United States Patent [19]

Wilson

[11] **3,710,658**

[45] **Jan. 16, 1973**

[54] SELF-ADJUSTING WRENCH

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[22] Filed: **Aug. 6, 1971**

[21] Appl. No.: **169,744**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 62,093, Aug. 7, 1970, abandoned.

[52] **U.S. Cl.** **81/367**

[51] **Int. Cl.** **B25b 7/12**

[58] **Field of Search** 81/367–380, 363

[56] **References Cited**

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2,751,801	6/1956	Hostetter	81/378
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Primary Examiner—Robert C. Riordon
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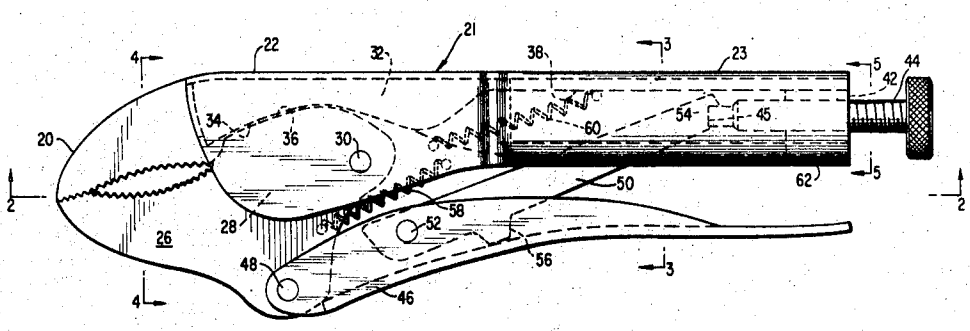
[57] **ABSTRACT**

A self-adjusting locking wrench having a first jaw means and second jaw means movably connected thereto. A first elongated handle portion is fixed to and extends rearwardly from the first jaw means and a second handle portion is pivotally connected to the second jaw means. An elongated cam bar is slidably mounted within the first handle portion and has a forward cam surface for locking engagement with a portion of the second jaw means. A link extends between the second handle portion and the rear part of the cam bar to force the cam bar rearwardly as an object is gripped. As a result, the forward cam surface is wedged against the second jaw means and the wrench is grippingly locked on the object.

10 Claims, 14 Drawing Figures



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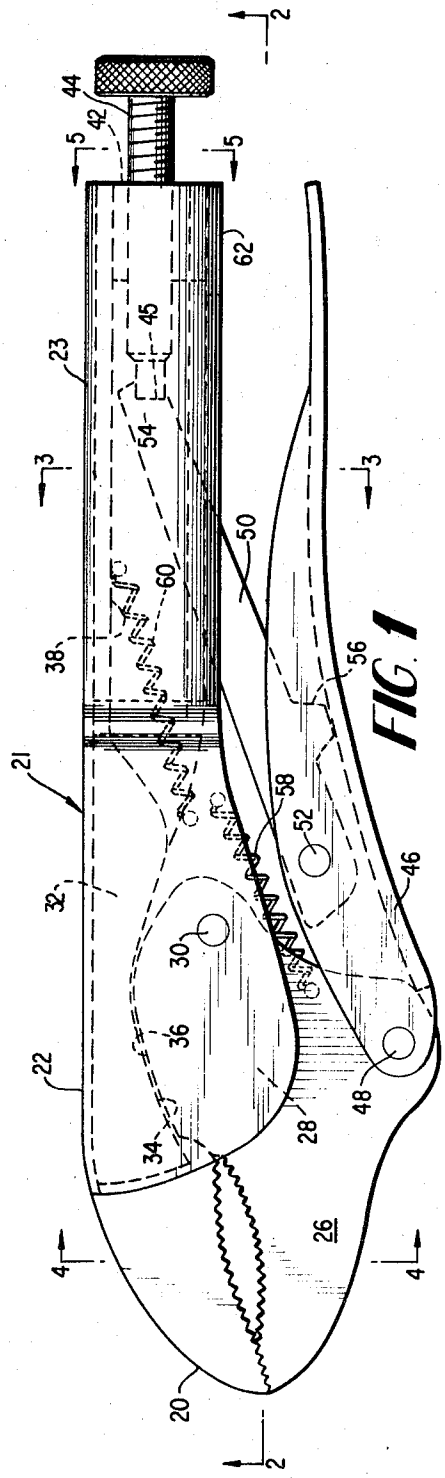

