Dec. 2, 1952 R. E. GRAY, JR 2,619,860

FLEXIBLE TOOL WITH PREDETERMINED OVERLOAD YIELDING MEANS

Filed Aug. 14, 1946

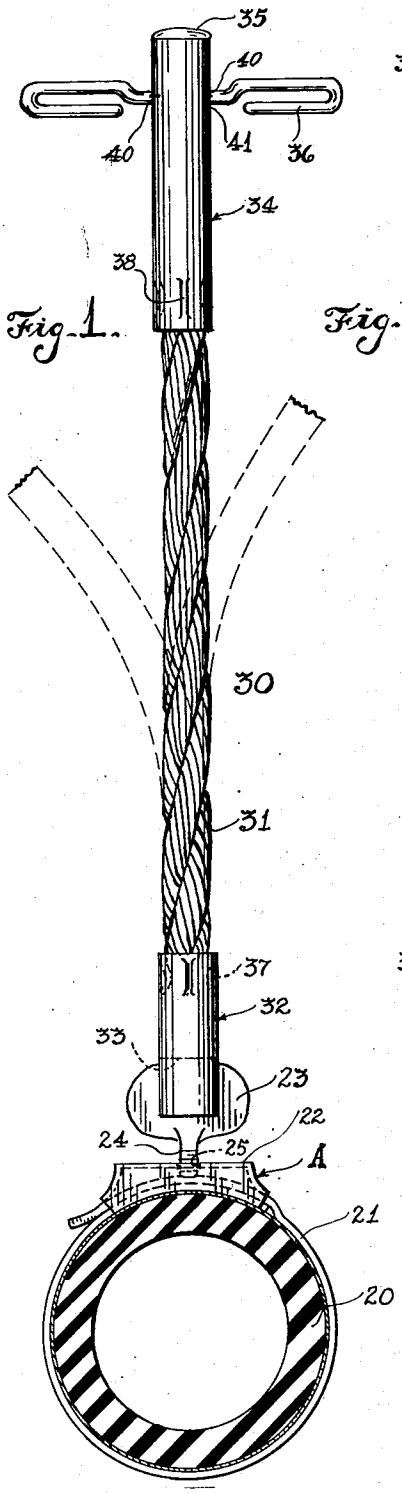


Fig. 1.

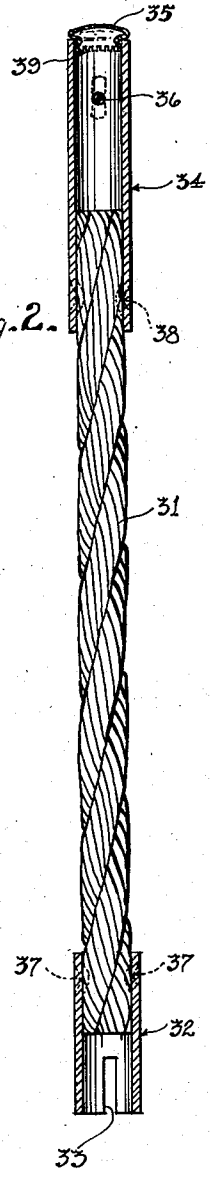


Fig. 2.

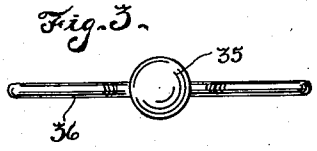


Fig. 3.

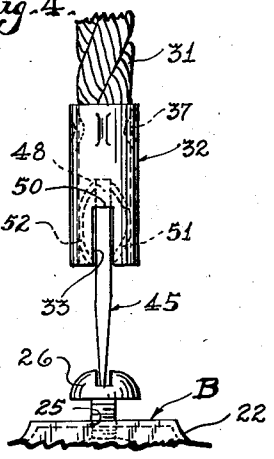


Fig. 4.

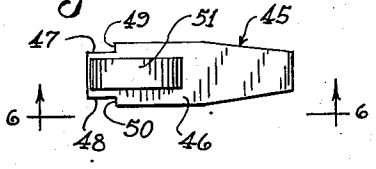


Fig. 5.

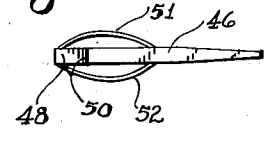


Fig. 6.

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FLEXIBLE TOOL WITH PREDETERMINED OVERLOAD YIELDING MEANS

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1 Claim. (Cl. 81—52.5)

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This invention relates to wrenches and is particularly concerned with flexible wrenches which, while being adaptable for general work, are particularly designed for light usage as a hose clamp tightener.

An object and accomplishment of the present invention is to provide a device of this character embodying a flexible drive shaft for the bit of the device so that the wrench may be employed in otherwise inaccessible places.

