Dec. 27, 1955 L. E. AUSTIN 2,728,365

DETACHABLE BIT TOOL

Original Filed Dec. 14, 1948

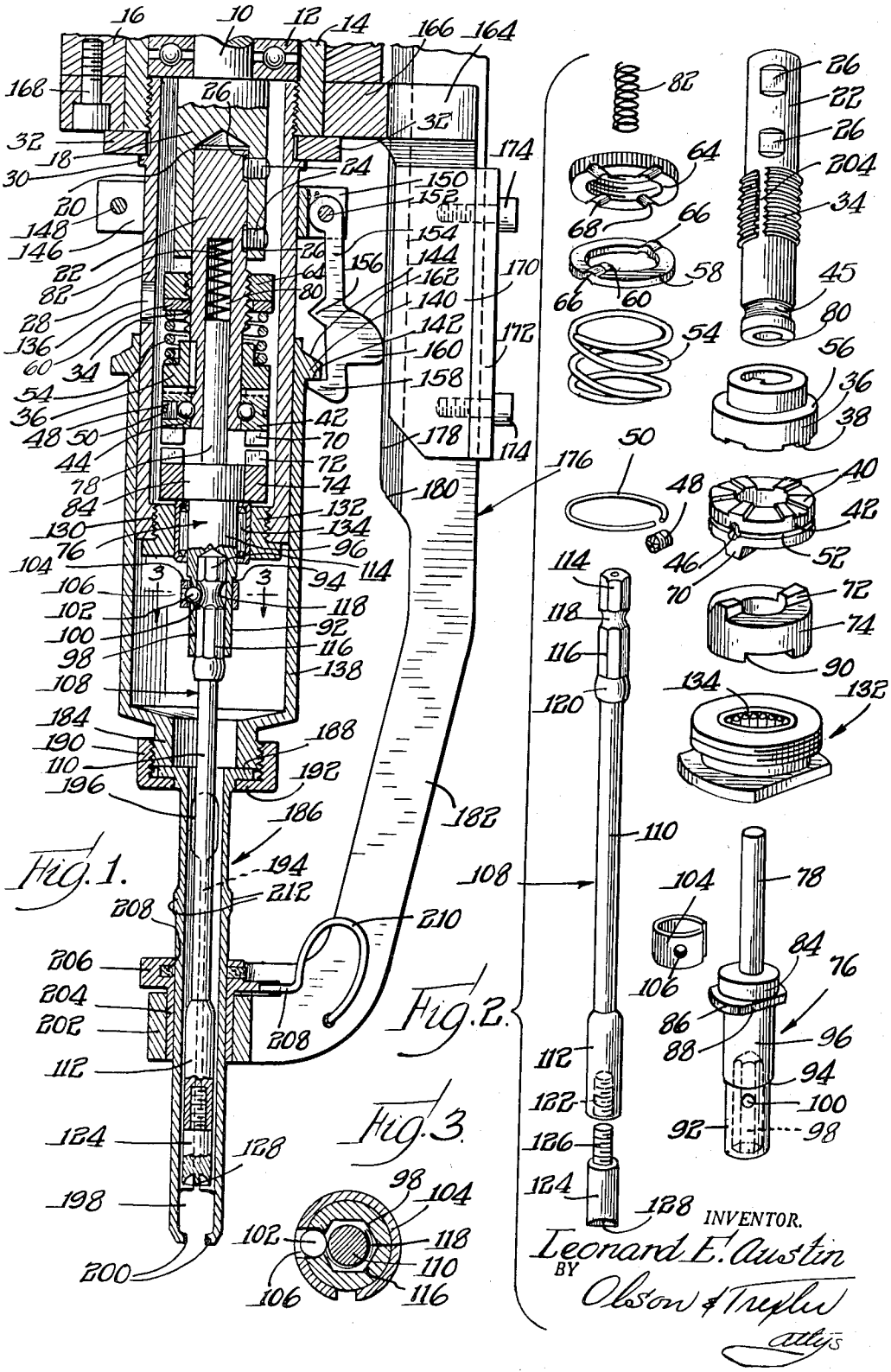


Fig. 1.