FIG. 1

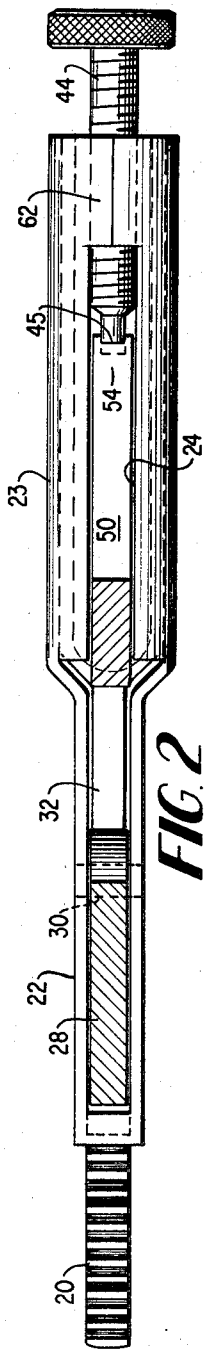

FIG. 2

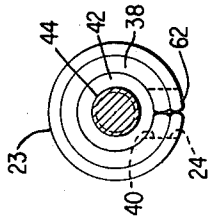

FIG. 5

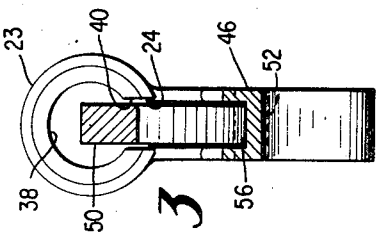

FIG. 3

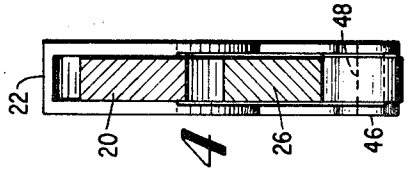

FIG. 4

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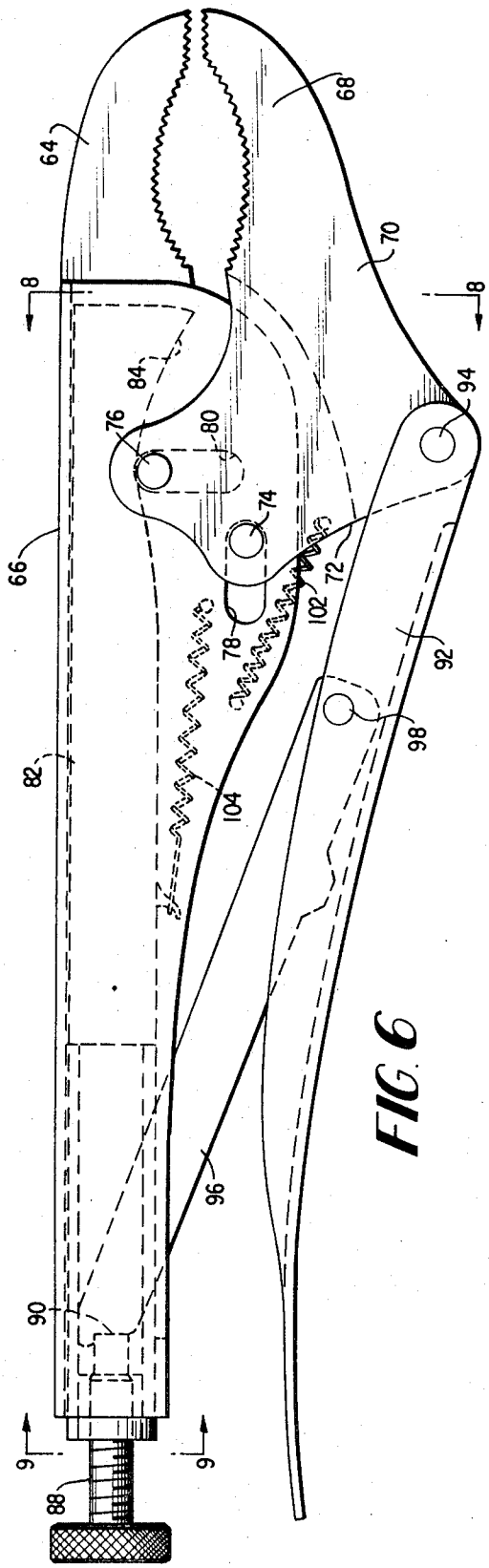

