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H. F. BRENHOLTS
POWER HAND TOOL ATTACHMENT

2,772,589

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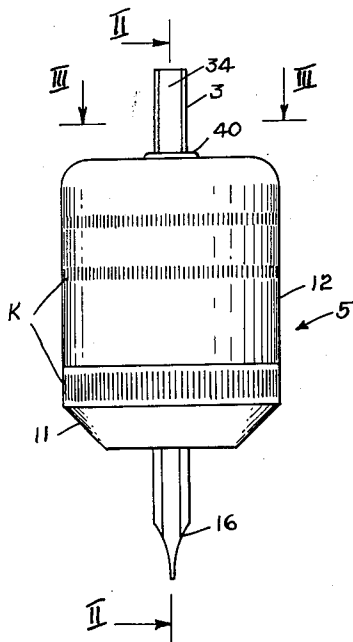


Fig. 1.

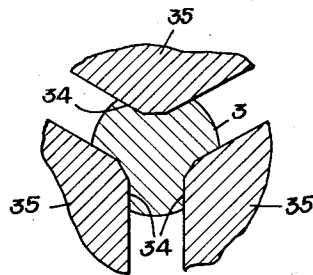


Fig. 3.

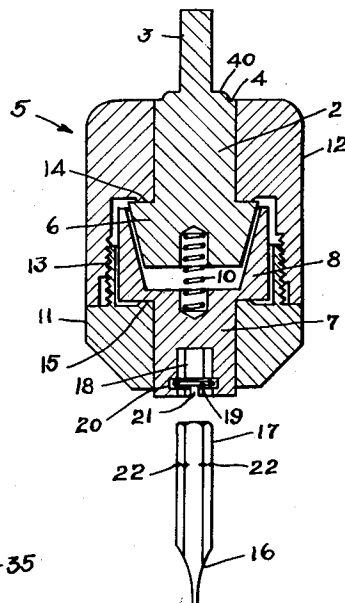


Fig. 2.

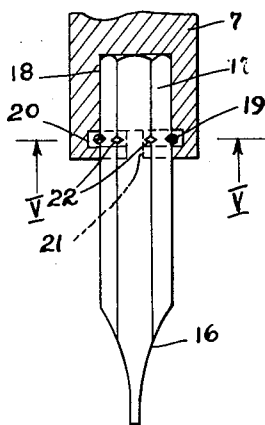


Fig. 4.

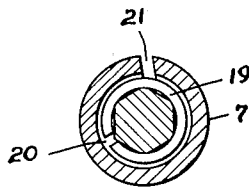


Fig. 5.

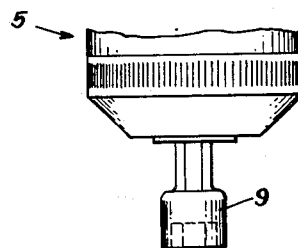


Fig. 6.

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POWER HAND TOOL ATTACHMENT

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3 Claims. (Cl. 81—52.4)

My invention relates to power-driven hand tools, and consists in a driving attachment for electric hand drills, say drills of the "pistol grip" type, or of the cross-handle type, which are in such wide use at the present time, it being noted that electric hand drills, so-called, are in fact not drills at all, but are electric motor units for driving drill bits.

The driving attachment of my present invention may be readily engaged to the drive shaft of an electric hand drill, to serve as a variable speed drive for tools other than the drill bits normally operated by such electric hand drills. By way of example, I mention screw driver bits, socket wrenches, and other rotary tools, as the implements which a conventional electric hand drill may be adapted to drive through the instrumentality of my attachment. Indeed, where variation in speed and yieldability of the rotative stress are desired in the driven tool, the attachment of this invention may be used with drill bits which otherwise are driven directly by an electric drill or drive unit.

Driving attachments of the sort alluded to may be found on the domestic market, and in exemplary way I mention the device disclosed in my copending application for United States Letters Patent, Serial No. 417,432, filed March 19, 1954. My present application comprises a continuation-in-part of said copending application.

