May 24, 1955 H. L. FISH 2,708,855

CLOSED RATCHET WRENCH

Filed June 28, 1951 2 Sheets-Sheet 1

FIG. 1.

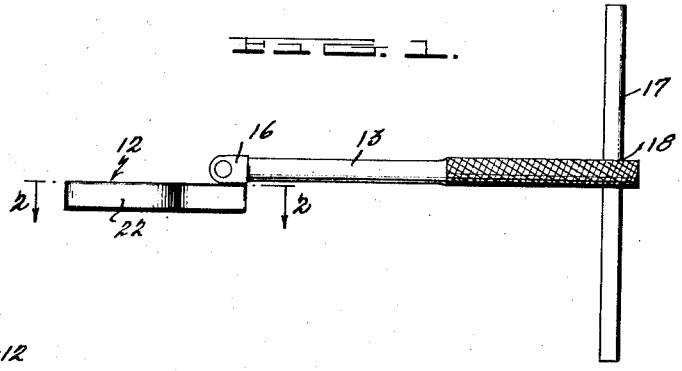


FIG. 2.

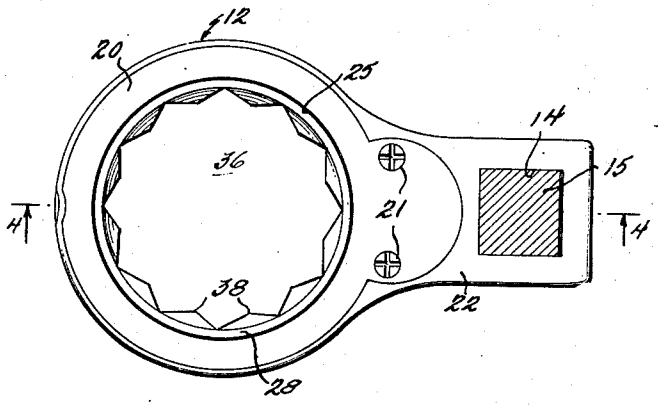


FIG. 3.

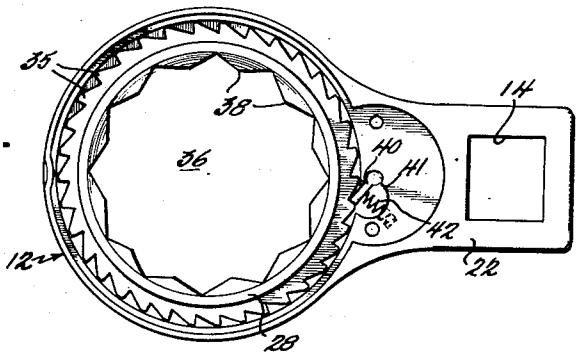
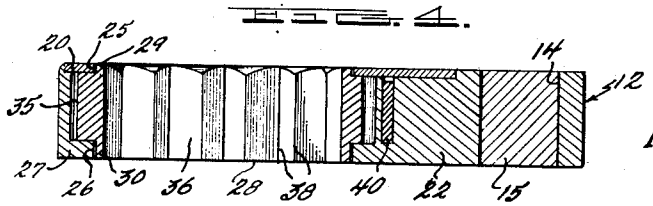


FIG. 4.



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CLOSED RATCHET WRENCH

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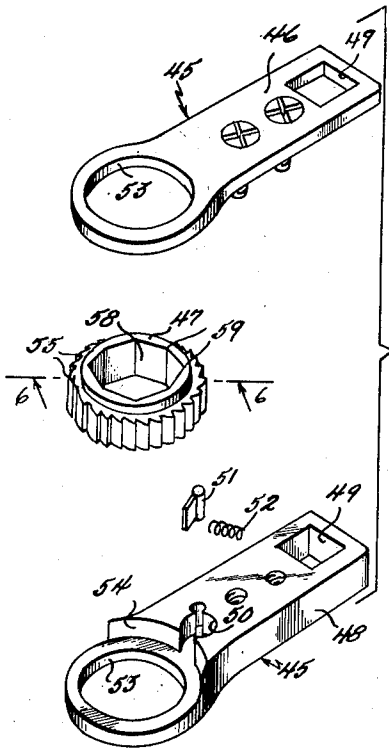


FIG. 1.

