May 24, 1960 S. D. McILWAIN 2,937,677

PORTABLE TOGGLE CLAMP WITH TRIGGER RELEASE

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FIG. 1

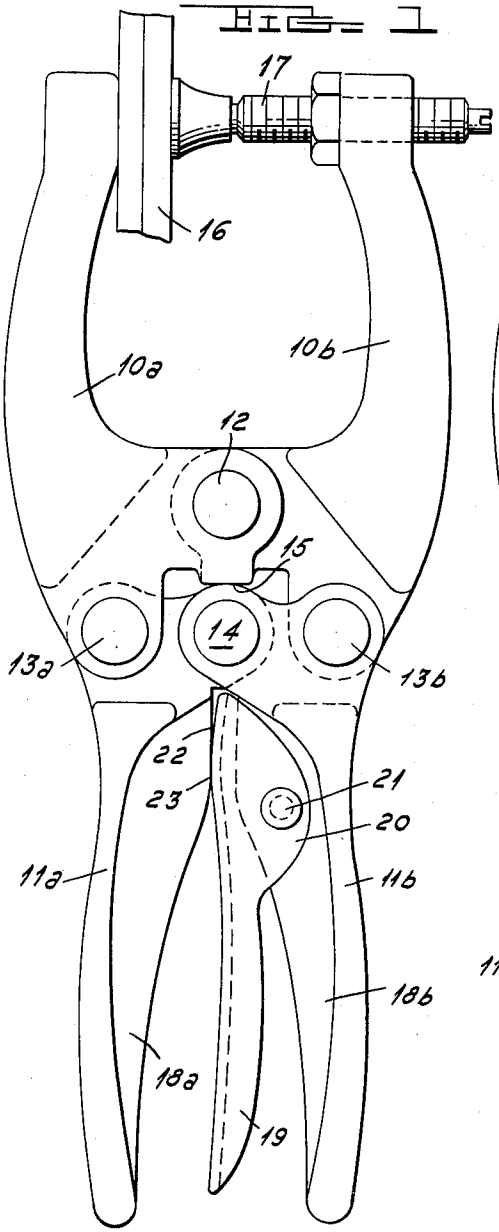
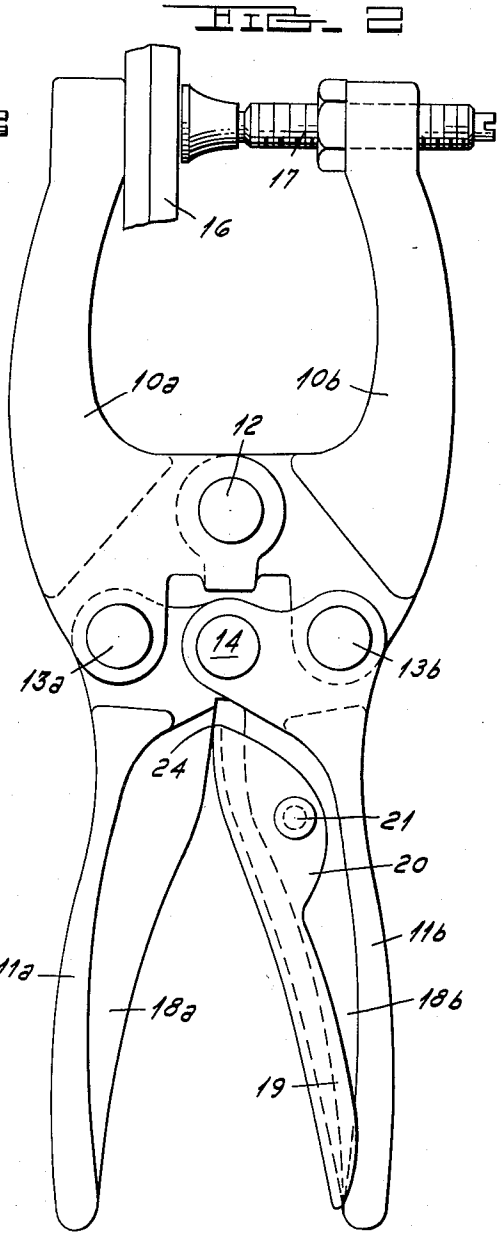


FIG. 2



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PORTABLE TOGGLE CLAMP WITH TRIGGER RELEASE

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2 Claims. (Cl. 144—302)

This invention relates to a portable toggle clamp of the type including a pair of actuating handles adapted for grasping and application of closing pressure by the single hand of an operator together with a trigger release lever interposed between said handle elements.

