Feb. 6, 1962 T. G. HARE 3,019,682

REVERSIBLE RATCHET TYPE WRENCH

Filed April 8, 1960 2 Sheets-Sheet 1

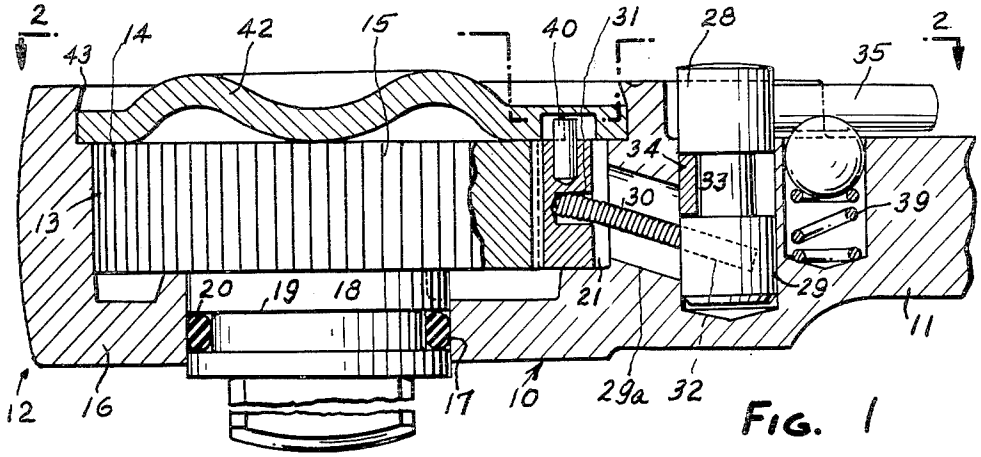

FIG. 1

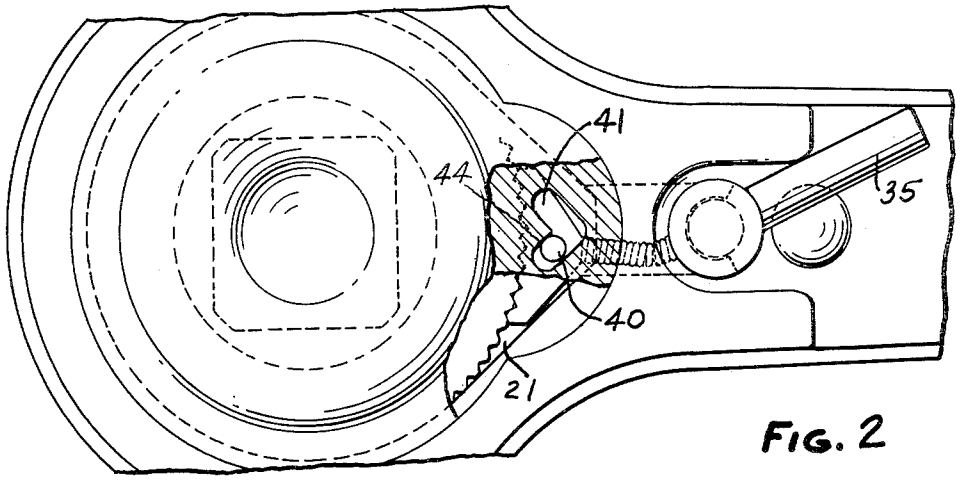

FIG. 2

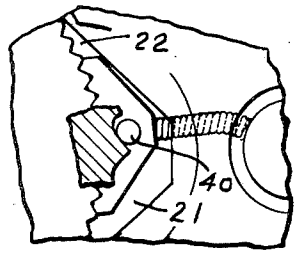

FIG. 4

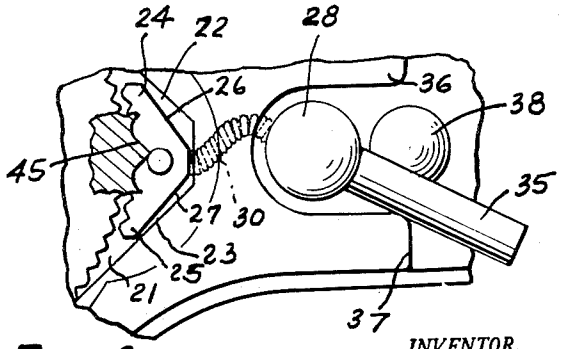

FIG. 3

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Filed April 8, 1960 2 Sheets-Sheet 2

