Oct. 27, 1953 W. J. JOHNSON ET AL 2,656,751

REPLACEABLE JAW INSERT FOR PIPE WRENCHES

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Fig. 1.

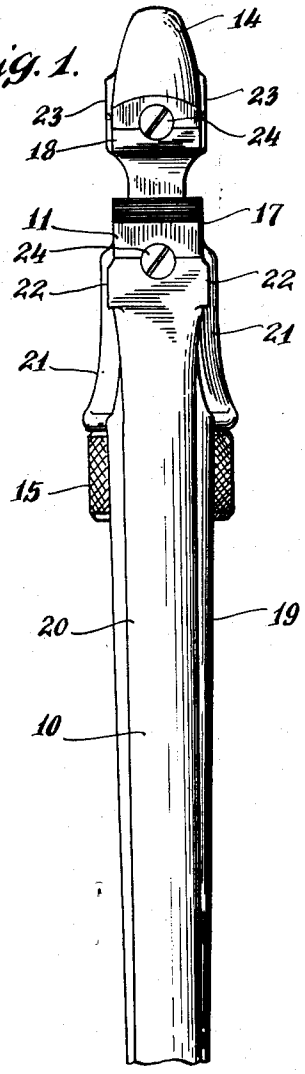

Fig. 2.

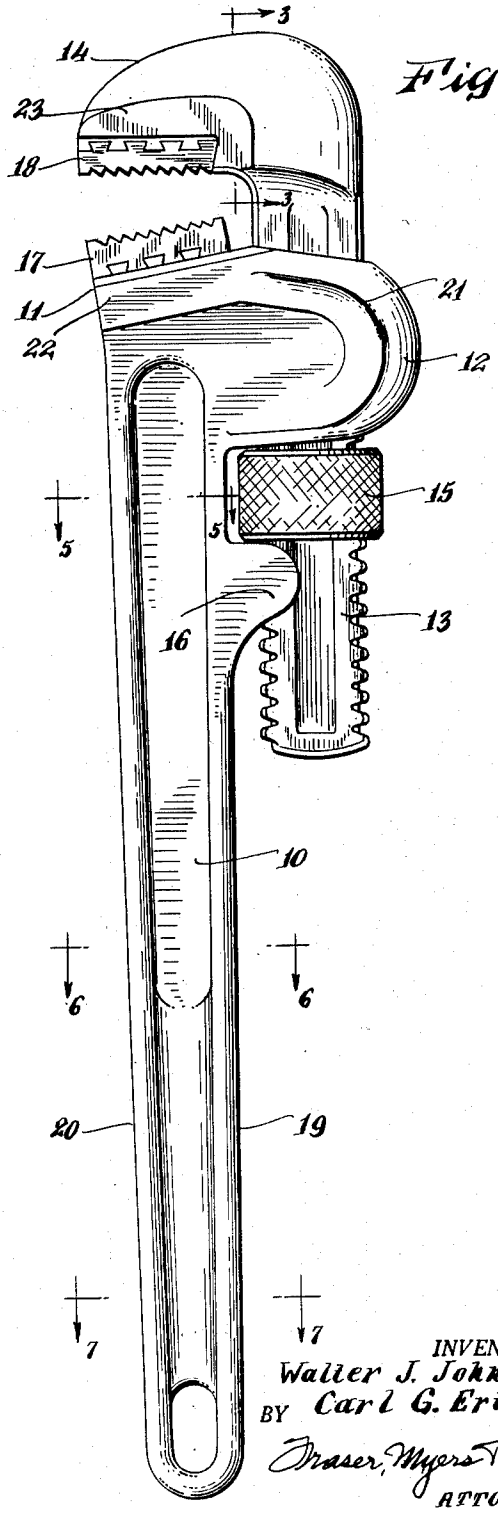

Fig. 3.

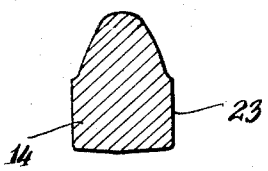

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Fig. 4.

