

QUICK-ACTION CLAMPS

This invention relates generally to clamps of the type used to temporarily clamp together two articles, for example, for gluing, or to hold a workpiece for welding, and more particularly to quick-action clamps wherein the moving jaw can be rapidly advanced or advances in small increments of selectable length. The concept of a bar clamp is old and well-known. In recent years, over-center toggle action handgrips have been incorporated for use in final tightening against the workpiece, for example, in U.S. Patents 4,088,313 by Pearson and 4,563,921 by Wallace. A disadvantage in the prior art lies in the fact that adjustment in the moving jaw over a substantial distance is cumbersome and imprecise. Frequently, the moving jaw is entirely disengaged and free to move until the final tightening of an object between the movable and fixed jaws is accomplished. A third hand would be helpful.

The concept of a C-clamp is also old and well-known. A C-shaped frame holds a fixed jaw, and a moving jaw is advanced toward the fixed jaw or retracted therefrom by rotation of a threaded shaft to which the moving jaw is mounted. A disadvantage of this arrangement lies in the fact that when the moving jaw has a substantial distance to travel before clamping

upon the workpiece or workpieces, a great number of turns is required on the threaded shaft supporting the moving jaw. Frequently, the handle for turning the shaft is a slide-type handle, moving transversely to the direction of shaft motion so that the handle can be slipped back and forth through the shaft with each half turn of the shaft. This is advantageous, where turning must be accomplished in a tight spot and a full 360° swing of the handle is not possible. However, slide-shifting of the handle is awkward and bothersome. Bar clamps using a threaded rod for adjustment have similar problems.

What are needed are clamps having a moving jaw which is rapidly movable over both short and long distances to clamp against a workpiece and is operable using one hand with complete control by the operator at all times.

According to the invention a quick acting clamp comprises a fixed jaw and an opposing movable jaw, the movable jaw being attached to one end of a slide which is movable to carry said movable jaw toward and away from said fixed jaw, and the fixed jaw being connected to support means for supporting said slide, the support means also being connected to a hand grip whereby the clamp is holdable, one-way drive means for releasably engaging and, when engaged, for advancing said slide and attached movable jaw from a first position to a second position closer to said fixed jaw, said one-way drive means comprising a driving lever acting on the slide and a trigger handle which is connected to the support means adjacent to the hand grip and co-operates with the driving lever such that actuation of the trigger handle causes the driving lever to engage and advance the slide, and a braking lever which normally engages the slide to prevent motion of the movable jaw away from the fixed jaw, but allows such motion when actuated and thereby released from the slide, the braking lever being positioned forwardly of the trigger handle in the direction of the movable jaw.

Thus, with one hand holding the hand grip either the trigger handle or the braking lever can be selectively actuated, the index and/or middle finger of the hand holding the grip being able to actuate the braking lever.

Thus the invention provides an improved quick-action bar wherein the moving jaw may be moved over short and long distances rapidly. Also, the moving jaw may be incrementally and precisely advanced from any position and may be advanced in increments of selectable length for each action of a driving handle.

Advantageously the movable jaw does not move its weight when the clamp is in a vertical position.

Further advantages are that clamp operation can be accomplished with one hand and that clamps in accordance with the invention can operate in narrow spaces.

Other advantages of the invention will be apparent from the following detailed description of preferred embodiments.

In the accompanying drawings:

Figure 1 is a front view of a quick-action bar clamp in accordance with the invention;

Figure 2 is a left end view to an enlarged scale of the quick-action bar clamp of Figure 1;

Figure 3 is a right end view to an enlarged scale of the quick-action bar clamp of Figure 1;

Figure 4 is a sectional view to an enlarged scale taken along the line 4-4 of Figure 3;

Figure 5 is a view similar to Fig. 1 of an alternative embodiment of a quick-action bar clamp in accordance with the invention;

Figure 6 is a section view taken along the line 6-6 of Figure 5; and

Figure 7 is a sectional view taken along the line 7-7 of Figure 5.