A further object of the invention is to provide a wrench of this character wherein the drive shaft of the device is made elastic or resilient for the purpose of preventing stripping of threads of hose clamps, the resilient drive shaft being so constructed that it will be unyielding, and will resist the torsional force required to tighten the nut of the usual hose clamp, and then yield if the device is additionally turned beyond a predetermined point of resistance, thereby to prevent stripping of the threads of the clamp head.

My invention has for a further object to improve the construction of wrenches of the above named class with respect to efficiency of operation and economy in its manufacture; and to this end it consists of the employment of a flexible wire cable as the drive shaft, the lay of the cable being such that the nut of a hose clamp can only be tightened sufficiently to a predetermined amount, but upon the building up of a predetermined torsional resistance, the cable will flex or unravel thereby preventing stripping of the threads of the clamp.

And the invention seeks, as a still further object to provide a flexible wrench which will successfully combine the factors of structural simplicity, efficiency and durability thereby to increase its versatility in practical use, and yet be economical to manufacture.

Additional objects, features, and advantages of the invention disclosed herein will be apparent to the persons skilled in the art after the construction and operation are understood from the within description.

It is preferred to accomplish the various objects of this invention and to practice the same in substantially the manner hereinafter fully described and as more particularly pointed out in the claim, reference being had to the accompanying drawings which form a part of this specification, wherein:

Fig. 1 is a side elevational view of the flexible wrench embodying the present invention, and

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illustrating its employment in conjunction with a typical conventional hose clamp;

Fig. 2 is a side elevational view of the flexible wrench illustrated in Fig. 1 with parts thereof shown in section to better illustrate the construction thereof;

Fig. 3 is a top plan view of the flexible wrench depicted in Fig. 1;

Fig. 4 is a fragmentary side elevational view of a portion of the flexible wrench depicted in Fig. 1 and having a screw driver attachment;

Fig. 5 is a side elevational view of the screw driver attachment depicted in Fig. 4; and

Fig. 6 is a side elevational view of the screw driver attachment taken substantially on the plane of the line 6—6 in Fig. 5.

The drawings are to be understood as being more or less of a schematic character for the purpose of disclosing a typical or preferred form of the improvements contemplated herein, and in these drawings like reference characters identify the same parts in the several views.

Referring to Figs. 1 and 4 wherein are illustrated, respectively, two forms of hose clamps with which the flexible wrench of the present invention may be advantageously employed. In Fig. 1, I have designated the hose clamp assembly in its entirety by the letter A and which comprises generally, a hose 20 of rubber or other suitable material and which may be of any desirable shape or design, a suitable band 21 enveloping the outer peripheral surface of the hose and provided with a clamp head 22 suitably secured to one end of the band 21 whereby the other end is free so that the same may be wrapped around the hose 20 and threaded through the clamp head 22 as shown in Fig. 1. In order to hold the band in this position, there is provided a suitable wing nut 23 having a threaded neck portion 24 adapted to be received in a suitably threaded aperture 25 in the clamp head and said threaded neck portion being adaptable to engage the band thereby to hold said band fixedly about said hose in a clamping position.

In Fig. 4, I have designated the hose clamp assembly in its entirety by the letter B, and which comprises generally the same construction as hereinbefore set forth for the clamp assembly A, with the exception that in some cases it has been found advantageous to substitute a slotted head screw 26 for the wing nut 23.

In both constructions, the conventional clamp head 22 is usually a stamping of relatively thin soft metal, thereby making the threads of the

apertures 25 very susceptible to stripping if great care is not exercised.

In an airplane, for example, many hose clamps as hereinbefore described are employed to operatively connect various liquid pumps to their related devices and the hose clamps being usually located and positioned in such a manner as to be inaccessible when using the usual conventional rigid tool. Heretofore, it has been necessary to exercise a great deal of guess work and hand tightening of the hose clamps which has resulted in many being tightened too tight with the resultant stripping of threads which makes a dangerous hose connection. The wrench of the present invention has overcome these difficulties by the provision of means, to be hereinafter fully described, whereby a predetermined amount of torsional resistance will cause the device to yield, thereby preventing the stripping of the threads. Accessibility to otherwise inaccessible clamps is accomplished by lateral flexibility of the shaft in all directions which will be hereinafter described in detail.

Suffice it to say, since the invention is not particularly concerned with the precise construction of hose clamps generally, they will not be further described in detail. It is to be understood that details of the construction of the hose clamps may be modified to suit particular conditions and I do not wish to be limited to the details of construction as set forth herein.

Having thus described the general environment surrounding the flexible wrench with which the present invention is particularly concerned, the specific construction and function of parts of said wrench will now be described in detail.

In the exemplary embodiment of the invention illustrated in Fig. 1, the flexible wrench which I have indicated in its entirety by the numeral 30, comprises generally, a flexible wire cable 31 of suitable thickness and strength, and having fixedly secured thereto at one end thereof, a bit 32 having a slot 33 adapted to receive the wing nut 23 of the hose clamp A. Fixedly secured to the other end of the cable 31, I have provided a head 34 having a cap 35 to close the top end of the head 34 and having a suitable handle as at 36. The specific construction and cooperating function of these parts is to be hereinafter described in detail.

