ABSTRACT: This invention pertains to a self-adjusting locking wrench, having plierlike handles, which firmly and securely grips an object of any size or thickness, within predefined limits, with substantially the same amount of pressure. The wrench, utilizing a pair of wedges and toggle link, has a pressure adjustment means for varying the pressure; a quick release lever and an improved toggle link for opening the wrench when it is securely gripping an object, the lever also serving as one of the handles of the wrench.
SELF-ADJUSTING LOCKING WRENCH

BACKGROUND OF THE INVENTION

This invention relates generally to plier-type wrenches and in particular to self-adjusting locking wrenches having plier-like handles interconnected by a toggle linkage, wherein one of the handles serves also as a quick release lever for breaking the set when the jaws are securely locked on a workpiece or object. This invention incorporates an improvement on the wrench of an earlier Pat. No. 26,280, titled Self-Adjusting Plier-Type Toggle Locking Wrench, reissued Oct. 17, 1967.

The earlier wrench utilized a toggle link pivotally connected on one end to the movable handle and at the other end to a first wedge of a pair of coacting wedges. A shoulder on the link engaged the second wedge, and upon moving the movable handle to unlock the jaws, the shoulder pushed the second wedge rearwardly and pulled the first wedge forwardly to break the set between the two wedges, thus permitting the jaws to open. When the pressure adjusting screw was positioned to provide maximum gripping pressure between the jaws, it was found that considerable force was required on the movable handle to break the set between the wedges. In fact an operator would, under the above circumstances, have to use two hands, one on each handle, to open the wrench.

Various release systems have been designed for the conventional toggle wrenches, however, the self-adjusting toggle wrench utilizing the opposed wedges requires greater pressure to break the set. The release systems of the conventional wrenches also provide a release lever separate from the two handles, thus increasing the cost of manufacture and adding to the complexity of manufacture. Furthermore, these release systems were found not to be effective in that in many instances both hands of the operator were actually required to accomplish the release.

SUMMARY OF THE INVENTION

The self-adjusting locking wrench of this invention provides a wrench having a pair of plier-like handles, the first handle having a stationary jaw and the second handle having a movable jaw pivotally connected thereto and also pivotally connected to the first handle, and a toggle linkage means cooperatively connected between the two handles. The linkage means includes a toggle link interconnected to one of a pair of wedges disposed in the first handle and coacts through a shoulder thereon with the second wedge. The second handle serves as a regular handle to close the jaws and as a quick release lever to open the jaws. In the latter event, the lever coacts with the toggle link to break the set between the wedges.

It is an object of this invention to provide a self-adjusting locking wrench with a release mechanism for unlocking the wrench.

Another object of this invention is the provision of a self-adjusting locking wrench having a release mechanism that effectively releases the lock with a minimum of pressure exerted thereon.

A further object of this invention is the provision of a locking wrench having a pair of plier-like handles wherein one of the handles also serves as the release lever.

Yet another object of this invention is to provide an improved toggle link which coacts with the wedges of a self-adjusting locking wrench for breaking the set between the wedges.

A still further object of this invention is the provision of a quick release lever and an improved toggle link for a self-adjusting locking wrench which only requires a slight pressure from the fingers of the hand gripping the handles to unlock the jaws of the wrench.

Still another object of this invention is to provide a self-adjusting locking wrench with a quick release mechanism which is economical to manufacture, rugged in construction and extremely effective in use.

These objects, and other features and advantages of this invention will become more readily apparent upon reference to the following description when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevational view, partly in section, of the wrench of this invention in a locked position;

FIG. 2 is a sectional view taken along the line 2—2 in FIG. 1;

FIG. 3 is a sectional view taken along the line 3—3 in FIG. 1; and

FIG. 4 is a side elevational view, partly in section, of the wrench in an unlocked position.

Referring to the drawings, and particularly FIG. 1, the self-adjusting locking wrench of this invention is indicated generally at 10 and comprises a first handle unit 11, a second handle unit 12, and a self-adjusting locking unit 13 interconnected between the handle units 11 and 12.