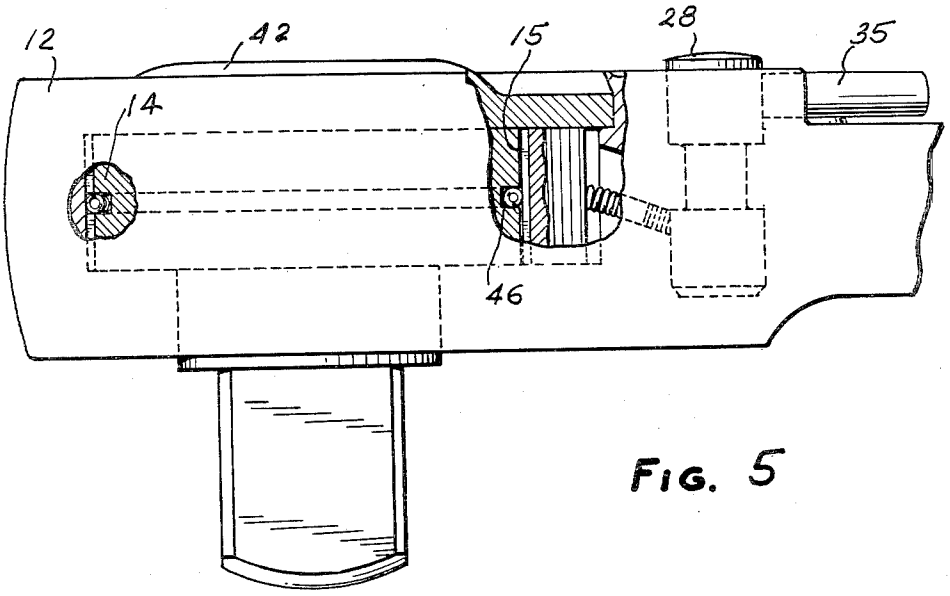

FIG. 5

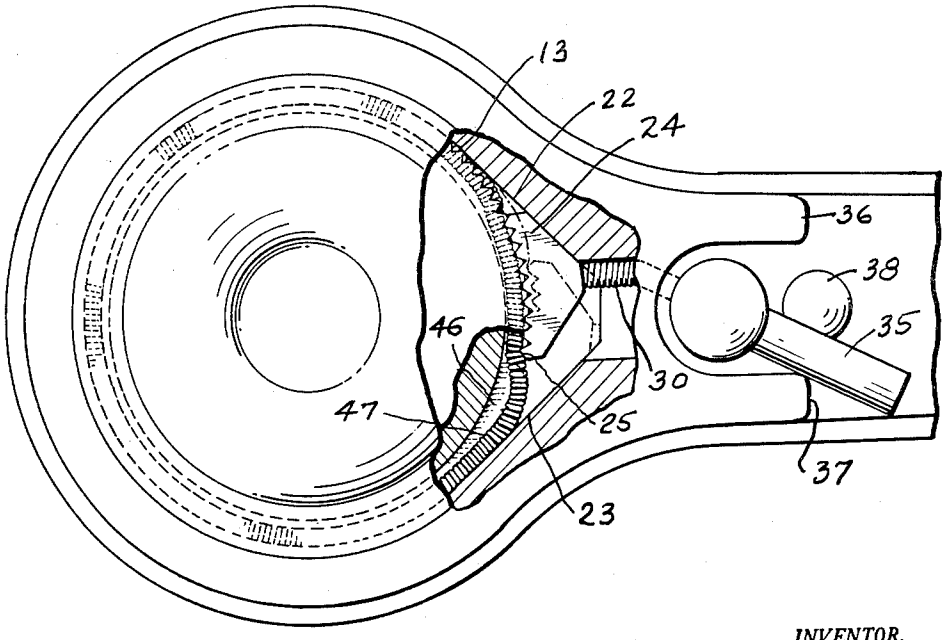

FIG. 6

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3,019,682
REVERSIBLE RATCHET TYPE WRENCH

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8 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.