With reference to Figures 1-7, a quick acting bar clamp 10 includes a movable jaw 12 connected to a slide bar 14. The slide bar is slidably supported in a slot 16 (Fig. 4) which passes through a handle/grip assembly 18.

The handle/grip assembly 18 includes a body 19 through which the slot passes, a handgrip 20 attached to the body 19 on one side of the slot 16, and a fixed jaw 22 attached to the body 19.

on the other side of the slot ⁷16. A trigger handle 24 is pivotably mounted to the body 19 adjacent the slot 16 by means of a pivot pin 26. The moving jaw 12 opposes the fixed jaw 22.

As best illustrated in Fig. 4, the handgrip 20 is hollow in part so as to receive the trigger handle in the cavity 28. A second cavity 30 in the body 19 divides the bore 16. A driving lever 32 is suspended on the slide bar 14 which passes through a hole 34 in the driving lever 32. A spring 36 is compressed between the driving lever 32 and a surface 38 of the cavity 30 urging the driving lever 32 against the upper end 40 of the trigger handle 24. The upper end 40 of the trigger handle 24 is forked and straddles the slide bar 14. Force of the spring 36 urges the trigger handle 24 against an inner surface 42 of the body 19 thus providing a standby condition. In the standby condition, the driving lever 32 is positioned perpendicular to the direction of motion, indicated by the arrow 44, of the slide bar 14 when in operation. Any motion of the handle 24 about the pivot pin 26 in the direction of the arrow 44 is accomplished against the bias of the spring 36.

A braking lever 46 is suspended from the slide bar 14 which passes through an opening 48 in the braking lever 46. One end 50 of the braking lever 46 is pivotably captured in a recess 52 within the body 19 such that the braking lever 46 may pivot within the constraints defined by the surfaces of the recess 52 and by binding of the braking lever 46 with the slide bar 14 when the edges of the opening 48 in the lever 46 engage the surface of

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the slide rod 14. A spring 54 seats in a recess 56 in the body 19 and biases the free end of the braking lever 46 away from the trigger handle 24. The biased position of the braking lever 46 is limited by the binding interference between the opening 48 of the lever 46 with the slide bar 14.

It should be noted that in the standby position illustrated in Figure 4, the driving lever 32 is substantially perpendicular to the longitudinal axis of the slide bar 14, whereas the portion of the braking lever 46, which engages the slide bar 14, is transverse to the longitudinal axis of the bar 14 but not perpendicular thereto. In this condition, if a force is applied to the moving jaw 12 in the direction indicated by the arrow 44, the slide bar 14 is free to move through the hole 34 in the driving lever 32 and through the spring 36. Because the braking lever 46 is free to pivot against the bias of the spring 54 when force is applied on the moving jaw 12 in the direction of the arrow 44, the braking lever 46 presents no obstacle to this motion of the slide bar and the moving jaw 12 may be advanced continuously toward the fixed jaw 22.

However, in the standby position as illustrated in Fig. 4, if a force is applied to the movable jaw 12 in the direction opposite to the direction indicated by the arrow 44, the edges of the opening 48 in the lever 46 bind against the surface of the slide bar 14 and it is not possible, without further action, to withdraw the moving jaw farther away from the fixed jaw 22, as described more fully hereinafter. Compression of the spring 56

by pressing on the braking lever 46 in the direction of the arrow 44, allows withdrawal of the slide bar 14 and movable jaw 12 away from the fixed jaw 22. This force brings the end 50 of the lever 46 into perpendicularity with the direction of the intended motion of the slide bar so that the slide bar 14 is free to slide in either direction through the opening 48 in the braking lever 46.

