Dec. 9, 1952 W. SARVIE 2,620,697

PLIERS

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Fig. 1.

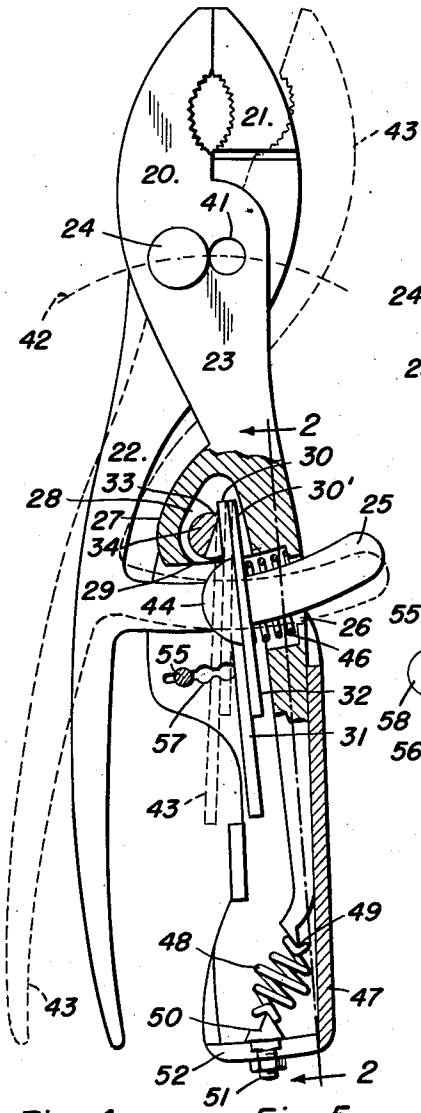


Fig. 2.

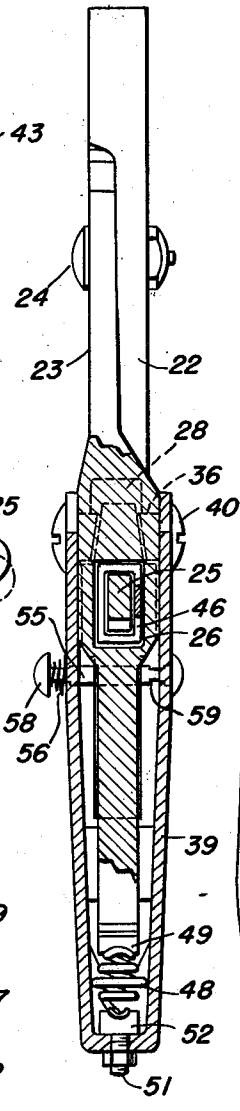


Fig. 3.

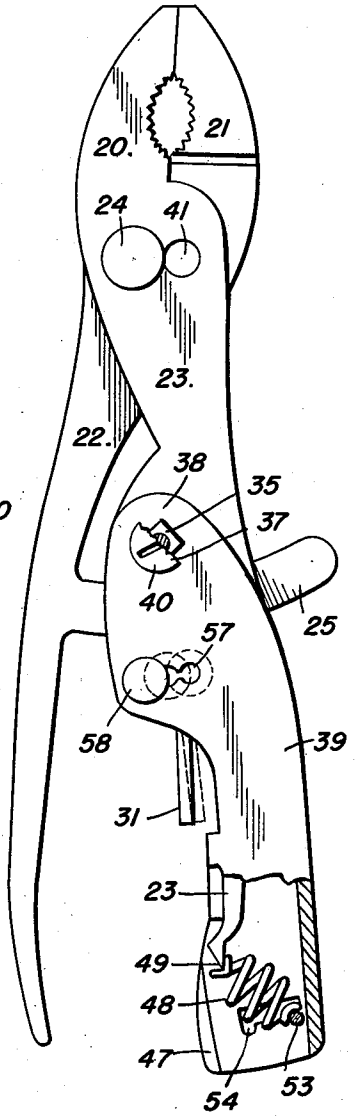


Fig. 4.

