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TOGGLE OPERATED PLIERS

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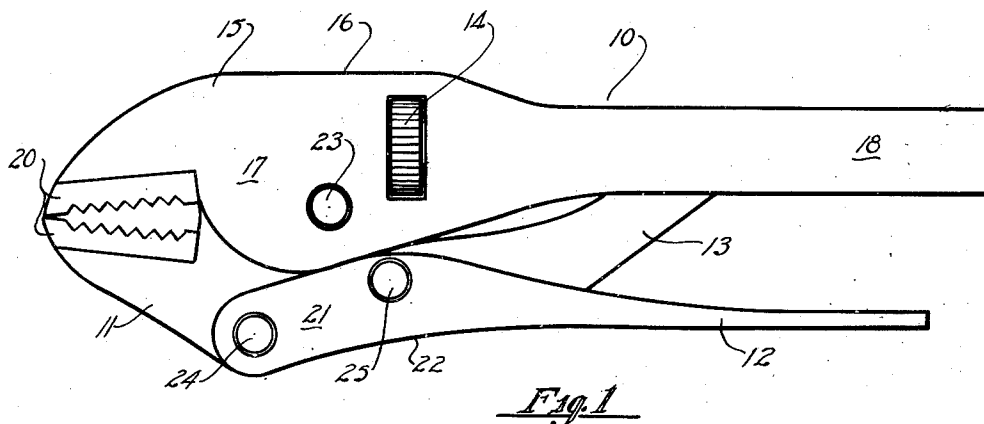


Fig. 1

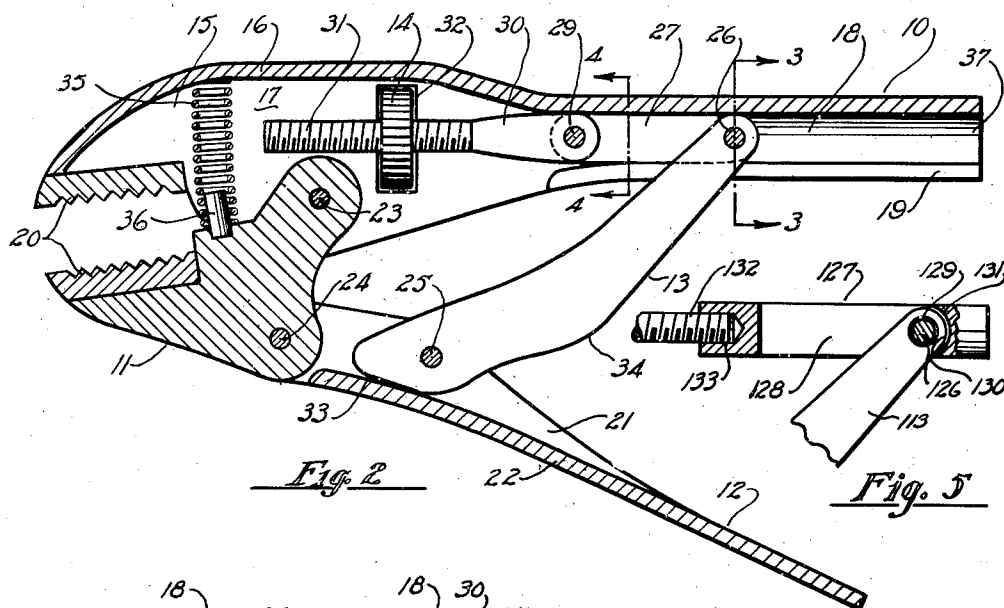


Fig. 2

Fig. 5

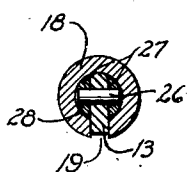


Fig. 3

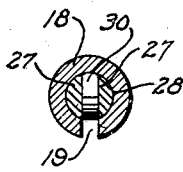


Fig 4

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TOGGLE OPERATED PLIERS

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8 Claims. (Cl. 81—84)

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This invention relates to hand tools; and, more particularly, to toggle actuated pliers in which the toggle linkage is adjustable to vary the locking displacement of the jaws of the pliers.