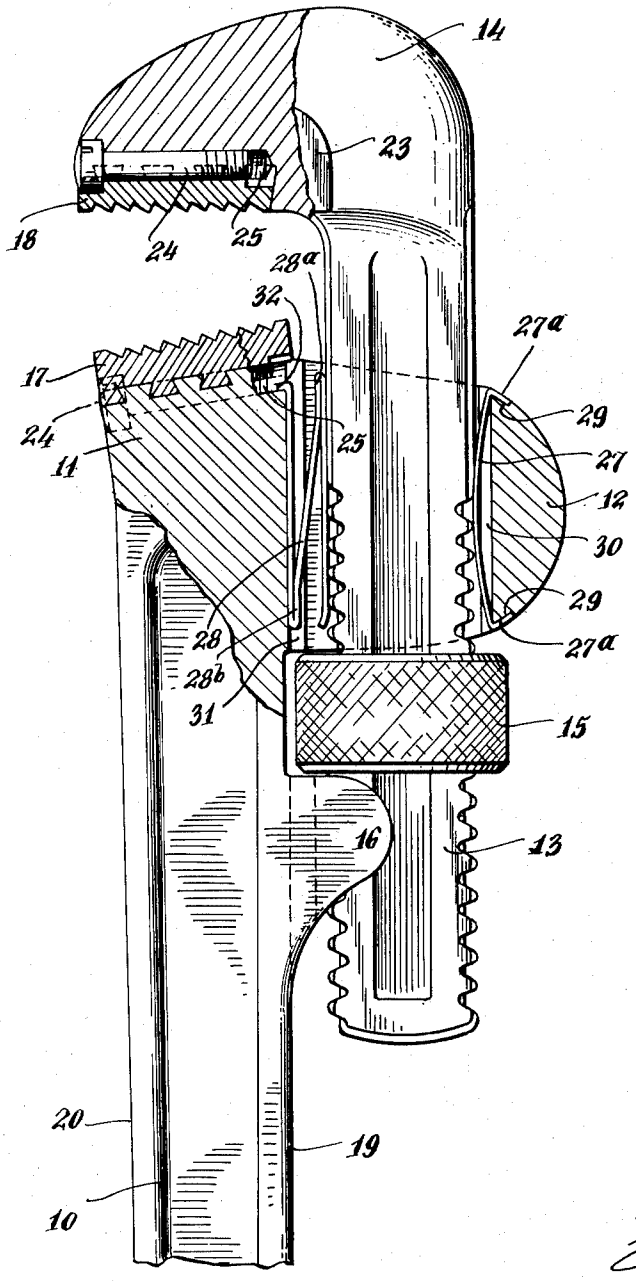


Fig. 5.

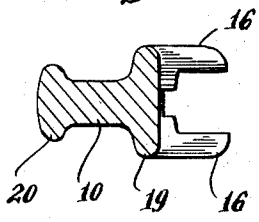


Fig. 6.

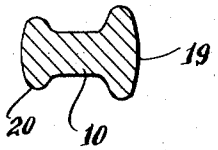
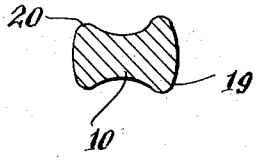


Fig. 7.



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REPLACEABLE JAW INSERT FOR PIPE WRENCHES

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2 Claims. (Cl. 81—186)

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The present invention relates to wrenches, and more particularly to light weight pipe wrenches having strengths, and more particularly yield points, which compare favorably with malleable iron and steel pipe wrenches of corresponding size.

Pipe wrenches of the class described, and particularly those of the larger sizes, are heavy to carry and handle and are dangerous to use on piping through which combustible or inflammable fluids flow because of the fire and explosion hazard from sparks which might be given off during the use or accidental dropping of a wrench. To overcome the aforementioned shortcomings inherent in malleable iron and steel pipe wrenches, it has been proposed to make pipe wrenches from aluminum and other light weight alloys and to provide such wrenches with hard, wear-resisting jaw inserts and also to make such wrenches from other non-ferrous alloys possessing requisite strength and spark resistance, such as beryllium copper alloys.

Wrenches made from aluminum alloys in part overcame the shortcomings of the malleable iron and steel wrenches but they possessed an inherent weakness of having yield points under proof load and ultimate strengths which were too low and hence frequently failed in use by breaking at the movable jaw in proximity to the juncture of the jaw and the jaw shank or at the handle just behind the frame through which the movable jaw shank extends. Wrenches made from beryllium-copper alloys, on the other hand, although possessing requisite yield point and strength, weigh about three times as much and cost more than three times as much as aluminum alloy wrenches of corresponding size.