FIG. 6

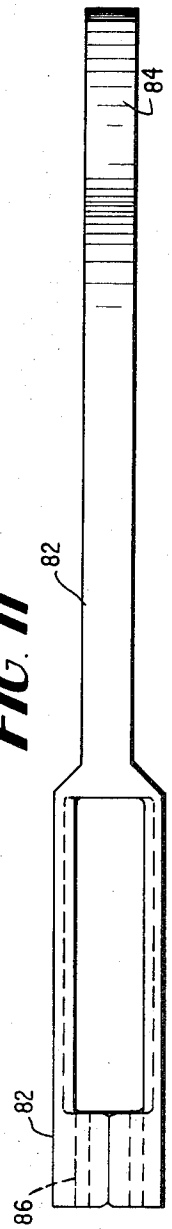

FIG. 11

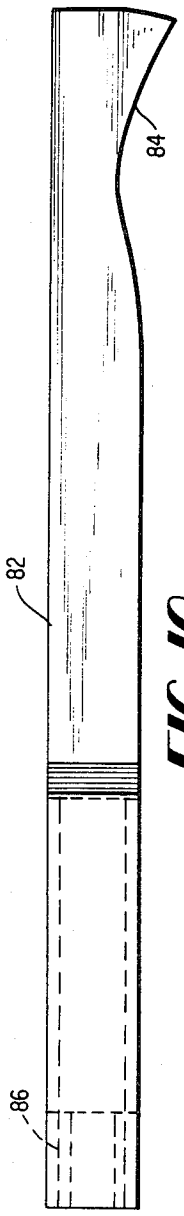

FIG. 10

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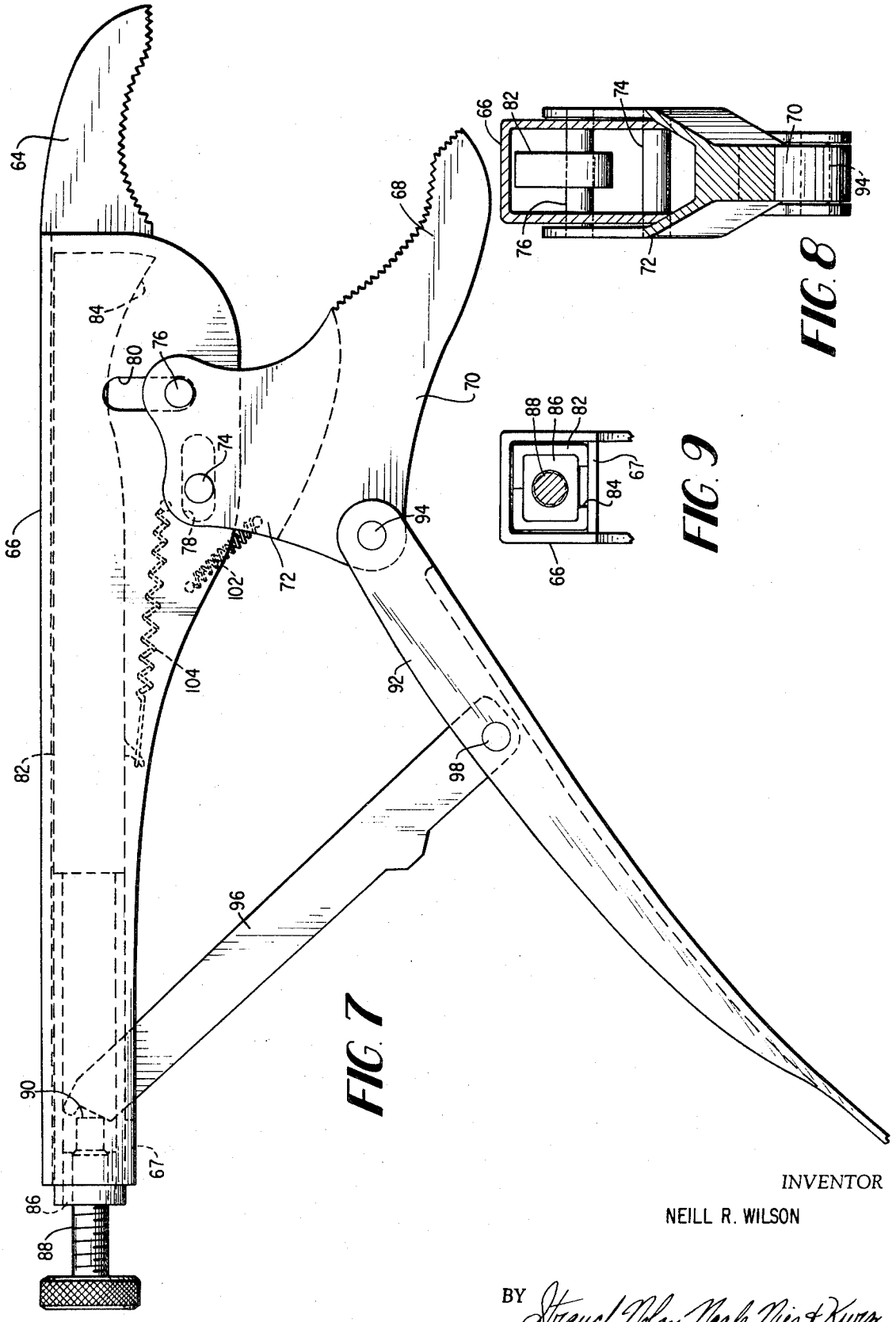