The first handle unit 11 (FIG. 1) includes an elongated handle 14, having a U-shaped body portion which forms an elongated recess, and a stationary jaw 16 secured to the forward end of the handle 14. The rear portion of the handle 14 has an upper wall 17 integral with the body which, in conjunction with the U-shaped body, forms a housing 18 that is open at the rearward end thereof. The sidewalls of the housing 18 have laterally disposed, aligned apertures 19 formed therein and the upper and lower surfaces of the housing are parallel, both to each other and to the length of the handle 14. The purpose of the apertures is described hereinafter.

Opposing the first handle unit 11 (FIG. 1) for operative association therewith is the second handle unit 12, having a trian-gularly shaped movable jaw 21 pivotally connected by a pin 22 to the forward end of the handle 14 wherein the movable jaw is operable to coact with the stationary jaw. Pivotally secured on one end thereof to the movable jaw 21 by a pin 23 is a rearwardly projecting, channel-shaped arm 24. The upper wall of the channel of the arm 24 has an indented 25 formed therein which project into the channel generally intermediate the ends of the arm. A combination second handle and quick release lever 26, wherein the lever 26 is substantially greater in length than the length of the arm 24, is pivotally attached intermediate the ends thereof to the other end of the arm 24 at a pivot pin 27. It will be noted in FIG. 1 that the combined length of the arm and lever is substantially equal to the length of the handle. The configuration and action of the lever 26 will be more fully described hereinafter.

The interconnecting, self-adjusting locking unit 13 (FIG. 1) comprises a toggle link 28 pivotally connected on one end thereof to the arm 24 by a pivot pin 29, with the other end thereof extending rearwardly and into the recess formed by the walls of the handle 14. The rearward end of the toggle link 28 is pivotally connected by a pivot pin 31 to the wide end of a first or hinged wedge 32 that is slidable disposed in the recess and housing 18. A second or floating wedge 33, also slidable disposed in the housing 18, is separated from the hinged wedge by a plate 34 having parallel planar upper and lower surfaces. Projecting laterally from each of the plate 34 is a holding lug 36. It will be seen in FIG. 2 that the lugs 36 are wider than the width between the inner walls of the housing 18, whereby in assembly, the separation plate is inserted into the housing at an angle and then turned into position. As positioned in FIG. 2, the lugs 36 project into the apertures 19 and prevent forward or rearward movement of the plate in the housing 18, however vertical movement therein is permitted. Although the plate 34 has been defined as having parallel planar outer surfaces, it is not intended to limit the invention thereby, and other means of separation are possible, for example, nonparallel surfaces, ball bearings, etc. Without a separation plate between the wedges, the friction therebetween becomes too great to overcome when in a locked position, thus preventing the opening of the jaws.
A stop 35 (FIG. 4) or indent is formed in both sidewalls of the handle 14 which protrudes into the recess forward of the hinged wedge 32. The stop prevents forward movement of the hinged wedge beyond a predetermined position when the wrench is in an open position.

The wedges 32 and 33 (FIG. 1) are arranged with the wide end of the hinged wedge disposed toward the jaw end of the wrench and the wide end of the floating wedge disposed away from the jaw end of the wrench. Secured, as by welding, to the forward end, or narrow end, of the floating wedge and projecting forward therefrom is a threaded shaft 37. Threadably connected to the shaft 37 is a knurled nut 38 having an annular recess 39 formed in the periphery thereof, wherein the forward end of the nut always projects forwardly of the forward end of the shaft. The toggle link 28 has a rearwardly facing shoulder 41 formed therein substantially forward of the opening for the pivot pin 31. The shoulder 41 is accurately formed and coats in a camlike action with the forward wall 42 of the nut 38.

