

April 5, 1938.

F. A. HAIST

2,112,840

METHOD OF MAKING WRENCHES

Filed May 8, 1935

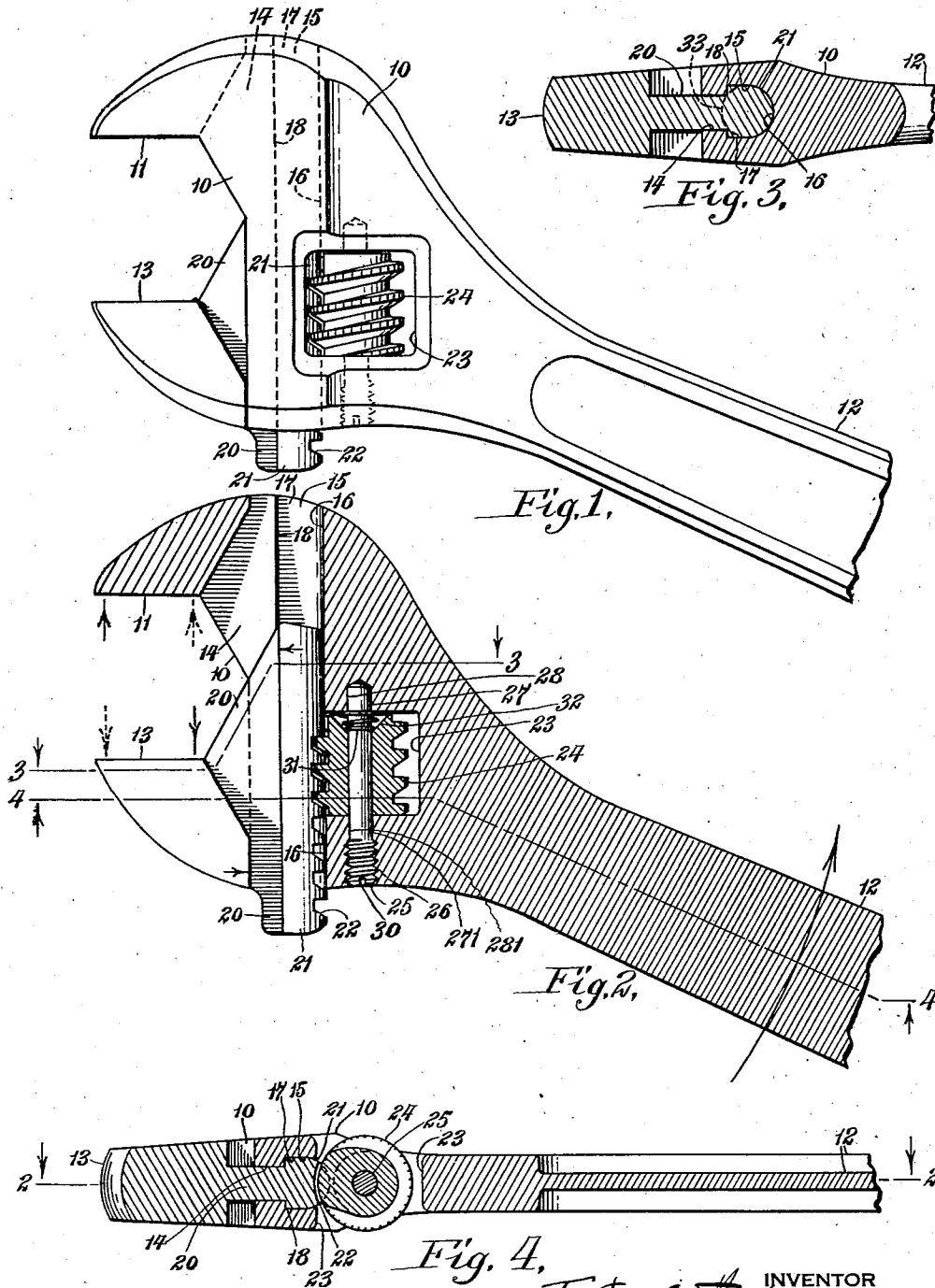


Fig. 4,
Foster A. Haist INVENTOR
BY
Popp & Popp. ATTORNEYS

UNITED STATES PATENT OFFICE

2,112,840

METHOD OF MAKING WRENCHES

Foster A. Haist, Buffalo, N. Y., assignor, by mesne assignments, to J. H. Williams & Co., Buffalo, N. Y., a corporation of New York

Application May 8, 1935, Serial No. 20,425

4 Claims. (Cl. 76—114)

This invention relates to the method of making a wrench, and more particularly to an adjustable end wrench in which the head, fixed jaw and handle are formed from one piece of metal.