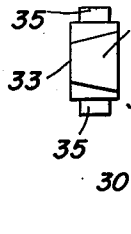


Fig. 5.

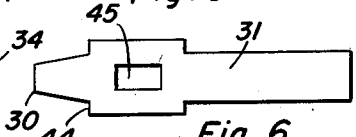
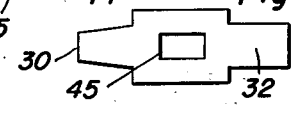


Fig. 6.



Inventor

Walter Sarvie

By Clarence A. O'Brien and Harvey B. Jacobson

Attorneys

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Fig. 7.

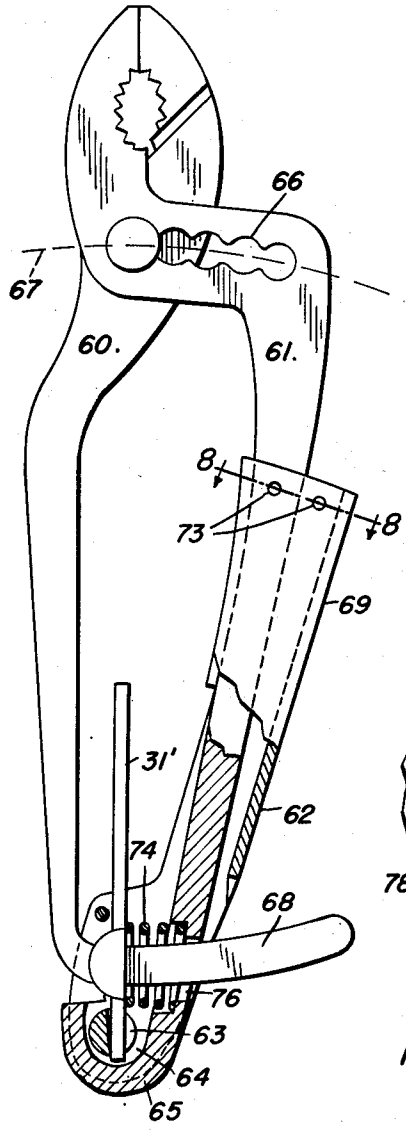


Fig. 8.

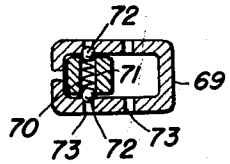
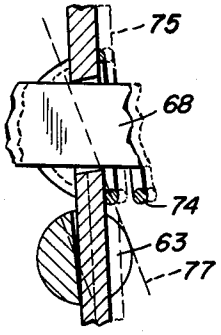


Fig. 9.



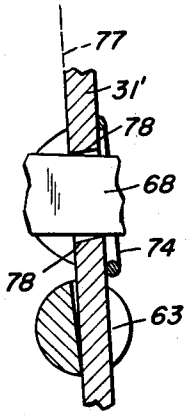


Fig. 10.

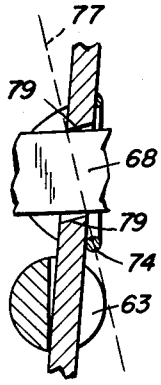


Fig. 11.

Inventor

Walter Sarvie

By Clarence A. O'Brien and Harvey B. Jacobson

Attorneys

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Fig. 12.

