July 5, 1955 J. D. KEITH 2,712,258

SPRINGLESS REVERSIBLE RATCHET TYPE WRENCH

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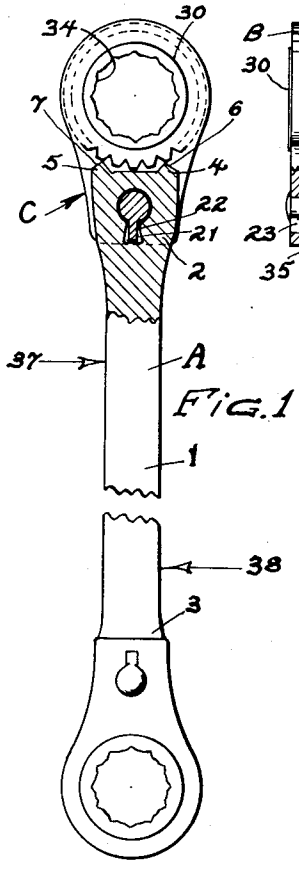


Fig. 1

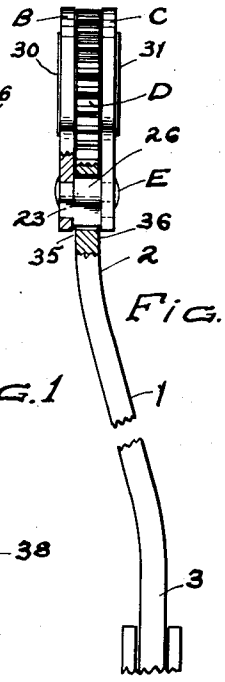


Fig. 2

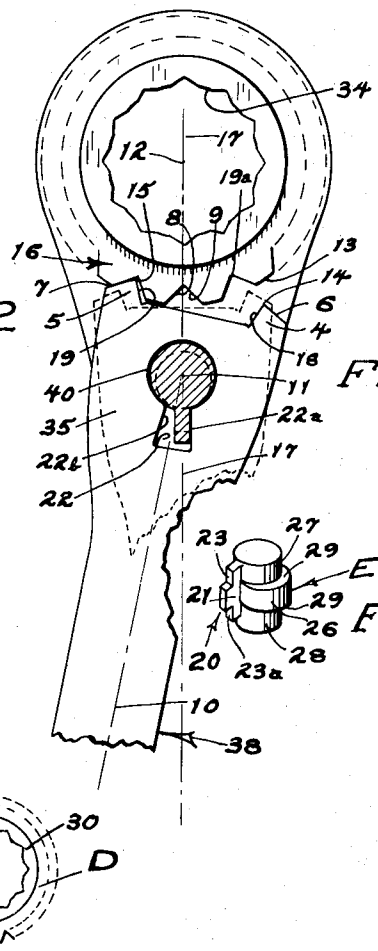


Fig. 3

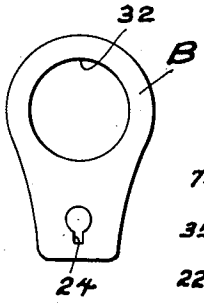
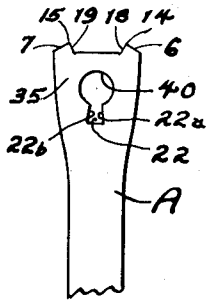


Fig. 4





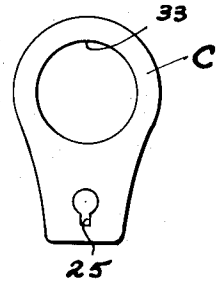


Fig. 5

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SPRINGLESS REVERSIBLE RATCHET TYPE WRENCH

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2 Claims. (Cl. 81—63)

The invention relates to wrenches and is specifically directed to a reversible type ratchet wrench. In prior art wrenches of this type there are certain inherent disadvantages which have been overcome in the present invention.

For example, most of the prior art wrenches of this type are overly heavy and unnecessarily so because of the arrangement of the dogs on the wrench handle in their coaction with the ratchet teeth on the wrench barrel. In the prior art wrenches the head portion of the wrenches are unnecessarily bulky and consequently are too heavy and difficult to handle.

