

July 15, 1958

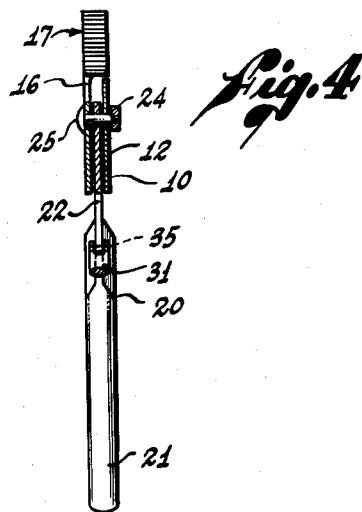
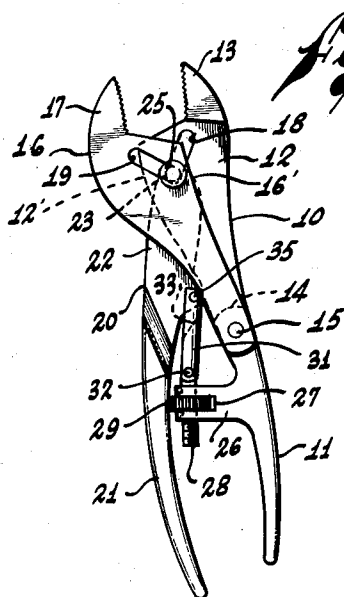
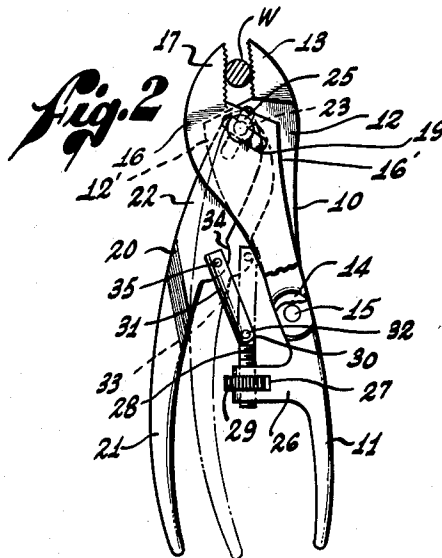
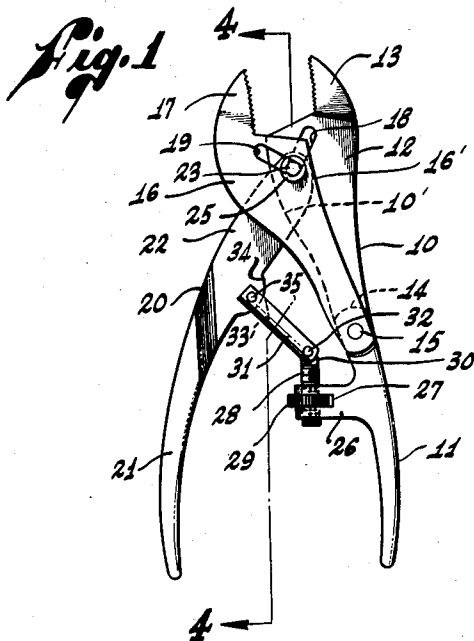
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2,842,996

COMPOUND LEVERAGE TOGGLE LOCKING PLIERS

Filed March 12, 1956

2 Sheets-Sheet 1



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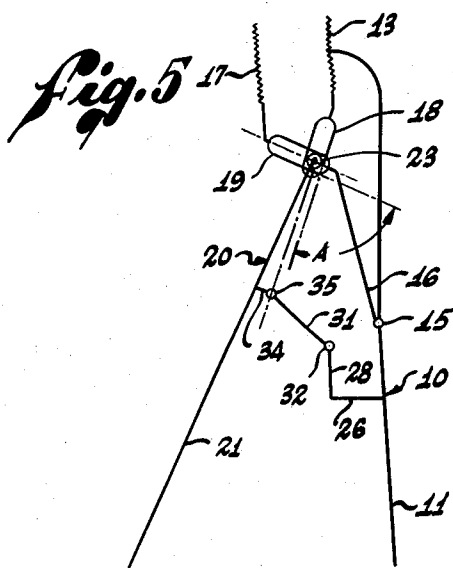