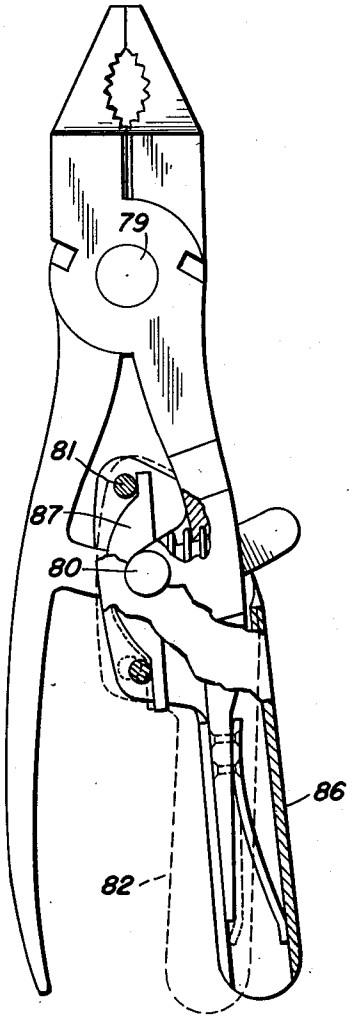


Fig. 13.

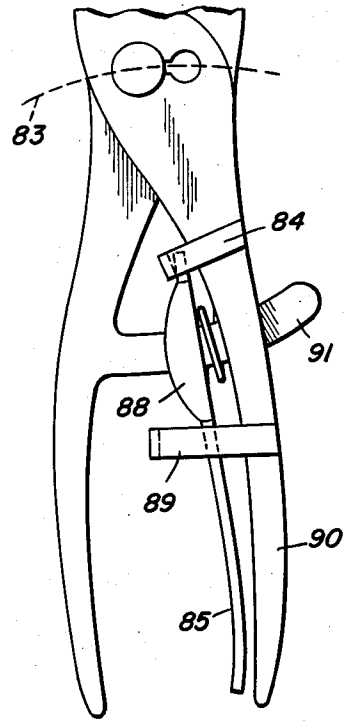
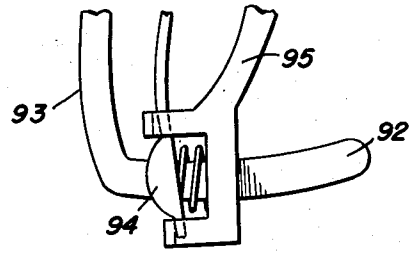


Fig. 14.



Inventor

Walter Sarvie

By Clarence A. O'Brien and Harvey B. Jacobson

Attorneys

Patented Dec. 9, 1952 2,620,697

UNITED STATES PATENT OFFICE

2,620,697

PLIERS

Walter Sarvie, Alexandria, Minn.

Application October 21, 1947, Serial No. 781,139

4 Claims. (Cl. 81—49)

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This invention relates to manually operable tools such as pliers, tongs, tweezers and the like.

Important objects of the present invention are: to provide an attachment in connection with a pair of slip joint pliers wherein the handles may be movable toward or away from each other in a normal manner but when resistance is encountered by the jaws, a multiplication of leverage will be obtained to produce a firmer grip by the jaws on the object, without adjustment, within the range of the tool; to provide an attachment for automatically locking the jaws in engagement with the article in any adjusted position of the handles and to retain the jaws in locked position after the pressure of the hand has been released; to provide an attachment for releasing the locking means readily by merely moving the handles away from each other in a normal manner to open the locked jaws; to provide a pliers type wrench construction incorporating means for a multiplication of leverage or self-locking, or a combined multiplication of leverage and self-locking, or the pliers can be operated in a normal manner with the said means inoperative; and, finally, to provide a wrench of this character which is relatively inexpensive and practicable to manufacture, simple and convenient to use, and which will give generally efficient and durable service.