Fig. 2.

Fig. 3.

INVENTOR.
Leonard E. Austin
BY
Olson & Trapler
Attys

United States Patent Office 2,728,365
Patented Dec. 27, 1955

2,728,365

DETACHABLE BIT TOOL

Leonard E. Austin, South Bend, Ind., assignor to Illinois Tool Works, Chicago, Ill., a corporation of Illinois

Original application December 14, 1948, Serial No. 65,277, now Patent No. 2,646,091, dated July 21, 1953. Divided and this application June 5, 1953, Serial No. 359,826

6 Claims. (Cl. 144—32)

This invention is a division of my copending application for "Power Screw Driver," Serial No. 65,277, filed December 14, 1948, now Patent No. 2,646,091, issued July 21, 1953, and is concerned particularly with a detachable bit tool and a socket for receiving the same.

The broad object of this invention is to provide a power driver having a driving bit which is readily replaceable.

More specifically, it is an object of this invention to provide a power screw driver wherein the bit is readily replaceable for driving different sizes and types of screws.

Another object of this invention is to provide an automatic chuck, a collet, or socket so constructed that a bit may be attached to and detached from a driving mechanism by simple axial insertion and removal of the bit.

A further object of this invention is to provide a separable socket and bit construction which is simple and economic to fabricate, and which is rugged and substantially foolproof in operation.

Other and further objects and advantages of the present invention will be apparent from the following description when taken in connection with the accompanying drawings wherein:

Fig. 1 is a sectional view of a portion of a power screw driver embodying the principles of my invention;

Fig. 2 is an exploded perspective view of the pertinent parts of the structure shown in Fig. 1; and

Fig. 3 is a cross-sectional view taken along the line 3—3 in Fig. 1.

My aforesaid copending application Serial No. 65,277 discloses a complete power screw driver for automatically feeding screws from a heterogeneous mass into driving position beneath a screw driver bit and for thereafter releasing the screws after they have been driven a predetermined distance. The principles of the invention herein claimed are applicable to screw drivers other than the one shown in my aforesaid copending application and therefore only a part of the screw driver is shown herein. Reference may be had to the aforesaid copending application by those desiring further details on a specific and complete screw driving machine embodying the principles of my invention.

The invention as herein shown and described includes a rotary shaft **10** rotatably journaled by means of ball bearings **12** in a sleeve **14** which is reciprocably mounted in a fixed cylinder or machine part **16**. The shaft **10** is provided at its lower end with an enlargement **18** having a cylindrical central bore **20**. The bore receives a stub shaft **22** which is held in place by means such as a pair of set screws **24** threaded through the wall or enlargement **18** and bearing against flats **26** on the stub shaft **22**.

A hollow cylinder or sleeve **28** is threaded at its upper end into the sleeve **14** at the lower end thereof. The sleeve or cylinder **28** is provided near its upper end and beneath the threaded portion with a circumferential

flange **30**. A pair of arms **32** of a fork (not shown) mounted for powered reciprocation in a vertical plane lie on opposite sides of the sleeve or cylinder **28** and directly above the flange **30**. When the fork is reciprocated by suitable means (not shown) the sleeves **14** and **28** are moved up and down.

The stub shaft **22** is provided intermediate its ends with a threaded portion **34**, and a clutch member or collar **36** is splined on the stub shaft just below the threaded section for rotation with the stub shaft, but having relative axial movement along the shaft. The clutch member **36** has its lower face provided with teeth or projections **38** adapted to engage complementary notches formed by similar teeth **40** on the upper face of a clutch member or collar **42**. The clutch member or collar **42** is rotatably mounted on the stub shaft **22** but is held against movement axially of the shaft by ball bearings **44** received in a groove **45** at the lower end of the shaft and in a confronting groove in the inner surface of the collar **42**. The ball bearings are inserted through a radial opening **46** in the collar **42**, and that opening is closed after insertion of the ball bearings by a set screw **48** threaded into the opening. The set screw **48** is locked in position by a wire ring **50** received in an annular slot or groove **52** in the collar **42** and in a driving slot in the set screw.