Fig. 6

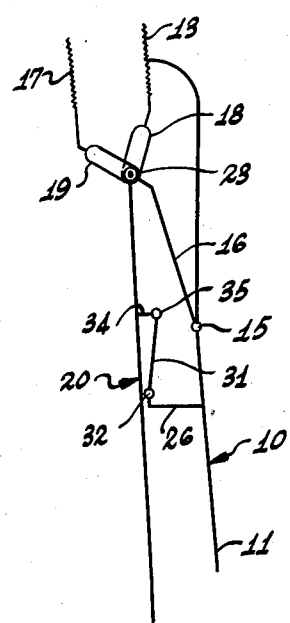
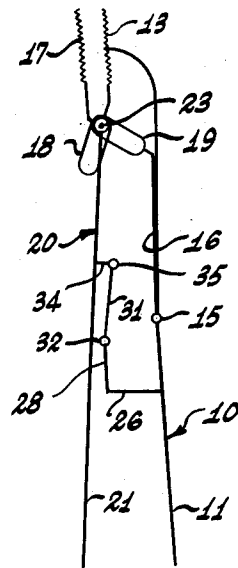


Fig. 7

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COMPOUND LEVERAGE TOGGLE LOCKING PLIERS

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6 Claims. (Cl. 81—378)

This invention relates generally to manually operable gripping tools and more particularly to a compound leverage, toggle lock plier.

Both toggle operated, or toggle lock, plier type tools and compound leverage plier type tools are generally well known in the art and each has certain distinct advantages which render it especially desirable as a manually operable gripping tool. This invention is concerned with, and has as its primary object the provision of, a plier type tool which embodies a compound leverage action and a toggle operating, or toggle locking arrangement and which, accordingly, possesses all the desirable features of both of the above mentioned types of plier tools.

Existing forms of these two types of plier tools have certain inherent disadvantages which render them unsatisfactory in certain applications. Thus, while compound leverage pliers enable a greatly increased gripping force to be applied to a workpiece, such pliers generally have no locking feature which enables the gripping jaws to be locked in gripping engagement with the workpiece. Such a locking arrangement, of course, is desirable since it permits the tool to be used both as a conventional plier and also as a clamp permitting removal of the operator's hands from the tool without release of the workpiece.

Existing toggle operated toggle lock pliers, on the other hand, are generally of sheet metal construction with the result that their cost of manufacture is relatively high and their size is excessively large and cumbersome. Moreover, since the handle members of these existing toggle operated pliers are fabricated of sheet metal, rather than being of solid metal construction, they are necessarily provided with wide side flanges so as to afford the required rigidity and strength. In order, therefore, to permit efficient gripping of the plier handles, opposing edge surfaces of the side flanges of the handle members are moved into close proximity when the jaws are closed to gripping position. Painful injuries are often sustained by users of the pliers due to pinching of the hand between such opposing edges of the flanges. Also, the hand operating the plier is prone to being pinched between the overlying flange portions of the handle members, adjacent the pivotal connection of the latter, and the relative thinness of the metal of the handle members results in the edges thereof being relatively sharp.

Accordingly, another object of this invention is the provision of a compound leverage plier whose gripping jaws may be locked in gripping engagement with a workpiece.

Still another object of the invention is the provision of a toggle operated plier which embodies a compound leverage action and which further avoids the foregoing and other deficiencies of existing toggle operating pliers.

A further object of the invention is the provision of a toggle operated plier which is relatively simple in construction, economical to manufacture, and compact in size.

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Still a further object of the invention is the provision of a toggle operated plier, embodying a compound leverage action, which substantially eliminates the possibility of injury to the user.

Yet a further object of the invention is the provision of a compound leverage, toggle operated plier wherein the toggle elements are movable past a dead center position so as to enable the two gripping jaws to be clamped on a workpiece and wherein further the toggle mechanism is fully adjustable to permit locking thereof over a wide range of jaw openings while retaining a convenient handle separation.

