Oct. 25, 1960 T. G. HARE 2,957,377

REVERSIBLE RATCHET TYPE WRENCH

Filed Sept. 13, 1957 2 Sheets-Sheet 1

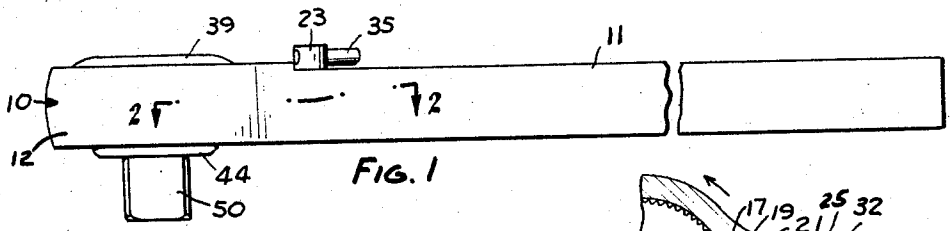

FIG. 1

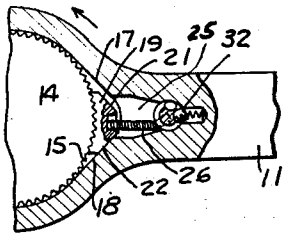

FIG. 2

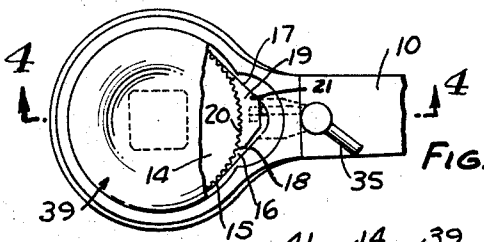

FIG. 3

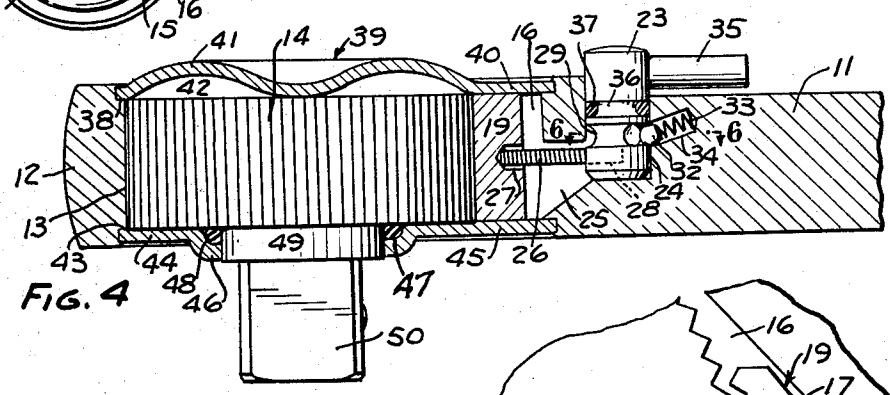

FIG. 4

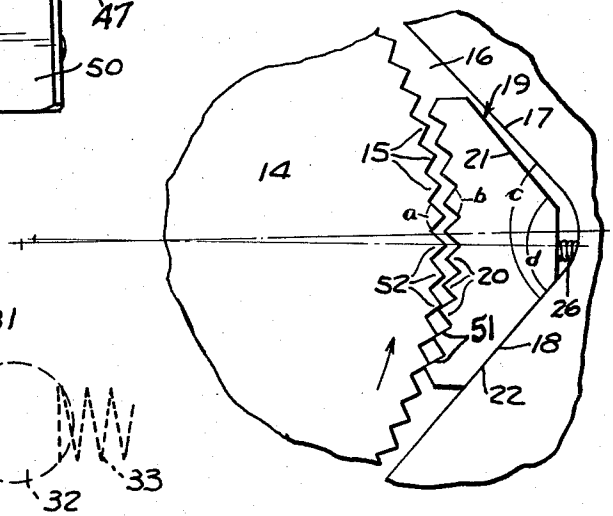

FIG. 5

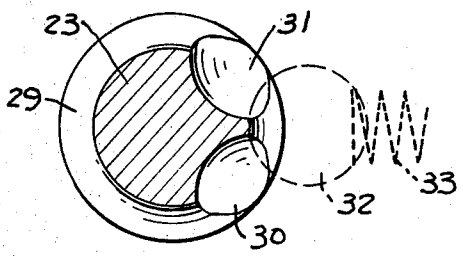

FIG. 6

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REVERSIBLE RATCHET TYPE WRENCH