Referring to Fig. 2, the bit 32 is preferably made of tubular stock having open ends, the slot 33 being cut into the side walls at one end thereof and the other open end is adapted to receive end portions of the cable 31 and a suitable fixed connection therebetween is provided such as, for example, by crimping the sides of the bit 32 as illustrated at 37.

The head 34 is preferably made of tubular stock having open ends, one of said open ends being adaptable to receive end portions of the cable 31 opposite the end portions secured to the bit 32 and a suitable fixed connection is provided between said head and said cable such as, for example, by crimping the sides of the head as at 38. The other open end of said head being adaptable to receive the cap 35 which is provided with suitable snap formations 39 adaptable to resiliently grip the inner surface of the tubular head thereby to removably hold the cap in place. Suitable apertures 40 are provided in the head 34 which are adaptable to receive the handle 36.

The handle 36 is preferably formed of rod stock of suitable thickness and is fixedly held in position with relation to the head by suitably crimping the neck portions of the handle and the head at their juncture at the apertures 40 as shown at 41 in Fig. 1. This may be accomplished by employing a chisel and exercising a sharp blow thereon by a hammer or the like.

The wire cable 31 may be of any conventional design; however, the size and resilient characteristics thereof being determinable by the required predetermined torsional resistance of the wing nuts of the clamps on which the wrench is to be employed. In any event, the lay of the cable is such that the nut of the hose clamp can only be tightened a predetermined amount, and upon building up such predetermined torsional resistance, the cable will flex or unravel thereby preventing further undesired tightening of the nut which would strip the threads in the clamp head 22.

For removing the nuts of the hose clamps, the lay of the cable is such that it will not flex or unravel regardless of the torsional resistance, thereby the nuts may be easily removed even though they may have rusted or have become slightly corroded in place.

Among the paramount advantages of the structure of the present wrench and of the wire cable of the present invention are, first, its adaptability to economical manufacture; and, second, its adaptability to yield in one direction when torsional resistance of a predetermined amount is encountered and its adaptability to become rigid in the other direction. The drive shaft thus constructed in accordance with the present invention is also flexible, so that it can be bent in any direction laterally as illustrated by the dotted lines in Fig. 1, and thus avoid normal obstructions which may make the hose clamps inaccessible to conventional rigid tools.

As has been hereinafter pointed out, in some cases it has been found advantageous to substitute a slotted head screw, as illustrated at 25 in Fig. 4, for the wing nut 23. In such cases, I employ a screw driver attachment which I have designated in its entirety by the numeral 45 and which is adapted to be received into and held securely in position by the bit 32 as illustrated in Fig. 4.

Referring to Fig. 5, the screw driver attachment 45 comprises generally, a body portion 46 suitably tapered at one end to form the semblance of a conventional screw driver and the other end is provided with recessed portions 47 and 48 forming abutment surfaces 49 and 50 which are adapted to abut the inner surface of the slot 33 thereby restricting the movement of screw driver attachment inwardly of the bit 32 when the device is in use. Other portions of the body 46 are adapted to fit snugly into and become engaged with the slot 33, as illustrated in Fig. 4, thereby to prevent lateral or axial movement of the screw driver relative to the bit. Suitably secured to the body portion 46 of the screw driver attachment, I have provided two arcuate springs 51 and 52 adapted to engage the inner surface of the tubular bit 32 thereby to hold said screw driver in position to the bit and providing an economical clasp whereby the screw driver may be easily and quickly attached to the device without requiring extra tools and extra parts which may be lost; and also providing an easy means of disengaging the screw driver from the bit by merely grasping the screw driver firmly and giving a slight pull to remove it from the bit.

While I have illustrated a preferred embodiment of my invention, many modifications may

be made without departing from the spirit of the invention, and I do not wish to be limited to the precise details of construction set forth, but wish to avail myself of all changes within the scope of the appended claim.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent of the United States, is:

A torque sensing device manually rotatable in two directions respectively for tightening and loosening a screw threaded article, comprising a flexible shaft, handle means secured to one end of said shaft for accomplishing manual rotation of said device, and a tool secured to the other end of said shaft and adapted to engage the screw threaded article, said flexible shaft comprising at least two metallic wire-like strands twisted about each other to define a cable, the lay of said strands being in the direction of rotation of said shaft when tightening the screw threaded article and tending to resist unwinding and to maintain their normal arrangement during a normal working range in the initial performance of such tightening work, and said strands being arranged to unwind responsive to

an amount of torque greater than that of the normal working range encountered during the initial performance of such tightening work, thereby indicating to the operator that the initial tightening work has been performed and to stop application of torque.

RALPH E. GRAY, JR.

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