FIG. 7

FIG. 8

FIG. 9

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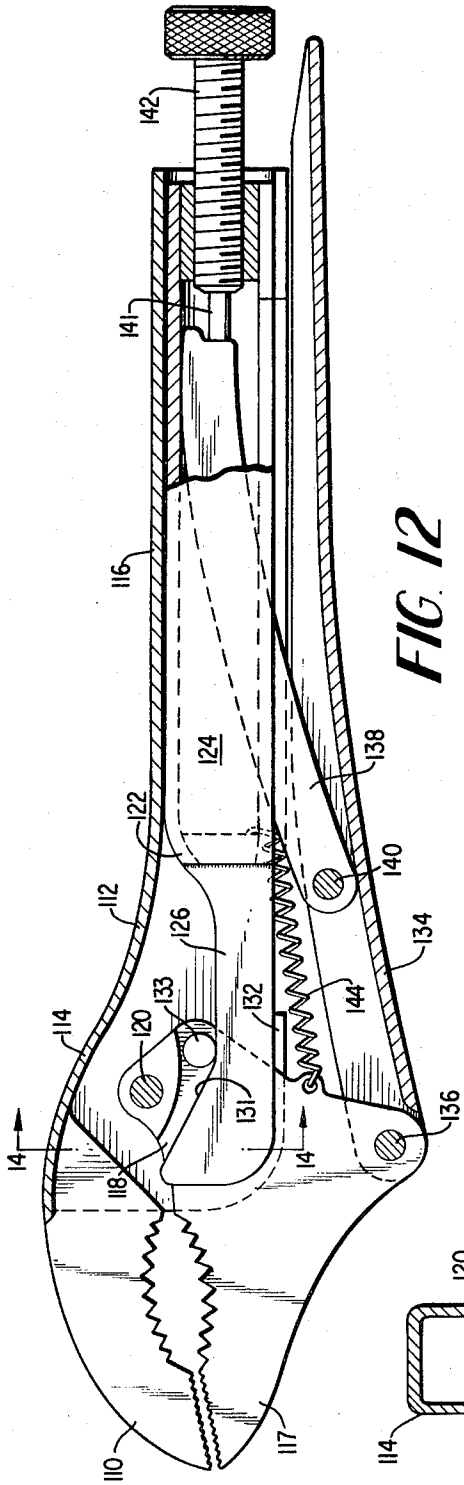

FIG. 12

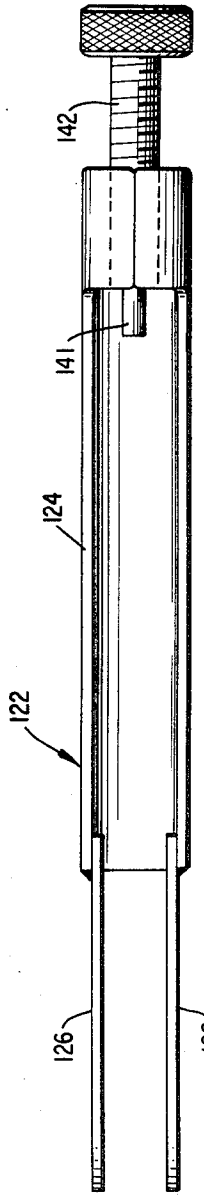

FIG. 13

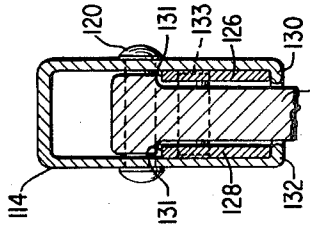

FIG. 14

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SELF-ADJUSTING WRENCH

RELATED APPLICATION

This application is a continuation-in-part of my co-pending application Ser. No. 62,093, filed on Aug. 7, 1970 and now abandoned.

BACKGROUND OF THE INVENTION

This invention is generally related to self-adjusting wrenches of the plier-type and more particularly to a novel, self-adjusting locking wrench capable of gripping objects of various sizes due to the fact that the gripping jaws are automatically adjusted to the thickness of the object, while still applying a selected, substantially constant gripping force regardless of the thickness of the object being gripped.

Self-adjusting wrenches of this type have commonly been used in the past, but have experienced various difficulties considered unsuitable and unreliable by many purchasers. Known prior art devices have generally been quite complex in structure in that they include numerous elements and linkages between the operating jaws and lock-up structural elements and, consequently, when one or more of these elements either slip, wear or become distorted during use of the tool, the effectiveness in maintaining the gripping force on the object is adversely affected. Moreover, the complicated linkages require rather sophisticated manufacturing procedures and as a result increase manufacturing costs of the tool. Examples of typical prior art devices are found in U.S. Pat. Nos. 2,751,801 and 3,104,571. This invention is considered to be a significant improvement over such conventional devices.

