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Dudek

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[54] **POWER WRENCH WITH INTERCHANGEABLE ADAPTERS**

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[52] **U.S. Cl.**.....**279/1 A,** 81/52.3, 173/29, 279/14, 287/53 SS, 287/127 R

[51] **Int. Cl.**.....**B25b 29/00,** F16d 1/06

[58] **Field of Search**.....81/52.3, 177 G, 177 A; 279/1 A, 14; 287/2, 535 S, 127 R; 145/50 R; 173/29

[56] **References Cited**

UNITED STATES PATENTS

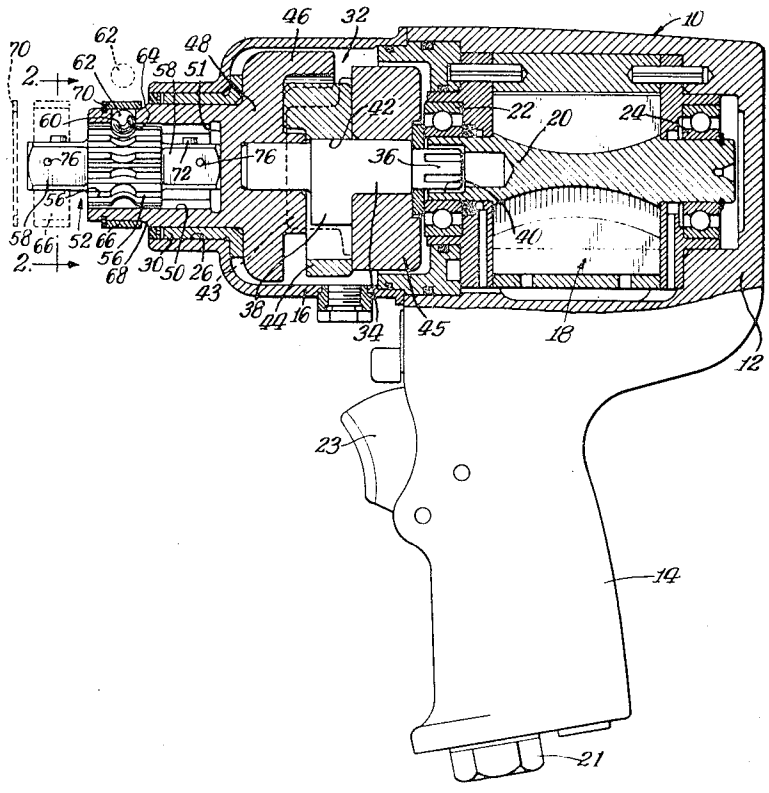
3,023,015	2/1962	Pankow	279/14
3,114,401	12/1963	Johnson	145/50 R
2,822,677	2/1958	Reynolds	81/52.3 X

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[57] **ABSTRACT**

A power wrench which has a spindle is provided with interchangeable adapters having drive portions of various sizes for connecting a socket or the like to the wrench. The adapters can be easily installed and removed from the spindle, but tampering with the wrench is minimized, since upon inspection it is not apparent that the adapter is easily removable from the spindle. Further, the adapter can be provided with two drive portions, one at each end. Should one portion be broken, the adapter can be reversed in the spindle, and the second drive portion can be used.

