July 13, 1943. R. L. ARTHUR 2,324,187

WRENCH

Filed April 5, 1941

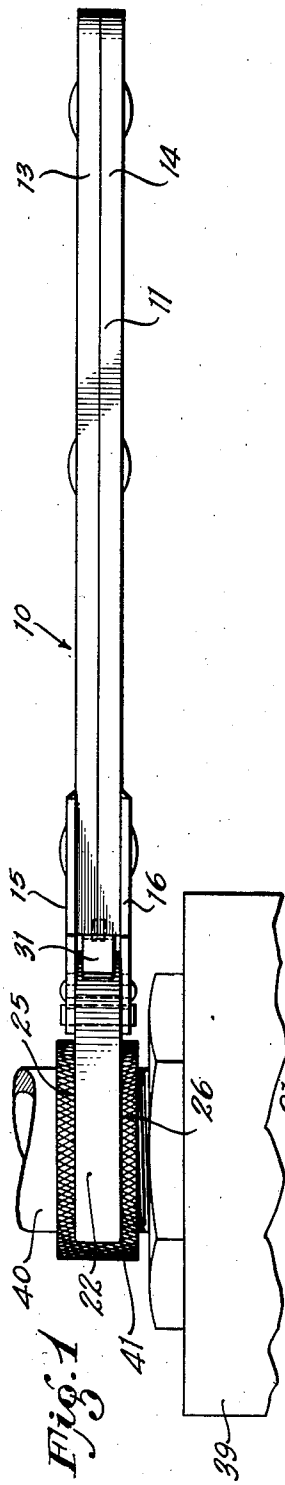


Fig. 1

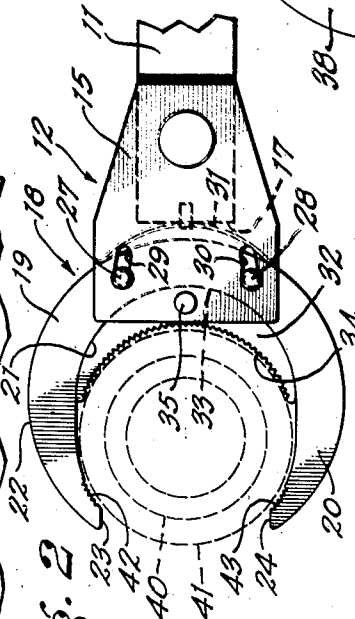


Fig. 2

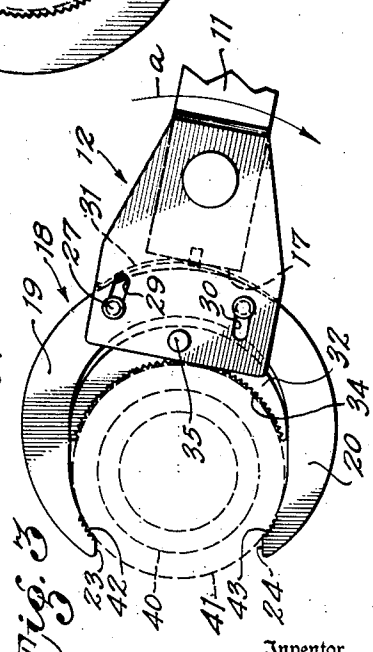


Fig. 3

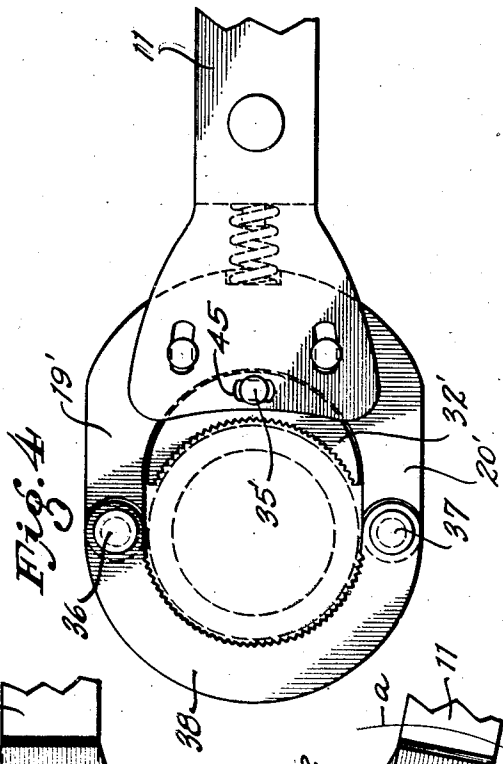


Fig. 4

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Patented July 13, 1943

2,324,187

UNITED STATES PATENT OFFICE

2,324,187

WRENCH

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Application April 5, 1941, Serial No. 387,021

6 Claims. (Cl. 81—91)

This invention relates to a wrench.

In the manipulation of threaded nuts, unions, pipe and tubing, it is desirable to provide a wrench of simple construction which will grip the element to be rotated and impart rotation thereto without requiring adjustment or manipulation of the wrench structure, and while insuring that the gripping jaws will not damage the surface or finish of the member embraced and engaged thereby. It is also desirable to provide a wrench which will act automatically in its gripping action, such for example as when used on parts of uniform and standard dimensions as a part of a piece of machinery to be assembled or dismantled, or specifically when used to tighten or loosen conduit nuts which are standard equipment upon airplanes and the like. It is the principal object of the present invention, therefore, to provide a wrench having object embracing and gripping means which act automatically when pressure is applied to grip and rotate the object while applying uniform and universal pressure to the object, and without possibility of objectionably distorting or marring the object being gripped and rotated.

The present invention contemplates the provision of a wrench having a handle adapted to be gripped at one end and being formed with a head at the opposite end, the head supporting a rigid object embracing member, providing gripping jaws fixed with relation to each other, the embracing member carrying yieldable gripping means acting in cooperation with the embracing member to grip an object automatically incident to the application of pressure to the handle.

The invention is illustrated by way of example in the accompanying drawing, in which:

Figure 1 is a view in side elevation showing one form of the invention and the application to a conduit nut, and further indicating the preliminary position of the wrench in dotted lines.

Fig. 2 is a view in plan showing the wrench.

Fig. 3 is a fragmentary view in plan showing the gripping action of the wrench as torque is applied by pressure on the handle.

Fig. 4 is a view in plan showing a modified form of the invention capable of use as pipe tongs or the like.