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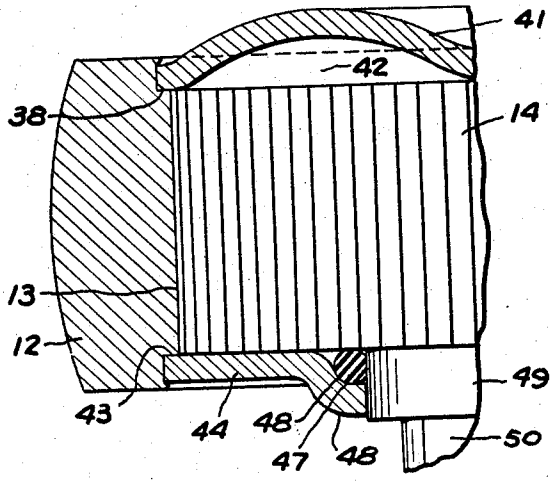

FIG. 7

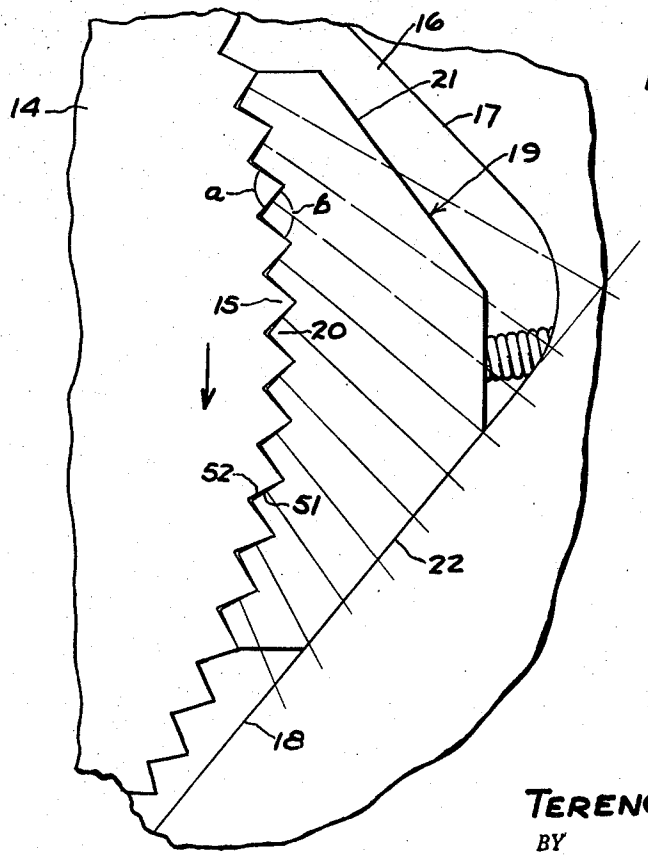

FIG. 8

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REVERSIBLE RATCHET TYPE WRENCH

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11 Claims. (Cl. 81—63.2)

This invention relates to manually operated wrenches and particularly to wrenches having reversible ratchet mechanisms.

In manually operated wrenches having reversible ratchet mechanisms it is desirable that the ratchet mechanisms be of such construction that they will operate with a minimum of maintenance to permit the tightening or loosening of a workpiece such as a nut. In addition, the construction should be such that the wrench is positively locked in tightening or loosening position and yet is easily changed from one position to another.

It is an object of this invention to provide an improved reversible ratchet type wrench.