The principal objects of the invention are to provide a strong, light and inexpensive wrench in which the sliding jaw moves freely and easily even after the wrench has been subjected to heavy abuse or overloading. Numerous other collateral objects of the invention and practical solutions thereof are disclosed in detail in the herein patent specification, wherein,—

In the accompanying figures:

Fig. 1 is a fragmentary side elevation of my improved wrench.

Fig. 2 is a vertical, longitudinal section thereof, taken on line 2—2, Fig. 4.

Figs. 3 and 4 are fragmentary, horizontal sections through said wrench, taken on correspondingly numbered lines of Fig. 2.

Similar characters of reference indicate like parts in the several figures of the drawing.

The present invention has been illustrated as applied to a solid, forged steel, adjustable end wrench of the oblique handle type. The invention, however, is not confined to this particular type of wrench, but may be utilized in any adjustable wrench although most effectively in an adjustable end wrench in which the head, fixed jaw and handle are formed from one piece of metal.

The wrench here illustrated consists primarily of a single steel forging constituting a head 10, a fixed jaw 11 and an oblique handle 12, and having a movable jaw 13 slidably mounted in said head 10. The medial portion of said head 10 at a point rearwardly of the fixed jaw 11 is cut away to form the relatively narrow, longitudinal, vertical, flat-faced alignment throat 14. Said throat is relatively narrow in a horizontal, transverse direction and opens at its rear end into a vertical guideway 15 which is relatively wide in a horizontal, transverse direction. The rear or inner portion 16 of said vertical guide 15 is semi-cylindrical in cross section (as seen in Figs. 3 and 4), while its front or outer portion is rectangular in cross section forming a pair of vertical, longitudinal, flat side walls 17, 17 and a pair of vertical, transverse, flat abutments 18, 18.

The movable jaw 13 of the wrench is integrally connected on its rear face with a vertical, longitudinal shank 20 which is relatively narrow in a transverse direction and is rectangular in horizontal section (see Figs. 3 and 4) and is slidably

received within the relatively narrow, flat-faced, alignment throat 14. This shank 20 maintains the movable jaw 13 in transverse alignment at whatever slidable position it may happen to occupy, i. e. said shank 20 in cooperation with said alignment throat 14 keeps the movable jaw 13 at all times in correct vertical register with the fixed jaw 11. Secured integrally to the rear end of said flat-faced alignment throat 14 is a vertical slide 21. The latter has the same horizontal cross sectional shape as the vertical guideway 15, being of semi-cylindrical, horizontal cross section at its rear part and of rectangular, horizontal cross section at its front part. Said vertical slide 21 of the movable jaw 13 extends some distance both above and below said movable jaw 13 for reasons which are well known in the art.

The rear, vertical, semi-cylindrical face of said slide 21 is hobbled or otherwise suitably machined to form a vertical rack 22. The head 10 of the wrench is suitably cut away to form the rectangular opening 23 which extends horizontally clear through said head 10. Arranged in said opening 23 is an operating worm gear 24, the spiral gear tooth of which engages the teeth of the rack 22 so that when said worm gear 24 is rotated in the one or other direction, the movable jaw 13 is moved toward or away from the fixed jaw 11 as may be desired for adjusting the wrench to any particular size of nut. The periphery of said worm gear is preferably knurled in the usual manner, as shown, to facilitate the turning of said worm gear manually.