The trigger handle 24 is squeezed in the direction indicated by the arrow 44 to incrementally advance the slide bar 14 with its attached movable jaw 12 toward the fixed jaw 22. When the handle 24 is squeezed between a user's hand (not shown) and the handgrip 20, pivoting occurs about the pivot pin 26 and the end 40 of the trigger handle 24 moves in the direction of the arrow 44. This causes the driving lever 32 to pivot about its upper end (Fig. 4), so that the driving lever 32 is no longer perpendicular to the direction 44 of intended motion of the slide bar 14. Pivoting the driving lever 32 compresses the spring 36 and also causes the edges of the hole 34 through the driving lever 32 to bind against the surface of the slide rod 14. Binding occurs because the driving lever 32 is no longer perpendicular to the direction 44 of the intended motion of the slide bar 14. Further motion of the trigger handle 24 causes the driving lever 32 to translate in the direction of the arrow 44. This motion further compresses the spring 36, and in the process, by means of the binding interference between the lever 32 and rod 14, advances the bar 14 and its connected movable jaw 12 toward the fixed jaw 22. The maximum distance of advance of

the movable jaw 12 with one stroke of the trigger handle 24 is limited when the spring 36 is fully compressed or, in an alternative construction, the handle 24 strikes the inner surface 58 of the handgrip 20.

However, the stroke of the trigger handle 24 can be through any lesser arc, thereby diminishing the distance the movable jaw 12 travels in a single stroke in proportion to the angle of the trigger handle stroke. Additional strokes may be applied to the trigger handle 24 of any magnitude until the jaws 12, 22 come together or, a workpiece (not shown) is firmly gripped between them.

After the trigger handle 24 is fully pivoted in the direction of the arrow 44 about the pivot pin 26, release of the trigger handle 24 causes the return of the trigger handle 24, driving lever 32 and spring 36 to the position shown in Fig. 4 as a result of the compressive forces in the spring 36 urging the components toward the movable jaw 12.

A transverse pin 60 passing through the free end of the slide bar 14 prevents withdrawal of the slide bar 14 from the slot 16 when the braking lever 46 is pressed in the direction of the arrow 44 and the movable jaw 12 is manually drawn away from the fixed jaw 22. It should be noted that operation of the trigger handle 24 is ineffective in accomplishing any motion of the slide bar 14 in the direction opposite to the arrow 44.

For illustrative purposes only, protective pads 62 are shown attached to the jaws 12, 22. Also for illustrative purposes, the

moving jaw 12 and the handle/grip assembly 18 are formed of halves which are held together by screws 68. In the illustrated embodiment (Fig. 4) in accordance with the invention, the slide bar 14 has a rectangular cross-section. In alternative embodiments in accordance with the invention, the slide bar 14 may be any shape, for examples, square, round, triangular, and the openings 34, 48 in the levers 32, 46, respectively are appropriately shaped for proper binding interference with the slide bar 14.

In summary, if it is considered that a workpiece is to be clamped between the jaws 12, 22, the movable jaw 12 can be advanced toward the fixed jaw 26 either in one continuous motion, merely by pushing in the direction of the arrow 44 on the movable jaw 22 or, by operating the trigger handle 24 in a series of strokes of length to be determined by the user. Large strokes may be used at first and small strokes later as the desired pressure is applied to the workpiece. During this advancing operation, the braking lever 46 prevents any backward motion of the slide bar 14 after each advance has been completed. While the braking lever 46 holds the bar 14, the trigger handle 24 is released. The spring 36 then returns the handle 24 and driving lever 32 to the positions shown in Fig. 4, ready for another stroke. At any time when the user desires to retract the movable jaw 12 away from the fixed jaw 22, for example, to release a workpiece or to open the bar clamp to receive a workpiece, it is only necessary to pull on the movable jaw 12 in the direction

opposite to the arrow 44 while simultaneously compressing the spring 54 by pressing on the braking lever 46 in the direction of the arrow 44.

It should be noted that all operations of the trigger handle 24 and braking lever 46 can be accomplished with the same hand while holding the bar clamp 10 with that hand. Either the index or middle finger is in position to actuate the braking lever 46 as required while the fingers encircle and contain the trigger handle 24 and handgrip 20.

As best illustrated in Figures 2 and 3, the overall quick-action bar clamp 10 in accordance with the invention is basically flat, takes up little space, and can be operated in tight places. Slide bars 14 of different lengths may be used.