Most of the prior art wrenches employ a spring mechanism for holding the handle of the wrench in offset relation relative to a center line drawn through the axis of the handle fulcrum and the axis of the wrench socket so as to maintain the second dog on the wrench handle out of the line of travel of the ratchet teeth to permit the return or "ratcheting" stroke of the wrench handle.

In the present invention ratcheting on the return stroke of the handle is effected without the use of a spring pressed holding mechanism and the elimination of this spring mechanism reduces the manufacturing costs of the wrench.

One object of the invention is to provide a reversible springless type ratchet wrench.

Another object of the invention is to provide a lightweight reversible type ratchet wrench having a narrow stream-lined handle construction and a wrench head assembly with a minimum of bulkiness.

Another object of the invention is to provide a reversible type springless ratchet wrench which is inexpensive.

Another object of the invention is to provide a reversible type ratchet wrench in which the fulcrum pin incorporates an offset portion for coaction with opposed walls in the wrench handle so as to absorb a major portion of the load imposed on the handle dog by the ratchet tooth of the wrench barrel.

Another object of the invention is to provide in a reversible type ratchet wrench a handle in which the actuating dogs are spaced a minimum distance from each other and have leading and trailing faces with a predetermined angle of inclination for coaction with the ratchet teeth on the wrench barrel, which ratchet teeth have faces with predetermined angles of inclination for coaction with the handle dogs in a manner so as to permit the return or ratcheting stroke of the handle while utilizing a minimum amount of oscillation of the handle about its fulcrum pin.

Another object of the invention is to provide a reversible type ratchet wrench having different size heads at each end of the wrench and a wrench handle of the offset type.

Other objects and advantages of the invention will be apparent from the ensuing specification and appended drawing in which:

Fig. 1 is a plan view of the wrench in full size with one end of the wrench broken in section and the handle being broken in its central region;

Fig. 2 is a side elevational fragmentary view of the wrench;

Fig. 3 is an enlarged fragmentary detail view of one end of the wrench;

Fig. 4 is an exploded view of the parts which make up one end of the wrench; and

Fig. 5 is a perspective detail view of the fulcrum pin.

In general the wrench includes a handle A, an upper cheek plate B, a lower cheek plate C, a socket barrel D and a fulcrum pin E.

The handle A may be formed as a forging or as a stamping and may be fabricated in an offset manner wherein the central portion **1** of the handle is inclined relative to the plane of each of the wrench heads. The handle embodies the offset end portions **2** and **3**, the end portions preferably lying in planes which are spaced from but parallel to each other.

The wrench handle is preferably of narrow construction intermediate the end portions making it lightweight and easy to handle. The end portion at each end of the handle converges outwardly slightly to the desired maximum width essential to accommodate the right and left dogs **4** and **5**. The spacing of the dogs **4** and **5** is computed in conjunction with the angle of inclination of the leading faces **6** and **7** of each dog and in further conjunction with the angle of inclination of the side faces **8** and **9** of each tooth on the periphery of the barrel D. The spacing of the dogs is such that when the longitudinal center line **10** of the handle passes through the axis **11** of the fulcrum pin E and thence through the axis **12** of the barrel D, rotation of the barrel D relative to the cheek plates B and C will permit the peripheral faces **13** of the ratchet teeth to just clear the apexes **14** and **15** of the dogs, such clearance of course being essential to permit the return or ratcheting stroke of the handle. The neutral position of the handle is shown in dotted lines in Fig. 3.

