July 5, 1955 H. L. FISH 2,712,256

OPEN RATCHET WRENCH

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FIG. 1.

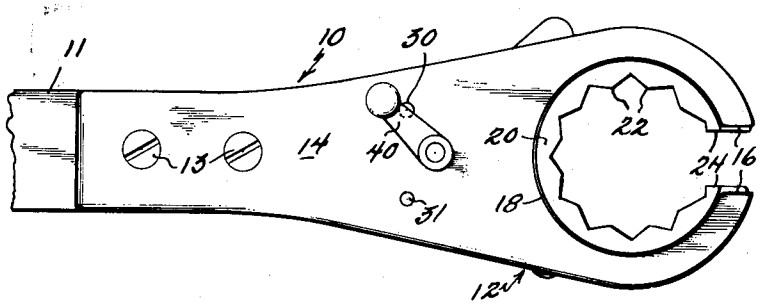


FIG. 2.

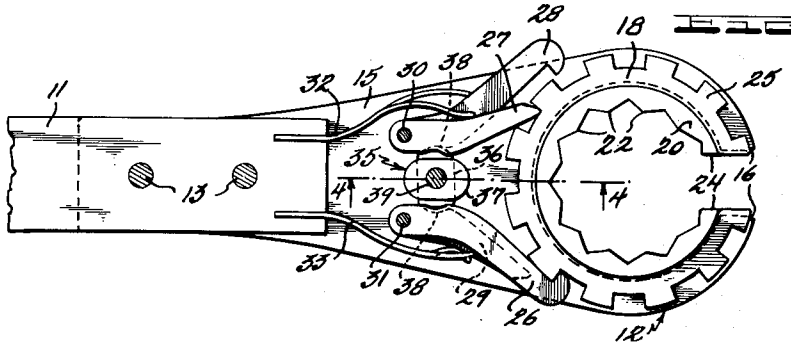


FIG. 3.

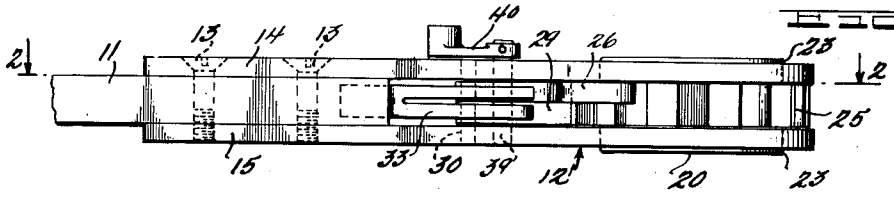
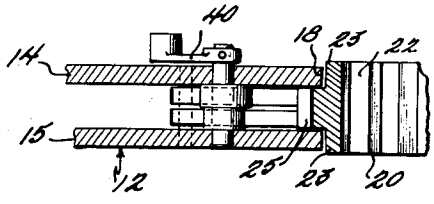


FIG. 4.



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FIG. 5.

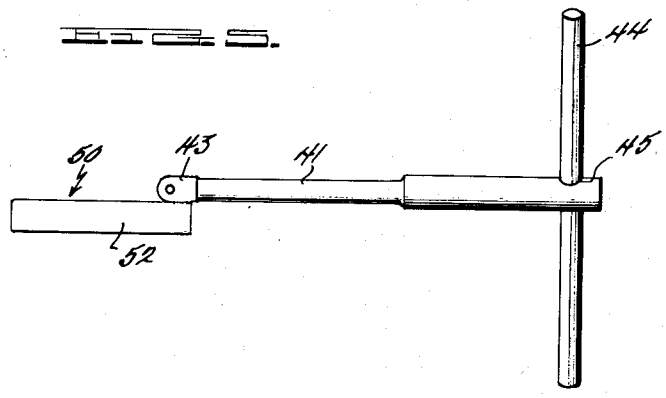


FIG. 6.