In a toggle clamp of this type it is necessary that the handle elements at the beginning of clamping action be sufficiently close together that they may be readily grasped in one hand and actuated to a locking position with the locking stroke consuming a limited travel corresponding to that portion of finger movement wherein squeeze pressure may be most readily applied. These requirements result in the handle elements being relatively close together in their locked position and provide narrow limitations on the stroke of any trigger release lever positioned between the handle elements for the purpose of unlocking the toggle elements through application of a further finger squeeze pressure, particularly where, as in the present case, it is desired to confine such trigger release lever to a length no greater than that of the handle elements thereby necessitating the allocation of a portion of the space between locked handle elements to finger clearance for grasping the trigger release lever. The remaining stroke available for such lever is thereby confined to a very small travel.

In addition, a considerable force is required to separate the handle elements in order to unlock the toggle joints of a high pressure toggle clamp, even when such force is applied near the outer ends of such handle elements, and the proportionately higher separating force required near the pivotal connections demands a high mechanical advantage in a trigger release lever which is anchored and supplies separating pressure near the pivots. On the other hand, in order for a release lever to properly serve its function it must open the toggle elements sufficiently to completely release the toggle pressure; otherwise the need for using a second hand to complete the opening of the toggle clamp would substantially defeat the purpose of the release feature which is directed to provide a convenient single-hand clamping and release action through the application of finger squeeze pressure. If, in view of the extremely limited travel available for the release lever, the mechanical advantage of said lever is made low enough to provide adequate separating travel to completely release clamp pressure, the force required to actuate the release lever tends to become excessively high particularly where the clamp is locked under high pressure. On the other hand, if a high mechanical advantage is employed for the release lever consistent with easy actuation, there is a tendency to "run out of travel" for the release lever stroke before the unlocking action is completed. Accordingly, a conflict in requirements is present which renders the provision of a satisfactory release lever exceedingly difficult.

In the present case an efficient release action has been effected through the coordination of a number of critical relationships. For example, the release lever form, pivotal location, and the cooperating form of the closed toggle clamp handle element upon which the release lever bears are adapted and arranged to provide relatively high initial mechanical advantage for the release lever during its initial travel when resistance to opening is at a maximum and relatively lower mechanical advantage and higher rate of opening travel during the final release movement where the resistance to opening is at a minimum. In order to accomplish this a cam surface of substantial length has been provided on the release lever adapted and arranged to provide an initial point of contact relatively close to the pivotal connection of the release lever and relatively remote from the pivotal connection of the handle element acted upon by the release lever, while at final travel of said release lever, the contact point is relatively remote from the release lever pivotal connection and close to the toggle pivotal connection thereby providing a compound change in mechanical advantage during the course of release lever actuation.

Accordingly, one object of the present invention is to provide an efficient toggle release lever for a portable toggle clamp of the type described wherein such release lever is entirely confined within the length of and between the symmetrical handle elements of such clamp.

Another object is to meet the requirements for high initial mechanical advantage and substantial total unlocking travel by providing a decreasing order of mechanical advantage during unlocking movement of the release lever.

Another object is to form the handle and release lever elements to provide maximum lever travel consistent with adequate finger clearance.

These and other objects will be more apparent from the following detailed description of a preferred embodiment of my invention and from an examination of the drawings disclosing such embodiment wherein:

Fig. 1 is a side elevation of a portable toggle clamp incorporating the present toggle release lever shown with the clamp in locked position; and

Fig. 2 is a similar view showing the clamp with the toggle joint unlocked.

Referring to the drawings it will be seen that the toggle clamp proper consists of symmetrical identical jaw elements **10***a*, **10***b* and symmetrical identical handle elements **11***a*, **11***b*, the respective jaw elements being pivotally connected to each other at **12**, to corresponding handle elements at **13***a*, **13***b*, and the respective handle elements being pivotally connected to each other at **14**, all of the pivotal connections being effected by headed connecting pins as is common in the art.

The pivotal connection **14** is brought into toggle locking alignment with pivotal connections **13***a*, **13***b*, as limited by positive stop **15**, upon the application of squeezing pressure to the handle elements **11***a*, **11***b*, thereby closing the jaws **10***a*, **10***b* to their clamping position in which any workpiece **16** may be clamped between the end of the jaw **10***a* and an adjustable bolt **17** which is threaded into the tapped end of the other jaw **10***b*.