The usual driving attachment comprises a driving spindle having a spindle portion at its upper end for engagement by the chuck jaws of the drill, and a frictional clutch element at its lower end. Cooperating with the driving spindle is a driven spindle having a frictional clutch element at its upper end to receive the said clutch element of the driving spindle. The driven spindle is provided at its lower end with means for securing a screw driver bit, or other tool, in service position. A "floating" or free-turning housing encloses the clutch elements and provides bearings for said spindles. The housing also provides a handle for the user of the tool. The driving spindle extends upwardly from the housing for ready engagement by the chuck of the drill, as mentioned, while the lower spindle, in all prior devices of which I have knowledge, extends downwardly from the housing and has a portion to receive and secure the tool to be driven. The result is that the effective tip of the tool is located at a substantial interval below the handle or housing of the device, with the consequence and effect that it is difficult, due to the vibration of the drill in operation, to keep the tool in desired engagement with the work. The problem is particularly acute when driving kerf-headed screws, since the screw driver bit tends to become dislodged from engagement with the kerfed head of the screw being driven.

In accordance with this invention, I provide within the housing or handle of the driving attachment the means for securing the screw driver bit or other tool, whereby the working tip of the driven tool is located a very short interval from the bottom of the driving attachment. In

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effect the driven tool is practically located within the grasp of the user, but without danger to his fingers. The handle is held stationary, while the spindles and tool rotate within it. As a result the tool is readily controlled by the user, and the otherwise objectionable vibration of the drill in operation is neutralized.

A further and cooperating feature of this invention is found in the combination of positive mechanical interlocks with the friction clutch in the mechanical torque train or transmission between the rotor of the electric drill and the driven tool. The driving attachment of the invention is sturdy, durable and efficient in service, and is relatively inexpensive to construct.

The invention will be understood upon reference to the accompanying drawings, in which:

Fig. 1 is a view in side elevation of a drill attachment embodying the invention;

Fig. 2 is a view of the device in vertical section;

Fig. 3 is a view in cross section and to larger scale, showing on the plane III—III of Fig. 1 the jaws of the chuck of an electric drill engaged to the driving spindle of the device;

Fig. 4 is a fragmentary view, showing to larger scale, partly in vertical section and partly in side elevation, the tool-securing socket of the device;

Fig. 5 is a view taken on the plane V—V of Fig. 4; and

Fig. 6 is a view in side elevation of a socket wrench for use with the device.

The driving attachment of the invention includes a driving spindle 2, which is of reduced diameter at its upper end 3 for engagement by the jaws of the conventional chuck of an electric hand drill. It will be perceived that the shoulder 4 between the portions 2 and 3 of the driving spindle provides an abutment against which the ends of the chuck jaws may bear, and in the assembled structure this shoulder 4 lies substantially flush with the top of a housing 5, later to be described in detail. At its lower end the driving spindle is provided with a clutch element, advantageously a conical clutch element 6 of hardened steel. Arranged in axial alignment with the driving spindle 2 is a driven spindle 7, provided at its upper end with clutch element in the form of a conical socket member 8 of hardened steel, adapted to receive the conical clutch element 6 of the driving spindle in a frictional driving engagement.

The driven spindle forms a tool bit carrier located within the housing 5, although it is readily accessible to permit the attachment and removal of the various tools which are to be driven. Between the clutch elements 6 and 8 a coil spring 10 is arranged, the clutch elements being socketed as shown in Fig. 2 to receive and stay the ends of the spring. The spring serves normally to hold the clutch elements out of engagement with one another.