In my copending application Serial No. 683,772, filed September 13, 1957, titled Reversible Ratchet Type Wrench, now Patent No. 2,957,377, issued October 25, 1960, of which this application is a continuation-in-part, there is disclosed and claimed a reversible ratchet wrench which comprises a body having a head and a handle. A circular member having ratchet teeth on the periphery thereof is journalled for rotation in the head. A pawl with ratchet teeth along one edge is positioned in a cavity in the head which opens to the periphery of the rotatable member. The pawl has a pair of side walls which engage the side walls of the cavity to limit the movement of the pawl in one direction or the other. Spring means are provided which bias the pawl so that it tends to move in a direction toward the rotatable member. The pawl is shiftable in the cavity circumferentially of the rotatable member in opposite directions as limited by interengagement by the side walls of the pawl and the side walls of the cavity. In addition, the pawl is shiftable in the cavity in a direction radially of the rotatable member to permit a ratcheting action.

It is an object of this invention to provide an improved reversible ratchet wrench of the type shown in the aforesaid application Serial No. 683,772.

It is a further object of this invention to provide such a wrench which includes a novel mechanism for reversing the operation thereof.

In the drawings:

FIG. 1 is a sectional view on an enlarged scale of a portion of a wrench embodying the invention.

FIG. 2 is a fragmentary part-sectional plan view taken along the line 2—2 in FIG. 1.

FIG. 3 is a fragmentary part-sectional plan view similar to FIG. 2 showing the parts in a different position.

FIG. 4 is a view similar to FIG. 3 showing the parts in a still different position.

FIG. 5 is a part sectional fragmentary elevation of a further modified form of wrench.

FIG. 6 is a part sectional plan view of the wrench shown in FIG. 5.

A form of wrench embodying the invention is shown in FIGS. 1–4 and comprises a body 10 having a handle 11 and a head 12. Head 12 is formed with a cylindrical opening 13 in which a cylindrical rotatable member 14 is journalled. Cylindrical member 14 is formed with a plurality of ratchet teeth 15 along the periphery thereof. The engagement of the teeth 15 with the sides of the opening 13 journals the cylindrical member 14 in the opening 13. Head 12 includes a bottom wall 16 which has an opening 17 through which a cylindrical projection 18 which is integral with member 14 extends. The periphery of projection 18 is formed with a groove 19 in which an O-ring 20 is seated for engagement with the walls of the opening 17 to provide a dirt and oil seal. The lower end

of the projection 18 is formed with a well-known type of disconnectable connection with various work-engaging members such as socket wrenches and the like.

Referring to FIGS. 1 and 2, body 12 is provided with a wedge-shaped cavity 21 which communicates with the periphery of the cylindrical member 14. Cavity 21 has converging straight sides 22, 23 which diverge in the direction of the periphery of the cylindrical member 14. A wedge-shaped pawl 24 is positioned in cavity 21 for limited floating movement as presently described. Pawl 24 includes an arcuate row of teeth 25 adjacent teeth 15 of cylindrical member 14 adapted to interengage said teeth 15. Pawl 24 also includes converging sides 26, 27 which are adapted to contact the sides 22, 23 of cavity 21 and thereby limit the circumferential movement of pawl 24. The sides 26, 27 of the pawl diverge in a direction toward the teeth 25 of the pawl.

A pin 28 is rotatably mounted in an opening 29 in the body 10 which opening has its axis parallel to the axis of rotation of the cylindrical member 14. A passageway 29*a* provides communication between cavity 21 and opening 29. A tightly wound helical coil spring 30 is positioned between pawl 24 and pin 28. The ends of the spring extend into openings 31, 32 in the pawl 24 and pin 28, respectively.

Pin 28 is provided with a reduced portion 33 intermediate its ends and is held in position in opening 29 by a C-shaped collar 34 which has a greater diameter than the diameter of the opening 29 and is compressed or sprung inwardly around the reduced portion 33 to frictionally hold the pin 28 in the opening 29. Pin 28 is adapted to be shifted or rotated between two positions for shifting the pawl as presently described. In order to facilitate the rotation of the pin, a shifting lever 35 is provided on the upper end of pin 28 externally of the body 10. The lever 35 and, in turn, the pin 28 are held in their adjusted position by engagement with bosses 36, 37 and by a spring loaded ball 38 that is yieldingly urged upwardly by a spring 39 to hold the shifting lever 35 against either the boss 36 or boss 37.

The relationship of the angles of the teeth 15, 25 is substantially the same as described in the aforementioned application Serial No. 683,772 so that with the lever 35 in one position pawl 24 is positioned in cavity 21 with one of its surfaces in parallelism and contact with an adjacent surface of the cavity 21. As the handle 11 of the wrench is rotated, the pawl is wedged by the action of the teeth and by contact with the adjacent surfaces of the pawl and cavity to prevent movement of the pawl and thereby cause the rotatable member 14 to rotate. A reverse rotation of the handle 11 of the wrench provides a ready ratcheting of the pawl over the teeth of the rotatable member 14. As shown in FIG. 2, the spring 30 is bent out of its normal straight condition and thus tends to urge the pawl toward surface 23 and in turn in wedging relation.