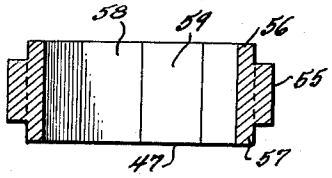


FIG. 5.

FIG. 6.

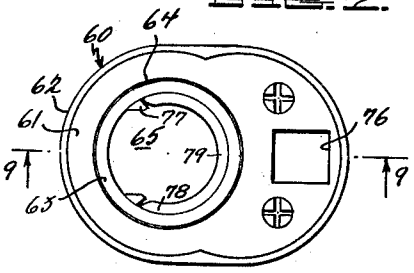


FIG. 2.

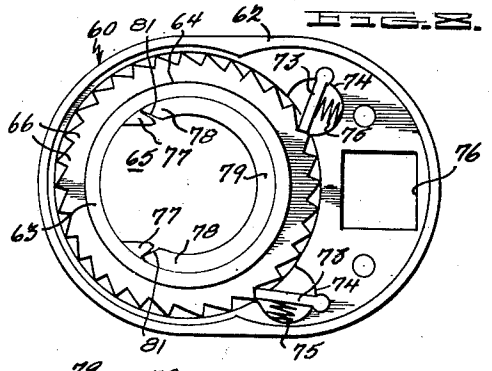


FIG. 8.

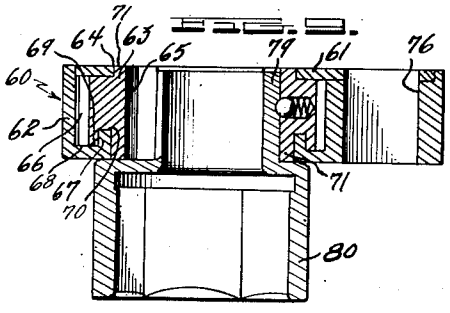


FIG. 9.

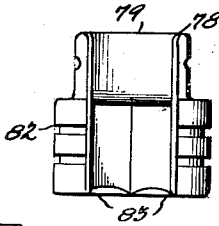


FIG. 11.

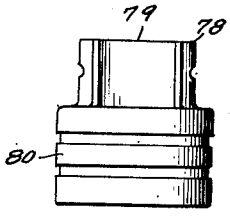


FIG. 10.

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CLOSED RATCHET WRENCH

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Application June 28, 1951, Serial No. 234,078

6 Claims. (Cl. 81—61)

This invention relates generally to wrenches and more particularly to a ratchet wrench construction adaptable for use with nut-engaging sockets or having direct nut-engaging members.

Wrenches of this general type are well known in the art and as a whole are characterized by one or more disadvantages making them unsuited for use in many important applications. In order that a wrench may be of maximmum utility, it is desirable that it be an all-purpose wrench as nearly as possible. For example, it should be capable of operation from various angles of approach; be so constructed as to have adequate strength without bulk, combined with the property in the case of a ratchet wrench, of being workable in restricted areas. It should be so constructed that the stud on a nut being tightened, as it lengthens, does not dislodge the wrench and/or socket from the nut; and in the case of a socket wrench, the various sized sockets should be readily interchangeable with a minimum of effort.

Accordingly, the chief object of the present invention is to provide an improved ratchet wrench and socket construction which will embody the above and other desirable characteristics.

Another important object of the present invention is to provide an improved ratchet wrench construction having highly machined complementary parts interfitting with a minimum tolerance as to form a self-reinforcing unitary structure substantially free from distortion and binding of the parts under high operating stresses.