Viewing Fig. 3 when the handle has been swung about the fulcrum pin E to the left until the leading face **7** of dog **5** engages the side face **8** of ratchet tooth **16**, the wrench handle will have been swung throughout an arc of approximately 9 or 10 degrees beyond the center line **17**, said arc of course being generated from the axis **11** of the fulcrum pin. The range of swing of the handle may be varied to include a minimum swing of about 7 degrees or a maximum swing of about 15 degrees by varying the angles of inclinations of the barrel teeth and the dogs accordingly. In confining this arc of oscillation of the handle to about 9 or 10 degrees I have found that the angle of inclination of the leading face **7** relative to its projected intersection with the center line **10** of the handle should be approximately 55 to 60 degrees. The angle of inclination of leading face **6** will of course be also 55 to 60 degrees relative to its projected intersection with the center line **10** of the handle. The angle of inclination of the side faces **8** and **9** of each ratchet tooth relative to a radial line drawn through the projected apex of each tooth and the axis **12** of the barrel will be approximately 35 to 40 degrees so that when the wrench handle is swung to the left of center as shown in Fig. 3 whereupon the leading face **7** engages the side face **8** of the ratchet tooth, the leading face of the dog will be in substantially full contact with the tooth face **8** throughout its entire length. The angle of inclination of the trailing faces **18** and **19** of the dogs is only critical to the extent that the resulting angle defined between the leading face **7** and the trailing face **9** from the vertex **5** will not be greater than the angle defined between the side face **9** of one tooth and the side face **8** of the succeeding tooth generated from the vertex **19***a*. It is desirable that the angle defined by each dog will be substantially identical with the angle defined between adjacent ratchet teeth so that the dogs will be

of maximum thickness at their bases to give them as much strength as possible.

The projected apex of each ratchet tooth is cut away leaving an arcuate end face **13** on each tooth which is generated from the axis **12** of the barrel. The peripheral faces of the teeth lie in common circumferential path about the axis **12** of the barrel. The amount of material which is cut away at the apex of each tooth is such as to provide a resulting tooth of sufficient circumferential thickness as to afford the necessary strength for nut tightening purposes when engaged by the dogs of the handle. By cutting away the apexes of each tooth I obtain the necessary clearance for rotation of the barrel—the peripheral faces **13** clear the apexes **14** and **15** of the dogs when the barrel is rotated with the handle in the neutral or central position as shown in Fig. 1.

Viewing Fig. 3 when the handle is swung to the left of center and the dog **5** is in engagement between two adjacent ratchet teeth for turning a nut or bolt in clockwise direction, the load which is imposed on the leading face **7** of the dog against the side face **8** of the ratchet tooth may be of very considerable extent and consequently I have provided a load counteracting mechanism which is located on substantially the diametrically opposite side of the axis **11** from the dogs **4** and **5**. The fulcrum pin E may be provided with an integral lug **20** which has its side face **21** engageable with the wall **22***a* formed in the handle at the same moment that the leading face **7** engages the side face **8** of the ratchet tooth **16**. Thus the load which is imposed against the leading face **7** is likewise imposed on the opposite side of the axis **11** against the wall **21** simultaneously and the total load is thus distributed throughout the combined surfaces **7** and **21** of the handle on opposite sides of the fulcrum pin, thereby lending additional rigidity to the overall structure.

The fulcrum pin which is locked to the cheek plates B and C is preferably provided with the radially extending lugs **23** and **23***a* which are received within the notches **24** and **25** formed in the cheek plates, thereby preventing rotation of the fulcrum pin relative to the cheek plates. The central body portion **26** of the fulcrum pin is of larger diameter than the trunnion portions **27** and **28** at each end thereof thereby providing the annular shoulders **29** which abut the inner faces of the cheek plates. The axial length of the body portion **26** is slightly greater than the thickness of the end portion of the handle whereupon when the cheek plates are assembled on opposite sides of the handle and the ends of the fulcrum pin are peened over to anchor the cheek plates together, the end portions of the handle will be free to oscillate about the fulcrum pin within the space defined between the inner faces of the cheek plates.

The barrel D includes cylindrical trunnions **30** and **31** at each end which are rotatably journalled in the circular apertures **32** and **33** formed in the cheek plates. The socket portion **34** of the barrel is preferably of the "twelve-point" type as shown in Fig. 3 to accommodate square-head nuts or bolts as well as hexagonal head nuts or bolts.

The apertures **22** in the handle ends are of truncated configuration wherein the side walls **22***a* and **22***b* converge toward the axis **11** of the circular aperture **40** which communicates with the aperture **22**, said side walls defining the limits of the arc of oscillation of the handle about axis **11**. The side wall **22***b* of course serves the load absorbing function as previously described relative to wall **22***a* whenever dog **4** is utilized on the power stroke.