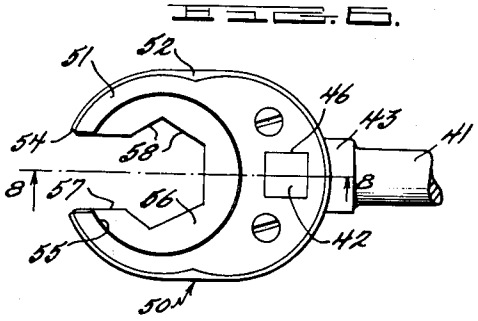


FIG. 4.

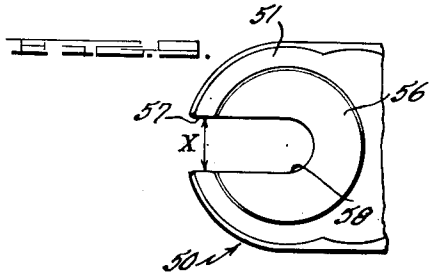


FIG. 7.

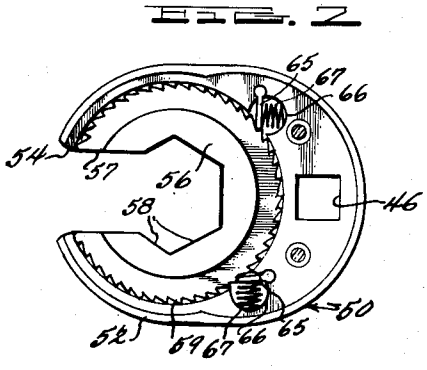
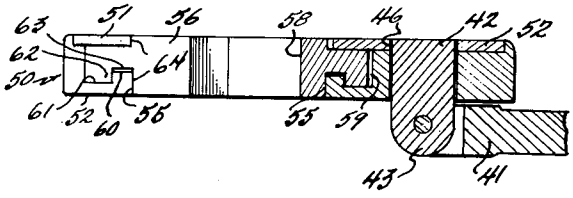


FIG. 8.



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OPEN RATCHET WRENCH

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Application June 28, 1951, Serial No. 234,077

4 Claims. (Cl. 81—58.2)

This invention relates generally to wrenches and more particularly to open end ratchet wrenches having direct nut-engaging portions.

This application is a continuation-in-part of my parent application Serial No. 590,577, filed April 27, 1945, now Patent No. 2,578,686, December 18, 1951, entitled Split Ratchet Socket Wrench which is a continuation-in-part of my now abandoned application Serial No. 531,325, filed April 17, 1944, entitled Split Ratchet Socket Wrench for B Nuts.

Wrenches of this general type are known in the art and are usually characterized by a number of undesirable features which limit their utility. Among these features are a lack of compactness rendering them impractical in limited working spaces; a lack of reversibility, an insufficiently rugged construction making them vulnerable to excessive spreading under heavy loads to which this type of wrench is often subjected; a general cumbersomeness in use rendering them unpopular with mechanics, and an unnecessarily high initial cost which prohibits sales success on the open highly competitive market.

Accordingly the chief object of the present invention is to provide a wrench construction which will obviate the foregoing disadvantages characterizing known structures.

Another important object of the present invention is to provide an open type ratchet wrench of maximum strength and minimum overall dimensions particularly adapted for use in difficult applications such as to encircle tubing, conduit, cable, shafting, etc. in close quarters when wrenches of ordinary construction cannot be used.

A further important object of the invention is to provide an improved ratchet wrench construction having means for reversing the driving connection between the pawl and the nut-engaging or driving hub.

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

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 an open end ratchet wrench of maximum strength and minimum overall dimensions which may be reversed and is so constructed and reinforced as to prevent excessive widening of the nut-engaging member under high stresses during use.

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

Figure 1 is a top plan view of one form of the wrench comprising the present invention;

Figure 2 is a top plan view thereof broken away in part to show certain details of construction as seen on line 2—2 of Figure 3;

Figure 3 is a fragmentary side elevational view thereof;

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

Figure 5 is a side elevational view of another form of the invention showing the detachable handle;

Figure 6 is a fragmentary top plan view thereof showing the handle inserted in the wrench head from the bottom;

Figure 7 is a top plan view of the wrench head with the cover plate removed;

Figure 8 is a fragmentary vertical sectional view of the invention taken on the line 8—8 of Figure 6; and

Figure 9 is a fragmentary top plan view of a further modification of the invention.

