Nov. 12, 1940. H. V. HOLMAN 2,221,325

ADJUSTABLE CLAMPING DEVICE

Filed Aug. 20, 1938

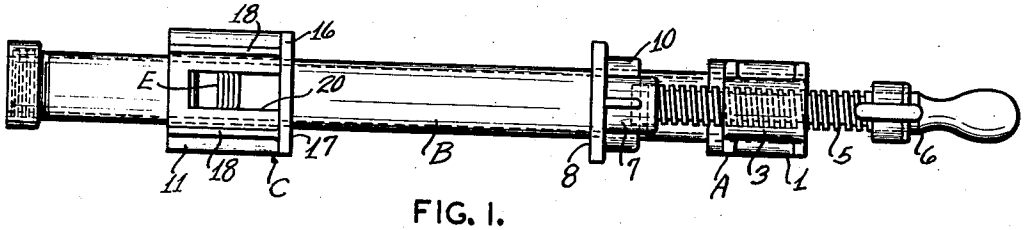


FIG. 1.

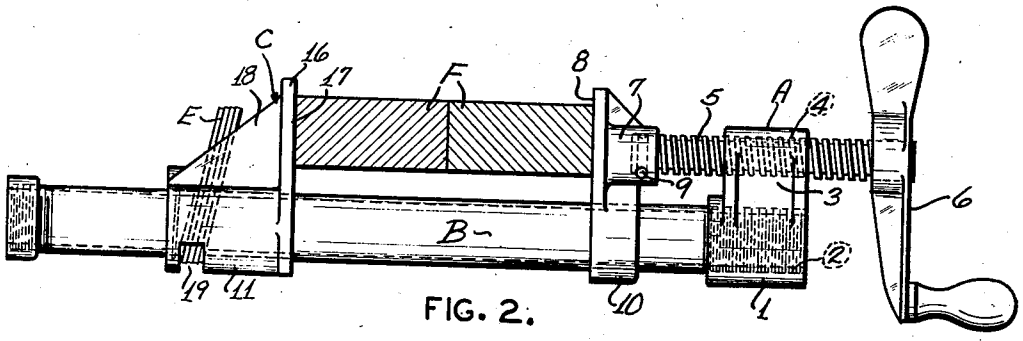


FIG. 2.

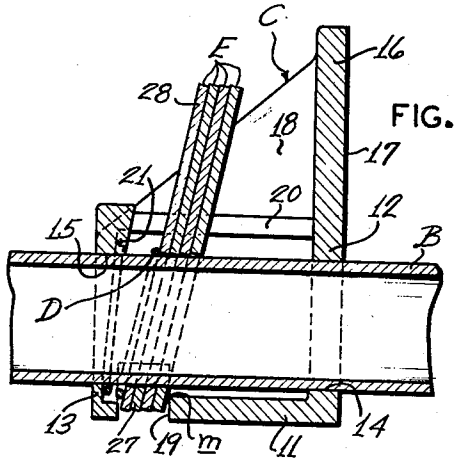


FIG. 3.

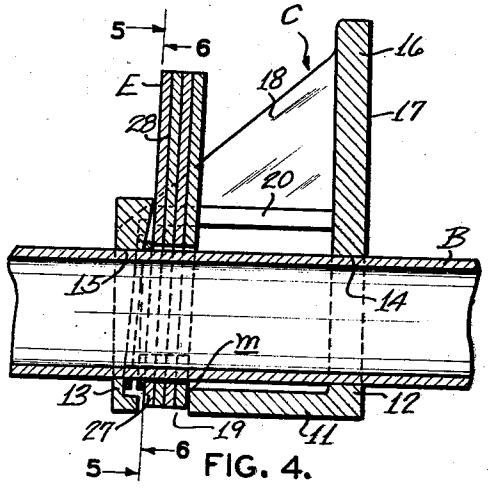


FIG. 4.

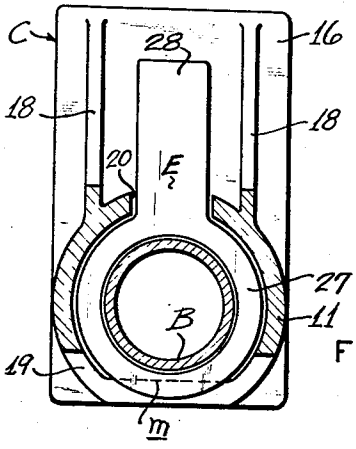


FIG. 5.