Accordingly, a primary object of the invention resides in the provision of a novel, self-adjusting locking wrench which is relatively simple in construction, but yet reliable and dependable throughout a long period of use.

Another object resides in the provision of a novel, self-adjusting wrench which includes a minimum number of parts which simplifies manufacturing operations and reduces overall manufacturing and material costs.

Still another object resides in a novel, self-adjusting wrench capable of usage with various sized objects and readily adjustable to provide a selected, relatively constant gripping force on the object regardless of the size thereof. The wrench may be manipulated with one hand, thereby advantageously freeing the other hand of the operator for other use.

A further object resides in the provision of a self-adjusting wrench which includes a first jaw having an elongated handle means and a second jaw movably connected to the first jaw, with a second handle portion being pivotally connected to the second jaw. An elongated cam bar is slidably mounted within the first handle means and has a forward cam surface which engages a part of the second jaw when an object is being gripped. A link extends between the second handle portion and the rear part of the cam bar and, as the two handle portions are moved toward each other to grip an object, the link forces the cam bar to move rearwardly within the first handle means and thereby wedge the cam surface against the second jaw to lock the wrench on the object being gripped.

Still another object resides in the provision of a self-adjusting wrench as described in the prior objects, wherein an adjusting screw threads through the rear portion of the cam bar and abuts against the rearward end of the link so that the amount of gripping force applied by the jaws on the object may be varied simply by adjustment of the adjusting screw.

Still another object of the invention resides in the provision of a preferred embodiment of the wrench in which the second jaw is pivotally connected to the first jaw and has a cam portion which coacts with the forward cam surface on the slidable cam bar to retain the wrench in a gripping position on the object.

A still further object resides in the provision of another embodiment of the invention in which the second jaw is movably connected to the first jaw by way of a pair of pins which slide in a pair of horizontal and vertical slots, respectively, as the jaws are moved relative to each other, with the cam surface of the cam bar acting against one of said pins to retain the wrench in a locking grip position.

Still further objects and advantages will become apparent from reading the following detailed description of the invention with reference to the accompanying drawings in which like elements are indicated by like numerals. However, the scope of the invention is not limited by the specific embodiments illustrated and described herein, but is determined solely by the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevation view of a preferred embodiment of the self-adjusting wrench of the invention;

FIG. 2 is a fragmented sectional view taken generally along line 2—2 of FIG. 1;

FIG. 3 is a sectional view taken along line 3—3 of FIG. 1;

FIG. 4 is a fragmented sectional view taken generally along line 4—4 of FIG. 1;

FIG. 5 is an end elevation view taken generally along line 5—5 of FIG. 1;

FIG. 6 is a side elevation view of another embodiment of the invention illustrated with the jaws in a substantially closed position;

FIG. 7 is a view similar to FIG. 6, but with the jaws in an open position;

FIG. 8 is a cross-sectional view taken generally along 8—8 of FIG. 6;

FIG. 9 is an end elevation view taken generally along line 9—9 of FIG. 6;

FIG. 10 is a side elevation view of the reciprocating cam bar employed in the embodiment of FIG. 6;

FIG. 11 is a bottom plan view of the cam bar shown in FIG. 10;

FIG. 12 is a fragmentary side elevation view of still another embodiment of the invention;

FIG. 13 is a bottom view of the cam bar employed in the embodiment of FIG. 12; and

FIG. 14 is a fragmentary sectional taken generally along line 14—14 of FIG. 12.

DETAILED DESCRIPTION OF SEVERAL EMBODIMENTS OF THE INVENTION

Referring now to the drawings, a preferred embodiment of the self-adjusting wrench of the invention is il-

lustrated in FIG. 1–5 and includes an upper jaw 20 to which an elongated handle 20 is connected, the handle including a generally U-shaped forward section 22 and a generally rearward circular section 23. Handle sections 22 and 23 have a bottom slotted opening 24 extending substantially throughout their length with the rear end of section 23 being closed on the bottom by a plate-like support 62. A lower jaw 26 has an inner portion 28 received within handle section 22 and pivotally connected thereto by a pivot pin 30.

An elongated cam bar 32 is longitudinally slidably mounted in handle 21 and includes a lower cam surface 34 on its bottom forward end which coacts with an upper cam surface 36 formed on the inner portion 28 of lower jaw 26. The rearward portion 38 of bar 32 is of hollow generally circular construction conforming generally to the shape of handle section 23 and has a bottom elongated slot 40 aligning with slot 24 of handle section 22. The rear end of tubular bar portion 38 is closed by a plug 42 which threadably receives an adjustment screw 44, the knob of which is external of the handle and, therefore, readily accessible to an operator.