8 Claims, 7 Drawing Figures



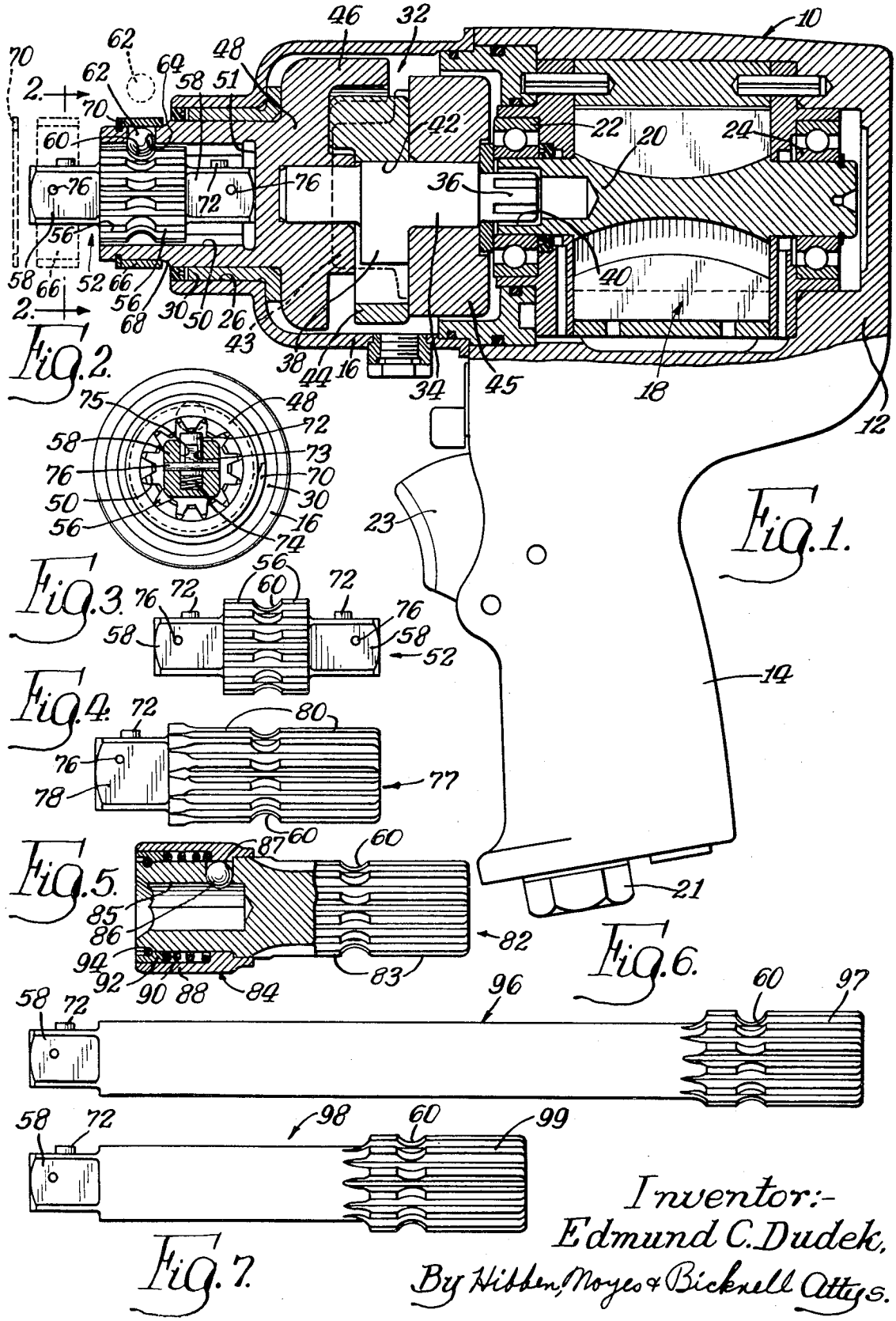


Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

Fig. 5.

Fig. 6.

Fig. 7.

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POWER WRENCH WITH INTERCHANGEABLE ADAPTERS

This invention relates to power or impact wrenches and more particularly to novel means for securing drive sockets or the like to the wrench.

Heretofore, impact wrenches or other power wrenches have been provided with an anvil or other driven spindle having an integral outer end portion or tool drive of square cross-section and fixed size which would accept a socket or other tool. Since the tool-mounting outer end portion or drive was integral with the spindle, it could not be changed without disassembling the wrench and replacing the spindle. Consequently, users of such wrenches found it necessary to have separate wrenches for each size tool drive. For example, if socket members with ¼ inch, ⅜ inch, and ½ inch tool drive sizes were used, three separate wrenches having spindles with corresponding drive sizes were required.

The drive end portions of the spindles, particularly in the smaller sizes, have been subject to wear or have been broken easily. At times, a replacement spindle is not available and cannot be conveniently secured. The wrench becomes inoperable until a new spindle is installed, and replacement of the spindle requires disassembly of the wrench, as mentioned above.

These disadvantages of power wrenches constructed according to the prior art result in time lost in replacing a spindle or the additional expense of having to have several wrenches with various size tool drives.