Referring to Figures 1–4 inclusive of the drawings, numeral **10** indicates the wrench as a whole which comprises a relatively thick handle **11** and a head **12** fastened thereto as by screws **13**. The head **12** comprises a pair of spaced jaws or body members **14** and **15** having a slot **16** formed therein, the inner portion **18** of the slot having the form of a segment of a circle. The width of the slots **16** is less than the diameter of the circular portion **18** of the slot.

For engaging a nut, a collar or hub **20** may have internal teeth-like elements **22** formed therein and external circular bearing elements or shoulders **23** constructed for engaging with a snug working fit in the circular portions **18** of the slots **16** in the bodies **14** and **15** and to be flush with their surfaces. A gap or slot **24** is provided in the hub **20** of approximately the same width as the slot **16**.

Ratchet teeth **25** are formed on the external surface or periphery of the hub **20** between the shoulders **23**, the outer diameter of the teeth being greater than the diameter of the shoulders **23** which fit snugly between the bodies **14** and **15**. The teeth **25** are designed to permit the hub to be revolved in either direction as may be convenient, for example, for operating on nuts having right- or left-hand threads.

For revolving the nut engaging hub **20** in a clockwise direction, a set of two right-hand pawls **26** and **27** (Figure 2) are pivoted to and between the bodies **14** and **15** to the right of the handle **11**. The pawls **26** and **27** are positioned so that their free ends engage the hub teeth **25** far enough apart as to always leave one of the pair of pawls in engagement with some of the teeth **25** when the free end of the other pawl of the pair is disposed in the gap in the pawl teeth which coincides with the slot in the hub **20**.

Another pair of pawls **28** and **29** are pivoted alongside the pawls **26** and **27** for revolving the hub **20** counterclockwise when such operation is desirable. The pawls **27** and **28** are preferably mounted on the same pin **30** fastened in the bodies **14** and **15**, and the pawls **26** and **29** are preferably mounted on the same pin **31**.

For pressing the pawls **27** and **28** into engagement with the teeth **25**, a single leaf spring **32** which has one end portion fastened in the handle **11**, has the other portion split and formed suitably for engaging the associated pawls. Similarly, a single split leaf spring **33** may be employed for pressing the pawls **26** and **29** against the teeth **25**.

For holding one of the pairs of pawls described above inoperative while the other pair is in use, a revolubie cam unit indicated as a whole as **35** may be mounted between the pawls pivoted on the pin **30** and the pawls pivoted on the pin **31**. This cam unit **35** has two integrally joined cams **36** and **37** so disposed that when the cam **36**, referring now to Figure 2, is in the position shown with its major axis transverse to the longitudinal axis of the wrench, it holds the pawls **28** and **29** outwardly in an inoperative position. A small round detent notch **38** in each of the pawls **28** and **29** engages with the opposite ends of the cam **36** and holds it securely in its

operative position and the pawls **28** and **29** in their inoperative positions.

The construction and operation of the cam **37** and the pawls **26** and **27** are similar to that of the cam **63** and its associated pawls. The cam unit **35** is mounted on a short shaft **39** which projects slightly above the surfaces of the body **14** and has fastened to it a short handle **40** for operating the cams **36** and **37**. It will be noted that the hub **20** is held securely in position in the wrench by means of the bodies **14** and **15** and spreading of the bodies or the hub **20** during the application of high stresses thereto is prevented by the reinforcement afforded by the shoulders **23** and their mutual cooperation.

Figures 5–8 inclusive of the drawings disclose a simpler form of the invention wherein the ratchet hub is not reversible by the means just described but wherein the same results may be obtained by reversal of the wrench body itself. In this form of the invention, the handle **41** is detachably mounted in the wrench by means of a short inner shank **42** and may be pivoted through an angle of 180° with respect thereto by means of a knuckle **43**. The handle is provided with a cross bar **44** which is slidably mounted in an aperture **45** and is used primarily for leverage purposes when the handle **41** and the inner shank **42** are in axial alignment.