The use of a toggle linkage in pliers is, of course, old in the art; as is the use of adjusting means to vary the effect of the toggle linkage to obtain different degrees of displacement between the jaws of the pliers when in locking position. Normally, such pliers include a handle having one of the plier jaws at one end and a slidable mounting for a toggle link at the other end. The co-operating plier jaw is pivoted to the handle and an activating lever is pivoted to the co-operating jaw laterally of the point of pivotal attachment with the handle. The other end of the toggle link is pivoted to the activating lever rearwardly of the point of attachment of the lever to the co-operating jaw and relatively forwardly of the slidable mounting referred to above. The mounting itself usually takes the form of an inwardly opening slot in the handle with a relatively restricted opening extending longitudinally of the handle and the link has an enlarged end slidable within the slot and restrained therein by the restricted opening. The rearward end of the handle is tapped and a bolt is threadedly mounted in it with the shank extending into the opening and adapted to bear against the enlarged end of the link. The head of the bolt lies rearwardly of the handle and by rotating it, the bolt may be advanced or retracted causing a corresponding movement in the longitudinal position of the enlarged end of the link and varying the locking position of the toggle linkage accordingly. A tension spring interposed between the co-operating jaw and the handle urges the jaws into the displaced position and thus displaces the slidable end of the link rearwardly and into engagement with the inner end of the adjusting bolt.

The disadvantages of this construction (and it should be noted that despite these the tool has come into widespread use) include a necessarily increased over-all length making the pliers particularly cumbersome when operating in restricted spaces; and the impossibility of readjusting the grip or relative displacement of the plier jaws while the tool is held in the normal operating position. The first disadvantage is at once apparent on viewing the tool since the adjusting bolt must extend rearwardly of the handle a considerable distance. As to the second, the tool is normally grasped in the right hand which extends around both the handle and the lever. When the plier grip is to be changed, the tool

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must usually be shifted to the left hand so the right hand may be used to turn the adjusting bolt head; or the right hand must be bent sharply at the wrist so the bolt head may be reached with the left hand. In either case, the tool must be withdrawn from proximity with the work which is to be engaged and the grip altered by a process of trial and error through subsequent comparison with the work until the proper displacement is obtained.

The present construction avoids both these difficulties and possesses additional constructional advantages as well. In essence, this invention contemplates the mounting of the adjusting bolt within the body of the handle with a nut thereon extending through opposite sides of the handle forwardly of the normal position of the hand in grasping the tool and the shank of the bolt engaging the slidable end of the toggle link in tension rather than compression. The handle, then, need be no longer than is required for a comfortable hand-grip and the over-all length of the tool is invariable. Further, when the grip is to be adjusted, the tool can still be held in the normal position with the handle downwardly and encompassed by the three lesser fingers of the hand while the lever lies within the palm. The thumb and index finger may then engage the head of the adjusting nut on opposite sides of the handle and may rotate it in either direction to change the effective locking position of the toggle linkage. This permits the tool to be held in the normal working position during adjustment, so that the jaws may be brought into proximity with the work to be gripped and direct comparison made between the jaw displacement and the work thickness as the adjustment proceeds.

This ease of adjustment makes the tool pre-eminently suited for one-hand operation; and, coupled with the decreased length, renders it usable without sacrifice of efficiency where the work space is restricted. In addition, the tool is much neater in appearance. As the adjusting bolt is enclosed within the body of the handle, the threads are protected and the life of the device extended. Since the over-all length of the tool does not change with the grip adjustment, it is quite easy to determine whether the tool will fit within the available space or not. A permanent connection at the slidable end of the toggle link is practicable and the jaw spring need not be relied upon to keep the components in operative position. It is possible to use a compression spring—either coil or leaf—and secure it within the body of the tool. Other advantages both in

construction and use will be apparent from inspection of the device.

With these and other considerations in view, the invention consists of the construction described in the specification, claimed in the claims and illustrated in the accompanying drawings, in which:

Figure 1 is a plan view of the pliers of this invention shown in the closed position adjusted for a minimum grip.

Figure 2 is a longitudinal sectional view corresponding to Figure 1 but in which the pliers are opened.

Figure 3 is a transverse section through the handle of the tool taken on the line 3—3 of Figure 2.

Figure 4 is a similar section taken on the line 4—4 of Figure 2.

Figure 5 is a partial longitudinal sectional view showing a modified form of the anchoring mechanism.