These and other objects of the invention are attained in the illustrative embodiment thereof by the provision of a first handle member integrally carrying a first gripping jaw at one end and having pivoted to an intermediate point thereof one end of an arm integrally carrying a second gripping jaw at its other end, the second jaw being movable into gripping relationship with the first jaw upon pivotal movement of the arm. The arm and first handle member are formed with intersecting, relatively inclined cam slots in which are guided opposite ends of a pin carried at one end of a second handle member which extends into a space between the arm and first handle member. Toggle means are connected between the handle members for moving the pin along the slot in the first handle member upon movement of the handle portions of the members together, with the resultant movement of the second jaw toward the first jaw by virtue of a camming action between said pin and the walls of the slots. The pivotal connection of the toggle means to one of the handle members may be adjustably positioned in a manner to permit locking of the toggle means, for a given handle spacing, over a wide range of jaw openings.

A better understanding of the invention may be had by reference to the following detailed description taken in conjunction with the annexed drawings wherein:

Fig. 1 is a side elevation of the present plier with its jaws separated;

Fig. 2 is a view similar to Fig. 1 but with the jaws closed to gripping engagement with a workpiece, the toggle locking position of the plier handles being shown in phantom lines;

Fig. 3 is a side elevation of the present plier in toggle locking position with the toggle locking means set for maximum jaw opening;

Fig. 4 is a section taken substantially along line 4—4 of Fig. 1; and

Figs. 5—7 are line diagrams illustrating the operation of the present plier.

Reference is now made to Figs. 1—5 of the drawings wherein a preferred embodiment of the invention is shown as comprising a first handle 10 which is arcuately formed at one end, as shown at 11. Handle 10, adjacent its other end, is flattened, as at 12, and has a first gripping jaw 13 formed at said other end which jaw projects above the flattened portion as shown.

Handle 10 is stepped at the lower end of flattened portion 12 to provide, in effect, a boss 14 having an upper planar surface spaced above the flattened portion 12 but below the adjacent side surface of handle 10. Extending through boss 14 is a threaded bore in which is fixed a pivot pin 15 for pivotally connecting one end of an arm 16 to the first handle 10. Pin 15 has an enlarged head flush with the outer surface of the arm.

Arm 16 is of a thickness to make its outer surface flush with the outer surface of arcuate portion 11, the opposite surface of the arm being spaced from the flattened portion 12 of handle 10 a distance equal to the height of the boss 14.

The other end of arm 16 is formed to provide a second

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gripping jaw 17 which projects beyond said opposite surface of the arm so as to be coplanar with the first jaw 13. It will be apparent that jaws 13 and 17 may be brought to gripping engagement with a workpiece W by pivotal movement of arm 16 on the handle 10.

Handle 10 and arm 16 are shaped to provide overlying portions 12' and 16', respectively, adjacent their jaws 13 and 17, which overlying portions are, respectively, formed with intersecting, relatively inclined cam slots 18 and 19. Slots 18 and 19 are each inclined toward the jaws on their respective parts, as shown.

Indicated at 20 is a second handle having one end arcuately formed, as shown at 21. The opposite end portion of the second handle is flattened on opposite sides to form a blade-like extension 22 disposed in a plane centrally of the sides of arcuate portion 21. The free end portion of extension 22 is positioned between arm 16 and flattened portion 12 of the first handle and fixedly carries a transverse pin 23.

One end of pin 23 is slidably guided in slot 18 in handle 10 and fixedly carries thereon a nut 24 bearing against the outer side of handle 10 at opposite sides of slot 18. The other end of pin 23 is slidably guided in slot 19 in arm 16 and has an enlarged head 25 bearing against the outer surface of the arm at opposite sides of slot 19.

Projecting toward second handle 20 from first handle 10, adjacent the pivotal connection of arm 16 to the first handle, is a toggle support 26 which has its free end slotted at 27 in a plane normal to the plane of pivotal movement of the handles 10 and 20 and arm 16. Extending through the furcations formed by slot 27, and normal to the slot, are coaxial bores for slidably receiving a threaded pin 28. Threaded on pin 28 and positioned in slot 27 is a generally disk-shaped adjusting nut 29 whose peripheral edge is serrated, as shown, to facilitate manual rotation thereof for reasons to be presently seen.