Referring more particularly to the drawing, 10 indicates a handle which has a grip portion 11 and a head 12. The handle may be made in any desired manner, although it is here shown as being formed with two complementary longitudinally separate sections 13 and 14 which may be spot welded or otherwise secured together. The head 12 comprises widened plates 15 and 16 which are formed integral with the handle sections 13 and 14, respectively, and project beyond the end face 17 of the handle body. The projecting portion of the members 15 and 16 lie parallel and form an intermediate space into which a substantially crescent shaped jaw structure 18 is positioned, said jaw structure providing diametrically opposite rigid jaw elements 19 and 20 which extend around one entire side of the object to be gripped and continue for a distance around the object to be gripped beyond the transverse plane of the longitudinal center of the object. The inner face of the jaws is represented by a substantially circular face portion 21 which is eccentric to the longitudinal axis of the object to be gripped. The outer face of the jaws is represented by a partial circular face 22 which is eccentric to the inner face and thus forms the jaws with a progressively restricted outer point and a thickened central portion giving strength to the jaw structure 18. The jaws terminate in opposed end faces 23 and 24. These faces are spaced apart a distance preferably less than the diameter of the object to be gripped. This is characteristic of the preferred form of the invention since a practical use of the device is to grip circular nuts which are carried upon members of smaller diameter, the wrench being applied by first passing the small diameter member through the throat represented by the space between the jaw points 23 and 24 and thereafter moving the wrench longitudinally to pass over the circular nut and into an embracing position therearound. It is of course to be understood that the wrench may be readily adapted for use with nuts of other outside contour, such for example as nuts of polygon shape. The rigid jaw structure 18 is made out of a piece of flat stock material so that it has upper and lower faces 25 and 26 which fit between the opposed faces of the portions 15 and 16 of the head and will be guided thereby for a purpose to be hereinafter described. The unit 18 is mounted to float in the plane of the handle of the wrench and to oscillate. This movement is controlled by fulcrum pins 27 and 28 which project from the faces 25 and 26 and into slots 29 and 30. The slots 29 and 30 are substantially parallel to each other and are formed through the plates 15 and 16 of the head 18. These slots are spaced equidistant upon opposite sides of the longitudinal center of the wrench. The outer surface 22 of the rigid jaw unit is spaced from the end face 17 of the handle in order to permit limited movement of the jaw member 18 with relation to the head. Suitable yieldable means, such as a flat spring 31, is interposed between the