A resilient means 43 (FIG. 1), such as a tension spring, is connected at one end to the movable jaw 21, intermediate the pivot pin 22 and 23 connections, and at the other end to the forward end of a connector 44. The connector 44 is generally U-shaped with the closed end bent to project normally to the longitudinal axis of the main body. The open ends of the connector are bent to form hooks for engaging the other end of the resilient means 43. It will thus be noted in FIG. 4 that the main body of the connector is disposed around the toggle link 28 and the closed end is looped around the knurled nut 38 and seated in the recess 39. The spring 43 and connector 44 are provided to resiliently pull the jaws open when the lever 26 is moved away from the handle 14 and more importantly to position the floating wedge 33 against the shoulder 41. The biasing of the floating wedge 33 against the shoulder accredits the positioning of the wedge 33 for the various sizes of workpieces placed between the jaws.

The forward end 46 of the quick release lever 26 (FIG. 1 and 3) is disposed in the channel of the arm 24, with the upper surface 47 thereof disposed substantially parallel to and spaced from the inner wall 48 of the arm and with the forward most portion thereof in juxtaposition with the indent 25. The indent 25 serves as a stop to prevent downward pivotal movement of the other end 49 of the lever 26. A portion of the lower surface 51 (FIG. 1) of the lever forward end is machined at approximately a 17° angle to the upper surface 47 to provide a flat surface 52 which is disposed in juxtaposition with the toggle link when the lever is in the closed position. However, the angle of the flat surface 52 is dependent on the dimensions of the various linkages and parts of the wrench, and will vary accordingly. The point 55 between the flat surface 52 and the forward portion of the lower surface 51 acts as a cam in aiding the opening of the wrench (FIG. 4).

In operation, at the start of the closing cycle the forward wall of the hinged wedge 32 (FIG. 4) lies against the stop 35. The spring 43 holds the jaws open and pulls the floating wedge fully forward against the shoulder 41 of the toggle link 28 and also holds the hinged wedge against the stop. The wedges are now free and ready for repositioning and the nut can be positioned to adjust the desired clamping pressure of the pin 21.

Movement of the combination second handle and quick release lever 26 from FIG. 4 position toward a FIG. 1, or closed position, causes the toggle link 28 to push the hinged wedge rearwardly and the shoulder 41 to push the floating wedge 32 rearwardly. The plate 34 adjusts upwardly automatically as the wedges move to the rear. Rearward movement of the wedges continues until the floating wedge 33 engages its engagement about the pin 36. At this point the spring 43 cannot overcome the friction between the wedges and the plate and the floating wedge cannot move forward. The floating wedge 33 and the plate 34 are in a locked condition and continued closing action of the lever 26 causes the hinged wedge 32 to move rearwardly for a short distance jaming the wedges in the housing and latching the wrench jaws.

When the lever is fully moved into a closed position (FIG. 1), the pivot pin 29 is disposed over the center of a line running between the pins 23 and 31. To snap over this theoretical line, the link 28 is compressed and the pins 23, 29 and 31 are placed under a deflecting force thus, if effect, causing the link and pins to store energy.

To open the wrench, pivotal movement of the lever 26 (FIG. 1) away from the handle causes the surface 52 to push against the link, thus pivoting the arm 24 about the pin 23. Partial rotation of the arm 24 causes the link 28 to pivot about the pin 31 until the pin 29 is in alignment with the pins 23 and 31. When the lever is fully pivoted about the pin 27, the rearward edge of the upper surface 47 contacts the inner wall of the arm 48 whereupon continued pressure on the lever causes the arm 24 to rotate upwardly and the forward point of the surface 52 to bear against the link 28 until the pin 29 passes over the centerline. As the flat surface 52 (FIG. 1) walks along the link upper surface, the cam passes the high point 55 and the shoulder 41 contacts the floating wedge 33 thus pushing it rearwardly while the link pulls the hinged wedge 32 forwardly to break the jaw between the wedges, the plate and the housing upper and lower surfaces. By positioning the shoulder substantially forward of the pin 31, the force against the nut by the shoulder 41, as the toggle link 28 pivots about the pin 31, is greatly increased because of the angularity of the forces applied thereto. The moment the centerline is passed, the stored forces in the wrench and the link to an open position without additional pressure on the lever.