With these and other objects definitely in view, this invention resides in certain novel features of construction, combination and arrangement of parts and portions which will be hereinafter described in the specification, particularly pointed out in the appended claims, and illustrated in the accompanying drawings, wherein:

Figure 1 is a top plan view of the invention as applied to a pair of slip joint pliers in one position, one jaw being shown in a second position in dash lines, a portion of the other handle being broken away and the underlying portions being shown in horizontal section and in plan;

Figure 2 is a horizontal sectional view on line 2—2 of Figure 1;

Figure 3 is a view similar to Figure 1, an end portion of said other handle being broken away to show underlying mechanism in another position and in plan;

Figures 4, 5 and 6 represent clutch plates and the pivot pin or cam shaft of the clutch mechanism removed from the pliers;

Figure 7 is a top plan view of a modified form of the invention, similar to Figure 1;

Figure 8 is a horizontal sectional view on line 8—8 of Figure 7;

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Figure 9 is an enlarged sectional view of a portion of the clutch mechanism in one position, the mechanism being shown in another position by dash lines;

Figures 10 and 11 are enlarged sectional views of a portion of a modified form of clutch mechanism;

Figure 12 is a sectional view of another form of this invention applied to a cutting pliers of a simple pivot, non-self-locking type, a handle lever in a second position being indicated by dash lines;

Figure 13 is a fragmentary plan view of this invention applied to slip joint pliers of the self-locking type; and

Figure 14 is a view of this invention similar to Figure 13 but with the clutch mechanism on end portions of the handles.

Similar characters of reference relate to similar parts throughout the drawings.

Referring to the drawing, one form of this invention is shown in Figures 1, 2 and 3 as applied to a pair of slip joint pliers having work-engaging jaws 20 and 21 which are operated by crossed handles 22 and 23 pivoted together by the pivot pin 24. One of the handles 22 is provided with an arcuate shank 25 extending operatively through aperture 26 in the other handle 23, the shank 25 being preferably rectangular in cross section. The handle 23 is also preferably materially thickened as at 27 between pivot 24 and the aperture 26 with a recess 28 formed within said thickened portion 27 opening at 29 toward aperture 26 to receive therein end portions 30 and 30' of the clutch plates 31 and 32 which abut adjacent a fulcrum portion 33 of the cam shaft 34. Enclosed transversely within said recess 28 is the squared end portion 35 of said shaft 34 and this squared end portion extends through apertures 36 in the side walls of said thickened portion 27 and projects outwardly to be received in matching squared apertures 37 on the end portions 38 of lever 39, which lever is suitably secured as by screws 40 to the cam shaft 34, so that said shaft may be operated in conjunction with the said lever 39. The lever 39 partially encircles the end portion of handle 23 to allow the lever to rock relative to the handle 23. The said shaft 34 in apertures 36 is equally spaced from the plurality of pivot holes 41 in handle 23, as shown by arc line 42, the rectangular cross sectional shape of the shank 25 aids in maintaining the clutch plates 31 and 32 in operative registration with shank 25 and with the clutch plate 31 abutting the cam shaft 34, in the various adjusted positions of an adjustable or slip joint tool, as shown

by dash lines 43. The clutch mechanism consists of one or more clutch plates, each additional plate providing two additional gripping edges, but a pair of plates will usually afford all the holding action necessary. In the form of this invention illustrated in Figures 1, 2 and 3, two plates 31 and 32 are used. The plate 32 is tapered in thickness with the thinner portion of the plate toward the pivot pin 24 and the inclined planes of the tapered plate meeting at said pivot 24, this construction coacting with the curved shank 25 to permit equalized gripping action by additional plates when such additional plates are used. In other words, the inclined surfaces of the plate 32 are always disposed transversely of the shank 25. The plate 31 need not be tapered and is reinforced against bending with suitable turned up half round side portions 44 adjacent the aperture 45 of said plate. Each plate embraces shank 25 somewhat loosely, and a compression spring 46 freely encircles the shank 25 and is interposed between the plates and handle 23, which handle has an annular inturned flange at the outer end of said aperture 26 to retain the spring in position.