The inner shank **42** is non-circular in cross-section and is adapted to be received in a conforming aperture **46** formed in the wrench head. The shank **42** may be provided with a spring pressed ball (not shown) for cooperation with a groove (not shown) formed in the sides of the aperture **46** as is conventional.

The generally oval shaped wrench head indicated as a whole as **50** comprises a cover plate **51** attached by screws to a lower body portion **52** and both formed with a slot **54** at one end for the accommodation of a conduit, etc. during use of the wrench. The slot **54** is in communication with a bore **55**, both extending throughout the thickness of the head **50**.

A hub **56** is rotatably mounted in the bore **55** as will be further described, and is also formed with a slot **57** corresponding to and of approximately the same width as the slot **54**, and opening into a direct nut-engaging aperture **58** of the crowfoot type. The hub **56** is provided with ratchet teeth **59** about its entire unslotted periphery.

An annular flange **60** forming a part of the body **52** and bounded by an annular groove **61** surrounds the base of the bore **55** (Figure 8). The hub **56** is guided and strongly reinforced in its rotation in the bore **55** by a depending annular flange **62** formed on the hub **56** and bearing in the groove **61**. The annular flange **62** is also bounded by a groove **63** in which the body flange **60** bears, that is, the body flange **60** and body groove **61** are complementary to the hub groove **63** and the hub flange **62**, respectively. It will be noted that the shoulders **64** of the hub **56** bear against and are reinforced by both the inside edges of the cover plate **51** and the flange **60** which define the bore **55**.

A pair of flat pawls **65** are pivotally mounted in recesses **66** of the body **52** and are urged against the ratchet teeth **59** by spring members **67**. The pawls **65** and the hub **56** are retained in the body **52** by means of the cover plate **51**. The pawls are so arranged and spaced that one is always in engagement with the teeth **59** for driving the hub **56** in a single direction regardless of the position of the slot **57**. In order to reverse the direction of rotation of the nut-engaging hub **56**, the wrench **50** must be turned over.

The nut-engaging aperture of the hub **56** is of the crowfoot type formed for direct engagement with a nut and is placed in engagement therewith axially of the nut. When a larger or smaller nut is to be operated upon, another hub **56** having the appropriate sized nut-engaging aperture **58** may be readily substituted by merely removing the cover plate **51**, or by using a different size wrench head.

The form of the invention disclosed in Figure 9 is identical in all respects to that shown in Figures 5–8 inclusive with the exception of the nut-engaging aperture in the hub **56**. As shown, the slot **57** indicated by "*x*" is U-shaped. This form of open end ratchet wrench may, therefore, be placed in engagement with a nut by moving the wrench over the nut either axially or transversely thereof.

In use, the slot **57** in the hub is aligned with the slot **54** in the body **52** and cover **51** whereupon the head **50** may be slid over a nut which is then engaged by the sides of the slot **57**. Where it is desired to axially engage a nut on a conduit, etc., the head **50** is moved so that the conduit enters the slots **54** and **57** to the central portion of the aperture **58** whereupon the sides of the aperture may be axially moved to engage the nut. The hub **56** is now rotated by continuous oscillation of the handle **41** to tighten or loosen the nut. To reverse the operation, the head **50** is removed from the nut after realigning the slots **54** and **57**, the handle **41** removed from the head which is turned over, and the handle reinserted or both the handle and head are turned over if space permits. The head is re-engaged with the nut whereupon oscillation of the handle in the same manner will loosen or tighten the nut.

It will be appreciated that the handle **41** may be pivoted through a full 360 degree angle. This is accomplished by detaching it and reinserting it on the opposite side of the wrench and pivoting it on that side an additional 180 degrees. It will be noted that this does not reverse the action of the wrench unless the head **50** 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 handle may originally be placed in the wrench 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. 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 now be readily apparent that the forms of the invention disclosed are of great utility around conduits, etc. where space is limited and will withstand high stresses without excessive widening or undue spreading of the jaws formed by the slots due to their reinforcing and guiding structure. The nut engaging hubs, as well as other parts, may be readily replaced for use of the head with different sized nuts, and the direction of rotation of the hubs 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 comprising a head having an annular bore therein and an open slot extending from the exterior of the head into said bore, a handle element fixed to said head for rotating the same, a hub journaled for rotation in said bore, said hub having an opening formed with a wall concentric with the axis of rotation of the hub, said hub also having an open slot extending from the exterior thereof into said opening and adapted to register with the slot in the head in one rotative position of the hub, ratchet drive means operatively connecting the head and the hub whereby the hub may be rotated upon rotation of the head, said ratchet means comprising an annular series of teeth formed on the periphery of said hub, two pairs of pawls mounted in said head, the pawls of each pair being alternately engageable with said teeth to rotate said hub in one direction or the other depending on