The handle elements are preferably constructed as forgings having relatively thin central reinforcing webs **18***a*, **18***b*, the latter serving to mount a trigger type toggle release lever **19** which is a symmetrically formed stamping having substantially parallel projecting ears **20** overlapping and pivotally connected to the central web **18***b*, by riveted connecting pin **21**. The lower end of the handle **19** is curved to approximate the adjacent contour of the web **18***b* in order to provide maximum finger clearance relative to the web **18***a* when the handle elements are in their closed position as shown in Fig. 1, as well as maximum travel for the lever **19** when actuated to a toggle releasing position as shown in Fig. 2.

The upper end of the release lever **19** is provided with a cam face **22** adapted to exert opening pressure on

the adjacent edge of the web **18***a* progressively between an initial contact point **23** best shown in Fig. 1 and a contact point **24** best shown in Fig. 2 during toggle release actuation of the lever **19**.

From the above description and a comparison of Figs. 1 and 2 of the drawings, the operation of the toggle release lever **19** may be readily understood. Thus, when the handle elements **11***a*, **11***b* are closed to the position shown in Fig. 1, the web **18***a* through engagement with the cam face **22** will move the release lever **19** to the position shown in Fig. 1. When it is desired to release the toggle clamp an operator holding the handle **11***b* in the palm of his hand may insert his fingers between the handle **11***a* and the release lever **19** and by applying squeeze pressure thereto move the lever **19** to a release position as shown in Fig. 2. During the progressive engagement of the cam face **22** from the point **23** shown in Fig. 1 to the point **24** shown in Fig. 2, a continuous separating movement will be imparted to the handle elements **11***a*, **11***b*, under a progressively decreasing order of mechanical advantage from a relatively high order determined by the closeness of the point **23** to the pivotal connection **21** and its corresponding remoteness from the pivotal connection **13***a* to a final relatively low order of mechanical advantage determined by the approximately equal distance between the point **24** and the respective last-mentioned pivotal connections. This arrangement and the respective dimensional proportions shown in the drawing (involving an overall clamp dimension of approximately 9 inches) have been found to provide sufficient mechanical advantage to permit toggle release action with a squeeze pressure as easily applied as the closing pressure to the clamp handle while at the same time providing a sufficient opening movement to completely break the toggle linkage and fully release the workpiece whether it be of relatively incompressible material such as metal or relatively compressible material such as soft wood.

Among the critical proportions contributing to satisfactory operation in these two important respects are a minimum leverage ratio in the release lever per se of approximately 3 to 1 (ratio of length of pivoted handle to the length between pivot and most remote point **24** of cam surface **22**), a location between the upper end of the release lever as close to the pivotal connection **14** as is feasible in order to develop maximum opening travel at the end of the release lever stroke; a relationship of three pivotal connections **21**, **13***b* and **14** in the handle **11***b* forming a substantially isosceles triangle such that the height exceeds the base distance between the pivots **13***b* and **14** and is substantially less than the locked-up position spacing between pivots **13***a* and **13***b*; and the point **24** in the toggle release position shown in Fig. 2 being substantially equidistant from the respective pivotal connections **21** and **13***a*.

Sliding engagement of the cam surface **22** and web **18***a* render the hardening of such surfaces desirable. Repeated release cycle tests under heavy clamping pressure have demonstrated an effective life for the release feature entirely comparable with that of the other elements of the clamp.

While a preferred embodiment of my invention has been disclosed and described above in detail, it will be understood that numerous modifications might be resorted to without departing from the scope of my invention as defined in the following claims.

I claim:

1. A portable toggle clamp comprising a pair of symmetrical pivotally connected jaw elements, a pair of symmetrical pivotally connected handle elements, a pivotal connection between each handle element and one of said jaw elements equally spaced in alignment on either side of said handle pivotal connection when said clamp is in locked position, a toggle release lever mounted to extend substantially midway between said handle elements when in its inoperative position, said lever having one end closely adjacent the pivotal connection of said handle elements and the other end in substantial alignment with the unconnected ends of said handle elements, the clearance spacing between handles and lever accommodating insertion of all fingers of an operator's hand between one handle element and said lever while his palm engages the other handle for exerting effective hand squeezing pressure moving said lever and other handle together, said one end of said lever reactively engaging said one handle to provide a fulcrum point closely adjacent the pivotal connection of said handle elements for exerting opening pressure between said handles throughout a substantial separating release movement of said handles beyond the point of frictional resistance incident to clamping pressure with only a relatively small limited movement of said lever toward said other handle, and a second fulcrum point on said lever intermediate said one end and the operator's hand position exerting a reaction pressure against said other handle.

2. A portable toggle clamp as set forth in claim 1 wherein said second fulcrum point comprises a pivotal connection directly between said lever and said other handle.

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