June 28, 1949. M. A. NAPIER 2,474,402

RATCHET MEANS

Filed July 12, 1945

Fig. 1.

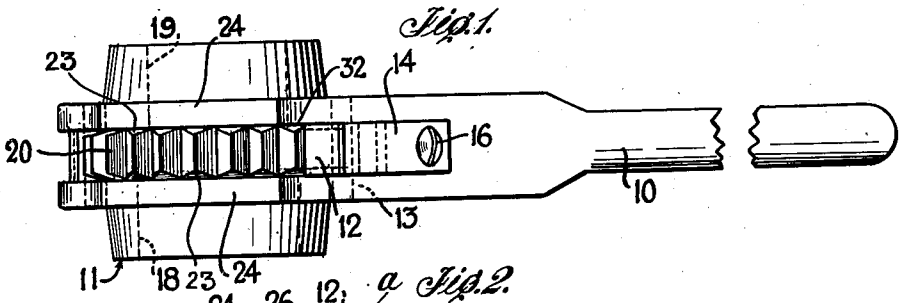


Fig. 2.

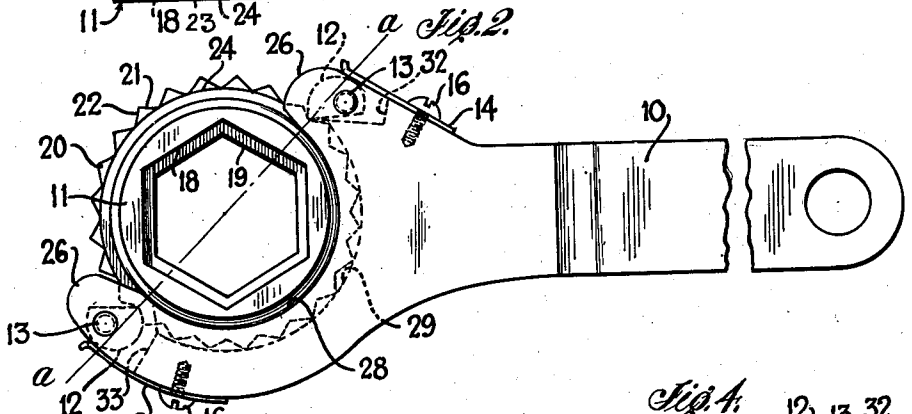


Fig. 3.

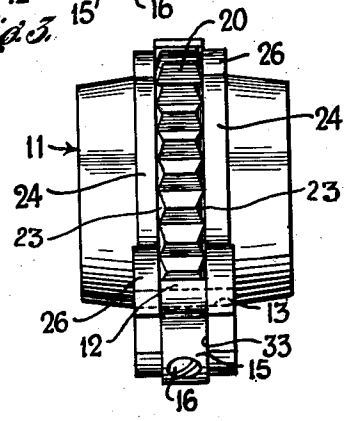


Fig. 4.

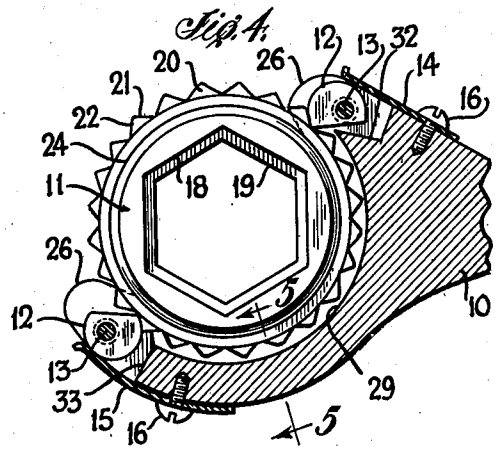


Fig. 6.

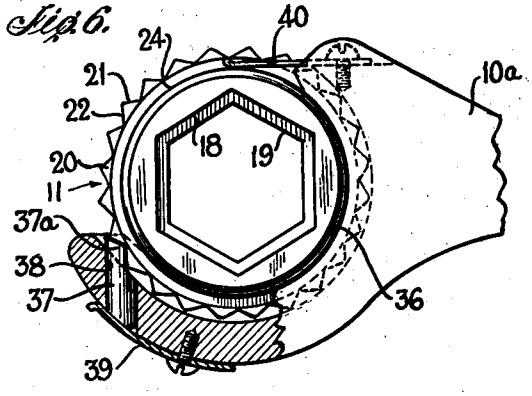
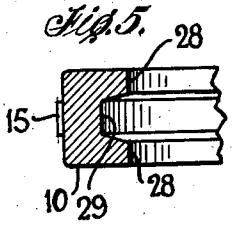


Fig. 5.