The upper end of threaded pin 28 is flattened at its opposite sides and formed with a bore to provide an apertured tongue 30 which is pivotally connected within a groove in one end of a toggle link 31 by a pivot pin 32. The other end of link 31 is longitudinally, diagonally slotted at 33 on that side thereof facing second handle 20 for receiving a generally semi-cylindrical tongue 34 projecting from the edge of extension 22 of second handle 20. A pivot pin 35 extends through the toggle link 31 and tongue 34 for pivotally connecting the link to the second handle. Handles 10 and 20 and link 16 are preferably of forged metal construction in the fashion of conventional pliers.

The action of the present toggle operated plier will be described by reference to Figs. 5 through 7, wherein the plier is illustrated in line diagram fashion. In these figures, the lines representing the different elements of the plier having been designated by the same numerals used to designate such elements in the preceding description.

It will be seen from Figs. 5 through 7 that movement of pin 23 along slot 18 in handle 10 toward first jaw 13 results in a camming action between pin 23 and one wall of slot 19 in arm 16. This camming action, as may be seen from the drawing, produces on arm 16 a torque about the pivotal axis 15 of the latter in a direction to move second jaw 17 toward first jaw 13. Movement of pin 23 in the opposite direction along slot 18 produces a camming action between pin 23 and the other wall of slot 19 which causes movement of second jaw 17 away from first jaw 13. It will be apparent that the jaw closing force generated by this camming action and acting on the arm at a point spaced from the pivotal axis 15 thereof provides, in effect, a compound leverage action.

The toggle means, comprising the toggle link 31, is provided for producing the aforementioned movement of

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pin 23 along slot 18, and resultant closing and opening of jaws 13 and 17, upon closing and opening movement of handles 10 and 20. Thus, it will be seen that as handle 20 is swung toward handle 10 about pin 23 as a pivot, toggle link 31 is pivoted toward handle 10 about its axis 32 with a resultant straightening out of the toggle linkage comprising the toggle link 31 and the portion of handle 20 between the upper toggle link pivot 35 and pin 23. This straightening out of the toggle linkage results in a force being applied to pin 23 to move the latter along slot 18 toward jaw 13 and move jaw 17 toward jaw 13.

It will be apparent from Fig. 5 that the camming force exerted on arm 16, and hence the torque acting to move jaw 17 toward jaw 13, will be a function of the included angle A between the slots 18 and 19. It will also be apparent that the torque applied to arm 16, for a given closing force applied to the handles 10 and 20, and hence the mechanical advantage, or compound leverage action, of the plier, may be varied by changing the angle A.

Sufficient closing of the handles 10 and 20 will cause the upper toggle link pivot 35 to move past its dead center position (Figs. 6 and 7), that is, past a line extending through pin 23 and lower toggle link pivot 32, so that the toggle will lock and the jaws will clamp on the work. The toggle link 31 is retained in this toggle locking position by abutment of its upper end against arm 16, as shown in Fig. 3.

From an inspection of the drawings, and especially Figs. 6 and 7 thereof, it may be seen that by adjustment of the position of lower toggle link pivot 32 toward or away from the jaws 13 and 17 by rotating adjusting nut 29 to axially position the threaded stem 28, the separation of the jaws 13 and 17, in the locking position of the toggle linkage may be varied so that the plier may be clamped on workpieces of various sizes. Also it will be noticed that the handle separation remains substantially unchanged so that a convenient handle separation is maintained in all locking positions of the toggle linkage.

It will be apparent from the foregoing that there has been described and illustrated a compound leverage, toggle operated plier which is fully capable of attaining all of the objects and advantages heretofore set forth.