face 17 of the handle and the surface 22 of the jaw structure 18, tending to urge the jaw structure 18 to its outermost position while the pins 27 and 28 tend to maintain the jaw structure 18 in its centrally aligned position.

As previously explained, the inner surface 21 of the jaw structure 18 is eccentric to the longitudinal axis of an object to be gripped. In the space between the surface of the object and the eccentric surface 21 a crescent shaped gripping dog 32 is positioned. The back face of this dog, as indicated at 33, is concentric with the portion of the surface 21 of the jaws. A gripping face 34 of the dog is concentric with or substantially conforms to the surface of the object to be gripped. The surface 34 is preferably serrated to increase its frictional engagement with the object to be gripped and rotated. Intermediate the ends of the gripping jaw 32 is a pivot pin 35 which passes through the plates 15 and 16 of the head 12 and will permit limited oscillation of the gripping dog 32 thereon for a purpose to be hereinafter described.

It may be desirable to provide a latch which bridges the throat between the points 23 and 24 of the jaws 19 and 20. A latch of this general character is indicated in Fig. 4 and will be hereinafter described.

Referring particularly to Fig. 4 of the drawing, it will be seen that a substantially identical structure with the one previously described is disclosed, save that the ends of the fixed jaws here indicated at 19' and 20' terminate substantially along the median plane of the longitudinal axis of the object to be gripped and carry latch pins 36 and 37. An arcuate latch element 38 may be secured in position by these pins and will thus insure that in cooperation with a gripping dog 32' substantially the entire circumference of an object to be gripped will be embraced and engaged.

In operation of the present invention the preferred form of the structure is assembled as shown in Figs. 1 and 2 of the drawing. It will be recognized that this invention is particularly adapted for use where an operation is often repeated, such for example as in the assembly and maintenance of airplanes and other machinery where parts of the same kind and dimensions must be often assembled and dissembled. This is particularly true in connection with airplane work where conduit nuts must be tightened and removed. In view of the fact that these nuts are of standard sizes the present invention contemplates that a wrench adapted for this particular operation shall be built so that it can be quickly used without adjustment, and will make it possible for an airplane to be rapidly overhauled, which is a matter of great importance in connection with military operations.

Referring to the dotted line portions of Figs. 1 and 2, 39 indicates a junction box into which a conduit 40 leads and upon which conduit a nut 41 is secured. As indicated in Fig. 2 of the drawing, the outside diameter of the conduit 40 is of a size which will pass through the throat occurring between the faces 23 and 24 of the jaws 19 and 20, after which the wrench is moved downwardly on the nut to the position shown in Fig. 1 so that the fixed jaws 19 and 20 and the arcuate surface 34 of the gripping dog 32 will embrace the side surface of the nut 41. It will be evident that due to this arrangement it is possible to provide a maximum bearing surface contact between the jaws and the dog and the outer surface of the nut 41. This eliminates the necessity for an objectionable excessive pressure at any point between the contacting surfaces of the wrench and the object being gripped. This has two particular advantages: one is that it does not mar the gripped object, and furthermore that it does not distort the object so that a suitable ground connection would be obtained as in the case of the use of a conduit nut.