A lower, generally U-shaped handle 46 is pivotally connected by pin 48 to lower jaw member 26, and a toggle link 50 is pivoted at one end by pin 52 to handle 46 and has its other end 54 extending upwardly through slots 24 and 40 into movable abutting engagement with the inner stop end 45 of adjustment screw 44. Link 50 also has a flat surface projection 56 which engages the inner surface of handle 46 when the jaws 20 and 26 are closed upon an object and the pivot pin 52 is in an overcenter position relative to an imaginary line extending between the pivot 48 and stop 45.

A first spring 58 extends between handle section 22 and lower jaw 26 to bias jaw 26 toward an open position. A second spring 60 extends between handle section 22 and tubular portion 38 of cam bar 32 and urges the cam bar toward a forward position generally illustrated in FIG. 1.

As shown in FIG. 5, rear portion of cam bar 32 is supported on plate 62 for sliding movement within handle 21.

To use the wrench illustrated in FIGS. 1–5, an operator initially adjusts the screw 44 to a selected position corresponding to the desired degree of gripping force imposed by jaws 20 and 26 upon an object being gripped. As the open jaws are placed over the object, cam bar 32 will be in its forward position and as handle 46 is moved toward handle 21, bar 32 remains in its forward position until the jaws 20 and 26 engage the object. At this time, jaw 26 and, therefore, pin 48 will become stationary and continued movement of handle 46 will cause the rear end 54 of link 50 to extend rearwardly within the tubular portion 38 of handle 21. As this occurs, cam bar 32 will be moved rearwardly with its outer surface in sliding engagement with the inner surface of handle 21 until such time as a portion of cam surface 34 abuts against a portion of cam surface 36 of lower jaw 26 and the cam bar 32 becomes wedged against any further rearward movement. The stop end 45 of adjustment pin 44 then becomes a fixed abutment and the continued closing force on handle 46 by an operator causes the pivot pin 52 connecting link 50 and handle 46 to pass over the imaginary center line extending between the effective fixed points 48 and 45 until the flat surface 56 abuts against the inner surface of handle 46. The jaws 20 and 26 of the wrench are then locked in gripping engagement with the object and cannot be released therefrom until the operator deliberately pushes downwardly on the handle 46 to cause pivot pin 52 to be moved from its locking, overcenter position, at which time the lower jaw 26 will be open under the bias of spring 58 and cam bar 32 will again be released to its forward position by spring 60.

The wrench is of course designed to handle objects within a specific design range and, regardless of the size of the object between jaws 20 and 26 within the range, the amount of gripping force imposed upon the object will be substantially constant for a selected setting of adjustment screw 44. To vary the amount of gripping force, an operator need only adjust screw 44 and thereby effectively change the position of the stop abutment 45 engaging the rear end 54 of link 50.

The design of the cam surfaces 34 and 36 is critical and must be such to insure that, for all sized objects within the design range, the surfaces 34 and 36 will at some portion thereof abut each other to provide a locking wedge between the inner surface of handle section 22 and lower jaw 26 to stop rearward movement of cam bar 32. In effect, the cam surfaces 34 and 36 conform to each other substantially throughout their operating length.

The preferred embodiment of FIGS. 1–5 is particularly advantageous in that all the movable parts of the lower jaw 26 and link 50 are positioned internally within handle 21 and thus are protected from damage which might result from abuse of the tool.

Another embodiment of the invention is illustrated in FIGS. 6–11 and comprises an upper jaw 64 having an elongated generally U-shaped handle section 66 extending rearwardly therefrom, with handle section 66 being open at its bottom side except where it is closed at its rear end by plate 67. A lower jaw 68 has a solid gripping portion 70 and a generally U-shaped mounting portion 72 which extends upwardly along the forward sides of handle section 66. Lower jaw section 72 has a pair of transverse pins 74 and 76 which ride in horizontal longitudinal slot 78 and vertical, transverse slot 80, respectively, formed in the sides of handle section 66, thereby permitting jaw 68 to be opened and closed relative to jaw 64.

An elongated cam bar 82 is longitudinally slidably supported within tubular handle section 66 and includes a lower cam surface 84 at its forward end for abutting engagement with the pin 76 fastened to lower jaw 68. The rear portion of cam bar 82 is generally U-shaped in conformity with the shape of handle section 66 and has a bottom slot 84 aligning with the bottom slotted opening in handle 66. The rear end of bar 82 is closed by a plug 86 through which an adjustment screw 88 threadably extends, with the inner end 90 of screw 88 providing an abutment stop.

A generally U-shaped handle section 92 is pivoted to lower jaw 68 by pivot pin 94 and a link 96 is pivoted at one end by pin 98 to handle 92 and has its other end passing upwardly through slot 84 into the tubular portion of cam bar 82 in movable abutting engagement with the adjustment end stop 90.