The clutch member or collar **36** is urged into driving engagement with the clutch member or collar **42** by a coil spring **54** interposed between a shoulder **56** of the clutch member **36** and a ring or washer **58** encircling the stub shaft **22**. The ring or washer **58** is formed with an inwardly directed radial key or lug **60** which is received in a key slot **204** in the threaded section **34** of the stub shaft **22**. The ring or washer **58** is adjusted axially along the stub shaft **22** and is held against axial movement by a ring nut **64** threaded on the threaded section **34** of the stub shaft. The ring or washer **58** is formed with upwardly extending knobs or projections **66** received in complementary radial notches **68** in the under surface of the ring nut **64**. It will be apparent that the keying of the ring or washer **58** to the stub shaft and the splining of the clutch member **36** on the stub shaft insure rotation of the clutch spring **54** with the stub shaft so that the spring exerts no drag on the rotation of the stub shaft. The ring or washer **58** also acts to hold the adjusting nut **64** in adjusted position.

The clutch member **42**, in addition to the clutch teeth **40** on its upper surface, is provided with a pair of diametrically spaced, substantially V-shaped, clutch teeth **70** on its lower surface. These teeth are adapted for cooperation with teeth **72** of similar disposition and configuration on the upper surface of a third clutch member or collar **74**.

The third clutch member or collar **74** is mounted on a tool receiving chuck or collet **76** which consists of a stub shaft having a reduced upper portion **78** received in an axial bore **80** in the lower portion of the stub shaft **22**. The reduced shaft portion **78** and bore **80** are of proper relative diameters to form a close frictional fit. A coil spring **82** is compressed in the bore **80** and bears against the upper end of the reduced shaft portion **78**.

The tool receiving chuck or collet **76** is formed with a ring portion or annular flange **84** on which the clutch member **74** is press fitted. The clutch member **74** is keyed to the chuck or collet **76** by a flange **86** on the chuck or collet, the flange having opposed flat surfaces **88** and being fitted in a cross slot **90** in the lower face of the clutch member **74** with the flat surfaces **88** engaging the flat sides of the slot **90**.

It will be understood that in place of the double clutch between the driving shaft and tool receiving chuck or

collet as described above, any standard or known double clutch functioning in a similar manner may be used.

The lower end of the chuck or collet is reduced in diameter as at **92**, thereby forming a small annular shoulder **94** between the reduced portion and an intermediate larger portion **96**. The chuck or collet is also formed at its lower end with a hexagonal axial aperture **98** opening at the lower end of the reduced portion **92**. The reduced portion **92** further includes a radial opening **100** which is shaped or countersunk to receive a ball, key or pin **102** resiliently pressed into the hexagonal opening **98** by a split ring spring retainer **104** having a hole **106** therein engageable with the ball **100** to preclude shifting of the ring to bring the slot therein into alignment with the ball.

The inwardly urged ball **102** detachably retains a driver bit **108**. The driver bit comprises a rod **110** having an enlarged portion **112** at its lower end, and hexagonal portions **114** and **116** at its upper end spaced apart by an annular groove **118**. The rod is also provided with an enlarged portion or protuberance **120** immediately below the hexagonal section **116** and larger than the hexagonal opening or bore **98** in the chuck or collet **76**, so that engagement of the protuberance **120** against the lower end of the chuck or collet **76** positions the annular groove in the plane of the retaining ball, pin, or key **102** which is urged part way into the groove by the split ring spring retainer **104** detachably to retain the bit **108** in the chuck or collet.