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RATCHET MEANS

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7 Claims. (Cl. 74—156)

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This invention relates to wrenches, and more especially it relates to improved ratchet wrenches.

The chief objects of the invention are to provide in an improved manner for ease and facility of mounting and dismounting the head of the wrench; to provide a ratchet wrench wherein the head is reversible in the handle or lever portion thereof, whereby the utility of the wrench is enhanced; and to provide a wrench of the character mentioned that will have relatively few operative parts. More specifically the invention aims to provide a ratchet wrench that is of simple construction, that is strong and durable, that may operate in situations difficult of access, and which may be manufactured at relatively low cost. Other objects will be manifest as the description proceeds.

Of the accompanying drawing:

Fig. 1 is a side elevation of a ratchet wrench embodying the invention;

Fig. 2 is a plan view thereof;

Fig. 3 is an end elevation of the wrench as viewed from the left of Fig. 2;

Fig. 4 is a fragmentary plan view of the operative end of the wrench, a part thereof being broken away and in section to reveal underlying structure;

Fig. 5 is a section on the line 5—5 of Fig. 4, the head of the wrench being omitted; and

Fig. 6 is a fragmentary plan view of another embodiment of the invention, a part thereof being broken away and in section.

Referring to Figs. 1 to 5 of the drawing, the wrench is shown as comprising a handle or lever portion 10, a rotatable head 11 carried thereby at one end thereof, a pair of pawls 12, 12 pivotally mounted on respective pivot pins 13 carried by said handle or lever, and engageable with said head, and spring elements 14 and 15 mounted upon the handle or lever 10 by means of screws 16, said springs engaging respective pawls.

The rotatable head 11 is shown, for illustrative purposes only, as a box type of wrench that has two sockets, indicated at 18, 19, which sockets are coaxially arranged at apposite ends of the head, and are of different sizes so as to engage two different sizes of nuts or bolts. It will be understood, however, that the head 11 is not limited to the box or socket type of wrench formation, but may be of any other type of tool-turning structure, for example, a chuck for a drill bit. Exteriorly, the head 11 is formed with a circumferential series of ratchet teeth 20 which preferably, though not necessarily, are located centrally of the head, midway between the ends thereof.

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The teeth 20 are symmetrical, that is, the opposite, pawl-engaging faces 21, 22 thereof are of the same size and slope so that the head may be assembled with the handle or lever with either side constituting the top thereof, for the purpose of utilizing either socket 18 or 19, or for the purpose of turning the head in a particular direction when the handle 10 is oscillated. Each of the lateral or end faces 23 of the teeth 20 are flat, said faces tapering or inclining somewhat toward each other, as shown in Figs. 1 and 3, from the roots of the teeth to the crowns thereof, for a purpose presently to be explained. At each side of the teeth 20 the head 11 is formed with respective cylindrical trunnions or bearing surfaces 24, which trunnions are coaxially aligned and concentric with the axis of the head. From said trunnions the periphery of the head tapers somewhat toward the adjacent ends thereof.

The handle or lever 10 is an elongate structure adapted to be grasped by an operator at one end thereof, its other end being arranged to receive the head 11. To this end the said handle or lever is formed at its operating end with a head-receiving recess, a portion of which constitutes an arc of 180° extent. The axis of said arc is on the centerline of the handle but the recess is not necessarily symmetrical with the handle, but may be asymmetrically arranged as shown. The arcuate portion of the recess is that portion thereof that is located to the right of line *a*—*a*, Fig. 2, said line extending diametrically of the arc. At each end of said arc, to the left of line *a*—*a*, the recess is slightly flared or widened, the surface thereof merging with surfaces 26, 26 of the handle structure at opposite sides of the recess.