While a preferred embodiment of the invention has been disclosed, it is not intended that the invention shall be restricted thereto but only by the spirit and scope of the following claims:

We claim:

1. A compound leverage, toggle operated plier comprising: a first handle member including a first gripping jaw, a jaw member pivoted on said handle member and including a second gripping jaw opposed to and movable toward the first gripping jaw upon pivotal movement of the jaw member, a second handle member, means rotatably and movably mounting one end of said second handle member on the first handle member for movement of said one end along a given linear path with respect to the first handle member, means rotatably and movably mounting said one end of the second handle member on said jaw member for movement of said one end of the second handle member along a linear path with respect to said jaw member inclined relative to the first mentioned path, and means connected between the handle members for moving said one end of the second handle member along said one linear path in a direction to move said second gripping jaw toward the first gripping jaw upon movement of the handle members together.

2. A toggle operated plier comprising: a first handle member formed with a first gripping jaw at one end, an arm pivoted at one end to an intermediate point of said first handle member and formed at its other end with a second gripping jaw opposed to and movable toward the first jaw upon pivotal movement of the arm, a second handle member, means mounting one end of said second

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handle member on said first handle member and arm for rotation about an axis passing through said one end of the second handle member parallel to the pivotal axis of the arm and for movement along a first linear path with respect to the first handle member and movement along a second linear path with respect to the arm, said paths being relatively inclined, and toggle means connected between the handle members for moving said one end of the second handle member along said first path in a direction to move said arm and second gripping jaw toward the first gripping jaw upon movement of the handle members together.

3. A compound leverage, toggle operated plier comprising: a first handle member formed with a first gripping jaw at one end, an arm pivoted at one end to an intermediate point of the first handle member and formed at its other end with a second gripping jaw opposed to and movable toward the first gripping jaw upon pivotal movement of the arm, the arm and first handle member being laterally spaced adjacent their jaws, a second handle member having one end positioned between the arm and second handle member, said one end of said second handle member carrying a transverse pin, linear guide means in said arm and first handle member for rotatably and slidably receiving opposite ends of said pin, said guide means being relatively inclined in a manner to cause said second gripping jaw to be cammed toward the first gripping jaw upon movement of said pin in one direction along the guide means in said first handle member, and means connected between the handle members for moving the pin in said one direction upon pivotal movement of second handle member toward the first handle member about said pin as an axis.

4. The subject matter of claim 3 wherein said guide means comprises a slot formed in each of said arm and first handle member, said slots having ends adjacent the jaws and ends remote from the jaws, said slots being inclined toward the jaws of their respective parts in the direction of said adjacent ends thereof.

5. A compound leverage, toggle operated plier comprising: a first handle member formed with a first gripping jaw at one end, an arm pivoted at one end to said handle member and formed at its other end with a second gripping jaw opposed to and movable toward the first gripping jaw by pivotal movement of the arm, said arm and first handle member having laterally spaced, overlying portions adjacent said jaws, said overlying portions having linear, overlying slots formed therein, said slots

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having ends adjacent the jaws and ends remote from the jaws, said slots inclining toward the jaw on their respective parts in the direction of said adjacent ends, a second handle member having one end positioned between said arm and first handle member and carrying a transverse pin having opposite ends rotatably and slidably guided in said slots, and toggle means comprising a toggle link having one end pivoted to the first handle member and the other end pivoted to the second handle member at a point nearer said jaws than the pivot at one end of the link.

6. A compound leverage toggle operated plier comprising: a first handle having a gripping jaw at one end, an arm pivoted at one end to an intermediate point of said handle and formed at its opposite end with a jaw opposed to and cooperable with said first mentioned jaw, said handle and arm being formed with relatively inclined, overlying cam slots, a second handle having a pivot carried by the forward end portion thereof, said forward end portion of the second handle being positioned between said arm and first handle member, said pivot projecting beyond opposite sides of said end portion of the second handle and extending slideably and rotatably into said cam slots, said pivot being movable along the slot in said first handle to cam said jaw carrying arm toward or away from said first handle, a toggle link pivotally connected at one end to an intermediate point of said second handle and at its opposite end to said first handle, so that said second handle is movable toward and from said first handle by fulcrum action on said first handle and toggle straightening action occurs in the toggle formed by said toggle link and the portion of said second handle between the point of said fulcrum action and said intermediate point of said second handle to cause said movement of said pivot along said slot in the first handle.

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