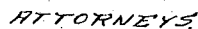


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WEDGE TYPE RATCHET WRENCH

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2 Sheets-Sheet 1



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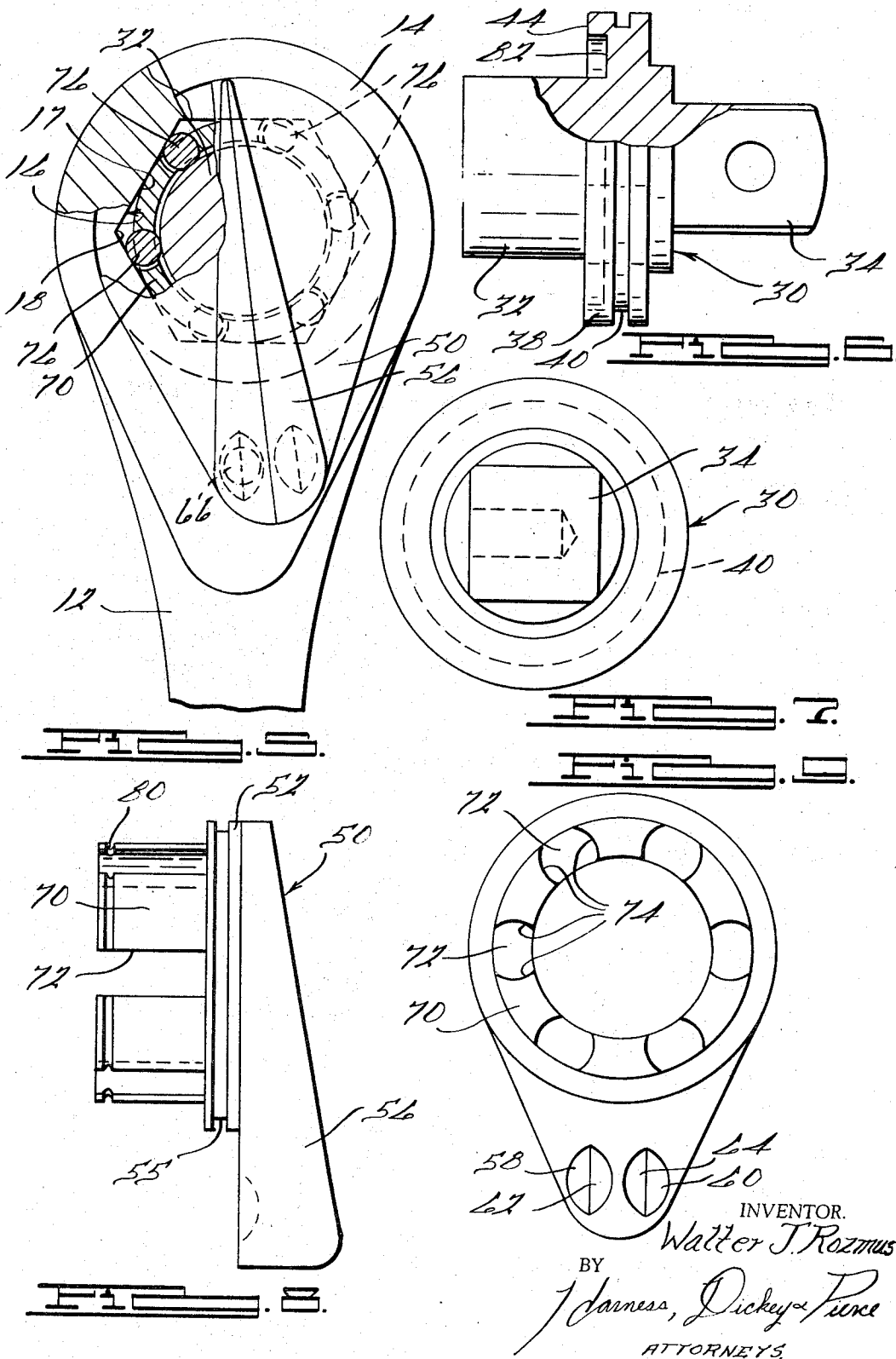
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WEDGE TYPE RATCHET WRENCH

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ABSTRACT OF THE DISCLOSURE

A ratchet wrench of the type in which a selector may be shifted to determine the directions in which the wrench will drive and slip. The wrench is made with an opening therethrough of hexagonal cross section. A socket driver is positioned in this opening with rollers being interposed between the flat walls of the wrench body opening and the driver. The shifting of these rollers will determine the direction in which the wrench will drive. The device is distinguished by the fact that each of the rollers will transmit torque in both directions of rotation and none of the rollers are in an idle position during one direction of rotation.