The thrust of the spring 46 holds the plates against the fulcrum portion 33 on the cam shaft 34 and causes the clutch plates to grip the shank 25 and to hold and to lock said shank from sliding outward or away from aperture 26 in handle 23, thereby locking the handles with the jaws in an article-gripping position. The outer end portion 47 of lever 39 serves as a handle or hand grip opposite the handle 22, and when force is applied inward on said hand grip, the spring 48 will be of sufficient strength so that at first the lever 39 and handle 23 will move as a single unit. However, as resistance is encountered upon the jaws coming in contact with the work spring 48 will then commence to yield and the lever 39 will move relative to the handle 23 pivoting on shaft 34, thus turning the shaft 34 clockwise to apply force to the clutch plates at the fulcrum portion 33 of said shaft 34 and likewise at the same instant to cause the clutch plates to grip shank 25 and thus to force the abutting clutch plates with shank 25 toward handle 23. The force applied at the jaws will be multiplied by the ratio of the distance from the point of application of pressure on the handle portion of lever 39 to the center of pivot shaft 34 and from the center of said shaft 34 to the outermost portion or fulcrum portion 33 which abuts the part 30 of the clutch plate 31.

The compression spring 48 is interposed pivotally between the outer end 49 of handle 23 and the part 50 of bolt 51 carried by the lever 39, and this spring operates with a snap toggle action when lever 39 is manually swung from one position to the other as the part 50 passes dead center either way to hold said lever in suitable locked positions. The bolt 51 which is movable in slot 52 allows the adjustment to either a combined self-locking and multiplication of leverage type or a multiplication of leverage type pliers by releasing the nut on said bolt 51 and sliding it to the preferred adjustment in said slot, thereafter securing the bolt in the slot by tightening the said nut. Another form of the adjustment mechanism is shown in Figure 3 and is adjustable in substantially the same manner as is represented in Figures 1 and 2. As shown in Figure 3, the compression spring 48 is interposed pivotally between the outer end of the handle 23 and a suitable pin 53 transversely and operatively connected, through slot apertures 54, on the sides adjacent the end of lever 39. The pin 55 is operative in the slot apertures 57 in the lever 39 by pressure applied to the head 58 of the pin 55 against the thrust of a compression spring 56 encircling the pin 55 between said head and the side of the lever 39 until detent 59 in pin 55 matches the smaller portion in the slot 59 and allowing sliding adjustment of the pin. This construction allows adjustment to release the locked clutch plates with the lever 39 when said lever is drawn away or outward from the handle 22, the pin 55 moving to abut against the clutch plate 31, and as the compression spring 48 is stronger than the spring 46, the said pin 55 will automatically tilt or cant the plates after said lever swings past dead center and will hold said plates back or away from the gripping position, thus releasing the locking mechanism and holding said plates in non-gripping position until suitable pressure is applied manually on level 39, to move the lever toward handle 22. This means is also adjustable to hold the clutch plates in an unlocked position at all times while lever 39 is swung in the furtherest position toward handle 22 past the dead center, as shown in Figure 1, allowing the pliers to be operative in a normal manner, said pin 55 holding the clutch plates from shifting relative to the handle 23 while shank 25 is withdrawn out of the clutch plates, as during adjustment of a slip joint plier. A secondary releasing means is also provided by suitable extension of said end portion of the clutch plate 31, permitting the application of manual pressure thereon.