Said worm gear 24 is rotatably mounted on a pin 25 the extreme lower end of which is enlarged and male threaded at 26 while the shank or rest of the pin is of cylindrical shape and is smaller in diameter than the threaded portion 26. The extreme upper portion 27 of the cylindrical shank of said pin is received within an upper vertical hole 28 situated just above the rectangular opening 23, while the lower portion 271 of the cylindrical shank of said pin is received within a lower, vertical hole 281 in axial alignment with aforesaid hole 28 and situated just below said rectangular opening 23. Said lower vertical hole 281 is employed to guide the tap when tapping the female thread which receives the male thread 26 of the pin 25. By this construction said pin 25 is solidly supported by its upper and lower cylindrical portions 27, 271 just above and below said rectangular opening 23 thus requiring of the thread 26 only the duty of pushing the pin 25 up vertically into place and firmly holding it in this position. This point

is of importance because of the fact that the best systems of thread tolerances can take care only of longitudinal forces and would be very difficult and expensive to properly carry into effect if also called upon to snugly fit laterally. Indeed this factor is of such importance that the present invention permits of the obtaining of a very sturdy wrench even though the male thread 26 is formed by a thread rolling operation with very generous tolerances. This permits the pin 25 to be manufactured from straight bar stock with no cutting operation other than the screw driver slot 30.

It is desirable to have the fixed and movable jaws 11 and 13, respectively, as far apart as possible for any given setting of the worm gear 24 and its companion rack 22, so as to take up whatever slack may be present. One point where this slack occurs (when the permitted manufacturing tolerances are very large) is in the vertical movement of the operating worm gear 24 in its rectangular opening 23. This slack is taken up in an improved manner in the present invention by a conical compression spring 31 the upper, large end of which bears upwardly against the upper flat face of the opening 23 while its lower, small end is received within and bears resiliently downwardly against the small end of a conical counterbore 32 formed axially in the upper end of the operating worm gear 24. Such a conical counterbore is much less expensive to obtain in large quantity production than the conventional rectangular counterbore and also has the advantage of permitting the use of a relatively long compression spring 31 without mechanically weakening the worm gear 24. This conical arrangement has the further advantage of imposing a greater than usual frictional resistance to turning of the worm gear 24 because of the fact that the frictional pressure which is normal to the face of the conical counterbore 32 (and hence is in opposition to the rotation of the worm gear 24) is greater than the vertical thrust of the conical spring 31 itself, similar to the increased friction obtained by a V power transmission belt as compared to an ordinary flat belt.

The method of manufacture

The first operation is the forging of the fixed jaw, wrench head 10 and handle 12 from one piece of properly alloyed high carbon steel. In this forging process the rectangular opening 23 is also formed. The wrench is then drilled, as shown in Fig. 3 by the dotted line 33 together with the full line 16, the latter forming ultimately the rear or inner end of the guideway 15 of the wrench head 10. Said guideway 15 is then broached with a suitable broach. It is to be particularly noted that, in this broaching operation, the broach cuts only at the front or outer part of said guideway 15 and is firmly braced, while doing this cutting, by the already formed semi-cylindrical surface 16. This broaching results in the formation of the flat side walls 17, 17 and the flat abutments 18, 18. The alignment throat 14 is then formed in the usual and well known manner.

The holes 28 and 281 are now drilled, and the latter then used as a guide for tapping the female thread which engages the male thread 26 of the pin 25. The movable jaw 13 with its integral shank 20 and slide 21 is then slid into place. The male thread 26 of the pin 25 is then formed by rolling or otherwise and assembled with its companion operating worm gear 24 and conical compression spring 31.

Operation

For maximum strength a wrench of this type should be rotated in the direction shown by the full line arrows of Fig. 2. It must be borne in mind, however, that the wrench will frequently be used in such a direction as to cause thrusts on the jaws of the type shown by dotted line arrows. In either case it will be noted that the force, to which the movable jaw 13 is subjected, tends to cause the same to move in a counter-clockwise direction (as seen in Fig. 2) relatively to the wrench head 10. This tendency tends to thrust the upper end of the slide 21 outwardly as shown by the upper horizontal arrow.

This thrust is taken care of, in the present invention, by the pressing of the flat, vertical, transverse faces of the slide 21 against the flat, vertical, transverse abutments 18, 18. These flat faces and abutments are disposed perpendicularly of the imposed pressure and consequently cannot spread the side walls of the guideway 15, as occurs in wrenches of conventional construction, whenever the wrench is subjected to heavy abuse or overloading beyond the elastic limit of the metal. As a result, this improved form of wrench maintains its original strength and smoothness of operation even if subjected to much abuse or overloading, provided, of course, that the load is not sufficiently excessive to strain the metal beyond its ultimate strength.