This invention relates to ratchet wrenches and particularly to a ratchet wrench of the roller-wedge type.

The present invention is characterized by the provision of a wrench body having a handle and a head provided with a cavity of regular polygonal cross-section receiving a cylindrical portion of the drive member. A plurality of rollers are positioned between the cylindrical portion of the drive member and the flat side walls of the head cavity surrounding said cylindrical drive member portion. The direction in which the drive member will be turned when the wrench body is oscillated is controlled by a selector member having a portion or portions controlling the positions of the rollers. When the selector member is shifted each roller is moved from a position in which it engages one cavity wall to a position in which it engages another adjacent cavity wall. For each setting of the selector member the cavity side walls will wedge the rollers against the drive member to frictionally couple or lock the drive member and wrench body together when the wrench body is rotated in a given direction.

One of the main advantages of all roller ratchet wrenches is that the wrench head is capable of coupling itself to the drive member immediately upon forward or "driving" rotation of the wrench body from any angular position. It is not necessary to oscillate the wedge handle through a predetermined arc to pick up a tooth, as is the case in a pawl type wrench. It is, therefore, an object of the present invention to provide a wrench having this desirable characteristic of wedge roller ratchet wrenches.

It is another object of the present invention to provide a wedge roller ratchet wrench in which the rollers are positively biased against the walls of the wrench head and drive member to prevent possible slippage of the wrench handle with respect to the drive member during initial rotation of the wrench handle.

It is another object of the present invention to provide a wedge roller ratchet wrench which has a minimum number of parts and is of structurally simple design, which may be manufactured at a relatively reasonable cost, which is easy to assemble and disassemble, which is strong, durable and reliable in use, and which is protected against the entry of dirt and other contaminating matter to its working parts.

It is still another object of the present invention to provide a wrench of the above character in which the selector member for changing the driving direction is easily shifted between its two positions.

These and other objects of the present invention will

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become apparent from the following detailed description taken in conjunction with the accompanying drawings wherein:

FIGURE 1 is a plan view of a wrench embodying the principles of the present invention;

FIG. 2 is an enlarged view partly in section of a portion of the structure illustrated in FIG. 1;

FIGS. 3 and 4 are sectional views of the structure illustrated in FIG. 2 taken along the lines 3—3 and 4—4 thereof, respectively;

FIG. 5 is a view of the structure illustrated in FIG. 4, but showing the parts in another position;

FIGS. 6 and 7 are side elevational and end elevational views, respectively, of one of the parts of the structure illustrated in FIGS. 1—5; and

FIGS. 8 and 9 are side elevational and plan views of another of the parts of the structure illustrated in the construction shown in FIGS. 1—5.

Referring now to FIGS. 1, 2 and 3, a ratchet wrench 20 is illustrated which includes a wrench body 10 composed of an integrally formed handle 12 and hollow head 14. The head 14 has a central open ended cavity 16 of hexagonal cross-section and defined by a plurality of flat side walls 17 merging at edges 18 disposed parallel to the central axis of the cavity 16. Formed in the head 14 at one end of the cavity 16 is a bore 19 extending inwardly toward the cavity 16 from an end face 20 of the wrench head 14. A bore 22, coaxial with the bore 19, extends inwardly from an opposite end face 24 of the head 14 and communicates with the cavity 16 at the opposite end thereof from the bore 19. The opening defined by the bores 19 and 22 and the cavity 16 extends completely through the head from the opposite end faces 20 and 24 thereof. As may be seen in FIG. 3, the bores 19 and 22 are both larger than the maximum diameter of the cavity 16, which leaves annular radially-extending shoulders 26 and 28 between the cavity 16 and the bores 19 and 22, respectively.