In the form of the invention shown in Figure 7, the clutch mechanism is mounted on the outermost ends of the pliers handles 60 and 61 with one end of the lever 62 pivoted with and suitably secured to cam shaft 63 operative in the transverse apertures 64 of the outer end 65 of handle 61. The center of the pivot cam shaft 63 is equally spaced from the plurality of pivot holes 66 in the handle 61, as shown by the arc line 67, to maintain a single clutch plate 31' in alignment with shank 68 which comprises a turned end of the handle 60, and in abutment on shaft 63 in the various adjustments of this slip joint plier. The part 69 of lever 62 partially encircles the portion of the handle 61 approximately at the middle thereof and said middle part carries, as shown in Figure 8, a spring 70 retained in a bore 71 biasing two balls 72 in opposite directions in said bore into frictional engagement with the inside walls of the said lever part 69, the two holes 73 being slightly smaller in diameter than the balls 72, to hold the lever 62 from swinging movement until pressure is applied to said lever 62 to adjust said lever from one adjustment to the other and to turn the shaft 63, as shown in Figure 9, from one position to the other. The solid lines in Figure 9 show the mechanism in a locked position and the dotted lines indicate the other position after further pressure has been applied on the handle 60 and on the lever 62 on handle 61, the said lever having turned the cam shaft 63 counter-clockwise and forced the abutting clutch plate away from said cam shaft and toward the compression spring 74. The gripped shank 68 has also been pushed further into the aperture 76 in the handle 61 and the handles have been subjected to a flexing and the bite upon a gripped object by the jaws will be still further increased. When the thickness of the clutch plate must, for purposes of strength, be made relatively great as when great loads are to be supported, the slope of the contact line 77 must

not be so steep that the clutch plate will not grip at all. In order to keep the contact line 77 at a small angle for maximum gripping in the locked position and more friction-free movement of the plate on the shank in the released position for all thicknesses and strengths of clutch plate, there may be employed one of the modifications shown in Figures 10 and 11. In the form shown in Figure 10, the sides 78 of the aperture in the clutch plate taper from one end to the other. Therefore, the line of contact 77 lies on one face of the clutch plate and is very nearly normal to shank 25. In the modification shown in Figure 11, the sides 79 in the aperture of the clutch plate slant similarly to allow friction-free operation of the clutch mechanism in the non-locking position and the clutch plate releases easily when it is tilted back against the spring 74, while still providing for better grip in the gripping position.

The form shown in Figure 12 is similar to that of Figures 1, 2 and 3 except that the invention is here applied to cutting pliers with a simple pivot 79 and less multiplication of leverage, as the distance between the center of the pivot 80 and a pin 81 carried by the lever 86 against the clutch plate 87 is greater than in the other forms. The pliers can be operated in the usual manner with the clutch plate free in a non-gripping position, as indicated by the solid lines, and the dotted lines 82 indicate the position of the parts when pressure has been applied. In Figures 13 and 14 there is shown a simpler form similar to Figure 1 and Figure 7, but in the self-locking type only. The arc line 83 in Figure 13 shows the concentric position of the fulcrum point of the clutch plate 88 in a loop part 84 and with relation to a plurality of pivot holes in a slip joint pliers. There is here illustrated a suitable extending lever portion 85 on the clutch plate 88 by which the clutch may readily be released from a locking position and a looped guard 89 for the lever 85 is carried by the handle 90. Figure 14 illustrates how structure similar to that shown in Figure 13 may be applied to the ends of the handles. The shank 91 in Figure 13 is incorporated, as at 92, with the handle 93, while the clutch plate 94 is carried by the handle 95 in a manner similar to that described in connection with Figure 7.

My invention is not limited to the exact forms of shank and clutch plates shown and described nor to the shapes and proportions thereof illustrated, since these will vary with the work to be performed, the kind of material employed in the shank and clutch plates, and the diameter of the shank.

The operation of this invention will be clearly understood from a consideration of the above description of the mechanical details thereof, although the operation differs somewhat in the different forms illustrated. Closing of the handles so that the jaws 20 and 21 grip a work piece is followed by pivotal movement of the lever 39 from the position shown in Figure 3 to the position shown in Figure 1 in full lines. This lever movement rotates the cam shaft 34 shifting the clutch plates so as to carry the shank 25 gripped thereby as to the right in the Figures 1, 2 and 5. The spring 48 has a snap action to lock the lever in this position. When it is desired to release the grip of the pliers, the lever is snapped back into the position shown in Figure 3 and the pin 55 shifts the clutch plates into a position allowing the clutch plates to slide freely on the shank 25.