Another important object is to provide an improved wrench head, handle and socket construction of the fewest operative parts possible, all of which are quickly and easily assembled or replaced, strong, and economically and readily manufactured.

A still further important object is to provide an improved socket for use with the wrench construction.

Another important object is to provide an improved ratchet wrench head with which a torque wrench may be used in limited working space, without the necessity of using additional adaptors or accessories.

Other objects and advantages of the invention will become apparent during the course of the following description.

In its broadest aspects, the invention comprises a wrench handle and socket construction in which the various parts bear on and reinforce each other in such a manner as to have maximum strength, minimum dimensions, freedom from distortion and resultant binding of the parts and be reversible by reversing the wrench body.

In the drawings, I have shown several embodiments of the invention. In these showings:

Figure 1 is a side elevational view of one form of the invention including the handle;

Figure 2 is a top plan view thereof to an enlarged scale, the handle being shown in section taken on the line 2—2 of Figure 1;

Figure 3 is a top plan view thereof with the cover plate removed showing the ratchet hub and pawl in operative position;

Figure 4 is a vertical sectional view thereof taken on the line 4—4 of Figure 2;

Figure 5 is an exploded perspective view to a reduced scale of another form of the invention;

Figure 6 is a central vertical sectional view of the ratchet hub thereof, taken on the line 6—6 of Figure 5;

Figure 7 is a top plan view to an enlarged scale of another form of the invention for use with sockets;

Figure 8 is a top plan view thereof with the cover plate removed;

Figure 9 is a central vertical sectional view thereof taken on the line 9—9 of Figure 7;

Figure 10 is an elevational view of one form of nut-engaging socket for use with the wrench shown in Figures 7–9 inclusive; and

Figure 11 is an elevational view of another form of nut-engaging socket for use therewith.

Referring to Figures 1–4 of the drawings, the wrench comprises a head 12 and a handle 13 which is detachably mounted in an aperture 14 in the head by means of a short inner shank 15. The handle 13 is pivotally connected to the shank 15 through an angle of 180° by means of a knuckle 16 and is provided with a cross bar 17 which is slidably mounted in an aperture 18. The cross bar is used primarily for leverage purposes when the handle 13 and the inner shank 15 are in axial alignment and mounted in the head 12.

The aperture 14 and the handle shank 15 are noncircular but conform in cross-section and the sides of the aperture may be provided with a groove (not shown) for the reception of a spring pressed ball (not shown) mounted in the shank to retain the latter in the head 12 as is conventional.

The wrench head generally indicated as 12 comprises a cover plate 20 attached by screws 21 to a body portion 22 and the plate and body have a circular bore 25 formed therein which is defined by the inner edge of the cover plate 20 and the inner side 26 of an inwardly directed annular flange 27 formed on the body 22.

A ratchet or nut-driving hub 28 is rotatably mounted in the bore 25 and includes a pair of annular shoulders 29 and 30 which bear respectively against the inner edge of the cover plate and the side 26 of the flange 27. The shoulders may or may not be of equal height but should terminate flush with the top and bottom surfaces of the head 12. The top and bottom edges of the hub 28 are confined between and have bearing on the bottom of the cover plate 20 and the upper surface of the flange 27 respectively. The hub 28 is provided with ratchet teeth 35 about its periphery and includes a central aperture 36 on the sides of which are formed hex nut-engaging teeth 38.

A flat leaf type pawl 40 is pivotally mounted in a generally circular recess 41 in the body 22 and is urged against the ratchet teeth 35 by means of a spring 42.

It will be noted that the heavy flange 27 strongly reinforces the body 22 at the point of application of torsional stresses thereto and is reinforced by the cover plate 20 when tightly screwed to the body 22. The ratchet hub 28 is thus snugly received and strongly and rotatably held against distortion during the application of high stresses by the confining and bearing surfaces of the flange 27, the cover plate 20, and their inner edges which snugly bear against the shoulders 30 and 29, respectively.