the direction of rotation of the head, and means mounted in said head and alternately engageable with pairs of said pawls to hold them out of engagement with said teeth, said last mentioned means comprising a double headed cam rotatable in said head and engageable with a selected pair of said pawls to hold said engaged pawls out of driving engagement with said teeth.

2. An open ended ratchet type socket wrench, comprising: a hollow radially slotted head portion; a handle element fixed within said head portion and extending therefrom, said head portion having an annular bore communicating with the inner end of the slot of said head portion; a hub member having an annular guide shoulder formed adjacent each end thereof engaging and coacting with the wall of said bore for mounting and supporting said hub member for rotative movement, said hub having an opening formed with a wall concentric with the axis of rotation of the hub and having a slot extending from the periphery thereof into said opening and adapted to register with the slot in the head portion in one rotative position of the hub member; a single annular series of ratchet teeth circumferentially formed about said hub member intermediate said shoulders; a pair of spaced bearing members carried with said head portion; two sets of paired pawls, one of each set pivotally mounted on each of said bearing members and spring biased into engagement with said series of ratchet teeth; and manually operable cam means for holding a selected set of paired pawls out of engagement with said ratchet teeth whereby the direction of rotation of said hub member may be preselected.

3. A wrench of the type described, comprising: a head portion having an opening therethrough; a handle element projecting from said head portion; a hub member; guide means carried by said hub member and coacting with guide means formed internally of said head for mounting and supporting said hub member on said head portion for rotative movement; an annular series of ratchet teeth circumferentially formed about said hub member; a pair of pawl elements journaled on a common bearing within said head portion; a second pair of pawl elements journaled on a common bearing spaced from said first mentioned common bearing; means tending to resiliently urge said pawl elements into engagement with said teeth; a pawl element of one pair of elements coacting with a pawl element of said second pair, as said handle element is swung in one direction, to rotatably drive said head element in one direction, the other pawl element of said first pair coacting with the second pawl element of the other pair of elements, as said handle element is swung in the opposite direction, to rotatably drive said hub

member in a direction opposite to the direction of the first mentioned drive; cam means rotatably mounted intermediate said spaced bearings and rotatable between alternate positions for holding a selected pair of coacting pawl elements out of engagement with said teeth; and manually operable means for actuating said cam means.

4. An open ended ratchet type socket wrench, comprising: a hollow radially slotted head portion; a handle element fixed within said head portion and extending therefrom, said head portion having an annular bore communicating with the inner end of the slot of said head portion; a hub member having an annular guide shoulder formed adjacent each end thereof engaging and coacting with the wall of said bore for mounting and supporting said hub member for rotative movement, said hub having an opening formed with a wall concentric with the axis of rotation of the hub and having a slot extending from the periphery thereof into said opening and adapted to register with the slot in the head portion in one rotative position of the hub member; an annular series of ratchet teeth circumferentially formed about said hub member intermediate said shoulders; a pair of pawl elements journaled on a common bearing within said head portion; a second pair of pawl elements journaled on a common bearing spaced from said first mentioned common bearing; means tending to resiliently urge said pawl elements into engagement with said teeth; a pawl element of one pair of elements coacting with a pawl element of said second pair, as said handle element is swung in one direction, to rotatably drive said head element in one direction, the other pawl element of said first pair coacting with the second pawl element of the other pair of elements, as said handle element is swung in the opposite direction, to rotatably drive said hub member in a direction opposite to the first mentioned drive; and means for holding a selected pair of coacting pawl elements out of engagement with said teeth.

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