The enlarged portion **112** of the driver bit is provided at its lower end with a threaded bore **122** which detachably receives a driver blade **124** having a threaded reduced upper end portion **126** thereon. The screw engaging and driving end of the driver blade **124** may take any of a number of different forms depending upon the head shape of the various screws which it is desired to handle. In general, the screw engaging and driving end of the driver blade is formed with a flat sided projection or blade **128** adapted to engage within the driving slot of a screw. The bottom of the blade **124** in addition to the flat sided projection **128** preferably is formed complementary to the shape of the head of a screw to be driven, and for illustrative purposes the under side of the blade **124** may be concave for driving round headed screws.

The sleeve or cylinder **28** is internally threaded at its lower end with left-hand threads as at **130**. A sleeve nut **132** is externally threaded with left-hand threads for cooperation with the threads **130** to preclude loosening of the nut by rotation of the tool receiving chuck or collet. The sleeve nut **132** is provided in its inner surface with needle bearings **134** which rotatably journal the intermediate portion **96** of the tool receiving chuck or collet **76**. The sleeve nut also serves as an abutment limiting the axial movement of the clutch member **74** in a direction away from clutch member **42**. The frictional fit of the reduced shaft portion **78** in the bore **80**, and the spring **82** serve frictionally to start driving of the tool receiving chuck or collet **108** as the clutch members **42** and **74** move toward one another for driving engagement.

The sleeve or cylinder **28** is provided with an opening **136** opposite the threaded portion **34** of the stub shaft **22** for adjusting the ring nut **64**. The ring nut is externally knurled, or may be provided with circumferentially spaced holes for cooperation with a tool which may be inserted through the opening **136** to rotate the nut. Such rotation of the nut adjusts the pressure exerted by the spring **54** on the clutch member or collar **42**, such rotation most readily being effected by holding the nut with the tool while manually turning the spindle of the power driver to rotate the shaft **10** and hence the stub shaft **22**. This determines the torque at which the clutch member **36** may move out of engagement with the clutch member **42**.

Means is provided for carrying screws in cooperation with the structure heretofore disclosed and includes a sleeve or cylinder **138** reciprocably mounted about the

sleeve or cylinder **28**. The cylinder **138** is formed adjacent its upper edge with a peripheral ring **140** having a square lower shoulder **142** and a beveled upper shoulder **144**. A split ring **146** is clamped on the sleeve or cylinder **28** above the top or sleeve of the cylinder **138** by any suitable or known means such as a screw **148**. The ring **146** includes a pair of spaced apart ears **150** having a pin **152** extending between them and pivotally carrying a hook **154**. The hook includes a tooth **156** having a pair of beveled working edges, and a tooth **158** having a square shouldered upper work engaging edge. The hook **154** further includes a lug **160** having a curved cam surface **162**.

A bracket **164** is provided with a ring-like portion **166** encircling the sleeve or cylinder **14**, and this ring-like part is secured by means such as countersunk bolts **168** to the under side of the fixed cylinder or machine part **16**. The bracket **164** is provided with a depending part **170** having a vertical flange **172** through which pass bolts or screws **174** adjustably to hold a control member **176** in operative position. The control member **176** includes a cam edge **178** cooperable with the protuberance **160** on the hook **154** to maintain the same in engagement with the flange **140** substantially as shown in Fig. 1. The cam surface is cut back diagonally as at **180** into a depending arm **182** on the control member.

The sleeve or cylinder **138** is provided with a threaded, reduced lower end **184**. A screw receiving and positioning means comprises a split sleeve **186** and has a circumferential flange **188** at its upper end which is held against the bottom end of the reduced portion **184** by a nut **190** threaded on this portion and having an inwardly directed flange **192** underlying the flange **188** on the screw receiving means. The screw receiving sleeve **186** is provided with a pair of longitudinal slits **194** extending substantially from end to end and each slit at the upper end thereof terminates in an enlarged opening **196**. The two halves of the sleeve **186** are provided along one of the slits **194** with a cut-away portion **198** for permitting passage of a screw head between the arms. Inwardly directed lips or fingers **200** are designed to support the head of the screw with the shank thereof extending out between the lips.