In use the wrench head is positioned adjacent a nut over which it is then axially moved until the nut-engaging teeth 38 formed in the sides of the hub aperture 36 engage the sides of the nut. The handle 13 is then oscillated to rotate the hub 28 by action of the pawl 40 and the nut is thus tightened or loosened as the case may

be. The action is reversed by removing the head **12** from the nut, detaching the handle **13** from the aperture **14** and reinserting it in the other side. The wrench is then placed over the nut as described above and oscillation of the handle **13** will rotate the hub in a reverse direction.

It will be appreciated that the handle **13** may be pivoted through a full 360 degree angle, 180 degrees on each side of the head **12**. It will be noted that this does not reverse the action of the wrench unless the head **12** is also reversed. This ability to pivot the handle more than 180 degrees by reinserting it in the opposite side is very important, especially when taken with the fact that the wrench may originally be placed in the handle at either of two positions—parallel to the plane of the head or at 90 degrees thereto. This enables the wrench to be used at almost any angle.

In the form of the invention shown in Figures 5 and 6, the wrench head **45** comprises a cover plate **46** which is adapted to confine a ratchet hub **47** between it and the body **48**. The body includes a handle receiving aperture **49**, a generally circular recess **50** for the reception of a pawl **51** and a spring **52** for urging the pawl into operative position against ratchet teeth, and a pair of threaded apertures so that the cover plate **46** may be strongly and rigidly attached thereto by means of screws.

A bore **53** is formed in the left end of the head **45** as seen in Figure 5 and it will be noted that the body **48** adjacent the bore **53** has been reduced to a thickness approximately equal to that of the cover plate **46** to form an arcuate shoulder **54** intersecting the recess **50** from which the pawl **51** projects. The ratchet hub **47** is provided with ratchet teeth **55** throughout its periphery and annular shoulders **56** and **57**. The hub is rotatably mounted in the bore **53** with the shoulders **56** and **57** snugly received and bearing respectively against the sides of the bore in the cap **46** and the body **48**. An aperture **58** is formed centrally of the hub and the sides of the aperture are provided with hex nut-engaging teeth **59**.

It will be readily apparent that the described structure snugly and rigidly confines the ratchet hub **47** for rotation therein in the general manner described with respect to the form shown in Figures 1–4 inclusive. The lower and upper surfaces of the cover plate and the body adjacent the bore **53** bear respectively on the upper and lower surfaces of the hub adjacent the teeth **55** while the sides of the shoulders bear against the edges of the bore formed in the cover plate and the body. A very strong wrench head is thus provided and the top and bottom surfaces of the shoulders **56** and **57** being substantially flush with the surfaces of the head **45**, minimum dimensions are maintained without a sacrifice of strength or rigidity.

In the form of the invention shown in Figures 7–9 inclusive of the drawings, the wrench head generally indicated as **60** comprises a cover plate **61** attached by screws to a generally oval shaped body **62**, both cover plate and body having a bore **64** formed therein. A ratchet hub **63** is rotatably mounted in the bore **64** as will be further described, and includes a central aperture **65**. The hub is provided with ratchet teeth **66** about its entire periphery.

An annular flange **67** forming a part of the body **62** and bounded by a groove **68** surrounds the base of the bore **64** (Figure 9). The hub **63** is guided and strongly reinforced in its rotation in the bore by a depending annular flange **69** formed on the hub **63** and bearing in the groove **68**. The annular flange **69** is also bounded by a groove **70** in which the body flange **67** bears, that is the body flange **67** and body groove **68** are complementary to the hub groove **70** and the hub flange **69**, respectively. It will be noted that the shoulders **71** of the hub **63** bear against and are reinforced by both the inside edges of the cover plate **61** and the flange **67** which define the bore **64**.

A pair of flat pawls **73** are pivotally mounted in recesses **74** of the body **62** and are urged against the ratchet teeth **66** by spring members **75**. The pawls **73** and the hub **63** are retained in the body **62** by means of the cover plate **61** and the body **62** and the plate are provided with a wrench handle receiving non-circular aperture **76**.