In Figures 1 and 2, the principal components of the device are shown assembled and include the handle 10, the co-operating jaw 11, the activating lever 12, the link 13 and the adjusting nut 14. The handle 10 is formed from a single stamping bent upon itself in such a manner as to define the forward housing 15 having a closed back 16 and spaced sides 17; and a substantially cylindrical rear section 18 having a downwardly opening slot 19 of restricted dimension as compared with the inner diameter of the section 18. The co-operating jaw 11 is preferably formed from a forging and serrated jaw pieces 20 are welded, brazed, soldered, riveted, or otherwise secured to the components 10 and 11. The activating lever 12 is also formed from a channel-shaped stamping having the sides 21 and the back 22 and the channel, of course, opens toward the associated handle 10. As described generally above, the co-operating jaw 11 and handle 10 are pivotally secured together by the rivet 23, the co-operating jaw 11 and the activating lever 12 by the rivet 24, and the link 13 and the lever 12 by the rivet 25.

The slidable anchorage of the handle end of the link 13 is effected through a pin 26 extending through aligned apertures in the end of the link 13 and a pair of arms 27 lying on either side of the link and within the section 18 of the handle 10. The outer surfaces 28 of the arms 27 (see Figures 3 and 4), conform, more or less, to the inner surface of the cylindrical section 18 and as the link 13 extends downwardly through the slot 19, the associated arms and link are slidable longitudinally of the handle. A similar pin 29 extends through aligned apertures adjacent the forward ends of the arms 27 and through the interleaved flattened rearward end 30 of the adjusting bolt 31. The bolt 31, in turn, is threadedly engaged in the adjusting nut 14 which is mounted in and extends through oppositely disposed slots 32 in the sides 17 of the handle 10. The link 13 is formed with a forward cam surface 33 which engages the back 22 of the lever 12 to limit the successive opened positions of the plier jaws which vary with the relative longitudinal positions of the pin 26; and a rearward cam surface 34 which comes into similar engagement with the back 22 just after the toggle linkage has passed the dead center or locking position when the jaws are in the various closed positions. A coil spring 35 is secured between the pin 36 mounted in the co-operating jaw 11 and the back 16 of the housing 15 and urges the co-operating jaw 11 in a

counterclockwise direction with respect to the handle 10.

The device is assembled by pivotally securing together the handle 10 and the jaw 11 and the lever 12 and the jaw 11 by the rivets 23 and 24, respectively. The adjusting bolt 31 and the link 13 are then placed between the arms 27 and the pins 26 and 29 are inserted through the respective aligned apertures in these elements. This sub-assembly is then introduced into the cylindrical section 18 through the opening 37 at the rear end of the section and slides forwardly until the forward end of the bolt 31 comes in contact with the nut 14 which is held centered in the slots 32. The nut 14 is rotated until it threadedly engages the bolt 31 drawing the subassembly forwardly. The pins 26 and 29 are, of course, held in engagement with the arms 27 and the flattened end 30 and the link 13 by being enclosed within the cylindrical section 18 and the link 13 extending through the slot 19 prevents relative rotation of the subassembly components and the handle 10. The jaws are now opened to their full extent and the spring 35 is slipped within the housing 15 and over the pin 36 into bearing on the back 16. The link 13 may then be brought between the sides 21 of the lever 12 and the apertures therethrough aligned and the components pivotally secured together by the rivet 25. This completes the assembly of the tool.

A modified form of the anchoring arrangement is shown in Figure 5 in which the link is indicated as 113. Instead of using the arms 27 of the first construction, their place is taken by a single, substantially cylindrical member 127 having a vertically disposed, longitudinal slot 128 terminating short of the ends of the member 127. A pin 126 extends across the slot 128 adjacent its rearward end and passes through the enlarged aperture 129 in the link 113 securing it in place. The end 130 of the link 113 is formed to correspond with the rear end 131 of the slot 128 and the clearance between the aperture 129 and the pin 126 is sufficient to permit the engagement of the surfaces 130 and 131 when the toggle linkage is loaded so that the stress is taken directly by the member 127 rather than through the pin 126. The rearward end 132 of the adjusting bolt 131 is threaded into the tapped hole 133 or otherwise secured to the forward end of the member 127.