In Figs. 1-4, the handle/grip assembly 18 is formed of halves which are held together by screws 66 and the trigger handle 24 is solid and slips into the cavity 28 in the handgrip 20. In an alternative embodiment (Figs. 5-7), a quick-action bar clamp 110 in accordance with the invention includes a one-piece handle/grip assembly 118, which includes no internal recess, and a basically U-shaped trigger handle 124. When the trigger handle 124 is squeezed against the handgrip 120, as will be apparent in Fig. 7, the handle 124 moves in the direction of the arrow 144 and straddles the handgrip 102. The end 150 of the braking lever 146 pivots in a recess 152 in the handle/grip assembly body 119. The trigger handle 124 pivots about an axis 126 and includes semi-circular tabs 170 which are recessed into correspondingly

shaped slots 172 in the body 119.

Operation of the bar clamp of Figs. 5-7 is the same as that for the embodiment of Figs. 1-4, taking note that the reference numerals in Figs. 5-7 correspond with those numerals used in describing Figs. 1-4, with addition of 100 thereto.

It will thus be seen that the objects set forth above, among those made apparent from the preceding description, are efficiently attained and, since certain changes may be made in the above construction without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings, shall be interpreted as illustrative and not in a limiting sense.

CLAIMS

1. A quick acting clamp comprises a fixed jaw and an opposing movable jaw, the movable jaw being attached to one end of a slide which is movable to carry said movable jaw toward and away from said fixed jaw, and the fixed jaw being connected to support means for supporting said slide, the support means also being connected to a hand grip whereby the clamp is holdable, one-way drive means for releasably engaging and, when engaged, for advancing said slide and attached movable jaw from a first position to a second position closer to said fixed jaw, said one-way drive means comprising a driving lever acting on the slide and a trigger handle which is connected to the support means adjacent to the hand grip and co-operates with the driving lever such that actuation of the trigger handle causes the driving lever to engage and advance the slide, and a braking lever which normally engages the slide to prevent motion of the movable jaw away from the fixed jaw, but allows such motion when actuated and thereby released from the slide, the braking lever being positioned forwardly of the trigger handle in the direction of the movable jaw.

2. A quick-acting clamp as claimed in claim 1 wherein when the one-way drive means is disengaged the slide and attached movable jaw are capable of continuous motion toward and away



from the fixed jaw by application of external force to the slide.

3. A quick-acting clamp as claimed in claim 1 or 2 wherein the braking lever has one end pivotably connected to the support means, and further including first bias means for urging the braking lever into engagement with the slide, withdrawal of the movable jaw away from the fixed jaw being prevented by said engagement, the braking lever being subject to release from engagement with the slide by application of an external force to the other end of the braking lever to counteract the first bias means and pivot the braking lever.

4. A quick-acting clamp as claimed in any preceding claim wherein the driving lever of the one-way drive means is normally disengaged from the slide, and movement of the trigger handle in a first direction from a standby position forces the driving lever into engagement with the slide thereby moving the slide and the movable jaw toward the fixed jaw.

5. A quick-acting clamp as claimed in claim 4 wherein the one-way drive means further includes second bias means for normally urging the driving lever out of engagement with the slide, and for returning the trigger handle in a direction opposite to the aforesaid first direction to the standby position after the trigger handle is released.



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6. A quick-acting clamp as claimed in claim 5 wherein the first and second biasing means are springs.

7. A quick-acting clamp as claimed in any preceding claim wherein the distance of slide advance for each actuation of the handle is directly related to the magnitude of handle motion.

8. A quick-acting clamp as claimed in any preceding claim wherein the engagement between the respective levers and the slide result from mechanical interference between the slide and the levers.

9. A quick-acting clamp as claimed in any preceding claim wherein the slide passes through respective openings in each of the levers and the engagement therebetween results from binding of the surface of the slide with edges of each of the openings.

10. A quick-acting clamp substantially as hereinbefore described with reference to and as illustrated in Figs. 1 to 4, or Figs. 5 to 7 of the accompanying drawings.