The housing 5 is floating or free turning, formed as a two-part block, as shown, to provide a handle for the user of the tool, as well as to provide an all-enclosing housing that is relatively rotatable to both of the clutch elements 6 and 8 of the two spindles which it encloses. In service the upper end 3 of the driving spindle, projecting upward from the handle 5, is engaged in the chuck of a power-driven hand drill, with the ends of the jaws of the chuck bearing against an abutment portion 40 on the shoulder 4 of the spindle, to transmit the manually applied axial thrust, as will presently appear. It will be noted that the body of the handle is formed of two cup-shaped members 11 and 12, united in a threaded joint 13 and forming an externally smooth and rounded body that may be readily and comfortably held in one hand of the user, while the electric drill is grasped in the other hand. The external surface of the handle

11, 12 may be knurled, as at K, to assure security in the grip of the user.

When the electric drill is in operation, the driving spindle 2 is powerfully rotated, say at a speed of from 1700 R. P. M. to 2200 R. P. M., the normal speed of such a drill, but the handle may be readily held in the hand against rotation. The driven spindle 7 normally remains at rest, since the clutch elements are held out of engagement by the spring 10. It will also be noted that the bodies of the two spindles provide journals which are rotatably engaged and supported by the housing or handle 5, that is, the body portions of the spindles located immediately adjacent to the clutch portions 6 and 8, respectively, serve as journals. These body portions of the spindles are of relatively large diameter with respect to the spindle portion 3. The outer rims or edges of the bores in the handle 5, in which the said journal portions rotate, are located at a substantial interval radially inward from the side surface of the handle, whereby the fingers of the hand grasping the handle do not lie close to the edges of the joints where there is a relative rotation between the handle and the journal portions. By virtue of these features a sturdy assembly of the spindles is assured, to withstand wear and endure relatively great stresses. The rotatable engagement of the clutch elements with the handle 5 is limited to annular portions 14 and 15 of relatively small areas, thereby tending to minimize frictional drag between the relatively rotating parts, and to facilitate the use of the handle, particularly when operating pressure is applied to drive a screw driver bit, or other tool.

The journal portion of the driven spindle 7 within the handle or housing 5 forms the tool-securing means of the driving attachment of my invention. More particularly, a bore 18 of hexagonal cross section is provided in the said journal portion, and this bore is adapted to receive the correspondingly sectioned shank 17 of the screw driver bit 16 and to hold such bit against rotation relatively to the driven spindle. A detent is provided for retaining the bit in assembly with the driven spindle, and such detent advantageously comprises a split annulus 19 formed of spring wire, which is secured in a circumferential groove 20 in the wall of the bore 18, near the mouth of the bore. The shank 17 of the screw driver bit is provided on the six ridges or edges of its hexagonal body with a circumferential row of notches 22, and when the shank of the bit is pressed into the bore 18 the split annulus 19, while held in groove 20, expands radially to permit the extrance of said shank to the bore. When the entering shank reaches fully inserted position the split annular spring 19 "snaps" into engagement with the notches 22 and retains the bit in operative assembly with the driven spindle 7. When the bit is intentionally pulled to remove it from assembly, the split spring 19 yields. A simplified and yet effective tool-securing device is thus provided in the journal portion of the driven spindle within the housing or handle 5.

A slot 21 in the end of the journal portion of the driven spindle extends inwardly to the groove 20, to facilitate the introduction of the spring 19 to the groove 20, or the removal of the spring.

In order to drive a screw, the upper end 3 of the driving spindle is "chucked" in the electric drill, and the head of the screw is engaged by the screw driver bit that is closely guided by the fingers of the hand of the user which engages the handle 5; next, the user bears downward upon the electric drill held in his other hand. The thrust thus created is transmitted by the chuck jaws of the drill against the rounded abutment portion 40 on the shoulder 4 of the rotating driving spindle 2, and under the effect of the thrust thus imparted to the rotating spindle 2 the spring 10 is compressed, and the clutch members 6 and 8 are closed in frictional engagement, thereby positively rotating the spindle 7 and the

screw driver bit carried thereby. The screw is driven home, as will be manifest.

