Sept. 16, 1969 H. J. HAZNAR 3,467,231

PAWL REVERSING MECHANISM FOR RATCHET WRENCHES

Filed Feb. 12, 1968 2 Sheets-Sheet 1

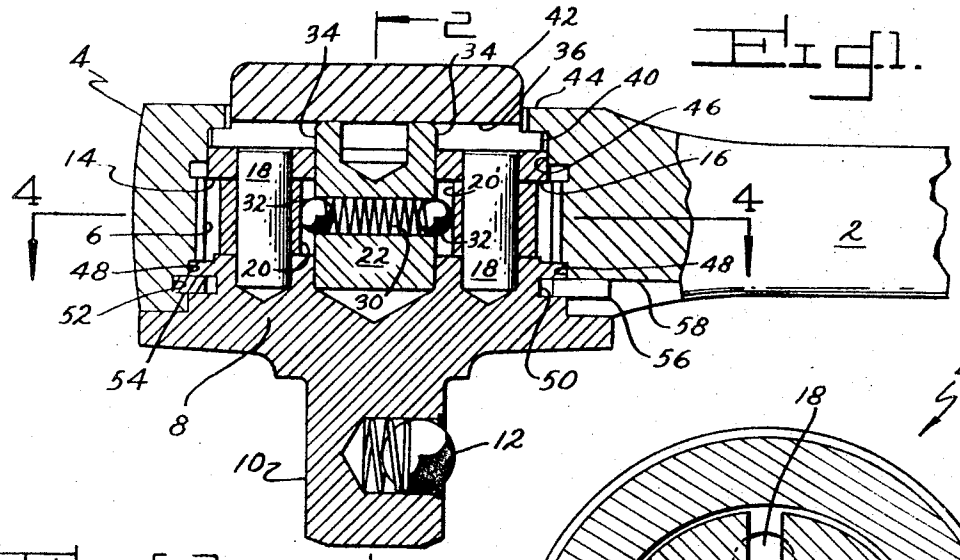

Fig. 1.

Fig. 2.

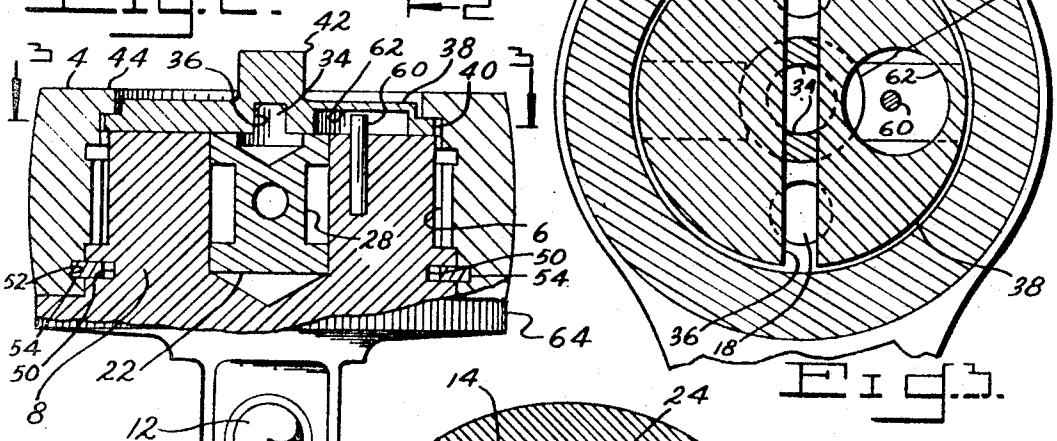

Fig. 3.