The arm **182** is provided at its lower end with a cylindrical portion **202** through which the split sleeve **186** and bit **108** extend. A bushing or liner **204** having a head or flange **206** is fitted in the cylindrical portion **202** and holds the arms of the split sleeve **186** in the position shown, these arms being resilient and biased so as to tend to spring apart from one another. A lubricating ring **208** may be fitted in a suitable groove in the inner face of the bushing **204** for lubricating the external surface of the split sleeve to reduce friction between the split sleeve and the bushing **204**. The bushing is held in place by a spring wire **208** having a finger portion **210**, all as explained in detail in my aforesaid copending application Serial No. 65,277. In the event that a screw should jam between the arms of the split sleeve **186**, or between the arms or driver blade **184**, the bushing **204** may be removed by pulling on the finger grip **210** to retract the wire **208** and raising the bushing.

The split sleeve **186** is completed by enlargements **212** normally positioned above the bushing **204**.

In the operation of the screw driving machine herein shown in part and more fully described in my aforesaid copending application Serial No. 65,277, a screw is fed from a hopper down a screw feeding chute (not shown) and through the opening **198** into position between the halves of the split sleeve **186** where the screw is supported in alignment with the driver blade **124** by the lips **200** fitting beneath the head of the screw, the shank of the screw protruding outwardly beyond the screw carrier or split sleeve **186**. Suitable mechanism (not shown) is provided which, in response to depression of a foot pedal or the like by an operator, lowers the fork arms **32** and thereby lowers the sleeve **28** and also the sleeve

14 and shaft 10. The split sleeve 186 and cylinder 138 are frictionally supported in the position shown in Fig. 1. Such downward movement of the shaft 10 lowers the bit 108 and driver blade 124 until the blade projection 128 engages a screw head. The reduced shaft 78 and the driver blade connected thereto are rotated by the frictional fit of the shaft 78 in the bore 80 of the stub shaft 22, and also by engagement of the spring 82 with the reduced shaft 78. Continued rotation and downward movement of the shaft 10 causes the blade projection 128 to engage in the driving slot of the screw and causes the clutch member 42 to move into driving engagement with the clutch member 74, thereby positively driving the chuck or collet 76, the bit 102, and the driver blade 124. At this time the lower surface of the tooth 56 engages the beveled surface 144 of the flange 140 to shift the cylinder 138 and screw receiving means or split sleeve 186 downwardly with a screw as it is screwed into a work piece.

After the screw has been screwed part way into a work piece, the lug 160 reaches the cut-back portion 180 of the cam surface 178 so that the hook is free to move out away from the flange 140 under the camming action of the upper surface 144 of the cam 140 and the lower surface of the tooth 156. Thus the screw carrier or split sleeve 186 is no longer lowered, but by this time the enlargements or protuberances 212 on the sleeve have passed through the bushing 204 so that the halves of the sleeve are free to move away from one another under their own outward bias. The screw head therefore is freed of restraint so that the screw may be driven home without damage to, or marring of the screw or work piece.

In returning the parts, the operation is substantially the opposite. The tooth 156 cams past the flange 140, but by the time the tooth 158 reaches the flange 140, the cam surface 162 of the lug 160 has ridden in on the cut-back 180 of the cam 178 so that the tooth 158 is caught beneath the square shoulder 142 of the flange 140 and the parts are retracted to the position shown. It will be evident that the drive bit blades 124 are readily detachable from and insertable in the shanks of the driver bits so that a single shank may be used with any one of a large variety of bit blades differing in size and in the shape of their screw receiving ends to handle a large variety of types and sizes of screws without requiring any change other than in the bit blade. It will be evident, however, that it may be desirable in a large number of cases to handle screws of types and sizes outside of that range which can be conveniently handled by insertion of driver bits in a single size bit shank. Therefore, the bit shank itself is readily detachable from and insertable in the tool receiving chuck or collet. Such detachment and insertion is readily accomplished by axial force imposed on the shank by the hand of the operator. The means for detachably holding the bit shank in place is relatively foolproof in operation and is simple and economical to fabricate, while being rugged in operation.

