ABSTRACT OF THE DISCLOSURE

Socket release plunger mechanism for fine tooth ratchet wrenches of the type having a head with a toothed bore, a driven member having a body with opposed double ended pawls engaging the toothed bore, an axially disposed reversing bolt in the body having resilient means for shifting the pawls, and a stud extending from the body at one side of the head provided with a socket engaging detent means.

BACKGROUND

This invention relates to a quick release mechanism for socket driving wrenches of the type known as fine-toothed ratchet wrenches and in particular to a wrench construction in which a reversing bolt is centrally located in the body of a driven stud carrying member for manually shifting the driving engagement with the head of a pair of diametrically opposed double ended pawls also carried by the driven member.

A ratchet wrench of the type described is exemplified by 1956 Pat. No. 2,772,763 and is also disclosed in the present applicant's pending application Ser. No. 704,688 filed Feb. 12, 1968. A quick release plunger for socket wrenches of a simple, more conventional type in which a driven member with an externally toothed body portion is a single unitary member with a stud extending therefrom is disclosed in 1965 Pat. 3,208,318.

The primary object of the present invention is to incorporate the feature of the quick release in a fine tooth type of wrench in a simple and efficient construction and without substantially increasing the cost thereof.

This result has been accomplished by incorporating the reversing or pawl shifting bolt as a detachable part of a dent tract release plunger slidably mounted in a bore extending axially through the stud and body of the driven member; by providing a dent release plunger portion in the stud bore; by forming an integral extension of the reversing bolt for passing through a key-hole slot in the reversing lever at the side of the head opposite the stud and thus providing an exterior plunger actuating button; and by limiting axial sliding movement of the reversing bolt so that the latter is operable by the lever for reversing the ratchet drive in any position of the plunger.

The above and other specific objects and advantages of the present invention will be apparent from the following description of an embodiment thereof as shown by the accompanying drawings in which:

FIG. 1 is a vertical sectional view of the head of a wrench embodying the invention, the parts of the drive mechanism being symmetrically arranged in a neutral position, and showing the socket holding position of the stud dent and related parts;
FIG. 2 is a view similar to FIG. 1 showing the parts in the socket releasing position;
FIG. 3 is a sectional view, on a reduced scale, as on line 3--3 of FIG. 1;
FIG. 4 is a sectional view as on line 4--4 of FIG. 1;
FIG. 5 is a sectional view as on line 5--5 of FIG. 1, the reversing bolt and pawls of the ratchet drive being in an operative position; and
FIG. 6 is a perspective view of the head and a portion of the handle.

Referring first to FIG. 6 the handle of the wrench is at 2 being formed integrally with a cylindrical head 4 at one end. A socket engaging stud at 6 of the driven member extends from one side of the head and carries a usual yieldable detent element as the ball 8 projecting from one face of the stud. A reversing lever is at 10 at the other side of the head and is provided with diametrically opposed integral projections 12 for manually turning the lever. Between the projections of the socket releasing button is at 14, the button being the upper generally rectangular end portion of a quick release plunger assembly. The button 14 is, more directly, an extension of a ratchet reversing bolt as will be later described. When the reversing lever 10 is turned, the button and bolt are rotated to reverse the ratchet drive. In FIG. 6, the button 14 is in its upwardly urged position and the yieldable detent ball 8 is outwardly urged to hold a socket on the end of a stud in the known manner. The holding action of detent 8 is released by depressing button 14. The mechanism for effecting this simple operational result will be apparent from FIGS. 1 and 2.

Describing the structure and operation of the ratchet mechanism, FIGS. 1 and 2 show the head 4 with a through bore of varying diameters. A cylindrical wall, lying centrally between the upper and lower sides of the head, is provided with teeth as at 16 extending parallel to the axis of the bore. Mounted for rotation in the bore is the body portion 18 of a driven member 20. A stud portion 6 extends from body 18 at the lower side of the head. The stud as shown is square in cross sectional outline, but may, of course, be of any polygonal shape for driving a socket as is well known in the art. In the stud 6 and opening onto one face thereof is a lateral passage 22 in which is carried the detent ball 8. The external end of the opening is staked as by deforming the metal as at 24 to keep the ball from falling out.