In the construction shown in Figure 7, the lever 62 pivots about cam shaft 63, the handles 60 and 61 are locked by the action of the spring biased clutch plate 31', and further tightening is accomplished by the lever 62 and the pivot cam shaft 63 which is moved by the lever 62. The lever 62 is releasably held by the action of the elements numbered 70–73.

In the embodiment shown in Figure 12 the initial closing of the handles is followed by a movement of the lever 86 about its pivotal connection 80 on one of the handles. This lever 86 carries the pin 81 against a latch plate 87, which is already in gripping position, causing a further closing of the handles. In this embodiment the lever 86 is spring biased into released position and a pin, not numbered in Figure 12, engages the latch plate and tilts the same out of gripping position when the lever is moved to said released position. The tool shown in Figure 12 may be considered as designed for providing augmented gripping action but without special means for locking the handles. The devices shown in Figures 13 and 14, on the other hand, show means for locking and unlocking the handles without means for augmenting the gripping action. The springs arranged coaxially of the shanks 91 and 92 urge the clutch plates 88 and 94 into gripping position and the clutch plates have handle portions which facilitate the shifting of the clutch plates into released position.

Having described the invention, what is claimed as new is:

1. A tool comprising a pair of jaws carried by a pair of crossed pivoted handles, one handle having an aperture, an arcuate shank carried by the other handle and inserted through said aperture, a clutch plate having an aperture receiving said shank, a spring encircling said shank and urging said clutch plate into gripping engagement on said shank, said one handle having a lever and a shaft pivotally securing the lever on said one handle, said shaft having a cam which engages said clutch plate to shift the clutch plate while the clutch plate is in shank-gripping position, whereby the clutch plate and shank and said other handle may be forced to move towards said one handle.

2. A tool comprising a pair of jaws carried by a pair of crossed pivoted handles, one handle having an aperture, an arcuate shank carried by the other handle and inserted through said aperture, a clutch plate having an aperture receiving said shank, a spring encircling said shank and urging said clutch plate into gripping engagement on said shank, said one handle carrying a shaft which engages said clutch plate while the clutch plate is in shank-gripping position, said shaft having a cam face, and said one handle having a lever pivoted thereon and rigidly secured to said shaft to control the disposition of said cam face relative to said clutch plate and when shifted in one direction to force said clutch plate, shank and said other handle toward said one handle.

3. A tool comprising a pair of jaws carried by a pair of crossed pivoted handles, one handle having an aperture, an arcuate shank carried by the other handle and inserted through said aperture, a clutch plate having an aperture receiving said shank, a spring encircling said shank and urging said clutch plate into gripping engagement on said shank, said one handle having a transverse shaft mounted thereon which engages said clutch plate while the clutch plate is in shank-gripping position, said shaft having a cam face and said one handle having a lever

pivoted thereon and rigidly secured to said shaft to control the disposition of said cam face relative to said clutch plate and when shifted in one direction to force said clutch plate, shank and said other handle toward said one handle, and means for selectively and releasably securing said lever in either a position for locking or a position for unlocking said handles.

4. A tool comprising a pair of jaws carried by a pair of crossed pivoted handles, one handle having an aperture, an arcuate shank carried by the other handle and inserted through said aperture, a clutch plate having an aperture receiving said shank, a spring encircling said shank and urging said plate into gripping engagement on said shank, said one handle having a transverse shaft mounted thereon which engages said clutch plate while the clutch plate is in shank-gripping position, said shaft having a cam face and said one handle having a lever pivoted thereon and rigidly secured to said shaft to control the disposition of said cam face relative to said clutch plate and when shifted in one direction to force said clutch plate, shank and said other handle

toward said one handle, means for selectively and releasably securing said lever in either a position for locking or a position for unlocking said handles, and a pin carried by said lever on the side of said shank remote from said shaft to engage and to release said clutch plate from gripping position on the shank when the lever is moved to a released position.

WALTER SARVIE.

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