It is a further object of this invention to provide such a wrench which requires a minimum of maintenance.

It is a further object of this invention to provide such a wrench which utilizes a minimum number of parts.

It is a further object of this invention to provide such a wrench which is sealed with proper lubricant during assembly and requires no further lubrication in use.

It is a further object of this invention to provide such a wrench which is sealed and may be plated as desired after being assembled.

In the drawings:

Fig. 1 is a side elevational view of the wrench embodying the invention.

Fig. 2 is a fragmentary sectional view taken along the line 2—2 in Fig. 1.

Fig. 3 is a fragmentary plan view, portions being broken away, showing the parts of the wrench in a different position from that shown in Fig. 2.

Fig. 4 is a sectional view on an enlarged scale taken along the line 4—4 in Fig. 3.

Fig. 5 is a fragmentary view on an enlarged scale of a portion of the wrench shown in Fig. 2.

Fig. 6 is a sectional view taken along the lines 6—6 in Fig. 4, on a greatly enlarged scale.

Fig. 7 is a fragmentary sectional view similar to Fig. 4 on an enlarged scale.

Fig. 8 is a fragmentary view on an enlarged scale of the portion of the wrench shown in Fig. 5 showing the pawl in engaged position.

Referring to Figs. 1 and 4, the reversible ratchet type wrench embodying the invention comprises a body 10 having a handle 11 and a head 12. Head 12 is provided with a cylindrical opening 13 in which a rotatable member 14 is journalled, as presently described. Rotatable member 14 is formed with a series of ratchet teeth 15 along the periphery thereof. Body 12 is provided with a wedge-shaped cavity 16 which communicates with the periphery of rotatable member 14. Cavity 16 has converging straight sides 17, 18 which diverge in the direction of the periphery of rotatable member 14. A wedge-shaped pawl 19 is positioned in cavity 16 for limited floating movement. Pawl 19 includes an arcuate row of teeth 20 adjacent teeth 15 of rotatable member 14 and adapted to interengage teeth 15. Wedge 19 also includes converging sides 21, 22 which are adapted to

contact sides 17, 18 of cavity 16 and thereby limit the circumferential movement of pawl 19. Sides 21, 22 diverge in a direction toward the row of teeth 20.

A pin 23 is positioned in an opening 24 in body 10 having its axis parallel to the axis of rotation of rotatable member 14. Body 10 includes a passageway 25 providing communication between cavity 16 and opening 24. A tightly wound helical coil spring 26 is compressed between pawl 19 and pin 23. Pawl 19 is provided with an opening 27 in the apex formed by sides 21, 22 into which one end of spring 26 projects and pin 23 is provided with a radially extending opening 28 into which the other end of spring 26 projects.

By rotating pin 23 it is possible to shift the end of spring 26 from one side of a line extending between the axis of the pin 23 and the axis of the rotatable member 14 to the other side of said line. Such a rotation of pin 23 bodily shifts pawl 19 through spring 26 from an extreme circumferential position in contact with one of the sides 17, 18 of cavity 16 to an extreme circumferential position in contact with the other of the sides 17, 18. In either circumferentially extreme position pawl 19 is prevented by contact with the side of the cavity from further circumferential movement toward the side but is permitted to move circumferentially in the other direction and radially by the yielding force of spring 26 on pawl 19. By this arrangement, pawl 19 controls the rotation of rotatable member 14 relative to body 10. In one position of pawl 19 rotatable member 14 may rotate only in one direction relative to body 10 and in the other position of pawl 19 rotatable member 14 may rotate in only the opposite direction.