Referring to the body portion 18 of driven member 20, opposed segmental recesses or slots are formed at opposite sides thereof as at 26 and 28 (see also FIG. 5). Mounted at diametrically opposed positions in the slots are pivot pins at 30 and 32 parallel to the axis of the bore. On the pins are carried double ended generally sector shaped pawls 34 and 36 to selectively engage the teeth 16 of the head. Pins 30 and 32 are seated in recesses as at 38 in the lower walls of the slots. The upper ends of the pins are held in through openings as at 40 of the upper walls.

Mounted above the body and rotatable relative thereto is the reversing lever disk 10. The peripheral edge of the disk is held between the upper wall of the body portion 18 and a flange at 42 at the top of the through bore of the head. The disk 10 is provided with sufficient clearance to be freely rotatable relative to the body portion and flange 42 by reason of an annular flange of the body at 44 positioned at the other side of the head against a shoulder of an enlarged bore portion immediately below teeth 16. Below shoulder 44 in the body is an annular groove at 46 in which the inner edge of a conventional type of split retainer ring 48 is held. The outer portion of ring 48 is received as shown in a groove 50 cut in the wall of the head. Thus the body portion 18 is also positioned for free rotation in the head. One free end of ring 48 is shown at 52 lying against a slabbled surface at 54 at the underside of the head. As is well known in the art the entire assembly of the driven member 20 may be removed by pinching the two free ends of the ring together to engage the ring entirely within groove 46 and the assembly thus removed from the head.

Referring to FIG. 2, a flanged section is at the extreme lower end of body portion 18 to underly the head, the outer wall of this flange being knurled as indicated at 56.
This flange provides a "spinner" action in using the wrench, that is to say the body can be manually rotated with the fingers without employing the handle and head for driving action. Thus a workpiece, if freely rotatable, can be turned rapidly until the greater force through the leverage of the handle is needed.

As seen in FIGS. 1 and 2, the pins 30 and 32 project upwardly at the top wall of the body portion 18 and are received respectively in diametrically opposite arcuate recesses 58 and 60 at the underside of the actuating lever 10 (see also FIG. 3). The reverting lever thus is limited in turning to a relative motion of the body.

Referring to FIG. 5, pawls 34 and 36 are shown in operative relation for driving in a counter-clockwise direction. The pawls are double ended and teeth 62 of pawl 36 are shown in full engagement with the internal bore teeth 16 of the head while teeth 62' on the diametrically opposite or corresponding end of the other pawl 34 are offset one-half pitch relative to teeth 16. This formation of the teeth and correlation of the parts in a driving position results in the fine-ratchet action. Thus, when the handle is drawn back in using the wrench to re-engage the teeth and again drive a workpiece, the teeth at the end of one of the operatively positioned pawls will be finally engaged while the teeth on the corresponding end of the other toothed pawl will be offset.

The full engagement at the end of one of the pawls depends on the degree to which the handle may be angularly rotated before a succeeding driving stroke is started. Thus a "fine" ratchet action is obtained as more completely explained in the disclosure of the aforementioned Patent No. 2,772,763. The pawls are held in operative relation for the desired ratchet action by the reversing bolt at 64 which, as will be described, forms the upper portion of the socket releasing plunger assembly. Bolt 64 is formed as a diametrically extending web formed by slotted or parallel chordal sidewalls extending upwardly from a lower cylindrical portion at 66. Portion 66 provides a lower bearing for the bolt and is slidable received in a portion 68 (immediately below segmental slots 26 and 28) of an axial through bore in body 18. As previously mentioned, the upper button portion 14 of the release plunger mechanism is an integral continuation of the bolt. It extends upwardly through the top of the body and is slidable received in the generally rectangular key-hole slot 70 cut centrally through the reversing lever between projections 12.