An object of the present invention is to provide a light weight pipe wrench having a yield point under proof load which compares favorably with malleable iron and steel pipe wrenches.

Another object of the invention is to provide a light weight pipe wrench which will be spark resistant.

A further object of the invention is to provide a pipe wrench of heat-treated forged aluminum alloy, the component parts of the wrench being proportioned so as to have a sufficiently high yield point under proof load and so as to resist breakage at the points where failure has most frequently occurred in prior constructions.

A still further object of the invention is to provide a wrench of the character set forth having interchangeable jaw inserts which are of

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novel design and are held in a novel manner onto the wrench jaws.

The accomplishment of the foregoing and other objects of our invention not specifically recited, and the invention as a whole will become apparent from the detailed description which follows when considered in connection with the accompanying drawings wherein:

Figure 1 is a front elevation of a pipe wrench embodying our invention.

Fig. 2 is a side elevation of the pipe wrench shown in Fig. 1.

Fig. 3 is a section taken along the plane of the line 3—3 of Fig. 2.

Fig. 4 is a side elevation, on an enlarged scale, of the wrench shown in Fig. 2, parts being broken away to better illustrate certain novel features of the invention.

Figs. 5, 6 and 7 are sections taken along the planes of the lines 5—5, 6—6 and 7—7, respectively, of Fig. 2.

Referring to the drawings, in the various figures of which corresponding parts are designated by the same reference characters, the pipe wrench may be said to consist of a handle 10 having a fixed jaw 11 and an integral frame 12 through which extends a threaded shank 13 of a movable jaw 14, which is adjustable relatively to the jaw 11 by a nut 15 engaging the shank and supported and retained between the frame 12 and a pair of bosses 16. The jaws 11 and 14 are provided with replaceable jaw inserts 17 and 18, respectively. The recited elements in their cooperative relationship set forth are conventional in pipe wrenches.

The present invention is directed to a pipe wrench of the type set forth in the preceding paragraph but formed essentially from a metal or alloy of light weight compared to malleable iron and steel, and which light weight metal or alloy is spark resistant. Such light weight alloys do not have as high a yield point under proof load as malleable iron and steel, hence, according to the present invention the various elements of the pipe wrench have been designed and proportioned to have yield points under proof load which compare favorably with malleable iron and steel pipe wrenches of corresponding size. In fact, the yield points under proof load of the wrenches made in accordance with the present invention fully meet the specifications pertaining to heavy duty pipe wrenches made of malleable iron and steel approved by the Director of Procurement for use in all departments of the United States Government, see federal specifica-

tion for pipe wrenches, bulletin GGG–W–651*a* and amendments thereto.

A pipe wrench according to the present invention is preferably formed of "Alcoa 75ST Alloy" which comprises aluminum, zinc, copper and titanium, and which alloy can be forged and heat-treated to produce sections suitable for pipe wrench design. These sections have been designed and proportioned to have a favorable tension/compression ratio and reduced unit stress. Accordingly, the handle **10** is formed of substantially H form in transverse section, as best shown in Figs. 5, 6 and 7, the arm **19** of the H section at the rear of the handle being of progressively increased height from the free end of the handle to the frame portion **12** thereon, and the arm **20** of the H section at the front of the handle beyond the free end thereof is of substantially uniform and less height than the rear arm **19** at any particular H section. In carrying forward this concept, the frame **12** is also proportioned to develop a favorable tension/compression ratio and reduced unit stress by having its top, rear and bottom boundary wall **21** of substantially greater thickness than the body of the frame, which is of substantially the same thickness as the handle whereat the frame **12** extends therefrom. Said thickened boundary wall **21** also preferably extends forwardly from the top of the frame across the handle **10** to provide beneath and adjacent the jaw insert **17** a reinforced section **22** of greater width than said jaw insert. Also for the purpose above set forth, the jaw portion of the hook jaw member **14** is reinforced by being formed with greater depth than in corresponding malleable iron and steel pipe wrenches and with additional thickness of metal **23** on each face of the jaw above and adjacent the jaw insert **18**, said reinforcement **23** forming with the metal above said jaw a substantially inverted T section.