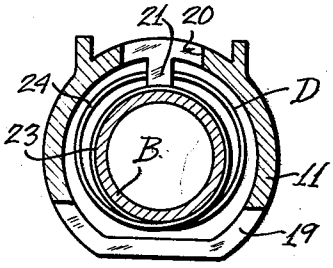


FIG. 6.

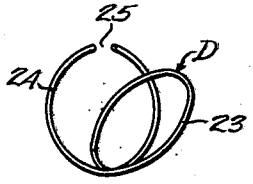


FIG. 7.

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2,221,325

ADJUSTABLE CLAMPING DEVICE

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Application August 20, 1938, Serial No. 225,948

2 Claims. (Cl. 144—303)

The present invention relates to adjustable clamping devices of the type for clamping, within a given range, any size of work to be clamped therein, and more particularly to the locking of the clamping jaw means which is adjustably accommodatable to the different sizes of the work to be handled.

Among the objects of the invention is to provide, in an adjustable type of clamping device which has a bar and relatively movable clamping jaws, such as a screw operated clamping jaw slidably connected to an end portion of the bar and an adjustable clamping jaw means slidable along the body of the bar in accommodation to any given size of work to be clamped between the jaws; a novel locking means for normally holding the adjustable clamping jaw means in clamping position and for adjusting the adjustable jaw means when the locking means is unlocked or released from locking position. The adjustable clamping jaw means comprises a rearwardly presented thrust point or abutting element, as at the rear end of a rearwardly extending portion of the jaw, for bearing, when under a clamping load, against an end of a locking key means, whether a single key element or consisting of a series of locking key elements. The key means has a finger gripping portion at the other end of the key means, and has intermediately the ends thereof spaced locking points for engaging opposite sides, as the upper and lower sides, of the bar when the key means is canted or tilted, as forwardly, by the thrust point or abutting element mentioned when the latter is bearing against the end of the key means, as at the lower end thereof, under a clamping load, or by manually moving the finger gripping end portion of the key means forwardly, that is, in the clamping direction.

In the present invention, it has been found in practice that the canted key means, when under a clamping load, has somewhat different actions upon the bar when comparing the locking points of the key means contacting the bar adjacent to the point where the clamping load bears against the key means, with the locking points of the key means contacting the bar on the side opposite to such bearing point of the clamping load against the key means. That is to say, where the clamping load is communicated most directly to the side of the bar, which is the same side where the clamping load bears against the key means, the edges or locking points of the key means are presented to the bar at such an angle that there is a tendency for the key means to bite or cut into the material of the bar, while on the other hand, the edges or locking points of the key means which are presented to the bar, by the canting action of the key means, at the point opposite to that where the clamping load is most directly applied, are at such angles that there is very little, if any, tendency for these edges or locking points to cut into the material of the bar, but rather to "drag" in relation to the motion which would be imparted by the action of the clamping in the device.

The present invention comprehends also the novel feature of releasing the locking means for immediate adjustment of the clamping jaw means, as rearwardly, which is in the same direction as for releasing the key means. When releasing the key means, which may become rather securely locked to the bar under the clamping load and canting action, for the purpose of making readjustment of the clamp opening size, the edge of the key means which is on the side of the bar opposite to the point of contact of the clamping load is more easily released than the edges or locking points which are more nearly adjacent the point of contact of the clamping load.

By the present invention, I have, contrary to all previously known practice, so changed the location of the bearing or abutting point of the clamping jaw means with the locking key means, that the clamping load is directed against the key means at a point diametrically opposite and remote from the finger gripping portion of the locking key means where the releasing force is very easily applied for readily unlocking the keys with much less force. This change in location of the load bearing point may be best expressed in terms of leverage required for the releasing of the locking key means. The contact point of the key means on the bar at the load bearing point being the more difficult to release is assumed to constitute the fulcrum of the leverage required in the releasing action. The end of the finger gripping portion of the key means is where the fingers apply force for the releasing action. In such device the power arm of the releasing leverage is practically that of the entire length of the key means, and is in the form of a second class lever, while in existing devices the canting key actions follow the first class lever principle, with consequent less length in the power arm.

Another object of the invention includes the idea of a key means with a finger gripping portion so related that the greatest ease and convenience may be had for adjustment of the

clamping jaw means. The latter may be adjusted forwardly to reduce the clamping size of the device by merely pushing the clamping jaw forwardly, and the drag of the key means on the bar, as the upper side thereof, will maintain the key means in unlocked condition. When adjusting the clamping jaw means rearwardly, it only requires that the key means be simultaneously released from the locked position thereof, the rearward pull on the finger gripping portion of the key means serving the double purpose of releasing the key means and pulling the clamping jaw rearwardly with but one action.