The axial through bore of the body, furthermore, intersects with slots 26 and 28 and a transverse through slot 72 formed to receive a spring 74 urging a detent ball 76 outwardly of each end to engage the centrally lobed inner faces of the opposed pawls. The bolt is rotatable through an arc to shift ball detents 76 from one side of a diametrical line joining the pawl axes to the opposite side thereof. The parts as positioned in FIG. 5 are for driving member 20 in a counter-clockwise direction. By turning the bolt counter-clockwise relative to body 18 (FIG. 5) the position of the pawls may be reversed and the drive thus reversed. This is accomplished by turning button portion 14 through rotation of lever 10 to which the button is keyed.

As above noted pins 30 and 32 limit the angular movement of lever 10 relative to the body 18 by reason of the slots 58 and 60. The bolt position of FIG. 5 is at one extreme of angular movement (with reference to FIG. 3, pin 30 would be engaging the uppermost end of slot 58 and the removal of slot 58 is noted illustrating a symmetrical relation of the parts. The limited angular movement maintains the detents in yieldable contact against the inner faces of the pawls at either end thereof for the desired ratcheting action. The pawls are shifted by the detent balls 76 riding over a central lobe as at 35 on each pawl inner face, reference being made to the above mentioned copending application for a fuller explanation of such shifting action.

Referring now to FIGS. 1 and 2, it will be noted that in the upper socket-holding position of the bolt 64 in the axial bore of body 18 the transverse bore 72 of the bolt is located adjacent the top of the opposed pawl slots 34 and 36. In the lower socket releasing position (FIG. 2) the transverse bore 72 holds balls 76 bearing against the pawls adjacent the bottom of the slots. Thus in any axially slideable position of bolt 64, the ball detents 76 are in engagement with the pawl surfaces for reversing the same since the dimension of the segmental slots or recesses axially of the body is at least equal to, or, may be greater than the full stroke of longitudinal plunger movement.

As previously mentioned bolt 64 forms an upper part of a release plunger assembly, the lower cylindrical bolt portion 66 being mounted in bore portion 68. This latter portion has a shouldered connection with a reduced bore portion 86 extending axially through the stud 6. Bolt portion 66 is slidable in the upper section of the enlarged bore 68 and has a depending reduced stud 80 in which a threaded opening is formed to receive the threaded stem 82 at the top of a detent release pin 84. Pin 84 is mounted to slide axially of the stud in bore 86. Wrapped around the threaded connection of the pin and bolt is a spring 88 seated at one end against the shouldered underside of the bolt, and at the other end against the shouldered portion of the through bore. Spring 88 thus yieldably urges the plunger assembly of pin 84 and bolt 64 upwardly and the ball detent 8 outwardly of its passage 22, as will now be described. First, lateral passage 22 communicates with stud bore 86. Pin 84 in bore 86 is provided with a lower inclined surface 90 which merges with a recess 92 of the pin inwardly thereof. When pin 84 is urged inwardly, the inclined surface 90 bears inwardly against ball 8 and yieldably pushes the same outwardly of the stud for releasably engaging therewith the interior 94 of stud 94. Socket 94 is of well known conventional construction and may or may not have a ball detent receiving recess 96.

In any event the pressure of detent 8 against the socket wall will hold the socket on the stud until the pressure is released. This is done by depressing the plunger against spring 88 and registering recess 92 opposite the ball, whereupon the user can flip the socket off the stud or the socket may simply fall away by gravity as illustrated by FIG. 2.

It will be noted that pin 84 will not turn, at least to any real degree because of the ball 8 engaged against the pin, when bolt 64 is turned in shifting the pawls. Normally bolt 64 will turn relative to the pin on the endwise threaded connection therewith. It will be apparent from considering FIG. 5 that the angular extent of bolt rotation is through an arc of less than 90°. Thus, the turning of bolt 64 creates no longitudinal movement of any consequence relative to its positional relation with respect to the upper bore section.