The jaw inserts **17** and **18** are interchangeable and replaceable and are formed of hard, wear-resisting metal, usually steel, but where the wrench is to be spark resistant, said inserts may be formed of any suitable hard spark resistant metal such as a beryllium-copper alloy. Preferably the jaw inserts **17** and **18** and the jaws **11** and **14** are formed with cooperating dovetail mortises and tenons having longitudinal axes extending parallel to the front face of the wrench, the jaw inserts being force-fitted onto the jaws and held against lateral movement thereon by set screws **24** extending from in front of the wrench and through side walls of the interengaging dovetails at a right angle to said longitudinal axes, the set screws being formed with enlarged heads which are seated within recesses at the front of the wrench jaws to lie flush therewith. The set screws **24** each have a diameter equal to at least the height of the dovetails and engage said dovetails throughout their height. Preferably the diameter of each set screw is about twice the height of the dovetails and screw-threadedly engage in threaded openings **25** in the respective jaws, there being openings in the jaw inserts to accommodate the screws.

Typical dovetail practice for mating or interengaging dovetail mortises and tenons provides for an included angle of 30°, i. e., 15° at each side of the dovetail. This typical practice, however, does not provide the desired clearance and/or interference of mating dovetails of two unlike metals such as an aluminum alloy and steel, which metals have different modulii of elasticity.

To remedy this shortcoming, we substantially increase the included dovetail angle to between 40° and 60°, and preferably 45°. The increased dovetail angle provides:

(1) An increased ratio of shear area of aluminum members, since aluminum has the lower allowable unit stress of the two metals;

(2) An increased contact area, since the deformation due to compressibility of aluminum is three times that of steel, and thus provides an increased area which reduces the deformation per unit of load;

(3) Decreased ratio of vertical movement to horizontal movement, since for each unit of horizontal clearance/interference, the vertical clearance/interference is the function of the tangent of the dovetail angle, and the smaller the angle the greater the vertical clearance/interference.

According to the present invention the movable jaw is resiliently suspended in the frame **12** by separate springs **27** and **28** which are removably mounted in the frame at the front and rear thereof, respectively. Preferably the spring **27** is bowed inwardly from end to end longitudinally of the frame and has its ends **27***a* bent rearwardly and seated in recesses **29** in the frame to allow for flexing of the spring, the rear wall of the frame between the recesses **29** being channeled, as indicated at **30**. The spring **28** is of flattened Z form and is held within a channel **31** in the front wall of the frame by one end of the spring being formed with a rearwardly bent portion **32** which seats in the rear end of the hole **25** in the jaw **11**. Preferably the ends **28***a* and **28***b* of the intermediate arm of the Z spring extend in substantially abutting relation to the top and bottom arms of said spring to permit ready flexing of the spring without breaking. In view of the character and disposition of the springs **27** and **28** it will be apparent that both springs are under compression in all jaw shank positions and the bowed spring **27** forms a compressible and dynamic rocking or pivot point for the movable jaw shank which is thereby resiliently suspended through its full angular movement except at its two extreme positions of angular movement.

Fourteen inch pipe wrenches made in accordance with the present invention from forged and heat-treated "Alcoa 75ST Alloy" under test showed a yield point under proof load far in excess of the requirements for 14" malleable iron and steel pipe wrenches as set forth in the federal specification hereinbefore referred to.

Pipe wrenches made in accordance with the foregoing disclosure fully satisfy all the objects of the invention as set forth in the opening statements of this specification and, while we have shown and described a preferred embodiment of our invention, it is to be understood that changes in the details of construction set forth may be made within the range of mechanical and engineering skill without departing from the spirit of the invention as hereinafter claimed.

What we claim is:

1. A pipe wrench the jaws of which are provided with replaceable, interchangeable, wear-resisting jaw inserts, a jaw and the insert therefor being formed with force-fitted, interengaging dovetail mortises and tenons having longitudinal axes extending parallel to the front of the wrench, and a locking pin extending from the front of the wrench and through side walls of the interengaging dovetails at a right angle

to said longitudinal axes, said locking pin having a thickness equal to at least the height of the dovetails and engaging said dovetails substantially throughout their height.

2. A pipe wrench the jaws of which are provided with replaceable, interchangeable, wear-resisting jaw inserts, a jaw and the insert therefor being formed with force-fitted, interengaging dovetail mortises and tenons having longitudinal axes extending parallel to the front of the wrench, and a locking pin extending from the front of the wrench and through side walls of the interengaging dovetails at a right angle to said longitudinal axes, said locking pin being a set-screw having a diameter approximately twice the height of the dovetails and screw-threadedly engaging threads wholly formed in the jaws.

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