After the wrench has been positioned as shown in Figs. 1 and 2, pressure may be applied to the handle 10 in either direction, such for example as in the direction of the arrow *a* shown in Fig. 3. When pressure is applied the handle structure swings on one of the fulcrum pins 27 or 28 and in this particular instance the pin 27 would act as a fulcrum. As the handle swings around this fulcrum the pin 28 will pass along slotted opening 30. The slotted openings 29 and 30 have been described as being substantially parallel. It is to be understood that they are so positioned as to be tangentially disposed to the arc described by the fulcrum pin moving therein. This will place them at a slight angle to each other. As the handle swings on the fulcrum 27 the pivot pin 35 will swing on the arc on the fulcrum pin 27 and toward the object being gripped. This will carry the gripping dog 32 forwardly and force it against the surface of the object being gripped so that the entire surface 34 will engage the object being gripped and will act with the arcuate gripping faces 42 and 43 respectively of the jaws 19 and 20 to hold the gripped object and to permit rotation thereof. When pressure is relieved the yieldable member 31 will restore the fixed jaw unit 19 to its original position, as shown in Fig. 2 of the drawing, and will temporarily release the object being gripped so that the handle may be swung in a counter-direction to that indicated by the arrow *a* preparatory to another gripping operation. It will be evident that due to the fact that the jaws do not have to be manipulated in any way except by the handle, it is possible to manipulate nuts and the like at remote and inaccessible points, and it will be evident that the action of the wrench may be reversed without any adjustment but merely by a reversal of the direction of pressure as applied to the handle.

In actual practice it has been found that where conduit nuts are involved in the operation it has heretofore been necessary, particularly in military operations, to discard the removed conduit nuts, due to the fact that they are often mutilated. With the present wrench, however, this material is saved, since the uniform pressure upon the nut and the character of the gripping action produced does not distort the shape of the nut or mar its outer surface.

It is also to be pointed out that while the surfaces 34, 42 and 43 have been indicated as being formed in the parts themselves, that these surfaces might be separate elements, either serrated or formed of removable inserts of material having a high coefficient of friction, such for example as "Bakelite."

Attention is directed to the fact that in Fig. 4 of the drawing pivot pin 35' is carried by the gripping dog 32' and extends through a slotted opening 45. This opening extends transversely of the longitudinal axis of the wrench and will permit lateral adjustment of the gripping dog 32' with relation to the object gripped. It is to be understood that this construction might be

employed in the form of the invention shown in Fig. 2 if desired.

While I have shown the preferred form of my invention as now known to me, it will be understood that various changes may be made in combination, construction and arrangement of parts by those skilled in the art, without departing from the spirit of the invention as claimed.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. A wrench, comprising a rigid handle, object embracing means including a pair of rigid jaws having a laterally open throat and embracing more than one-half of the circumference of an object to be gripped, said jaws engaging the object near the ends of the jaws, means articulately mounting said embracing means at one end of the handle for movement in the normal pressure plane of the wrench, a gripping dog disposed between said jaws and centrally pivoted upon a fixed pivot on the handle, whereby relative movement between the handle and the embracing member will force the gripping dog toward the object being gripped and will cooperate with the gripping ends of the fixed jaws in gripping and rotating the same and yieldable means tending to hold the parts in a non-gripping position.