Means are provided for yieldably locking the position of pin 23 and, in turn, spring 26 and pawl 19 in one or the other of the permissible positions and includes an annular groove 29 on the periphery of pin 23. Pin 23 also has a pair of circumferentially spaced spherically curved concave detent surfaces 30, 31 formed along the annular groove. A ball 32 is mounted in body 10 for movement toward and away from annular groove 29, and a light coil spring 33 is compressed between ball 32 and the base of a cylindrical opening 34 in body 10 to yieldingly urge ball 32 toward annular groove 29, the ball 32 engaging one or the other of the detent surfaces to lock pin 23 in one or the other of its positions. The axis of cylindrical opening 34 forms an acute angle with the axis of pin 23 to retain pin 23 in cavity 24. A lever 35 is mounted on the end of pin 23 which projects to the exterior of body 10 to serve as a means for rotating pin 23.

An oil seal is provided between pin 23 and the body 10 and comprises an annular groove 36 on the periphery of pin 23 and an O-ring 37 positioned in annular groove 36 and contacting the surface of opening 24.

One end of cylindrical opening 13 in head 12 is sealed by a generally circular cap 39 which abuts against annular shoulder 38 of head 12. Cap 39 includes a tab 40 which overlies one end of cavity 16. Cap 39 has an annular portion 41 thereof overlying the periphery of rotatable member 14 spaced from the rotatable member to provide an annular space 42 into which lubricant may be placed.

An annular wall 44 is provided on the other end of the cylindrical opening 13 and abuts shoulder 43 of head 12. Annular wall 44 includes a tab 45 which overlies the other end of cavity 16. A portion of the inner periphery of annular wall 44 is struck out to form a radially inwardly extending and axially offset flange 46 which provides an annular seat 47 for supporting an O ring 48. Rotatable member 14 includes a cylindrical shoulder 49 which cooperates with O ring 48 to provide an oil seal. A work-engaging projection 50 extends axially from rotatable member 14 through the opening

in annular wall 44. Projection 50 may be of any well-known type for providing a disconnectable connection with various work-engaging members such as socket wrenches and the like. Cap 39 and annular wall 44 are sealed to head 12 by suitable means, for example, by staking around the periphery.

In use lever 35 is placed in either of the positions shown in Figs. 1 and 3. When lever 35 is in the position shown in Fig. 2, pawl 19 is positioned in cavity 16 with surface 22 in parallelism to and in contact with surface 18 of the cavity. In this position, if projection 50 is in engagement with a work-engaging member which is to be rotated and handle 11 is moved to rotate head 12 counterclockwise in the direction of the arrow as shown in Fig. 2, pawl 19 will be wedged between the teeth 15 and surface 18, causing rotatable member 14 to move with head 12. If handle 11 is moved in the opposite direction to rotate head 12 clockwise as viewed in Fig. 2, pawl 19 is permitted to move outwardly away from teeth 15, causing teeth 20 on pawl 19 to ride over the teeth 15 while pawl 19 slides along surface 18. In this manner the rotatable member 14 does not rotate when head 12 is rotated clockwise.

Shifting lever 35 to the position shown in Fig. 3, shifts pawl 19 to bring surface 21 into parallelism and in contact with side 17 of cavity 16. If lever 35 is in the position shown in Fig. 3 and handle 11 is rotated in a clockwise direction, pawl 19 is wedged by the action of teeth 15, 20 and by contact of surface 21 with side 17 of cavity 16 to prevent the movement of the pawl and thereby cause rotatable member 14 to rotate in a clockwise direction with head 12. If the handle 11 is moved to rotate head 12 in a counterclockwise direction as viewed in Fig. 3, the teeth 20 of pawl 19 override teeth 15 so that the rotatable member 14 does not rotate with head 12.

The included angle *a* of the teeth 15 must be large enough to insure a ready ratcheting action of the pawl 19 when the handle 11 is rotated in the direction opposite to that for causing a wedging action of the pawl 19. If the included angle *a* is large, the pawl will ratchet easily. On the other hand, the surfaces defining the angle *a* of the teeth engaging pawl 19 must be angularly related to side surfaces 17, 18 such that the side surfaces acting on the pawl 19 produce a wedging action against the teeth when the handle 11 is rotated in a direction tending to cause wedging of the pawl 19. The angle *c* between the side surfaces 17, 18 of cavity 16 must be smaller than the angle *d* between the wedge surfaces 21, 22 of the pawl 19.