A spring 102 extends between handle 66 and lower jaw 68 and biases jaw 68 to an open position. Another spring 104 extends between cam bar 82 and handle section 66 and normally urges cam bar 82 to a forward position.

In use, an operator simply adjusts the readily accessible screw 88 to a selected position corresponding to the desired amount of gripping force at jaw 64 and 68 and then places the jaws around the object to be gripped. As handle section 92 is moved toward handle 66, pivot pin 94 will move forwardly counterclockwise as viewed in FIG. 6, pin 74 will move forwardly in slot 78, and pin 76 will move upwardly in vertical slot 80 until the jaws 64 and 68 come into engagement with the object. Up to this time cam bar 82 will be maintained in its forward position by spring 104. When the object is gripped, jaw 68 and pin 94 become stationary and continued movement of handle 92 towards handle section 66 will cause the rear portion of link 96 to move rearwardly within handle section 66, and due to its abutting engagement with stop 90, the link forces cam bar 82 to move rearwardly within handle section 66. When the cam bar 82 has been moved rearwardly a distance sufficient to enable a portion of cam surface 84 to engage the upper edge of pin 76, the bar becomes wedged between pin 76 and the inner surface of handle section 66 and can no longer move in a rearward direction. At this time, the stop abutment 90 becomes fixed and continued movement of handle 92 toward handle section 66 causes the pivot pin 98 to pass over-center of the imaginary line passing between the effective stops 90 and 94 and handle 92 will then be locked in a gripping position. The object between jaws 64 and 68 cannot be released until the operator deliberately moves handle section 92 in a downward direction away from handle section 66 to move pin 98 to its release position. Spring 102 then biases lower jaw 68 to its open position and spring 104 returns cam bar 82 to its forward release position.

A chief advantage of the embodiment illustrated in FIGS. 6-11 resides in the fact that there is limited surface contact between the cam surface 84 and pin 76 and no dirt or grease is likely to accumulate on the pins 74 and 76 which might interfere with the locking action of the tool.

Another embodiment of the invention is illustrated in FIGS. 12, 13, and 14 and comprises an upper jaw 110 to which the handle 112 is welded, with handle 112 including a generally U-shaped forward section 114 and a rearward section 116 which is identical to the rear handle section 23 in FIG. 1. A lower jaw 117 has an inner portion 118 received within handle section 114 and pivotally connected thereto by pivot pin 120.

An elongated cam bar 122 (FIG. 13) is longitudinally slidably mounted in handle 112 and includes a rearward portion 124 identical in construction to rear portion 38 of cam bar 32 in FIG. 1, and a forward portion formed by a pair of laterally spaced cam elements or fingers 126 and 128 welded to and extending forwardly from portion 124. The bottom surfaces of fingers 126 and 128 rest on a pair of lower lips or flanges 130 and 132, respectively, formed on the bottom edges of handle section 114. The upper surfaces of fingers 126 and 128 provide cam surfaces 131 which coact with the ends of a hardened steel pin 133 that floats within an opening provided in the jaw section 118. Pin 133 of course is prevented from falling out of the opening in jaw section 118 by the side walls of the handle section 114.

As in the embodiment of FIG. 1, a lower handle 134 is pivotally connected to jaw 117 by a pin 136, and a toggle link 138 is pivoted at one end by pin 140 to handle 134 and has its other end extending upwardly through aligned slots in handle section 116 and cam bar section 124 into movable abutting engagement with the inner stop end 141 of adjusting screw 142. A spring 144 extends between jaw 117 and cam bar section 124 to move the elements to an unlocked position when handle 134 is actuated to a release position.

In operation of the embodiment illustrated in FIGS. 12-14, when an object is gripped between jaws 110 and 117, pin 136 will become stationary and continued closing movement of handle 134 will cause the rear end of link 138 to extend rearwardly within tubular portion 116 of handle 112. As this occurs, cam bar 122 is moved rearwardly until the cam fingers 126 and 128 become wedged between the ends of cam pin 133 and the lips 130 and 132. Stop end 141 then becomes a fixed abutment and continued movement of handle 134 places it in an over center, locking position. The jaws then remain in gripping engagement with the object. To release the object, handle 134 is merely moved downwardly to break the wedging engagement between fingers 126, 128, pin 133 and lips 130 and 132.

Particular advantages of the embodiment of FIGS. 12-14 are that the upper jaw 110 may be welded directly within the space available in the forward section 114 of handle 112, and, additionally, the cam surfaces 131 need not be so precisely machined because they coact only with the simple cam pin 133.