Although either the action of the shoulder against the nut or the action of the lower surface of the lever against the link greatly decreases the required pressure to unlock the wrench, the combination of the two allows only finger pressure of the hand grasping the handle and lever to accomplish the same.

Adjustment of the clamping pressure is accomplished by rotating the nut 38 about the shaft 37. Positioning of the floating wedge forwardly by moving the nut rearwardly on the shaft provides greater clamping pressure as the wedges set sooner in the housing. A lesser clamping pressure is accomplished by rotating the nut to move it forwardly on the shaft.

In a normal open position (FIG. 4) the gap between the jaws is approximately three-fourths of an inch. If a greater gap is required, the nut 38 is grasped and moved rearwardly, without rotation, thus pushing the floating wedge rearwardly in the housing. The spring 43 pivots the movable jaw 21 about the pin 22, which action pushes the hinged wedge rearwardly.

Although a preferred embodiment of the invention is described to be hereinabove, it will be remembered that various other modifications and alternate constructions can be made thereto without departing from the true scope and spirit of the invention as defined in the appended claims.

1 claim:

1. A self-adjusting locking wrench comprising in combination:

an elongated handle provided at a forward end with a stationary jaw and at a rearward end with a housing, said housing having parallel planar upper and lower surfaces; a movable jaw pivotally connected to said handle forward end and operable to coact with said stationary jaw; a channel-shaped arm pivotally secured to said movable jaw with the other end thereof projecting rearwardly, said arm having an indent formed in the channel which projects upwardly therein; a toggle link pivotally secured on one end to said arm with the other end thereof extending rearwardly toward said housing, said link having a rearwardly facing shoulder formed thereon substantially forward of said other end; a hinged wedge slidable disposed in said housing and pivotally connected at its wide end to said link other end; separation means disposed in said housing; a floating wedge disposed in said housing and separated from said hinged wedge by said separation means, said wedges arranged with the narrow end of said floating wedge and the wide end of said hinged wedge disposed toward said jaws;
adjusting means adjustably secured to said floating wedge narrow end;
resilient means interconnected between said movable jaw and said adjusting means to bias said adjusting means against said shoulder; and
a lever pivotally attached near its forward end to said arm other end and projecting both rearwardly and forwardly therefrom, said forward end disposed in said channel and having a lower surface a portion of which is normally disposed against said indent and having an upper surface formed to provide a flat portion thereon adapted to contact said link when said jaws are closed, wherein pivotal action on said lever away from said handle forces said lever upper surface to push against said link thus pivoting said arm and unlocking said jaws;
said lever having a length substantially greater than the length of said arm; and the combined length of said arm, lever and movable jaw is substantially equal to the length of said handle.

2. In an adjustable locking wrench having an elongated handle provided with a stationary jaw at one end and an abutment disposed near the other end, a movable jaw pivotally connected to the handle and operable to coat with the stationary jaw, and resilient means interconnected between the movable jaw and the handle for biasing the movable jaw away from the stationary jaw, a quick release mechanism comprising:
an arm pivotally secured on one end to the movable jaw with the other end thereof projecting rearwardly therefrom, said arm being channel-shaped with two upstanding walls and an interconnecting base wall and having an indent formed in said base wall which projects upwardly between said upstanding walls;
a toggle link pivotally secured on one end to said arm with the other end thereof disposed against the handle abutment; and
a lever pivotally attached to a pivot pin disposed between said arm upstanding walls, said lever having a substantially U-shaped forward end with the forward portion of one edge thereof normally disposed against the indent and the rearward portion of said one edge normally spaced from and parallely disposed to said arm base wall, and the forward portion of the other edge projecting upwardly toward said link with the upper portion thereof inclined rearwardly therefrom and then downwardly toward the lever rear end, said other end upper portion forming a flat portion disposed substantially forward of the pivot pin and adapted to contact said link when said jaws are closed, wherein pivotal action on said lever away from said handle forces said lever other edge to push against said link, thus pivoting said arm and unlocking said jaws;
said lever having a length substantially greater than the length of said arm; and the combined length of said arm, lever and movable jaw is substantially equal to the length of the handle.