It is to be further noted that provision has been made on the projecting button portion 14 of the bolt for an indicator groove at 98. This serves to assist in accurately assembling the plunger in the body. One such ball 8 have been inserted in place (FIG. 1 position) in the stud bore 86, the spring 88 may be dropped into place against the bore shoulder. The bolt may then be dropped into bore 68 and by pressing downwardly against the spring the bolt can be turned on the threads of stem 82 to fix the bolt to the pin. The bolt is turned until the indicator groove 98 is engaged with the upper surface of body portion 18. When so registered, the transverse bore 72 with ball detents 76 is accurately and properly positioned relative to this pawl faces. In other words, in either the upper or lower position the detents 76 will be engaged with the pawls and this relationship is established by the mark 98 without the need for a blind trial and error groping for such proper placement.
What is claimed is:

1. In a ratchet stud drive wrench for sockets the combination of a quick release and ratchet reversing mechanism comprising a plunger having first and second portions rotatably interconnected in end-to-end relation, the first portion of said plunger including radially operable detent means, ratcheting pawl means pivotally disposed in the head of said wrench and engaged by said radially operable detent means, the second portion of said plunger including a socket engaging detent extending retractably from the socket receiving stud portion of said wrench and operable in response to longitudinal movement of said plunger for the selective retention and release of a socket therefrom, said first portion being rotatable independently of said second portion in response to operation of said reversing mechanism for the pivotable actuation of said pawl means by said radially operable detent means, said plunger also being movable longitudinally as a unit relative to said radially operable pawl means for controlling the operation of said socket engaging detent.

2. In a ratchet stud drive wrench for sockets the combination of a quick release and ratchet reversing mechanism comprising a plunger having first and second portions rotatably interconnected in end-to-end relation, the first portion of said plunger including radially operable detents, ratcheting pawls pivotally disposed in the head of said wrench and engaged by said radially operable detents, the second portion of said plunger including a socket engaging detent extending retractably from the socket receiving stud portion of said wrench and operable in response to longitudinal movement of said plunger for the selective retention and release of a socket therefrom, said first portion being rotatable independently of said second portion in response to operation of said reversing mechanism for the pivotable actuation of said pawls by said radially operable detents, said plunger also being movable longitudinally as a unit relative to said radially operable pawls for controlling the operation of said socket engaging detent.

3. In a ratchet stud drive wrench for sockets, the combination as set forth in claim 2 in which the dimension of said pawls corresponding to the direction of longitudinal movement of said plunger is not less than the length of the longitudinal stroke of said plunger.

4. In a ratchet stud drive wrench for sockets the combination as set forth in claim 2 in which the first and second portions of the plunger are connected in end-to-end relation by screw threads to permit relative rotation of said portions and unitary longitudinal movement.

5. In a ratchet stud drive wrench for sockets the combination as set forth in claim 4 in which said radially operable detents are engaged with said pawls throughout the length of said plunger stroke.

6. In a ratchet stud drive wrench for sockets having a ratchet reversing mechanism including radially operable detents for releasably engaging grooves in oppositely disposed pawls in the head of said wrench and pivotable in response to circumferential rotation of said detents relative to said pawls, a quick release device for selective retention and release of sockets by said wrench comprising a plunger having first and second portions rotatably interconnected in end-to-end relationship, said radially extending detents of the reversing mechanism being carried by the first portion of said plunger and being rotatable in response to rotation of said reversing mechanism independently of said second portion, a socket engaging detent operable by said second portion, said detent extending retractably from the socket receiving stud portion of said wrench and operable in response to longitudinal movement of said plunger, said plunger being longitudinally movable as a unit relative to said stud and pawls, said pawls having a dimension measured parallel to the longitudinal stroke of said plunger not less than the length of said stroke.

7. In a socket wrench as set forth in claim 6 in which said plunger portions are interconnected by screw threads.

References Cited

UNITED STATES PATENTS

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2,772,763 12/1956 Johnson

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