As is best shown in Fig. 5, the configuration of the head-receiving recess is such as to provide a pair of concentric concave bearing surfaces 28, 28 that are separated by a groove 29. The radius of the bearing surfaces 28 is the same as the radius of the trunnions 24 of the head 11, said trunnions seating upon the respective bearing surfaces in the operative condition of the wrench, and the peripheral teeth 20 of the head being received in the groove 29. The latter is deeper than the height of the teeth 20 so that the crowns thereof do not touch the bottom of the groove. The lateral walls of the groove, however, are tapered toward the bottom thereof, which taper is complemental to the taper of the lateral faces of said teeth. Preferably there is slight clearance between the lateral walls of the groove 29 and the lateral faces of the teeth 20 so that there is but a modicum of friction therebetween. The

arrangement is such as to facilitate the mounting of the head 11 in the handle 10, and to restrain relative axial movement between head and handle.

Those portions of the handle 10 that are located at opposite sides of the open end of the head-receiving recess are slotted at 32, 33, parallel to the plane of the head between opposite faces thereof, a pawl 12 being located in each of said slots. As is most clearly shown in Fig. 4, each pawl 12 has a profile formed of two flat sides and a curved side, said flat sides meeting at an obtuse angle that constitutes a nose portion adapted to enter the notches between adjacent teeth 20 for the purpose of operatively engaging the teeth. The curved side of each pawl may be and preferably is the arc of a circle, and the axis of said arc is eccentrically disposed with relation to the pivot point of the pawl on the pin 13. The pawl 12 that is located in slot 32 is urged into engagement with the teeth 20 by the flat leaf spring 14 that overlies said slot and engages the arcuate surface of said pawl. In like manner the arcuate leaf spring 15 overlies the slot 33 and engages the arcuate surface of pawl 12 therein.

The pawls 12 are reversely arranged so that both operatively engage the teeth 20, when the lever 10 is turned in counterclockwise direction, thereby to effect turning of the head 11. When the lever 10 is turned in clockwise direction, the pawls ratchet over the teeth 20, being lifted by the latter against the force of the springs 14, 15. This result is achieved by reason of the fact that the pivot pins 13 of the pawls are so eccentrically disposed with relation to the respective axes of the curved surfaces of the pawls 12, that in the lifting of the latter the surface areas of the pawls that progressively move into engagement with the springs 14, 15 are progressively more remote from the respective pivot pins.

The pawls 12 are arranged to engage the head 11 at exactly diametrically opposite points, which points are at opposite ends of the arcuate region of the lever-recess in which said head is located, as will be seen by reference to line *a*—*a* of Fig. 1. The arrangement is such that stresses incidental to operation of the wrench are distributed between two widely separated regions of the lever 10, whereby it is possible to employ the wrench for relatively heavy work without danger of breakage to the wrench. The head 11 cannot be removed from the lever 10 by direct pull in the direction normal to line *a*—*a*, but requires, in addition, concurrent relative rotary movement of head and lever whereby the head will pivot about one pawl 12 as it is pulled past the other pawl against the force of spring 14. The operation is reversed when the head is to be mounted in the lever, at which time the teeth 20 are pushed past pawl 12 against the force of spring 15, while turning pivotally about the other pawl 12. Both in dismounting and remounting the head 11, the relative movement between head and handle is all in plane of the wrench structure, that is, transversely of the axis of rotation of the head.

The embodiment of the invention shown in Fig. 6 is somewhat similar to the embodiment previously described, and in some respects is identical thereto. Thus the ratchet head 11 is the same head that is employed in the previously described embodiment. The handle or lever 10*a* is similar to the lever 10 in that it is formed with an arcuate recess 36 of 180° extent in