The hub **63** has a central aperture formed therein and the inner faces thereof are adapted to receive the shank of a nut-engaging socket. To this end, the sides of the aperture are provided with a pair of substantially hook-shaped driving shoulders **77**, thereby providing recesses for the ends **78** of an arcuate-shaped socket shank **79** (Figures 7–10 inclusive). The nut-engaging sockets which may be used with the ratchet hub **63**, such as the socket **80** shown seated in the aperture of the hub **63**, may be of all standard sizes and of any conventional construction on the nut-engaging end. The sockets may be of any desired depth and as shown are provided with an axially extending shank **79** with arcuate shape, its outer face being contiguous with the sides of the aperture formed in the hub **63**.

It will be noted that the ends **78** of the arcuate shank **79** terminate in driven faces **81** which are inclined at an acute angle to the sides of the aperture and that the angle of the driving faces is greater than the angle of the faces of the driving shoulders **77**. By this means, potentially distorting contact between the shank **79** and the driving shoulders is prevented. Thus, the hook-shaped driving shoulders **77**, although subject to a great deal of direct strain, will not be peened over nor the hooked shoulders bent out of line. Instead, the torquing forces will be directly absorbed by the innermost angles of the shoulders and the stresses will be distributed throughout the driving hub **63** bearing against the edges of the cover plate and the flange **67**.

In Figure 11, I have shown the modified form of socket **82** in which the open portion of the shank is continued downwardly through the socket portion so as to form a slot **83** throughout the vertical height of the socket and shank. The advantage of the socket **82** over socket **80** is that in its application to a nut to be tightened or loosened, the socket **82** may be slid laterally over a pipe or tubular conduit and then axially over the nut whereas the socket **80** may only be slid axially over the nut head.

The wrench and sockets disclosed in Figures 7–11 inclusive of the drawings are operated in the manner previously described in connection with the other forms of the invention. It will be appreciated that the rotary hub **63** is strongly reinforced and guided not only by the complementary body and hub flanges and groove described but that the shoulders of the hub are further guided and bear against the edges of the cover plate **61** and flange **67** which define the bore **64**. Moreover, the upper and lower faces of the shoulders of the hub **63** terminate flush with the upper and lower faces of the wrench head **60** to thus provide minimum over-all dimensions therefor.

The wrench forms disclosed in the drawings may be made of any suitable ferrous material and chrome molybdenum steel has been found to be highly satisfactory. The surfaces of the various mating parts may be highly machined so as to avoid friction and permit close tolerances to be used. It will be obvious that the improved ratchet wrench heads disclosed may be used with a torque wrench in limited working space without the necessity of using additional adaptors or accessories.

It will be readily apparent that the forms of the invention disclosed are of great utility in applications where space is limited and will withstand high stresses without distortion or binding of the parts due to their reinforcing and guiding structure. The nut-engaging sockets which may be readily replaced with others of different sizes distribute the torque stresses to the hub and body of the wrench and the direction of rotation of the hub may be readily reversed as described.

It is to be understood that the forms of my invention herewith shown and described are to be taken as preferred examples of the same and that various changes in the shape, size, and arrangement of parts may be resorted to without departure from the spirit of the invention or the scope of the subjoined claims.

I claim:

1. A wrench of the type described comprising: a closed head having an annular bore therein; a hub journaled for rotation in said bore, said hub having an opening presenting an internal cylindrical wall concentric with the axis of rotation of the hub; abutment means internally carried by said hub and projecting inwardly of said cylindrical wall; a replaceable nut-engaging socket having a hub engaging portion adapted to be inserted axially into said opening, said portion having an external arcuate surface complementary to said cylindrical wall and adapted to lie contiguous thereto in the inserted position of said portion; an abutment formed at the opposite ends of said arcuate surface and engageable with said abutment means of the hub to provide driving connection between the hub and said socket; and ratchet means operatively connecting the head and the hub whereby the hub and the socket engaged therewith may be rotated upon rotation of the head.