I have found that it is preferable to distribute the wedging action tending to lock the rotatable member 14 to handle 11 over a plurality of teeth 15, 20. Specifically, the surfaces of the teeth should be related to the cam surfaces 17, 18 in such a manner that in a wedged position more than half of the teeth 20 are in wedging engagement with teeth 15. This is accomplished by making the angle between surfaces 17, 18 such, with respect to the angle of the surfaces of the teeth 15, 20, that a locking force is applied to the teeth 15. Specifically, for at least about half of the teeth 20, the surfaces 51 at one side of teeth 20 are angularly related to the cam surface 18 such that a perpendicular line extending from surfaces 51 toward surface 18 forms an angle of 90° with surface 18 or less than 90° in a direction measured on the side of the line away from the center of the pawl. Similarly, a majority of the surfaces 52 of teeth 15 which engage with teeth 20 are related to surface 18 such that lines extending at right angles from the surfaces 52 form an angle of 90° or less with surface 18 in a direction measured on the side of the line away from the center of the pawl (Fig. 8).

I have found that the angle *b* is preferably equal to 90°. The angle *a* is less than 90° and depends on the number of ratchet teeth.

I have further found that the surfaces 17, 18, 21, 22 should preferably be lubricated and machined such that there is a minimum of friction therebetween.

It can thus be seen that I have provided a reversible ratchet type wrench which has a minimum number of parts and which can be effectively locked in one or the other of its operating positions. The wrench is sealed upon assembly and lubricant may be placed within the sealed wrench during assembly to permanently lubricate the operating parts. In addition, after assembly the sealed construction permits the entire wrench to be plated in order to improve the appearance of the wrench and its resistance to corrosion as may be desired. The sealed construction permits the entire wrench to be placed in a solvent bath when in use it is desired to clean the exterior of the wrench.

The center depressed portion of cap 39 provides a convenient thumb-receiving area for supporting the wrench when the wrench is used in a position where the projection 50 extends upwardly, for example, in working on the underframe of an automobile.

I claim:

1. In a wrench, the combination comprising a body having a head and a handle, said head being formed with a cylindrical opening, a rotatable member journalled in said opening, said rotatable member being formed with a plurality of ratchet teeth on the periphery thereof, said body having a wedge-shaped cavity communicating with the periphery of said rotatable member, a wedge-shaped pawl positioned in said cavity, said pawl being formed with an arcuate row of teeth adapted to engage the periphery of said rotatable member, each side of said pawl being adapted to engage a side of said cavity to limit the circumferential movement of said pawl between a first extreme circumferential position to a second extreme circumferential position, a pin, said body having a transversely extending opening spaced from the axis of rotation of said rotatable member and rotatably supporting said pin, said body having a passageway communicating with said cavity, a spring, said pawl being formed with an opening into which one end of said spring projects, said pin being formed with an opening into which the other end of said spring projects, said pin being rotatable between two positions to shift said pawl through said spring between said first and second extreme circumferential positions, whereby in each circumferential position the further circumferential movement of said pawl in one direction is prevented by engagement of the side of said pawl with the side of said cavity while circumferential movement in the opposite direction and radial movement is yieldingly resisted by the action of said spring, and means for locking said pin in one or the other of said positions.

2. The combination set forth in claim 1 wherein said means for locking said pin in each of said positions comprises an annular groove in said pin, said pin being formed with circumferentially spaced spherical detent surfaces in said groove, a ball mounted in said body and contacting said groove, and a spring compressed between said ball and said body and yieldingly urging said ball into engagement with said groove.

3. The combination set forth in claim 2 wherein the axis of said spring forms an angle with the axis of said pin and thereby applies a yielding force tending to oppose movement of said pin outwardly with respect to said body.