When the shifting lever 35 is shifted, the direction of the axis of the opening 32 in the pin 38 is rotated thereby tending to shift the axis of the spring 30. As shown in FIGS. 1 and 2, an upwardly extending pin 40 is provided on the pawl 24 and extends upwardly into a V-shaped slot 41 in the top wall 42 of the wrench. The top wall 42 comprises a separate member that is held in position to cover the opening 13 and cavity 21 as by staking as shown at 43.

The relationship of the pin 40 to the slot 41 is such that during the normal ratcheting action of the pawl the pin 40 and slot 41 do not affect the action of the pawl but during the shifting of the pawl in order to reverse the rotation of the wrench, the pin engages the sides of the slot to positively insure the shifting of the pawl.

Specifically, when the shifting lever 35 is moved from the position shown in FIG. 2 to the position shown in FIG. 3, the spring is distorted forcing the pin 40 to engage the side wall 44 of the slot 41. Since the spring 30 tends to straighten out, the spring causes the pawl to ride up the wall 44 and radially outwardly away from the cylindrical member 14 onto the other side wall 45 of the slot. As shown in FIG. 4, the pawl is then free to move into wedging relationship with the surface 22 of the cavity 21 or to ratchet out of engagement in the normal fashion of operation of the wrench.

When the shift lever 35 is returned to the position shown in FIG. 2, the pin 40 is caused by the bending or distortion of the spring 30 to engage the side wall 45 of the slot 41 and ride up the side wall 45 thereby moving the pawl radially away from the rotatable member 14 and disengaging the teeth of the pawl from the teeth of the rotatable member and thereafter down the side wall 44.

The length of the legs of slot 41 is such that the pin 40 does not contact the ends of the slot at any time.

It can thus be seen that the pin 40 and slot 41 operate only during the shifting of the pawl to insure the disengagement of the teeth of the pawl from the teeth of the rotatable member. Such action is preferred in instances where dirt, grime and the like may have entered the interior of the wrench and might tend to interfere with the shifting of the pawl but not necessarily with the racheting action of the pawl.

A modified form of wrench embodying the invention is shown in FIGS. 5 and 6 wherein the pin 40 and slot 41, which operate during the shifting of the pawl, are replaced by a different structure. In all other respects, the wrench shown in FIGS. 5 and 6 is identical to the wrench shown in FIGS. 1–4 and for purposes of clarity identical reference numerals have been used to describe the wrench. As shown in FIGS. 5 and 6, the rotatable member 14 is provided with a peripheral groove 46 intermediate the upper and lower ends thereof. A tightly wound endless spring 47 is positioned in the peripheral groove 46. The outer diameter of the spring 47 in the untensioned state is greater than the outer diameter of the circle formed by the apexes of the teeth 15 on the rotatable member 14 so that when the spring 47 is in position in groove 46 and the rotatable member 14 is within the head 12 a portion of the spring 47 is always pushed or bulged outwardly in the space between the pawl 24 and the sides 22, 23, as the case may be. When the shifting lever 35 is shifted, tending to shift the axis of the spring 30, a force is placed on the pawl 24 tending to eliminate the bulge in the spring 47. This forces the pawl 24 away from the teeth 15 on a rotatable member 14 so that the bulge between the pawl 24 and one side of the cavity 21 is eliminated and a bulge in the spring is provided between the pawl 24 and the other side of the cavity 21. In this manner, a positive movement of the pawl away from the rotatable member is insured during the shifting. In normal operation of the pawl, the spring 47 does not affect the ratcheting of the pawl.

In both forms of the invention, a ready ratcheting action is provided. The reversing mechanism can be actuated when the wrench is under torque without damaging the wrench. If the reversing action is actuated when the wrench is under torque the pawl will shift when the torque is relieved. In both forms of the invention, the torque is transmitted through the rotatable member to the head of the wrench by contact of the teeth on the rotatable member with the inner surface of the opening in the head in which the rotatable member is positioned.