It will be understood that the specific example herein shown and described is for illustrative purposes only. The detachable bit tool can be used with other types of screw drivers, and the tool may vary structurally within the spirit and scope of the appended claims.

I claim:

1. A detachable bit tool comprising a rotary fastener driver receiving collet having a bore of non-circular shape to receive a complementary shaped end of a rotary fastener driver bit, said bore communicating with a transverse passage, a rotary fastener driver retaining latch member mounted in said passage and projectable into the bore to engage and retain a rotary fastener driver bit inserted into the bore, a split spring ring retainer encircling said collet and covering said passage to urge said latch member into said bore, needle bearing means for rotatably mounting said collet in a power machine, and means on said collet engaging said bearing means to limit axial movement of said collet in said bearing means while allowing axial movement in the opposite direction.

2. A detachable bit tool as set forth in claim 1 wherein the limiting means comprises a clutch member engageable with a driving clutch member on a power machine for rotatably driving said rotary fastener driver.

3. A detachable bit tool comprising a threaded plug adapted to be threaded into engagement with a complementary threaded portion of a power machine, anti-friction bearing means in said plug, and a collet rotatably journaled in said anti-friction bearing means, said collet having a bore of non-circular shape to receive a complementary shaped end of a rotary fastener driver bit communicating with a transverse passage in said collet, a rotary fastener driver retaining latch member mounted in said passage and projecting into the bore to engage and retain a rotary fastener driver bit in the bore, and an elastic retainer encircling said collet and covering said passage for resiliently urging said latch member into said bore.

4. A detachable bit tool as set forth in claim 3 wherein the collet is provided with a clutch member engageable with a complementary clutch member on a power machine, the collet is axially movable in the bearing means, and said clutch member engages said bearing means to limit axial movement in one direction.

5. A detachable bit tool comprising a rotary fastener driver receiving collet having a bore of non-circular shape to receive a complementary shaped end of a rotary fastener driver bit, said bore communicating with a transverse passage, a rotary fastener driver bit retaining latch member mounted in said passage, an elastic retainer encircling said collect and covering said passage, said retainer resiliently projecting said latch member into the bore to engage and retain a rotary fastener driver bit inserted into the bore, a substantially cylindrical sleeve coaxial with said bore and projecting a substantial distance forwardly from said collet, said sleeve having a diameter which is small relative to its length, and a rotary fastener driver bit cooperable with said collet and with said sleeve, said bit having a non-circular end portion received in said bore and having a shank projecting axially from said bore on the same order of distance as said sleeve, a substantial portion of said shank having a small diameter compared with that of said sleeve, and the forwardly projecting end of said bit having a diameter on the same order of magnitude as that of said sleeve.

6. A detachable bit tool comprising a rotary fastener driver receiving collet having a bore of non-circular shape to receive a complementary shaped end of a rotary fastener driver bit, said bore communicating with a transverse passage, a rotary fastener driver retaining latch member mounted in said passage and projectable into the bore to engage and retain a rotary fastener driver bit inserted into the bore, a resilient retainer encircling said collet and covering said passage to urge said latch member into said bore, anti-friction bearing means for rotatably mounting said collet in a power machine, and means on said collet engaging said bearing means to limit axial movement of said collet in said bearing means while allowing axial movement in the opposite direction.

References Cited in the file of this patent

UNITED STATES PATENTS

722,324	Pitkin	Mar. 10, 1903
1,391,177	Du Sell	Sept. 20, 1921
1,742,040	Lynch et al.	Dec. 31, 1929
1,952,395	Tillyer et al.	Mar. 27, 1934
2,394,348	Wilhide	Feb. 5, 1946
2,472,392	Alexander	June 7, 1949
2,484,364	Whitledge	Oct. 11, 1949