The foregoing disadvantages of prior art wrenches have been eliminated by the present invention which provides a driven spindle which accepts interchangeable accessory spindles or adapters having various size drive portions or other means for detachably mounting a socket or other tool member having a corresponding opening. If desired, the adapter connection with the driven spindle may be such that the adapter is not easily changed by an unauthorized person; for upon casual examination of the wrench, such person would be led to believe that the tool drive is integral with the spindle and could not be changed or removed without complete disassembly of the wrench. Further, in one form the adapter may be reversed in the tool so that drive portions at either end of the adapter may be used. Should one of the drive portions become worn or broken the adapter may be removed from the wrench, reversed, and then installed in the wrench so that the other drive portion may be used. Thus, an extra drive portion is available and can be conveniently carried with the wrench.

Accordingly, it is a general object of the present invention to provide, in a power wrench, a novel multiple adapter arrangement which makes available in a single tool the versatility of several conventional impact wrenches.

A further object of the invention is to provide, in a power wrench, a novel combination of a spindle and a plurality of interchangeable adapters having drive portions of various sizes for mounting sockets or other tool members.

Another object of the invention is to provide an adapter for the foregoing purpose which has two drive portions and is reversibly attachable to the spindle.

Still another object of the invention is to provide, in a power wrench, a removable adapter mounted in the wrench so as to appear to be removable only upon complete disassembly of the wrench.

Other objects and advantages of the present invention will become apparent from the following description and accompanying figures of the drawing in which:

FIG. 1 is a sectional view, with some parts shown in elevation, of an impact wrench and an adapter comprising a first embodiment of the present invention;

FIG. 2 is a sectional view taken along the line 2—2 of FIG. 1;

FIG. 3 is a side elevational view of the adapter shown in FIG. 1;

FIG. 4 is a side elevational view of a second adapter;

FIG. 5 is a side elevational view of a third adapter, with parts broken away and in section;

FIG. 6 is a side elevational view of a fourth adapter; and

FIG. 7 is a side elevational view of a fifth adapter.

Referring now to FIG. 1, an impact wrench is illustrated which incorporates an impact spindle and an accessory spindle or adapter in accordance with the present invention. The wrench has a housing **10** comprising a rear housing section **12**, including a handle **14**, and a forward housing section **16**. Enclosed within the rear housing section **12** is a pneumatic motor **18** of the usual reversible rotary vane type which has a center motor shaft or rotor **20** journaled in ball bearing units **22** and **24**. Air under pressure can be selectively admitted through an inlet **21** to operate the motor **18** under the control of a trigger **23**. The forward housing section **16** is removably secured to the rear housing section **12** and is provided with a forward nose portion having an opening **26** in which a bushing **30** is mounted.

A conventional impact clutch **32**, such as is disclosed in the Kaman U.S. Pat. No. 2,801,718, is rotatably supported in the wrench housing **10** and includes a drive shaft **34** having a splined end **36** and a cam lug **38**. The splined end **36** engages a corresponding opening **40** in the motor shaft **20** to rotate the drive shaft **34** and to support one end of the clutch **32**. The cam lug **38** engages a cam opening **42** in an impact clutch member **44** and reciprocates the impact clutch member **44** in guides **43** located on the front of a rotating hammer member **45**. The impact clutch member **44** has an impact surface (not shown) which, when the impact clutch member **44** is in an extreme end position, strikes an impact jaw **46** on an anvil or impact spindle **48**. The spindle **48** is rotatably mounted in the bushing **30** in the front housing section **16** and is driven or rotated by the blows that strike the impact jaw **46**.

The spindle **48** removably receives an adapter, designated generally at **52**, and to this end has at its forward end a central non-circular or splined opening **50**. The splined opening **50** engages a mating splined portion provided on the adapter **52** to transmit torque from the spindle **48** to the body of the adapter.