which the head 11 is received and wherein it is adapted to rotate relatively of the lever. The embodiment of the invention shown in Fig. 6 differs from that previously described in that the pivotally mounted pawls 12 are omitted, and a single spring-pressed detent 37 is employed, which detent is located at one end of the arcuate recess 36 in which the head is mounted. Said detent is of general cylindrical shape and is mounted for axial movement in a bore 38 in the lever structure 10*a*, an arcuate leaf spring 39 on the latter engaging the outer end of the detent and urging it toward the teeth 20 of the head. The inner end of the detent 37 is formed with a nose portion 37*a* composed of two flat surfaces meeting at an angle that is complemental to the angle of the notch between two adjacent ratchet teeth 20, the plane of one of the flat surfaces of said nose portion being parallel to the axis of the detent, as shown. The detent 37 is disposed in non-radial relation to the head 11, the nose portion of the detent being adapted to engage in a notch between two ratchet teeth 20, the arrangement being such that when the head 11 is held stationary and the lever 10*a* turned in counter-clockwise direction, as viewed in Fig. 6, the detent 37 will be forced outwardly, against the force of the spring 39, and thus enabled to ratchet over the teeth 20; when the lever is turned in clockwise direction, the detent is subjected to lateral stress, and cramped between a tooth 20 and the bore 38 in which it is mounted. This prevents regressive movement of the detent, and the head 11 is caused to turn with the lever 10*a*. The head 11 is yieldingly retained in the recess 36 of the lever 10*a* by a bifurcated leaf spring 40 that is secured to the lever at a point substantially diametrically opposite the detent 37, and which engages the respective trunnions 24 of the head, tangentially thereof, at a point substantially beyond the adjacent end of the recess 36 in which the head is seated. Thus the head and lever are maintained in operative association when desired, but readily are separated by a pulling and turning movement, against the force of spring 40, when desired. The operation is reversed when it is desired to mount the head in the lever. The modified embodiment of the invention retains substantially all of the advantageous features of the embodiment first described, but is intended for lighter work than the latter for the reason that stresses are localized in the region of the detent 37.

The invention provides an improved ratchet wrench in which different sizes and/or types of heads readily are employed. The heads are readily mountable and dismountable in the lever without requiring the use of other tools. The feature of employing a tapered groove for receiving ratchet teeth having complementally sloped lateral faces facilitates centering of the head during the mounting thereof. The wrench has relatively few parts and is economically produced, and achieves the other advantages set out in the foregoing statement of objects.

Modification may be resorted to without departing from the spirit of the invention or the scope thereof as defined by the appended claims.

What is claimed is:

1. In a ratchet wrench the combination of a lever, and a head removably mounted on one end thereof, said head formed circumferentially with ratchet teeth having end faces that taper toward each other, and with trunnions at each side of the ratchet teeth, said lever formed with

a recess of 180° extent in which said head is receivable, which recess comprises a groove having sides tapered complemental to the ratchet teeth and adapted loosely to contact the latter, there being bearing surfaces each side of said groove on which the trunnions of the head are seated, and ratchet means carried by the lever at relatively widely spaced points and engaging said ratchet teeth on the head for turning the latter when the lever is turned in one direction, said ratcht means including spring mechanism adapted normally to retain said head in said lever-recess, and being yielding so as to enable both dismounting and remounting of the head by relative movement of head and lever in the plane of the wrench structure.

2. A combination as defined in claim 1 whereof the ratchet means consists of two pivotally mounted spring-backed pawls that engage the ratchet teeth 180° apart.

3. A combination as defined in claim 1 whereof the ratchet means comprises a pair of pivotally mounted pawls each having an arcuate marginal face that is arranged eccentrically of its pivot, and spring means bearing against the arcuate faces of said pawls.

4. A combination as defined in claim 1 whereof the ratchet teeth on the head have opposite faces of equal size and slope, the ratchet means comprising a spring-pressed detent disposed nonradially of the head and having a nose shaped complemental to a notch between two adjacent ratchet teeth, the plane of one of the faces of said nose being parallel to the axis of the detent.

5. In a ratchet wrench of the character described, the combination of a lever, and a head removably mounted on one end thereof, said head formed circumferentially with ratchet teeth that have opposite faces of equal size and slope, and with trunnions at each side of said ratchet

teeth, said lever formed with a recess of 180° extent in which said head is receivable, which recess comprises a groove for receiving said teeth, there being bearing surfaces each side of said groove on which the trunnions of the head are journaled, a spring-pressed detent carried by the lever at one end of said lever-recess and engaging said ratchet teeth, said detent being movable non-radially of said head, and spring means carried by the lever and engaging said head, beyond the other end of said recess, to retain the head yieldingly therein.

6. A combination as defined in claim 5 whereof the detent is formed with a nose portion shaped complemental to a notch between two ratchet teeth, the plane of one of the faces of said nose portion being parallel to the axis of the detent.

7. A combination as defined in claim 5 whereof the last mentioned spring means is a bifurcated leaf spring that bears against the respective trunnions of the head.

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