any suitable manner, such for example, by means of a hammer. When such force or blows are applied to the shank 45 the sleeve 46 will slide lengthwise of the shank sufficiently to permit the driving member 54 to engage the head 61. Generally after the first blow on the fastener, the magnet is no longer required to hold the fastener in correct position, but after the first blow, the magnet will hold the tool in correct relation to the fastener, thus facilitating the driving of the fastener into its final position.

In Figs. 7 and 8, I have shown my improvements applied to a power driven screwdriver of the type having a slidable sleeve or magnet holder 65 which does not rotate during the driving of the screw or bolt, so as not to mar or scratch any work with which it comes into contact, the sleeve being made of non-magnetic material. In this construction 66 represents the shell or housing of a motor of any suitable type, not shown, which rotates a member 67 provided with a clutch or coupling of any suitable type to which a driving member or screwdriver bit 68 may be secured. The housing 66 has a cylindrical extension or part 70 of reduced diameter projecting from one end thereof within which the sleeve 65 is slidably mounted. A hollow cylindrical horseshoe magnet may be suitably mounted adjacent to the outer end of the sleeve 65 in any suitable manner, and in the construction shown, the outer end of the sleeve has a bore of reduced diameter within which a magnet 72 of this type may be secured in any suitable manner, for example, by driving the magnet into the outer portion of the bore of the sleeve 65.

In order to so space the magnet with reference to the driving member or bit 68, that this member will not cause magnetic lines of force to pass from one pole of the magnet to the other through the bit of the driving member, means are provided for normally spacing the magnet relatively to the end of the driving member so that this end will normally not extend between the two poles. For this purpose the sleeve 65, which is slidably mounted on the tubular extension 70 of the motor housing, is normally held in its outer position by means of a coil spring 73 one end of which engages the inner end of an enlarged portion 74 of the sleeve 65. The other end of the spring engages an inwardly extending flange or shoulder 75 of the motor housing. The sliding movement of the sleeve 65 relatively to the motor housing is preferably limited, for example, by means of a slot 77 extending lengthwise in the enlarged portion 74 of the sleeve 65, and a screw or pin 78 which extends through an aperture in the extension 70 of the motor housing and into the slot 77. The ends of the slot limit the extent to which the sleeve may move relatively to the driving member or bit 68 and also prevents rotation of the sleeve relatively to the motor housing.

In the operation of this device, the head of a screw, bolt or other fastener is placed into engagement with the outer end of the magnet 72 so that it will be securely but removably supported thereby. The fastener is then positioned at the hole in the work in which it is to be driven and when so positioned, pressure is exerted on the motor housing 66, thus causing the driving member or bit 68 to engage the slot

in the head of the fastener and turn the same for moving it into its final operative position.

Magnetic screwdrivers of this type have the advantage that it is not necessary to manually start the screw or other fastener in the hole in which it is to be driven. Tools of this type, therefore, not only save time in applying fasteners in positions which are relatively inaccessible, but also facilitate and expedite the application of fasteners under any conditions.

By means of the constructions described, driving members or bits of conventional construction and materials commonly used in connection with tools of this type may be employed without weakening the force exerted by the magnet on the fastener. Consequently, the driving members may be made of the desired grade of steel without consideration of its ability to conduct magnetic flux, and when my improvements are used in connection with power-operated screwdrivers, the same screwdriver bits formerly employed may be used. The construction described also has the advantage that the magnet holder or sleeve extends slightly beyond the outer end of the magnet so as to facilitate the positioning of the fasteners on the tool and to protect the magnet against damage by contact or impact with other objects.

The term "non-magnetic" is herein used in practical sense to designate materials of very low magnetic permeability.

It will be understood that various changes in the details, materials, and arrangements of parts which have been herein described and illustrated in order to explain the nature of the

invention, may be made by those skilled in the art within the principle and scope of the invention, as expressed in the appended claim.

I claim as my invention:

A tool for applying fasteners comprising a shank having a driving end, a non-magnetic sleeve slideable on said shank and encasing said driving end, a hollow cylindrical magnet coaxially aligned with the axis of said shank secured to the inside of said sleeve and polarized across a face, said face facing in the direction of the object to be held, a spring acting against said sleeve to maintain the magnet in a position relative to said driving end, in which position said driving end is located within said magnet and spaced from the outer end thereof, and upon retraction of said sleeve, said driving end projects to a point beyond the innermost limit of said face of said magnet, said sleeve having a portion extending beyond said face of the magnet having inner walls substantially parallel to the axis of said shank.

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