2. A wrench, comprising a rigid handle structure including a gripping portion and a head, a rigid embracing unit including two arcuate jaws having a laterally open throat between their ends and being disposed in fixed relation to each other for encompassing more than one-half of the circumference of an object to be gripped and engaging the object near the ends of the jaws, means articulately connecting said rigid embracing member to the head of the handle while supporting the embracing member in the normal plane of pressure of the wrench and permitting oscillating movement of the embracing means in said plane, an arcuate gripping dog disposed between the fixed jaws and within the confines of the embracing means, a fixed central pivot mounting said gripping jaw upon the head of the handle and whereby pressure applied to the handle in an operating plane will tend to swing the handle with relation to the embracing member and force the gripping dog toward the object embraced by the fixed jaws, whereby to grip and rotate the object.

3. A wrench, comprising a handle including a gripping portion and a head at one end thereof, a rigid embracing unit formed with fixed spaced jaws adapted to encompass an object to be gripped for a distance greater than one-half of its circumference, fixed pins carried by said rigid member and disposed in equal spaced relation to the longitudinal median line of the handle, slotted seats in the head of the handle to receive said pins, whereby the handle may swing with relation to the embracing member using either of said pins as a fulcrum, yieldable means tending to hold the embracing member in its normal central position, an arcuate gripping dog encompassed by said embracing member and disposed between the jaws thereof, and a fixed pivotal mounting for said dog on the head of the handle, whereby relative movement of the head of the handle with the embracing means will force the gripping dog against an object to be gripped and will cooperate with the fixed jaws to grip and rotate the same as pressure is applied to the handle.

4. A wrench, comprising a handle including a gripping portion and a head at one end thereof, a rigid embracing unit formed with fixed spaced jaws adapted to encompass an object to be gripped for a distance greater than one-half of its circumference, fixed pins carried by said rigid member and disposed in equal spaced relation to the longitudinal median line of the handle, slotted seats in the head of the handle to receive said pins, whereby the handle may swing with relation to the embracing member using either of said pins as a fulcrum, yieldable means tending to hold the embracing member in its normal central position, an arcuate gripping dog encompassed by said embracing member and disposed between the jaws thereof, and a fixed pivotal mounting for said dog on the head of the handle, whereby relative movement of the head of the handle with the embracing means will force the gripping dog against an object to be gripped and will cooperate with the fixed jaws to grip and rotate the same as pressure is applied to the handle, said fixed jaws being characterized as forming an entry throat of less width than the outside dimensions of the object to be gripped.

5. A wrench, comprising a handle structure having a gripping portion and a head at one end thereof, an embracing element for an object to be gripped, said embracing element including a pair of jaws fixed with relation to each other and forming a throat at their outer terminating ends of a width less than the diameter of an object to be gripped, the inner surface of the jaws describing a portion of a circle, a pair of fulcrum pins carried by the jaws, one disposed at each side of the longitudinal center line of the wrench, guideways in the head of the wrench and at the outer ends of which said pins normally seat, whereby pressure applied to the wrench handle in the plane of the embracing member will cause the handle to fulcrum in the end of one of said guideways and the other guideway to move along its fulcrum pin, and an arcuate dog disposed between the fixed jaws and pivotally mounted to the head along the plane of the longitudinal axis of the wrench, whereby as the wrench handle swings upon one of its fulcrum pins the arcuate dog will move against an object being gripped and will cooperate with the fixed jaws to grip and rotate the same.

6. A wrench, comprising a rigid handle, object embracing means including a pair of rigid jaws the outer ends of which are spaced apart to form a throat, said jaws embracing more than one-half of the object, means articulately mounting said embracing means at one end of the handle for movement in the normal pressure plane of the wrench, a gripping dog disposed between said jaws and centrally mounted upon a fixed pivot on the handle, whereby relative movement between the handle and the embracing member will force the gripping dog toward the object being gripped and will cooperate with the fixed jaws in gripping and rotating the same, the pivotal connection between the arcuate dog and the head being a pin carried by the dog and extending into a laterally disposed elongated seat in the head.

ROBERT L. ARTHUR.