2. A wrench of the type described, comprising: a closed head having a bore therein; a hub journaled for rotation in said bore, said hub having an opening formed therethrough presenting an internal cylindrical wall surface concentric with the axis of rotation of said hub; ratchet drive means operatively connecting the head and said hub whereby the hub may be rotated upon rotation of the head; shoulders carried by and circumferentially spaced apart on said cylindrical wall surface; and a replaceable nut engaging socket having a hollow hub engaging portion adapted to be inserted axially into said opening, said portion having an external arcuate surface corresponding to said cylindrical wall surface and adapted to lie contiguous thereto in the inserted position of said portion; and a pair of faces formed on the ends of said portion and engaging respectively said spaced apart shoulders in the inserted position of said portion to provide a driving connection between the hub and said socket.

3. A wrench, comprising: a head having a bore therein; a hub journaled for rotation in said bore, said hub having an opening formed therein presenting an internal cylindrical wall concentric with the axis of rotation of the hub; ratchet means operatively connecting the head and the hub whereby the hub may be rotated upon rotation of the head; driving shoulders carried by said hub and projecting inwardly of said wall, said shoulders being circumferentially spaced apart and presenting oppositely directed drive faces; and a replaceable nut-engaging socket having a hub engaging portion adapted to be inserted axially into said opening, said portion having an external arcuate surface corresponding to said cylindrical wall and adapted to lie contiguous thereto in the inserted position of said portion, the end faces of said arcuate surface being spaced apart a distance equal to the distance between said drive faces and engaging the same in the inserted position of said portion to provide driving connection between the hub and the socket.

4. A wrench, comprising: a head having a bore therein; a hub journaled for rotation in said bore, said hub having an opening formed therein presenting an internal cylindrical wall concentric with the axis of rotation of the hub; ratchet means operatively connecting the head and the hub whereby the hub may be rotated upon rotation of the head; driving shoulders carried by said hub and projecting inwardly of said wall, said shoulders being circumferentially spaced apart and presenting oppositely directed drive faces; and a replaceable nut-engaging socket having a hub engaging portion adapted to be inserted axially into said opening, said portion having an external arcuate surface corresponding to said cylindrical wall and adapted to lie contiguous thereto in the inserted position of said portion, the end faces of said arcuate surface being spaced apart a distance equal to the distance between said drive faces and engaging the same in the inserted position of said portion to provide driving connection between the hub and the socket; the faces of said shoulders and the end faces of said arcuate portion being angularly inclined with respect to said opening, the faces of said arcuate end portions being inclined at a greater angle with respect to said opening than the faces of said shoulders.

5. A replaceable workpiece-engaging member for ratchet wrenches having a driving member presenting an internal cylindrical wall surface having circumferentially spaced, inwardly projecting driving shoulders, comprising: a body having wall means shaped to engage a workpiece to be turned; a hollow shank coaxially extending from said body and having an external arcuate surface adapted to correspond to and lie contiguous with the internal wall surfaces of the driving member; and an abutment formed at the opposite marginal edges of said arcuate surface engageable with said driving shoulders thereby to mount said workpiece engaging member for rotation with the driving member of said wrench.

6. A replaceable socket for ratchet wrenches having a driving member presenting an internal cylindrical wall surface having circumferentially spaced inwardly projecting driving shoulders, comprising: a nut-engaging body portion; and a hollow shank coaxially extending from said body portion and formed with a longitudinally extending slot, said shank presenting an external arcuate surface complementary to said internal cylindrical wall surface of the driving member and adapted to lie contiguous thereto after said shank has been inserted axially of said cylindrical wall surface, the defining edges of said slot forming circumferentially spaced abutments engageable with said driving shoulders whereby said socket is rotatably driven with the driving member.

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