From the above description of the several embodiments of the invention, it is apparent that a tool constructed according to the invention has a minimum number of parts and thereby could be readily manufactured at an acceptable cost. In addition, because of the few parts involved, the likelihood of damage and need for repair during use is substantially reduced and an increased life expectancy with dependable and reliable operation is anticipated.

Various other embodiments are visualized as encompassed within the scope of the invention. For example, in another embodiment similar to FIG. 6, the lower pin 74 may simply be fixed to serve as a pivot, and the upper pin 76 may ride within arcuate slots provided in the sides of handle section 66, and a cam surface 84 of a cam bar 82 will operatively cam against the upper pin as the jaws are gripped in a locking position on an object. Also, in some instances it may be desirable to roughen or serrate the cam surfaces 34, 35 and 84 to provide a more positive wedging action of the cam bar in the illustrated embodiments of the invention.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiments are therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

What is claimed and desired to be secured by Letters patent is:

1. A wrench comprising first jaw means having first handle means extending therefrom, second jaw means connected to said first handle means for movement relative to said first jaw means, second handle means pivotally connected to said second jaw means, cam means slidably mounted within said first handle means, said cam means having a forward cam surface for locking engagement with at least a portion of said second jaw means, link means connected at opposite ends to said second handle means and a rear portion of said cam means, whereby upon closing of said jaw means upon an object by moving said first and second handle means toward each other, said link means will cause said cam means to move rearwardly within said first handle means and wedge at least a portion of said cam surface against said portion of said second jaw means and thereby cause said jaws to lockingly grip said object.

2. A wrench as defined in claim 1, said cam means comprising an elongated bar slidably mounted within said first handle means, said bar having a cam surface at its forward end for locking engagement with at least a portion of said second jaw means and a hollow tubular portion at its rearward end, an adjustment screw adjustably positioned in the rearward end of said cam bar and having a terminal stop abutment located within said tubular portion, said link means having one end pivotally connected to said second handle means and its other end connected to said terminal stop abutment within said tubular portion of said cam bar, whereby rearward movement of said other end of said link means will cause rearward movement of said cam bar until said forward cam surface wedges against said portion of said second jaw means with the gripping force of said jaw means being selectively varied by adjustment of said adjustment screw.

3. A wrench as defined in claim 2, wherein said second jaw means is pivotally connected to said first handle means and includes a second cam surface for coacting engagement with the cam surface of said cam bar, whereby said cam bar will be wedged between said second cam surface and said first handle means when said jaw means are lockingly gripped on an object.

4. A wrench as defined in claim 2, said second jaw means comprising first and second pins movably mounted in longitudinal slot means and transverse slot means, respectively, in said first handle means, so that as said jaw means are closed upon an object, said first pin will move forwardly in said longitudinal slot means and said second pin will move transversely in said transverse slot means, with said cam surface of said cam bar engaging said second pin when the wrench lockingly grips an object.

5. A wrench as defined in claim 1, wherein said first handle means is an elongated handle section having an elongated longitudinal slot, said cam means comprises an elongated cam bar having a forward cam surface and a rearward hollow portion with a longitudinal slot aligning with the longitudinal slot of said elongated handle section, adjustment means extending through the rear end of said hollow portion and having a terminal stop abutment within the said hollow portion, said link means having one end pivotally connected to said second handle means and its other end extending through said slots into engagement with said terminal stop abutment, whereby the gripping force attainable by said jaws on an object may be adjusted by proper positioning of said adjustment means.

6. A wrench as defined in claim 5, said second jaw means having an inner portion pivotally mounted within the forward end of said elongated handle section and having a second cam surface coacting with the cam surface on said cam bar to lock the cam bar against rearward movement within the elongated handle section as the first and second jaw means are lockingly gripped upon an object.

7. A wrench as defined in claim 5, said second jaw means comprising first and second pins movably mounted in longitudinal slot means and transverse slot means, respectively, in said first handle means, so that as said jaw means are closed upon an object, said first pin will move forwardly in said longitudinal slot means and said second pin will move transversely in said transverse slot means, with said cam surface of said cam bar engaging said second pin when the wrench lockingly grips an object.

8. A wrench as defined in claim 5, comprising first spring means extending between said second jaw means and said first handle means for biasing said second jaw means toward an open position, and second spring means extending between said first handle means and said cam bar for biasing said cam bar toward a forward release position within said first handle means.

9. A wrench as defined in claim 2, said second jaw means including a cam pin which coacts with the cam surface of said bar to wedge said bar in a locking position.

10. A wrench as defined in claim 9, said elongated cam bar including a pair of spaced cam fingers at its forward end each formed with a cam surface along one edge for coacting engagement with said cam pin, said first handle means having a pair of lips for engaging the other edges of said cam fingers, whereby, when the wrench is locked, said cam fingers are wedged between said cam pin and said lips.

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