It will be understood that the rotative speed of the usual electric drill is normally too great for driving the screw driver bit, and it is to be noted that the required reduction in speed is obtained by "slipping the clutch." That is to say, the pressure or thrust applied to the spindle 2 is such that the conical clutch element 6 slips within the socket element 8, and thereby causes the screw-driving bit to rotate at much lower speed than the motor of the electric hand drill, while providing mechanical advantage in the torque transmitted. By varying the thrust applied to the spindle 2 the speed of rotation and the torque developed may be regulated to suit the particular job to be done. Furthermore, when the screw reaches fully driven position the clutch will slip and will thus prevent the head of the screw from being twisted off, as might be the case if an unyielding drive were provided for the screw driver bit. Furthermore, the friction clutch may slip and permit the bit to be freed from the kerf in the head of the screw, without damage to the surrounding surface of the work.

Fig. 6 illustrates a socket wrench bit 9 that may be used in the driving attachment for rapidly driving machine screws or applying nuts to bolts.

The chuck of the electric drill engaged to the driving spindle 2, 3, together with the clutch elements 6 and 8, and the driven spindle 7, form a mechanical train, through which the torque developed by the rotor of an electric drill is transmitted with selected speed reduction and force to the driven tool or bit. As already mentioned, the selected speed and transmitted torque may be determined by the degree of the manual pressure applied to the electric drill to engage the clutch elements 6 and 8. With this in mind, it is important to note that the mechanical torque train of the device of my invention includes two positive mechanical interlocks between the driving rotor of the electric drill and the driven tool bit, and between such two positive mechanical interlocks a frictional clutch is provided.

It is to be noted that the stem or spindle portion 3 is formed with three grooves 34 that extend longitudinally of such portion, and each groove is in cross section rounded to receive in snug engagement the clamping edge of one of the three jaws 35 of the chuck of the electric drill that drives the device, as may be understood upon considering the cross-sectional view of Fig. 3. This engagement of the driving chuck jaws with the spindle portion 3 provides the first mechanical interlock in the torque train mentioned.

The second mechanical interlock is provided by the engagement of the shank of the bit in the bore 18 in the driven spindle 7 of the device, while the elements 6, 8 provide the frictional clutch between the said pair of mechanical interlocks of the train. This specific combination of interlocking and frictional units is very effective. Advantageously the grooves are formed in the spindle portion 3 in a "coining" operation.

It is further noteworthy that the portion 40 not only transmits the axial thrust which the user manually applies upon the electric drill, but also provides mechanical reinforcement in the region where the spindle portion 3 of reduced diameter is integrated with the driving spindle journal portion 2 of larger diameter, while forming a wear-resisting element between the chuck jaws and the engaged driving spindle in the region where fracture or mechanical failure may occur in service.

The usual electric drills of today are driven by reversible electric motors, wherefore it will be understood that the bits described may be driven to remove, as well as to install screws, nuts and the like.

The device of my invention perfects the utility of electric drills to a great variety of uses. A single electric drill becomes, in a word, a great number of effective power tools. Various modifications of the structure de-

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scribed lie within the spirit of the invention defined in the appended claims. For example, the bore 18 and the bit shank 17 engaged therein are defined to be hexagonal in cross section, but it will be obvious to the mechanic that the bore and the shank may take any one of a number of cross-sectional contours which will be effective to prevent relative rotation between the bit and the driven spindle 7.

I claim:

1. In a driving device for an electric drill having a rotor equipped with a chuck, said device comprising a driving spindle having a portion at its upper end for engagement by the jaws of said chuck and a frictional clutch element at its lower end, a driven spindle having a frictional clutch element at its upper end to receive said clutch element of the driving spindle, means for securing a tool to the lower end of the driven spindle, and a "floating" housing adapted to be held stationary in the hand of the user while enclosing said clutch elements and providing a bearing for a journal portion on each of said rotary spindles, both the chuck-receiving and tool-securing ends of said spindles being severally accessible at the top and bottom of said handle without danger to the fingers of the user during the rotation of the spindles; the invention herein described wherein said driven spindle is enclosed substantially entirely within said stationary handle and includes a bore of hexagonal cross section to provide said tool-securing means, said tool having a shank of complementary cross section for an engagement with said bore, and a detent for releasably securing said tool in assembly with said journal portion of the driven spindle within said handle, with the effect that the body of the tool is substantially the only rotating element exposed below the bottom of the stationary handle.