In the use of the wrench the opposed faces **35** and **36** of each end of the handle are flat and unrestricted throughout a major portion thereof to permit free oscillation of the handle between the flat and unrestricted inner faces of the cheek plates. There are no holding spring mechanisms for positioning the handle relative to the cheek plates to effect the return or ratcheting stroke of

the handle. The return or ratcheting stroke of the handle is effected in a unique manner by applying a compound or double-acting force to the wrench handle as will be explained hereinafter.

On the power stroke the central portion **3** of the handle is grasped in the palm of the hand and force is simply applied on one side of the handle—the side of the handle opposite from the dog which is engaged against the ratchet tooth (viewing Fig. 3 the force would be applied at **38** in the direction of the arrow). At the completion of the power stroke, the barrel, of course, remains stationary and the dogs must be retracted past several of the ratchet teeth on the return stroke. The handle must not be oscillated back beyond the neutral position as shown in Fig. 1, otherwise the right dog **4** will become caught between two ratchet teeth. To prevent this it is necessary to apply a compound exerting force on the handle wherein a force is applied at **37** in the direction of the arrow by the fingers for oscillating the handle and cheek plates in a counter-clockwise direction about the axis **12** of the barrel and at the same time a counteracting force is imposed by the palm of the hand at **38** in a direction opposed to the force **37** whereby to prevent the handle from being oscillated about the axis **11** of the fulcrum pin beyond the neutral or center position. The application of the force at **38** causes the dog **5** to drop between the ratchet teeth whereupon the trailing face **19** then rides along the face **9** until the apex **14** clears the peripheral base **13** of that tooth and the same condition prevails on each successive tooth thereby causing a "ratcheting" noise common in ratchet type devices.

I claim:

1. In a reversible wrench: a barrel having a polygonal wrenching aperture, said barrel including trunnion portions at its respective ends and an intermediate body portion of enlarged diameter provided with peripheral teeth; a pair of cheek plates including bearing rings in which said trunnions are journalled and shank portions projecting radially from said bearing rings in spaced parallel relation; a handle having one end portion embraced between said shank portions and having in said end portion an opening including a circular area and an extension area of limited circumferential extent, projecting toward the other end of the handle, said handle having a cylindrical wall defining said circular area and a pair of opposed stop shoulders defining the sides of said extension area; and a fulcrum pin extending through said opening and secured at its ends to said cheek plate shanks, said pin including a cylindrical body portion fitted within said cylindrical wall with just sufficient clearance for free oscillation of the handle between the cheek plate shanks, and including an integral radially projecting stop lug extending into said extension area with clearance between said stop shoulders such as to accommodate a few degrees of oscillation of the handle with reference to the cheek plates and engaging said shoulders at respective limits of such oscillation to prevent further relative oscillation; said handle having at said one end, dogs disposed symmetrically on opposite sides of said opening and engageable with said barrel teeth for establishing respective driving connections between the handle and the barrel in opposite directions of wrenching operations, said dogs being positioned for full engagement with said teeth simultaneously with limiting engagement of said fulcrum pin lug with respective stop shoulders.

2. A wrench as defined in claim 1, wherein said cheek plate shanks have circular apertures provided with lateral extension portions, corresponding generally in shape to said handle opening but of smaller dimension; and wherein said fulcrum pin includes integral end portions of smaller diameter than its said cylindrical body portion, and includes anchor lugs integral with said end portions and projecting radially therefrom to a shorter length than said stop lug, in a common plane and integral with said stop lug at opposite ends thereof, said anchor lugs being

snugly received in said extension portions of the apertures, said end portions of the pin extending through said apertures and being headed against the outer faces of the cheek plate shanks to secure the cheek plates against spreading, and said cylindrical body portion of the pin being eccentric with respect to said end portions thereof and projecting therefrom diametrically opposite said lugs, whereby to provide on said cylindrical body portion, end shoulders which are engaged against the inner faces of the cheek plate shanks to secure the same in spaced relation snugly embracing said one end portion of the handle with clearance for free oscillation of the handle between the cheek plates.

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