Referring now to FIGS. **1** and **3**, the adapter **52** has a splined portion **56** located on a central large diameter part of the adapter body and has a tool-mounting or drive portion **58** of square cross-section at each end. The relative lengths of the splined portion **56**, the drive portions **58**, and the opening **50** are selected so that one end of the adapter **52** may be inserted into the splined opening **50** in abutting engagement with the base **51** thereof and with the splined portion **56** engaging the splined opening **50** and fully received therein so that the outermost end of the portion **56** is in flush

alignment with the outer end of the spindle **48**. The adapter **52** has a circumferential groove **60** in the splined portion **56** in which a ball detent **62** can partially lie, the other part of the ball **62** being received in a hole **64** in the drive spindle **48**. Engagement of the ball detent **62** in the groove **60** and the hole **64** retains the adapter **52** in the spindle **48**.

While the wrench could be provided with a quick change chuck to retain the adapter in the spindle, in this instance the wrench has been constructed so that the drive portion **58** and drive spindle **48** appear to the casual observer to be integral with each other and removable only upon disassembly of the tool. The ball detent **62** is retained in the hole **64** by a sleeve **66** which fits over the hole **64** in the spindle **48** and abuts a shoulder **68** on the spindle. Removable means in the form of a spiral or snap ring **70** is received in a groove in the spindle **48** and fixedly retains the other end of the sleeve **66**, the snap ring being removable by a tool or pliers. Since the ring **70** and sleeve **66** have substantially equal outside diameters the ring appears to be integral with the sleeve and not removable. The adapter **52**, however, can be easily detached from the spindle by removing the ring **70**, sleeve **66**, and ball **62**, as is shown in the dashed lines in FIG. **1**.

While an adapter could be provided with different size socket posts or drive portions at each end (e.g. ½ inch square and ⅜ inch square) for convenience when various drive sizes are needed, in this instance the adapter **52** has been provided with two drive portions **58** of equal size. This feature is particularly advantageous in the most frequently used small size drives which are subject to heavy use, e.g. ½ inch. Should one drive portion **58** be broken, the adapter **52** may be reversed and the other drive portion used.

As is shown in FIG. **2** each drive portion **58** has a plunger **72** which is slidable in a hole **73** for retaining a conventional nut or bolt-engaging socket or the like on the drive portion **58**. The plunger **72** is urged outwardly by a spring **74** and is retained in place by a roll pin **76** which is disposed in the drive portion **58** transversely of the plunger **72** and extends through a slot **75** in the plunger.

Adapter **77** shown in FIG. **4** has a larger drive portion **78** (e.g. ⅝ inch square) and a lengthened splined portion **80** which can transmit increased torque from the wrench to the adapter. In this case the adapter has only a single drive portion, and when the adapter is mounted in the spindle **48** the forward end of the splined portion **80** projects beyond the outer end of the spindle **48**.

The adapter **82** shown in FIG. **5** has a splined end portion **83** and at its other end is constructed to provide a conventional quick change chuck **84** for rapid changing of sockets or other tool members. The chuck **84** comprises an axial recess **85** in the end of the adapter, a ball **86** sealed in an opening **87** in the adapter which extends into the recess **85** to engage the socket or other tool member (not shown) to retain it in the chuck, and a retractable sleeve **88**. The sleeve **88** is slidable between a first position which keeps the ball **86** in engagement with the socket and a second position in which the ball **86** is free to move out of engagement with the socket or the like so the socket can be removed. The sleeve **88** is urged into the first position by a spring **90** which abuts a ring **92** held in place by a retainer ring **94**.

FIG. **6** and FIG. **7** show two extended adapters **96** and **98** which have splined end portions **97** and **99**, respectively, and drive end portions **58**. The adapters can be of any length required and are useful in reaching into corners and openings.

Although the invention has been described with particular reference to certain specific structural embodiments thereof, it should be understood that other modifications and equivalent structures may be resorted to without departing from the scope of the invention as defined in the appended claims.

I claim:

1. In combination, a power wrench comprising a tool housing, a driving member rotatably mounted in said tool housing, and a driven spindle member rotatably mounted in said tool housing and being relatively rotatable with respect to said driving member, said driven spindle member having one end extending from said tool housing, a plurality of interchangeable adapters each having a non-circular portion of the same size, said one end of said spindle member having a corresponding non-circular opening for receiving said non-circular portions of said adapters, and retaining means on said driven spindle member for detachably securing one of said adapters in said opening of said spindle member, each of said adapters at one end having a socket post of a different size, whereby said wrench can be used with sockets having different size socket post openings by changing adapters.