2. In a driving device for an electric drill having a rotor equipped with a chuck, said device comprising a driving spindle having a portion at its upper end for engagement by the jaws of said chuck and a frictional clutch element at its lower end, a driven spindle having a frictional clutch element at its upper end to receive said clutch element of the driving spindle, means for securing a tool to the lower end of the driven spindle, and a "floating" housing adapted to be held stationary in the hand of the user while enclosing said clutch elements and providing a bearing for a journal portion on each of said rotary spindles, both the chuck-receiving and tool-securing ends of said spindles being severally accessible at the top and bottom of said handle without danger to the fingers of the user during rotation of the spindles; the invention herein described wherein a torque train is provided between said rotor and said tool comprising two mechanical interlocks between which said frictional clutch elements are operable, said upper portion of the driving spindle being of reduced diameter and projecting from said handle and having means for engagement by said chuck jaws to provide one of said mechanical interlocks in the torque train between said rotor and tool, the other of said mechanical interlocks in the torque train between said rotor and tool comprising said means for securing the tool in the driven spindle, which means include a bore of hexagonal cross section formed in the journal portion of said rotary driven spindle, said driven spindle being substantially entirely enclosed within said handle, said tool having a shank of complementary cross section for engagement with said bore, and a detent for

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releasably securing said tool in assembly with said journal portion of the driven spindle within said handle, with the effect that the body of the tool is substantially the only rotating element exposed below the bottom of the stationary handle and with the further effect that the distance of the working tip of the tool from said handle may be held to a minimum and objectionable vibration of the tool inhibited in service.

3. In a driving device for an electric drill having a rotor equipped with a chuck, said device comprising a driving spindle having a portion at its upper end for engagement by the jaws of said chuck and a frictional clutch element at its lower end, a driven spindle having a frictional clutch element at its upper end to receive said clutch element of the driving spindle, means for securing a tool to the lower end of the driven spindle, and a "floating" housing adapted to be held stationary in the hand of the user while enclosing said clutch elements and providing a bearing for a journal portion on each of said rotary spindles, both the chuck-receiving and tool-securing ends of said spindles being severally accessible at the top and bottom of said handle without danger to the fingers of the user during rotation of the spindles; the invention herein described wherein a torque train is provided between said rotor and said tool comprising two mechanical interlocks between which said frictional clutch elements are operable, said upper portion of the driving spindle being of reduced diameter and projecting from said housing and including a plurality of longitudinally extending grooves for engagement severally by said chuck jaws to provide one of said mechanical interlocks between said rotor and tool, a spindle-reinforcing portion integrally formed in the body of said driving spindle where the grooved projecting spindle portion of reduced diameter merges with the journal spindle portion of larger diameter, said spindle-reinforcing portion comprising an annular shoulder accessible externally of said housing to the ends of the chuck jaws engaged to the grooved spindle portion for transmitting thrust applied through the chuck jaws to said driving spindle, the other of said mechanical interlocks in the torque train between said rotor and tool comprising said means for securing the tool in the driven spindle, which means include a bore of hexagonal cross section formed in the journal portion of said rotary driven spindle, said driven spindle being substantially entirely enclosed within said handle, said tool having a shank of complementary cross section for engagement with said bore, and a detent for releasably securing said tool in assembly with said journal portion of the driven spindle within said handle, with the effect that the body of the tool is substantially the only rotating element exposed below the bottom of the stationary handle and with the further effect that the distance of the working tip of the tool from said handle may be held to a minimum and objectionable vibration of the tool inhibited in service.

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