A drive member 30 is carried by the head 14 with a circular cylindrical portion 32 thereof disposed within the cavity 16 in radially inwardly spaced relationship to the walls 17. A driving lug 34, forming a portion of the drive member 30, projects from the head 14 and carries a ball detent 36 for engagement with a conventional wrench socket (not shown). Disposed between the lug 34 and the cylindrical portion 32, is an enlarged cylindrical portion 38 which is closely fitted within the bore 22 and is supported by the bore 22 for rotation about the axis thereof. The drive member portion 38 has a groove 40 formed in the outer periphery thereof which carries an O-ring 42 engageable with the cylindrical wall of the bore 22 to prevent the entrance of dirt and other contaminating matter to the interior of the wrench through the bore 22. A shoulder 44 on the inner end of the enlarged cylindrical portion 38 of the drive member 30 is engageable with the shoulder 28 to limit axial movement of the drive member in one direction. Opposite axial movement of the drive member 30 is arrested by a retaining ring 46 positioned in a groove 48 formed in the wall of the bore 22.

A selector member 50 has a cylindrical portion 52 closely fitted in the bore 19 for angular movement about the axis thereof. The selector portion 52 carries an O-ring 54 in a groove 55 formed in its outer periphery. The O-ring 54 is engageable with the wall of the bore 19 to prevent the entrance of dirt and other contaminating matter into the cavity 16 through the bore 19. The selector member 50 has an integral handle portion 56 which projects laterally out of alignment with the bore 19 toward the wrench body handle 12. The handle portion 56 is provided on its underside with a pair of laterally

spaced recesses 58 and 60. The recesses 58 and 60 define a pair of inclined cam surfaces 62 and 64, respectively, which converge downwardly toward one another and are engageable with a ball detent 66 carried by the head 14 of the wrench body 10. The ball detent 66 is biased toward the handle portion 56 by a spring 68 to apply an angular force to the selector member 50 about the axis of the bore 19. When an opposing angular force is manually applied to the handle 56, the inclined surface 62 or 64 which is engaging the ball 66 will force the ball detent 66 downwardly against the spring 68 to permit the selector member 50 to be shifted to its other position in which the ball detent 66 will lie in the other one of the recesses 58 or 60.

The selector member 50 has an inwardly projecting segmented sleeve portion 70 having six axially extending openings 72 which are defined by a pair of segmentally cylindrical walls 74 of the sleeve portion 70 lying on opposite sides of each opening 72. The sleeve portion 70 extends between the cylindrical portion 32 of the drive member 30 and the flat walls 17 of the cavity 16 and functions to position six circular cylindrical rollers 76. One roller 76 is disposed within each one of the openings 72. The rollers 76 are of a slightly lesser diameter than the spacing between the opposite walls 74 confining them and are able to rotate freely in place. Each roller 76 is engageable with the cylindrical portion 32 of the selector member 50 at one end thereof and with a retaining ring 78 at its opposite end. The retaining ring 78 is fitted in a groove 80 formed in the outer periphery of the sleeve portion 70. The drive member 30 is cut away as indicated at 82 in FIG. 6 to accommodate the inner end of the sleeve portion 70 and the retaining ring 78.

As will be apparent from an examination of FIG. 4, the ball detent 66 applies a positive angular force to the selector member 50 by its engagement with the surfaces 62 or 64. This angular force causes one of the two walls 74 of each opening 72 to engage its adjacent roller 76 and positively bias said roller against one of the walls 17 and the outer peripheral surface of the cylindrical portion 32 of the drive member 30. By this means, positive driving contact of the rollers 76 with the drive member 30 and the wrench body 10 is assured. By way of example, FIG. 2 shows the ball detent 66 disposed in the recess 60 where it engages the surface 64 thereof, each roller 76 is biased into engagement with the drive member cylindrical portion 32 and a wall 17 just to the clockwise side of a radius extending from the center of the cavity 16 through each edge 18. FIG. 5 shows the position of the parts with the selector member 50 shifted to its other position. In such other position the ball detent 66 rests in the recess 58 so as to engage the surface 62 thereof. In this position each of the rollers 76 engages the drive member cylindrical portion 32 and the walls 17 just to the counterclockwise side of a radius passing through an edge 18. It will thus be apparent that upon the shifting of the selector member 50 each roller 76 is moved across a radius passing through each juncture between the flat walls 17. Each of the six rollers 76 performs a driving function irrespective of the rotational direction selected by shifting the selector member 50. It will also be apparent that the distance which the selector member 50 must be indexed is not great.