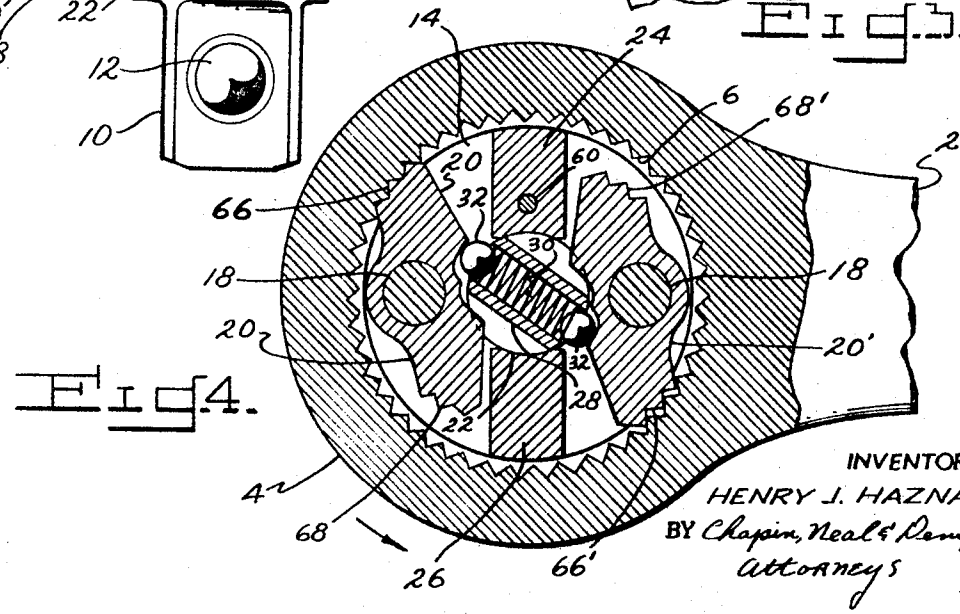

Fig. 4.

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Sept. 16, 1969 H. J. HAZNAR 3,467,231

PAWL REVERSING MECHANISM FOR RATCHET WRENCHES

Filed Feb. 12, 1968 2 Sheets-Sheet 2

Fig. 5.

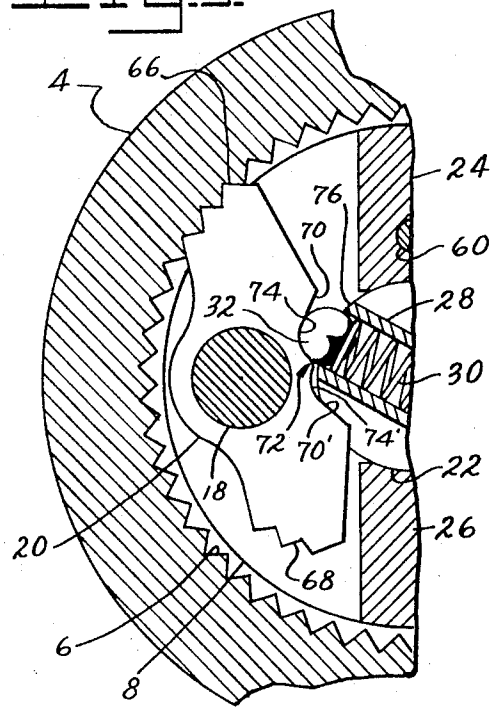


Fig. 6.

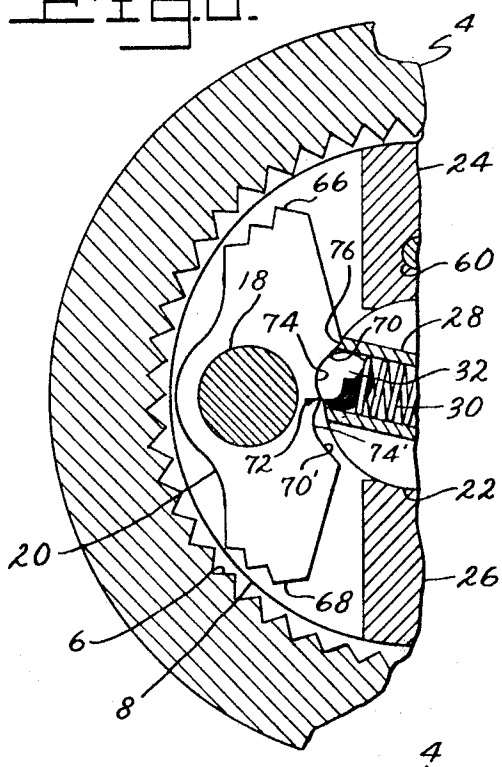


Fig. 7.