In this connection it is to be noted that even for loads within the elastic limit of the metal, this improved wrench is superior to the conventional wrench in that the slide 21 of the movable jaw 13 is prevented from binding in its guideway 15 because of the fact that any lateral pressure exerted in any lateral direction by said slide is imposed upon a surface which is perpendicular of said force, whereas in a number of conventional wrenches of this general type longitudinal pressures in a forward or outward direction are imposed upon a surface which is oblique to said pressure, similar to the manner in which a V power transmission belt exerts more pressure than a flat belt.

When an operator is using a wrench of this character, he usually moves the movable jaw 13 to a certain position and then successively applies the wrench to the nut, gives the same a partial turn, removes the wrench and returns to its original position and gives said nut another partial turn. In this procedure it is important that the operating worm gear 24 be not moved out of its properly adjusted position. This is effected, in the present invention, by providing a more than usual frictional resistance to the turning of said worm gear by the provision of the conical compression spring 31 in the conical counterbore 32, in this case deliberately obtaining the very V belt type of friction which in the case of the slide 21 was seen to be objectionable. This conical construction also permits of a long spring to give a soft resilient, frictional action and to take up the slack of the worm-gear 24 relatively to the wrench head 10, and accomplishing these results without mechanically weakening said worm gear 24, as would occur if a counterbore of equivalently large diameter were to extend an equivalent distance cylindrically into the upper face of said worm gear.

In addition to the foregoing, said worm wheel 24 always moves freely on its pin 25 by reason of the fact that any lateral forces to which said worm gear or pin may be subjected are not imposed upon the thread 25 but only upon the cylindrical

surfaces of the holes 28, 281 which may be accurately drilled (and even reamed if desired) at relatively little expense. Because of this fact said pin does not become loosened when the wrench is being used, and hence said pin 25 does not become loosened and finally fall out as frequently occurs when the wrenches are subjected to constant vibration, as when being carried in the tool box of an automobile.

10 I claim as my invention:

1. The method of making a wrench consisting of the forming of a head having a fixed jaw; drilling a hole in said head perpendicularly of said fixed jaw; passing a broach into said drilled hole and cutting a flat abutment on only the front side of said hole; guiding and supporting the rear side of said broach during the broaching operation on the rear cylindrical surface of the drilled hole; assembling a movable jaw having a guide which is received within said broached hole and has a semi-cylindrical rear portion and a flat-faced front portion; and providing means for moving said movable jaw relatively to said head, in a direction parallel to said broached hole.

2. The method of making a wrench consisting of the forming of a head having a fixed jaw; drilling a hole in said head perpendicularly of said fixed jaw; passing a broach into said drilled hole and cutting a pair of flat abutments on only the front side of said hole; guiding and supporting the rear side of said broach during the broaching operation on the rear cylindrical surface of the drilled hole; assembling a movable jaw having a guide which is received within said broached hole and has a semi-cylindrical rear

portion and a dual shouldered front portion; and providing means for moving said movable jaw, relatively to said head, in a direction parallel to said broached hole.

3. The method of making a wrench consisting of the forming of a head having a fixed jaw; drilling a hole in said head perpendicularly of said fixed jaw; passing a broach into said drilled hole and cutting a flat abutment at a point located rearwardly of its extreme front portion; guiding and supporting the rear side of said broach during the broaching operation on the rear cylindrical surface of the drilled hole; assembling a movable jaw having a guide which is received within said broached hole and has a semi-cylindrical rear portion and a flat faced front portion; and providing means for moving said movable jaw, relatively to said head, in a direction parallel to said broached hole.

4. The method of making a wrench consisting of the forming of a head having a fixed jaw; drilling a hole in said head perpendicularly of said fixed jaw; passing a broach into said drilled hole and cutting a pair of symmetrical flat abutments each at a point located rearwardly of its extreme front portion; guiding and supporting the rear side of said broach during the broaching operation on the rear cylindrical surface of the drilled hole; assembling a movable jaw having a guide which is received within said broached hole and has a semi-cylindrical rear portion and a symmetrical dual-shouldered front portion; and providing means for moving said movable jaw relatively to said head, in a direction parallel to said broached hole.

FOSTER A. HAIST.