4. In a wrench, the combination comprising a body having a head and a handle, a circular member journalled for rotation in said head, said rotatable member having ratchet teeth around the periphery thereof, said body having a cavity therein opening to the periphery of said rotatable member, said cavity having opposite side wall portions diverging in the direction of the periphery of said rotatable member, a pawl within said cavity having along one edge ratchet teeth engageable with the ratchet

teeth on the rotatable member and having a pair of side walls diverging in a direction toward said edge, said pawl being shiftable in said cavity circumferentially of said rotatable member in opposite directions as limited by interengagement of said side walls of the pawl and said side wall portions of the cavity and being shiftable in said cavity in a direction radially of said rotatable member, and means biasing said pawl so that it tends to move in a direction toward said rotatable member.

5. In a wrench, the combination comprising a body having a head and a handle, a circular member journalled in said head and having ratchet teeth on the periphery thereof, said body having a wedge-shaped cavity communicating with the periphery of said circular member, a wedge-shaped pawl positioned in said cavity, said pawl being formed with an arcuate row of teeth adapted to engage the periphery of said circular member, each side of said pawl being adapted to engage a side of said cavity to limit the circumferential movement of said pawl between a first extreme circumferential position to a second extreme circumferential position, and means for yieldingly urging said pawl toward the periphery of said circular member and for selectively shifting said pawl between said first and second extreme circumferential positions, whereby in each circumferential position the further circumferential movement of said pawl in one direction is prevented by engagement of the side of said pawl with the side of said cavity while circumferential movement in the opposite direction and radial movement is yieldingly resisted by said means.

6. The combination set forth in claim 5 wherein said means for yieldingly urging said pawl toward the periphery of said rotatable member comprises an abutment, a coil spring compressed between said pawl and said abutment, said abutment being rotatable from a first position to a second position to shift the axis of the spring and, in turn, the pawl between one side and the other of a line extending between said abutment and the axis of rotation of said rotatable member.

7. The combination set forth in claim 6 wherein said abutment comprises a pin rotatably mounted in said body, said pin having one end extending to the exterior of said body, and a handle on one end of said pin and means for yieldably locking said abutment in each of said first and second positions.

8. In a wrench, the combination comprising a body having a head and a handle, said head being formed with a cylindrical opening, a cylindrical member journalled in said opening, said cylindrical member having an axial projection, the ends of said head being closed except for an opening through which said axial projection extends, said body having a wedge-shaped cavity communicating with the periphery of said cylindrical member, a wedge-shaped pawl positioned in said cavity, said pawl being

formed with an arcuate row of teeth adapted to engage the periphery of said cylindrical member, each side of said pawl being adapted to engage the side of said cavity to limit the circumferential movement of said pawl between a first extreme circumferential position to a second extreme circumferential position, and means for yieldingly urging said pawl selectively toward said first and second extreme circumferential positions, whereby in each circumferential position the further circumferential movement of said pawl in one direction is prevented by engagement of the side of said pawl with the side of said cavity while circumferential movement in the opposite direction and radial movement away from the cylindrical member is yieldingly resisted.

9. The combination set forth in claim 8 including control means for said pawl exteriorly of said body, means providing an oil seal between the projection on the cylindrical member and the opening in said body through which said projection extends, and means providing an oil seal between said control means and the interior of said body.

10. The combination set forth in claim 8 wherein the part of said head opposite the opening through which the axial projection extends has portions thereof overlying the periphery of said cylindrical member which are spaced from said cylindrical member to define a central finger engaging depression.

11. In a wrench, the combination comprising a body having a head and a handle, said head being formed with an opening, a rotatable member journalled in said opening, said rotatable member having an axial projection, the ends of said opening in said head being closed except for an opening through which said axial projection extends, ratchet means in said head adapted to cooperate with the periphery of said rotatable member, control means for selectively positioning said ratchet means for operation with said rotatable member, said control means having a portion thereof projecting to the exterior of said body for manually positioning said ratchet means, means forming an oil seal between said body and said axial projection of said rotatable member, and means forming an oil seal between said body and the portions of said control means which extend to the exterior of said body.

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