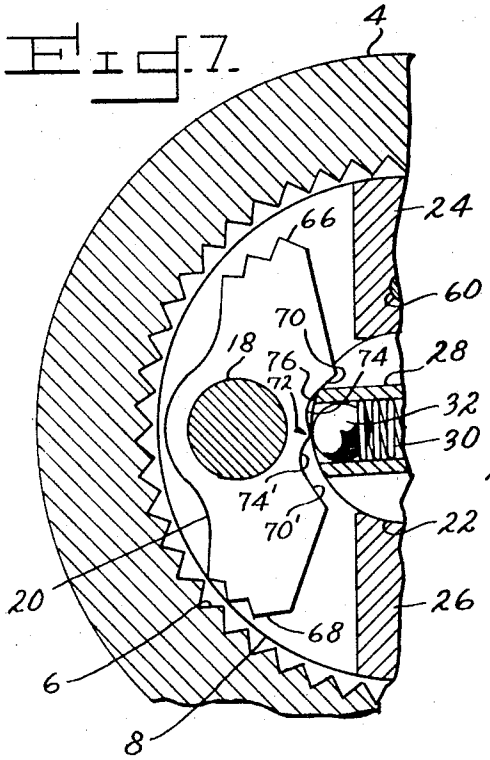
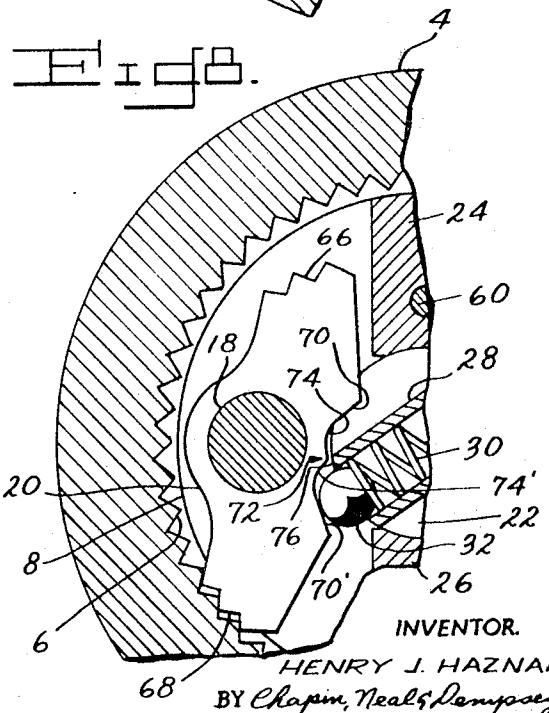


Fig. 8.



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United States Patent Office 3,467,231
Patented Sept. 16, 1969

3,467,231

PAWL REVERSING MECHANISM FOR RATCHET WRENCHES

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Filed Feb. 12, 1968, Ser. No. 704,688
Int. Cl. F16d 11/06, 13/04; B25b 13/46
U.S. Cl. 192—43.1 3 Claims

ABSTRACT OF THE DISCLOSURE

In a ratchet wrench of the type having diametrically opposed double ended toothed pawls for fine-tooth ratchet action, a rotatable bolt having yieldable pawl engaging members at each end and movable to reverse wrench operation, and pawls having centrally projecting lobes and recessed faces at each side thereof engaged by said yieldable members when the bolt is turned, the arcuate movement of said members in contacting and passing over said lobes causing reversal of pawl position.

Background

This invention relates to ratchet mechanisms for wrench driving tools and the like and in particular to a known type of ratchet wrench in which a driving member or head is integrally formed or otherwise connected to a conventional handle for manual operation, and, in which the driven member, provided with a socket engaging shank or other work engaging tool connection, is rotatably mounted in the head with a pair of double-ended toothed pawls cooperating with the internal ratchet teeth of the head for a so-called fine-tooth ratchet action.

In this type of wrench the fine-tooth ratchet action is obtained without increasing the number of internal teeth in the head and weakening the same by forming teeth of small pitch.