The torque is not only transmitted through the pawl in each of the forms of the invention but, in addition, from the head to the rotatable member because of the bearing action of the head on the teeth of the rotatable member and the opening in the head through which the to facilitate this action, the apexes of the teeth on the

periphery of the rotatable member are flattened as shown in FIGS. 1–6.

In order to further facilitate the bearing action between the head and the rotatable member, the tolerance between the periphery of the head, that is, the apexes of the teeth, and the interior opening in the head is less than the tolerance between the projection on the rotatable member and the opening in the head through which the projection extends. In this manner, the O-ring permits a slight lateral movement of the rotatable member as may be needed to provide the bearing action without binding of the projection in the opening. For example, in the form of the invention shown in FIG. 1, the tolerance between the periphery of the rotatable member 14 and the cylindrical opening 13 is less than the tolerance between the cylindrical projection 18 and the opening 17, the O-ring 20 taking up the difference in tolerance so that an effective bearing action will occur between the teeth 15 and the surface of the opening 13.

I claim:

1. In a wrench comprising a body having a head and a handle, a rotatable 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, the improvement including means interengaging between said pawl and said body during the shifting movement of said pawl circumferentially to reverse the operation of said wrench, said means being operable during said shifting to move said pawl radially outwardly away from said rotatable member, thereby insuring the disengagement of the teeth on said pawl from the teeth on said rotatable member.

2. In a wrench comprising a body having a head and a handle, a rotatable 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 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, and means for yieldingly urging said pawl toward the periphery of said rotatable 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 latter means, the improvement including means interengaging between said pawl and said body during the shifting movement of said pawl circumferentially to reverse the operation of said wrench, said means being operable during said shifting to move said pawl radially outwardly away from said rotatable member, thereby insuring the disengagement of the teeth on said pawl from the teeth on said rotatable member.

3. In a wrench comprising a body having a head and a handle, a rotatable 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 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, and means for yieldingly urging said pawl toward the periphery of said rotatable member and shifting said pawl between said first and second extreme circumferential positions comprising 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 the line extending between said abutment and the axis of rotation of said rotatable member, the improvement which comprises interengaging means between said pawl and said body adapted to positively guide the movement of said pawl radially outwardly away from said rotatable member during the shifting of the axis of the spring from one side to the other of a line extending between the abutment and the axis of rotation of the rotatable member.

4. The combination set forth in claim 3 wherein said interengaging means comprises a pin on said pawl, said body having a V-shaped slot the sides of which diverge toward the periphery of said rotatable member, said pin being adapted to engage the sides of said slot to guide the movement of the pawl.

5. The combination set forth in claim 3 wherein said interengaging means comprises a pair of intersecting surfaces in said body diverging toward the periphery of said rotatable member and the pawl being adapted to engage said surfaces during the shifting of said pawl from one circumferential position to the other.

6. In a wrench comprising a body having a head and a handle, a rotatable member journalled in an opening in said head and having ratchet teeth on the periphery thereof, a cover fixed on said body and closing the opening in said head, 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, and means for yieldingly urging said pawl toward the periphery of said rotatable member and shifting said pawl between said first and second extreme circumferential positions comprising 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 the line extending between said abutment and the axis of rotation of said rotatable member, the improvement which comprises interengaging means between said pawl and said cover adapted to positively guide the movement of said pawl radially outwardly away from said rotatable member during the shifting of the axis of the spring from one side to the other of a line extending between the abutment and the axis of rotation of the rotatable member.

7. The combination set forth in claim 6 wherein said interengaging means comprises a pin on said pawl, a V-shaped slot in the underside of said cover, the sides of said slot diverging toward the periphery of said rotatable member, said pin being adapted to engage the sides of said slot to guide the movement of the pawl.

8. In a wrench comprising a body having a head and a handle, a rotatable 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 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, and means for yieldingly urging said pawl toward the periphery of said rotatable member and shifting said pawl between said first and second extreme circumferential positions comprising an abutment, a coil spring positioned 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 the line extending between said abutment and the axis of rotation of said rotatable member, the improvement which comprises a circumferential groove in the periphery of said circular member, and an endless coil spring positioned in said groove, the outer diameter of said latter spring being greater than the diameter of said rotatable member whereby a portion of said spring extends outwardly between the pawl and the wedge-shaped cavity in any adjusted position of said pawl, said latter portion acting to move said pawl radially outwardly away from said rotatable member during the shifting of the axis of the spring from one side to the other of a line extending between the abutment and the axis of rotation of the rotatable member.

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