It is believed that the foregoing description will serve both as a complete disclosure of the precise structure of the tool and as an explanation of its advantages in use and the ease with which it may be assembled in manufacture. It will be apparent that the tool may be managed with much more dexterity than the conventional adjustable toggle pliers and that the same mechanical advantage can be obtained in a device having much smaller over-all dimensions. The operating structure is entirely shielded and the tool may be readjusted in use without the necessity of the operator shifting his grip or using his other hand. The parts are fixedly secured together rather than being urged into engagement by spring pressure. The tool presents a much neater appearance and there are no projecting parts presenting possibility of injury to the user. The invention claimed is:

1. In an adjustable toggle pliers, a handle having a jaw at the forward end thereof and a hollow handgrip at the rearward end thereof, a co-operating jaw member pivotally secured to said handle adjacent the forward end thereof, an ac-

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tivating lever having its forward end pivotally secured to said jaw member, a toggle link pivotally secured at its forward end to said lever and having its rearward end slidably received within said handgrip, a bolt having its rearward end secured to said rearward end of said toggle link and extending forwardly therefrom within said handle, a nut rotatably mounted transversely of said handle with a portion thereof extending outwardly of said handle and threadedly engaging said bolt, and spring means resiliently urging said jaw member and said jaw on said handle apart.

2. The structure of claim 1 which is further characterized in that said handle is substantially channel-shaped in cross section and the handgrip portion thereof is formed with a restricted inwardly opening slot through which said toggle link extends.

3. The structure of claim 1 which is further characterized in that said handle is substantially channel-shaped in cross section, oppositely disposed slots are formed in the walls of said channel forwardly of said handgrip, said nut being mounted in said slots.

4. The structure of claim 1 which is further characterized in that said handle is substantially channel-shaped in cross section, said handgrip portion thereof is formed with a restricted inwardly opening slot through which said toggle link extends, transversely spaced arms slidably retained within said handgrip and pivotally secured at their rearward ends to opposite sides of said link, said arms being secured to the rearward end of said bolt adjacent its rearward end, whereby rotation of said nut with respect to said handle will occasion the advance or retraction of said arms within said handgrip to change the effective position of said link.

5. The structure of claim 1 which is further characterized in that said lever is at least partially substantially channel-shaped in cross section, said link having a cam surface forwardly of its point of pivotal attachment to said lever engaging the bottom of said channel to limit the distended position of said jaws, said link having a cam surface rearwardly of its point of attachment to said lever engaging the bottom of said channel immediately after said link has passed the dead center position in which said jaw and said jaw member are in relatively closed position, said cam surfaces being so formed as to enter said engagement in successive positions of adjustment of said slidably mounted end of said link.

6. The structure of claim 1 which is further characterized in that said handgrip portion thereof is substantially cylindrical in cross section and is formed with a restricted inwardly opening slot through which said link extends, an anchor member slidably retained within said handgrip and having a slot aligned with said handgrip slot terminating forwardly of the end of said member, means pivotally securing said link to said anchor member within said slot therein adjacent the

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rear end of said slot, said pivotal securing means having sufficient clearance to permit the rear end of said link to engage the rear end of said anchor member, said bolt being secured to the forward end of said anchor member.

7. In an adjustable toggle pliers, in combination, a handle having a jaw at the forward end thereof and a handgrip at the rearward end thereof, a co-operating jaw member pivotally secured to said handle adjacent the forward end thereof, an activating lever having its forward end pivotally secured to said jaw member laterally of said pivotal attachment between said jaw member and said handle, a toggle link pivotally secured to said lever rearwardly of said pivotal attachment between said lever and said jaw member and extending rearwardly into said handgrip through a restricted slot opening inwardly in said handgrip, attaching means slidably retained within said handgrip by said restricted slot and pivotally secured to the rearward end of said lever therewithin, a bolt having its rearward end secured to said attaching means and extending forwardly therefrom within said handle, a transverse slot in said handle forwardly of said handgrip, a nut rotatably mounted within said transverse slot and having portions extending transversely of the body of said handle, said nut threadedly engaging said bolt, and spring means forwardly of said nut resiliently urging said jaw and said jaw member apart.

8. In an adjustable toggle pliers, a handle having a jaw at the forward end thereof and a hollow handgrip at the rearward end thereof, a co-operating jaw member pivotally secured to said handle adjacent the forward end thereof, an activating lever having its forward end pivotally secured to said jaw member, a toggle link pivotally secured at its forward end to said lever and having its rearward end slidably received within said handgrip, a bolt having its rearward end secured to said rearward end of said toggle link and extending forwardly therefrom within said handle, a nut threadedly engaging said bolt and rotatably mounted transversely of said handle and restrained against movement longitudinally of said handle with a portion of said nut extending outwardly of said handle through a slot therein.

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