Such fine-tooth action is obtained by providing diametrically opposed pawls having teeth at each end thereof and correlating movement of the pawls for the teeth at an end of the pawls and the teeth at the diametrically opposed end of the other pawl to be placed in operative relationship with the internal teeth of the driving head. The teeth on the pawls and the teeth on the driving head are so formed and related that in either of the driving positions the teeth of one pawl are fully engaged with the teeth of the driving head while the teeth at the corresponding (i.e. diametrically opposed) end of the other pawl are offset approximately one-half pitch relative to the teeth of the driving head. Thus, in using the wrench when the handle is drawn back for reengaging the teeth to again drive a workpiece, the teeth on either of the operatively positioned ends of the pawls may become fully engaged and the teeth on the other end are offset, all depending on the degree to which the handle is angularly rotated before a succeeding driving stroke is started. Thus the fine ratchet action is obtained by full tooth engagement of either one of the toothed pawl ends.

This type of construction in ratchet wrenches is known in the art and for a fuller and more complete explanation thereof reference is hereby made to prior Patents Nos. 2,395,681 (1946) and 2,772,763 (1956). The present invention is particularly directed to an improved combination of the means for reversing the position of a pair of opposed pivotally supported double-ended pawls as shown in the latter Patent No. 2,772,763, which discloses a driven member incorporating pivotal pawl elements. In the prior structure a pawl shifting bolt is recessed on the axis of the driven member which is rotatably mounted in the head. The bolt carries means for resiliently urging

the toothed pawl ends into engagement with the internal teeth of the head for the ratcheting action. Integral abutments on the bolt are utilized for mechanically engaging the pawl to turn the same and effect a reversal of the wrench drive.

By the specific pawl face construction and relationship thereto of the reversing bolt of the present invention a reversal of the pawls is accomplished by the rotative movement of the resiliently urged pawl engaging member alone. The pawl engaging member projects outwardly of the bolt as in the referenced patent structure and by reason of a projecting central lobe formed on the pawl the pivoting action is more readily accomplished in use. Furthermore, the pawl surfaces are formed for contact by the yieldably urged means to permit an oscillating ratchet action of the pawl with a minimum of "chattering" effect on the reversing bolt and external actuating lever which operates the same.

The particular construction and specific advantages of the present invention will be described in connection with the following disclosure of an embodiment thereof as shown by the accompanying drawings in which:

FIG. 1 is a vertical sectional view through the head of a ratchet wrench embodying the invention, the pawls and reversing bolt being shown symmetrically arranged;

FIG. 2 is a vertical sectional view on line 2—2 of FIG. 1;

FIG. 3 is a horizontal sectional view on line 3—3 of FIG. 2;

FIG. 4 is a horizontal sectional view on line 4—4 of FIG. 1, the pawls and reversing bolt being positioned in an operative relationship for driving action; and

FIGS. 5, 6, 7 and 8 are partial sectional views showing on an enlarged scale various positional relationships of the reversing bolt and pawl during the reversal thereof to a position opposite that shown by FIG. 4.

In FIG. 1 is shown a conventional handle portion at **2** for manually turning the cylindrical or round head **4** of a wrench. Head **4** has a through bore of various diameters and is formed with a central wall provided with teeth as at **6** extending parallel to the axis of the bore (see also FIG. 4).

Head **4** constitutes the driver of the wrench. In the bore of head **4** is rotatably mounted the driven member of the wrench, formed as a body portion **8** having various diameters to fit in suitable rotatable relationship in the bore and a standard type of socket engaging shank **10** of polygonal shape depending therefrom, a conventional spring pressed ball detent at **12** being recessed in the fact of the shank.

In the body **8** are opposed segmental slots as at **14** and **16**. Mounted in the slots at diametrically opposite positions are pivot pins **18** on which are carried double ended pawls **20** (FIG. 4) for selectively engaging teeth **6** of the bore as will be later described. Pins **18** are seated in recesses in the lower walls of the slots (FIG. 1) and are set in position by insertion in through openings of the upper slot walls, the upper ends of the pins being held in these openings.