2. The combination as in claim **1**, wherein each of said adapters has a groove therein, and said retaining means comprises a ball detent located in a hole in said spindle member and engageable in the groove of each of said adapters, a sleeve located on said spindle member over said hole, said sleeve abutting said spindle member at one end, said ball detent being held in engagement in the groove of each of said adapters by said sleeve, and removable means on said spindle member fixedly holding the other end of said sleeve on said spindle member.

3. In combination, a power wrench comprising a tool housing, a driving member rotatably mounted in said tool housing and a driven spindle member rotatably mounted in said tool housing and being rotatable relative to said driving member, said driven spindle member having one end extending from said tool housing with a shoulder thereon and a spaced groove therein, an adapter having a groove formed therein and a splined portion, said one end of said spindle member having a corresponding splined opening for receiving said splined portion of said adapter, a ball detent located in a hole in said spindle member and engageable in said groove of said adapter, a sleeve located on said spindle member over said hole and abutting said shoulder, said ball detent being held in engagement in said groove of said adapter by said sleeve, and removable ring means fitting in said groove on said spindle member for fixedly holding said sleeve on said spindle member, said sleeve and ring means having substantially equal outside diameters, whereby said ring means appears to be integral with said sleeve so that it is not apparent said ring means is removable.

4. In combination, a power wrench comprising a tool housing, a driving member rotatably mounted in said tool housing and a driven spindle member rotatably mounted in said tool housing and being rotatable relative to said driving member, said driven spindle mem-

ber having one end extending from said tool housing, an adapter having a central non-circular portion, said one end of said spindle member having a corresponding non-circular opening for receiving said non-circular portion of said adapter, and retaining means for detachably securing said adapter in said opening of said spindle member, each end of said adapter having a socket post, said adapter being reversible in said spindle member whereby either socket post of said adapter may be used.

5. The combination as in claim **4,** wherein said adapter has a groove therein, said spindle member has a shoulder thereon and a groove therein spaced from said shoulder, said retaining means comprises a ball detent located in a hole in said spindle member and engageable in the groove of said adapter, a sleeve located on said spindle member over said hole and abutting said shoulder at one end, said ball detent being held in engagement in said groove of said adapter by said sleeve, and removable ring means on said spindle member fitting in said groove on said spindle member and fixedly holding the other end of said sleeve on said spindle member, said outer diameters of said sleeve and ring means being substantially equal.

6. An adapter as in claim **4,** wherein both of said socket posts are of equal size, whereby should one of said socket posts require replacement the adapter need only be reversed in said wrench.

7. In combination, a power impact wrench comprising a tool housing, a driving member rotatably mounted in said tool housing, a driven spindle member rotatably mounted in said tool housing and being rotatable relative to said driving member, said spindle member extending from the forward end of said tool housing and having an exposed circumferential shoulder adjacent said tool housing and a circumferential groove in said spindle member spaced forwardly of said shoulder, a radial opening in said spindle member between said shoulder and said groove on said spindle member, and a splined axial opening in the forward end of the spindle member extending beyond said radial opening, a sleeve slidable on said spindle member to abut said shoulder at one end, said sleeve being of a length substantially equal to the distance between said shoulder and said groove on said spindle member, said sleeve having an inside diameter substantially equal to the outside diameter of said spindle member, removable ring means fitting in said groove and closely adjacent said sleeve to fixedly hold the other end of said sleeve, said ring means and sleeve have substantially the same outside diameters so as to appear to be integral, a plurality of adapters each having a splined portion at one end and at least one socket post at the opposite end, said splined portion having a circumferential groove therein, said grooves in said adapters aligning with said radial opening in said spindle member, a ball detent insertable through said radial opening and partially engageable in said radial opening and said groove in each of said adapters to hold one of said adapters in position, each of said adapters having a socket post of a different size, whereby, though not visibly apparent, said adapters may be changed to permit sockets with different socket post openings to be used with said power wrench.

8. The combination of claim **7,** wherein one of said adapters has a socket post of the same size at each end so that should one post break another identical post can be substituted.

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