With the parts in the position illustrated in FIG. 2, the wrench body 10 will serve to transmit torque to the drive member 30 when turned in a counterclockwise direction. By such movement the rollers 76 will be wedged between the walls 17 and the cylindrical portion 32 of the drive member 30, and thereby lock the wrench body 10 and drive member 30 together for corotational movement. When the wrench handle 12 is rotated in a clockwise direction with the parts in the position shown in FIG. 2, flat walls 17 in the areas of the rollers 76 will be in the spacing between the cylindrical portion 32 and the

larged, permitting the rollers 76 to rotate within their openings 72 as they move around the periphery of the cylindrical portion 32. Similarly, with the parts in the positions illustrated in FIG. 5, rotation of the wrench handle 12 in a clockwise direction will serve to wedge each of the rollers 76 between the walls 17 and cylindrical drive member portion 32 to transmit driving torque from the wrench body 10 to the drive member 30. Of course, counterclockwise rotation of the wrench handle 12 with the parts in the position shown in FIG. 5 will permit the wrench body 10 to slip with respect to the drive member and the drive member 30 will not be turned.

The ratchet wrench illustrated herein is designed to have its parts made by convenient low cost manufacturing methods. For example, the cavity 16 may be machined by a simple broaching operation and the bores 19 and 22 formed by other inexpensive machining methods. Similarly, the drive member 30 may be formed largely by a turning operation and at a very reasonable cost. It is significant to note that the location of the ball detent 66 renders the machining of the opening for receiving the ball detent 66 very convenient, and the formation of the recesses 58 and 60 are also facilitated by their location on the selector member handle portion 56.

The assembly and disassembly of the ratchet wrench should be readily apparent from the foregoing description. The wrench is disassembled by the simple removal of the retaining ring 46 from its groove 48. It is then possible to remove the drive member 30 in an axial direction out through the bore 22. Finally, the retaining ring 78 is removed to permit the removal of the selector member 50 out through the bore 19. The parts are assembled by the reverse of the foregoing procedure.

While one preferred form of the invention has been illustrated herein, it will be apparent that the invention is susceptible of modification, variation and change without departing from the fair meaning or scope of the following claims. For example, it will be obvious that the cavity 16 may be of any suitable regular polygonal cross-section and need not necessarily be of hexagonal cross-section. If the number of side walls 17 is increased or decreased the number of rollers 76 would be increased or decreased accordingly.

What is claimed is:

1. A ratchet wrench including a body having a cavity of regular polygonal cross-section provided with a plurality of contiguous flat side walls, a drive member having a cylindrical portion enclosed by said side walls, a plurality of rollers disposed between said cylindrical portion and separate ones of said side walls, a selector member having circumferentially spaced portions confining said rollers in locations spaced equally about a given circular cylinder and operable to locate said rollers in selected angular positions, said selector member being angularly movable between two different positions to shift the axes of said rollers across radii extending from the center of said cavity through the edges between said side walls and to move each of said rollers from contact with one of said side walls to contact with another adjacent one of said side walls whereby each of said rollers is operable to transmit torque from said body member to said drive member upon angular movement of said wrench in one direction of rotation for each position of said selector member.

2. The structure set forth in claim 1 including detent means operable to hold said selector member in each of said positions and to apply an angular force to said selector member which positively biases said rollers against said side walls and said cylindrical portions in each of said positions.

3. The structure set forth in claim 1 including a handle on said selector member extending to a position out of axial alignment with said cavity, a pair of recesses disposed on the side of said handle adjacent said wrench body, a detent carried by said wrench body engageable

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in said recesses for selectively retaining said selector member in either of its said positions.

4. The structure set forth in claim 1, including a pair of bores formed in said wrench body on opposite sides of said cavity, one of said bores being operable to support said drive member for rotation about a fixed axis and the other of said bores being operable to support said selector member for angular movement about said axis.

5. The structure set forth in claim 4, including an outer cylindrical surface on said drive member in closely spaced confronting relation to the bore in which said drive member is supported, an annular seal carried by said drive member at its said cylindrical surface engageable with the wall of its said bore, and an outer cylindrical surface on said selector member in closely spaced relation to the bore in which it is supported, and a seal carried by said drive member cylindrical surface engageable with the wall of its said bore.

6. The structure set forth in claim 4 including a shoulder formed on said wrench body between one of said bores and said cavity, and a shoulder formed on said drive member engageable with said body shoulder, and

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a retaining ring carried by said body operable to confine said drive member shoulder substantially adjacent said body shoulder.

7. The structure set forth in claim 1 in which said rollers are of an identical number to the flat side walls of said cavity.

8. The structure set forth in claim 1 in which said cavity is of hexagonal cross-section and in which there are exactly six rollers.

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