In a central recess on the axis of the body **8** a cylindrically formed reversing bolt **22** is also inserted. The bolt is positioned between and separates the diametrically extending portions, as at **24** and **26** (FIG. 4), of the body formed by the parallel inner chordal walls of slots **14** and **16**. The cylindrical lower end of bolt **22** is seated in a recess set below the segmental slots, being inserted into position through an opening at the top of the body **8**. The upper part of bolt **22** in the top opening is cylindrical. Between the upper and lower cylindrical bearing portions segmental slots are formed and provide a diametrically disposed web **28** (FIGS. 2 and 4). The ends of the web extend outwardly of the chordal inside walls

of slots **14** and **16**. Web **28** has a central diametrically extending through bore carrying resilient pawl engaging means here shown as a spring **30** pressing a ball **32** outwardly at each end. The reversing bolt is mounted for limited rotation on the axis of the driven member as will be later described.

At the upper end of bolt **22** are a pair of diametrically opposed prongs or horns **34** extending therefrom beyond the top wall of the body. As shown by FIGS. 1 and 2 the prongs are received in a diametrically extending slot **36** cut in the underside of a manually actuated reversing lever **38** mounted in the upper end of the bore of head **4**. The lever **38** is formed as a circular disk covering the upper end of the bore and has an annular retaining flange **40**. It is provided on its upper surface with a diametrically disposed upraised handle **42** for finger manipulation of the lever.

The bore of the head **4** is formed with various diameters and provides shouldered portions for the suitable mounting of the body **8** and actuating lever in the assembly. The reversing lever is retained for rotation by flange **40** disposed at the underside of the annular upper flange at **44** of the bore. The cylindrical upper portion of the body **8** which includes the upper walls of the segmental slots **14** and **16** is received by the wall portion of the bore of the head as at **46**. This latter bore portion is of a lesser diameter than that of the toothed portion below it. And below the toothed portion is a shouldered bearing portion at **48** of an increased bore diameter. Body **8** below the segmental slots **14** and **16** is formed with a cylindrical wall of enlarged diameter which is received in this shouldered bearing portion. The top of the enlarged body portion is defined by the lower walls of the slots and the outer edges thereof bear against the shoulder of portion **48**. Below this shoulder the enlarged body portion has an annular groove **50** cut in the wall thereof as seen in FIGS. 1 and 2 and a matching annular groove **52** is likewise cut in the bearing portion **48** of the bore for registration with groove **50**. Thus a standard type of retainer spring **54** may be inserted into groove **50** with the free ends (one of which is shown at **56** in FIG. 1) pinched together while the body assembly is inserted into position in the bore with the prongs **34** set in cross slot **36** of lever **38**. When in position the ends of the spring are released and the spring expands in a well known manner to the position shown for releasably keeping the assembly together. The free ends of the spring are spread apart on the slabbed section at **58** at the underside of the head at the connection with handle **2** for access to take the assembly apart again if desired. As will be apparent the parts may in practice be assembled with the head **4** upside down so that the reversing lever may just be dropped into place and the body assembly lowered into position against it.

It will be noted that with the lower bearing portion of the body resting against the shouldered portion at **48** of the bore, the upper wall surface of the body **8** is prevented from exerting any pressure against the lever to inhibit the free movement thereof in manually shifting the lever.

The lever is restricted in movement and accordingly the reversing bolt **22** is likewise limited to rotation between limits. Referring to FIGS. 2 and 3 it will be noted that a stop post **60** extends upwardly from the top wall of the body **8** and that the upper end thereof is received in a counterbore hole **62** cut in the underside of the reversing lever **38**. Accordingly, rotation of the lever **38** is restricted to movement between positions in which the post **60** engages opposite sides of the counterbore hole **62**. In the assembly shown by FIGS. 1, 2 and 3 the parts appear in symmetrical relationship and it will be recognized that the post **60** is therefor seen in a halfway position between the limits of rotation of the lever and reversing bolt. Normally as will be appreciated the parts are in either of the two driving positions of pawl

tooth engagement. It will also be noted that the hole **62** is of circular shape as a matter of convenience only in using a standard tool to cut the recess rather than forming an arcuate slot to accommodate rotation of the lever.

In the particular assembly shown and as may be particularly seen from FIG. 2 the flanged extreme lower portion of the body **8** underlying the head **4** of the driver is formed with a knurled outer wall at **64**. This makes available a desirable "spinner" action in the use of the wrench. In other words the body can be manually rotated and "spin" with the fingers and without employing the handle or head for driving the shank **10**. Thus a work piece can be easily and rapidly turned if in a freely rotatable condition until such time as the greater force available through the leverage of the handle is required.

As will be seen from FIG. 4 the axis of each pawl pivot pin **18** and axis of the reversing bolt **22** lies in the plane of a diameter of the body **8** of the driven member. The axis of each pin is equally distance from the common axis of the body **8** and bolt **22**. Each pawl is double ended, is generally in the form of a sector, and symmetrical relative to the pivotal support pin **18**. The teeth of pawl **20** at opposite ends are indicated at **66** and **68** and at the corresponding ends of pawl **20'** are indicated at **66'** and **68'**. The operation of the wrench and the action of the pawls in the assembly shown by FIGS. 1–4 to obtain a fine-tooth ratchet action has been generally set forth above. The specific structure as thus far disclosed is substantially the same and functions to drive the work-engaging shank in the same general manner as the wrench of the above mentioned Patent No. 2,772,763. It will be noted that while the teeth **66** of pawl **20** are fully engaged to drive the body and shank as in a counterclockwise direction the teeth **66'** on the corresponding or diametrically opposite end of pawl **22'** are offset one-half pitch with respect to teeth **6**.

In the enlarged showing of FIGS. 5, 6, 7, and 8 the conformation at the inside face of the pawls for engagement by the outwardly urged balls **32** and the relationship thereof in reversing the driving action will be particularly described. As may be noted from FIG. 4 the fully engaged pawl teeth **66** provide a driving relationship for a counterclockwise turning of the driven member. This driving condition is maintained by the yieldable spring urged ball pressure engaging the outer edges of the corresponding diametrically opposed faces of the opposed pawls. In FIGS. 4 to 8 the reversing bolt with web **28** is illustrated at opposite limits of travel and in several intermediate positions relative to the pawl movement as the web is rotated in a counterclockwise direction to reverse the pawl drive positions. Initially the ball is carried from the operating position of FIG. 4 along an outer flat surface indicated at **70** to the position shown by FIG. 5. Full engagement of teeth **66** is maintained during this movement of the ball which is toward a central lobe **72** of the pawl. In FIG. 5 the ball is brought into an inner arcuately curved portion indicated at **74** adjacent the lobe. Portion **74** is preferably formed on a radius of curvature approximating that of the ball radius. From the FIG. 5 position further rotation of the bolt and ball exerts pressure laterally against the central lobe **72**. Such lateral force is directed across the transverse center line of the pawl and inwardly of the axis of the pivot pin **18**. Accordingly, the pawl will rotate on pin **18** to disengage teeth **66** from teeth **6** (FIG. 6). The disengaging action and pivoting of the pawl from the position of FIG. 5 to that of FIG. 6 is free of any restraining forces with the exception of that required to depress the ball against spring **30** until the parts occupy the position of FIG. 6. It will be noted in FIG. 6 that the rotative path of the web has brought the trailing outside edge thereof at **76** into an intersecting relation with the path of pivotal movement of the flat outer face portion **70** of the pawl. It will therefor be appreciated that the trailing edge in contacting this portion at **70** will serve to prevent further

unrestrained pawl movement. A neutral position of the pawl will thus be maintained during a period of further manual rotation of the bolt web. Contact of the trailing edge with the pawl surface continues until the ball rides onto the lobe **72** while rotating the pawl until lobe **72** is carried to the position shown by FIG. 7. Lobe **72** is on the transverse center line of the pawl and in the FIG. 7 position has been turned by the ball past the diametrically extending line joining the axes of the bolt and pin. The pawl in effect has passed "over center."

FIG. 7 shows the condition in which the ball is pressed inwardly to its greatest extent at the top of the lobe. In such position the trailing edge **76** of the web will be seen as about to separate on further rotation from contact with the flat surface **70** of the pawl. As the ball is carried by rotation of the web from the position of FIG. 7 to that of FIG. 8 it will readily be understood that the ball is initially spring pressed into the curved portion at **74'** adjacent the other side of the lobe as by a snap action, and, that it is then carried onto an outer flat linear portion at **70'**. The teeth at the now engaged end of the pawl are shown in FIG. 8 as in a half-pitch relation to teeth **6**. As previously explained the teeth at the corresponding end of the opposed pawl will be in full engagement for a clockwise driving action of the driven member.

It will be noted from the above description of the relationship of the resiliently urged ball and the pawl surfaces during reversal of the pawl positions that the pawl is turned on its pivotal support solely by action of projecting ball when rotated by the reversing bolt. Contact of the trailing surface of the web against the pawl holds the neutral position of the pawl until, as described, the opposite end is rotated into meshing engagement by the thrust of the ball against the surfaces at the other side of the central lobe **72**. The surfaces at each side of the lobe **72** are symmetrically formed and the reversal of the pawls in the opposite direction of that shown and described is accomplished in an identical manner. As above mentioned the lobed projection of the pawl extends inwardly and lies on the transverse center line between the ends of the pawl. The symmetrical surfaces on opposite sides of the lobe are recessed for the ball engagement as noted, the curved inner portions adjacent the lobe being preferably of a radius approximating the radius of the ball. Also the curved portions are of an arcuate length not greater than 90° so as to avoid any pocketing of the ball or other spring pressed member as a plunger head. The outer flat linear portions **70** and **70'** merge with the inner portions and are tangentially related thereto. Preferably these linear portions are formed on an angle which has a definite acute angular relationship with the direction of thrust of the ball when the ball contacts the same for engaging the teeth at that end of the pawl. With this relationship of the ball to the pawl surface a ratchet action of the pawl teeth will result only in depressing the ball back and forth against the spring **30** and without causing any oscillating movement of the bolt itself or the operating lever.

What is claimed is:

1. In a pawl and reversing mechanism for ratcheting devices in which,

a driver is formed with a toothed cylindrical bore, a driven member is rotatable in said bore and provided with double ended pawls mounted in segmental recesses of the driven member on diametrically opposed pivots for selective engagement with the teeth of said bore, and a reversing bolt recessed centrally in the driven member is pivoted for limited rotation on the axis of the driven member, and

said reversing bolt has a diametrically extending web provided with radially outwardly urged resilient means at each end, the web ends being rotatable to positions at opposite sides of the center line joining the bolt and pawl axes when said bolt is turned from one limit of rotational movement to the other, said pawls having inner faces engageable by said resilient means between said limits of movement,

the improvement which comprises

said inner pawl faces each being provided with a lobed projection directed inwardly of the driven member on the transverse center line between the ends of the pawl,

each pawl face at opposite sides of the lobe forming a recessed section engageable by the resilient means, each said section having an inner curved portion at the side of the lobe of an arcuate length not greater than 90° and an outer flat linear portion merging therewith and tangentially related thereto from the end of said curved inner portion,

said resilient means in engagement with an outer flat portion urging the teeth at that end of the pawl into engagement with the teeth of the bore, and when said reversing bolt web is turned towards the lobe, resiliently engaging said inner portion and exerting pressure laterally against the side of said lobe for pivoting said pawl and disengaging said toothed pawl end,

said reversing bolt web at its trailing edge having a path of rotation intersecting the path of pivotal movement of the outer flat pawl face portion when the pawl teeth at said corresponding end are disengaged, said web trailing edge contacting said outer face portion and maintaining a neutral pawl position with both pawl ends disengaged until said resilient means passes over said lobe,

the pressure of said resilient means on moving into engagement with the outer face portion at the other side of the lobe urging the teeth at that end of the pawl into engagement with the teeth of the bore for a reversal of ratchet action.

2. The structure of claim **1** in which

said resilient means at each end of the web of said reversing bolt includes a ball urged outwardly thereof, and

said inner curved portion adjacent the sides of the lobe has a radius of curvature approxiamtely that of the radius of the ball.

3. The structure of claim **2** in which

the inner and outer portions of the pawl faces at opposite sides of the lobed projection are symmetrical, and

the flat linear outer portions are each in acute angular relationship to the direction of the outwardly urged thrust of the ball when in contact therewith and the reversing bolt is thereby releasably held at its adjacent limit of rotational movement.

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U.S. Cl. X.R.

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