In existing structures, a separate action is necessary, namely, the key means must be pressed in the clamping direction to unlock the key means, and the latter must be held in that condition for adjustment of the clamping jaw means regardless of the direction of adjustment, but especially so when adjusting the clamping jaw means rearwardly. The present invention embodies the advantage of greater convenience and directness in the action of adjustment.

In structures where the keys bear on a fulcrum about midway of the length of the keys, operating on a first class lever principle, it is necessary to apply considerably more effort on the handles or finger gripping portion of the series to effect such counter-canting as to unlock the keys from the bar, and, moreover, the movement of the finger gripping portion to effect release of the jaw is in the clamping direction of the jaw instead of the releasing direction as is the case in the present invention. Also in the case of the first class lever type of keys the initial movement of the keys in the counter-canting direction effects a deeper biting of the locking points before passing by the point where unlocking starts. In the present invention, wherein the keys operate on a second class lever principle, the unlocking action begins immediately upon the initial movement of the series, and, it will be noted, in the releasing direction of the adjustable clamping jaw.

Furthermore, in such other structure above referred to, as well as in other clamping devices for similar purposes, at least two actions are necessary to adjust the slidable adjusting jaw rearwardly. When the key bears on a fulcrum about midway of the length of the key, operating on the principle of a first class lever, in order to unlock the key it is necessary to press the finger-grip portion forwardly or in the clamping direction of the jaw, and to hold the key in this position against the pressure of the spring while at the same time also exerting effort in exactly the opposite direction in order to move the adjustable jaw rearwardly to the desired position before the key may be released by the hand. Other types of clamping devices require different means of holding their respective locking devices open, such as a lateral or upward or downward pressure upon a pawl or cam, or upon the jaw itself, while at the same time also exerting some effort of propulsion rearwardly, or other combinations of movement or effort to obtain such desired rearward movement of the adjusting jaw. A very important and valuable advantage of the present invention lies in the fact that only one movement or effort in one direction serves both to unlock the adjustable clamping jaw and to move it rearwardly to a new location on the bar in that direction. This further tends to reduce the amount of effort required to unlock and move the adjustable jaw rearwardly, and makes a time-saving element in the operation of such a clamp. It will be noted that in this structure a forward movement of the clamping jaw may be had simply by pressing the jaw forward and that the locking device may be effective only as against movement rearwardly. These are important and valuable advantages. The effort required is immensely less. Because the movement is in the releasing direction of the jaw, the counter-clamping force acts in aid of the unlocking action of the series.

In the particular embodiment chosen to illustrate the invention, the adjustable clamping jaw means has a thrust or abutting element which bears against the lower end of the locking key means, comprising a series of keys, on the opposite side of the bar from that where the finger gripping portion of the key means is disposed for releasing the key means from locked position;

By this means a much greater leverage in the power arm is obtained without increasing the length or the weight of the key means, and also a change of direction of the motion required to release the key means is effected advantageously in the direction of adjustment of the adjustable clamping jaw means.

Other objects, advantages, capabilities, features or the like are comprehended by the present invention, as will later appear and as are inherently possessed by the invention.

Referring to the drawing:

Fig. 1 is a top plan view of a device embodying the invention;

Fig. 2 is a side view in elevation thereof, showing the work or work-piece in section;

Figs. 3 and 4 are longitudinal fragmentary sectional views, on an enlarged scale, of the invention, showing the locked and unlocked conditions thereof respectively;

Fig. 5 is a vertical transverse sectional view taken in a plane represented by line 5—5 of Fig. 4 of the drawing;

Fig. 6 is a similar view taken in a plane represented by line 6—6 of Fig. 4 of the drawing; and

Fig. 7 is a perspective view of a spring that may be used in the device.

Referring now more in detail to the drawing, the embodiment selected to illustrate the invention is shown in an adjustable type of clamping device comprising a bar B, which as shown is of tubular or pipe form but may be of any cross-sectional shape desired, whether hollow or solid, such as oval shaped, square, rectangular, polygonal, or otherwise.

To an end of the bar B is secured, as by threads or the like, an end piece A comprising a socket 1 having a thread 2 for securement therein of the threaded end of the bar B, and a nut part 3 having a thread 4 for operative reception of a clamp screw 5 having a hand crank 6 at an end thereof. The other end of the screw 5 is rotatively connected to a clamping jaw 7 having a work clamping face 8. The rotative connection is by way of a usual groove and pin connection 9. The jaw 7 carries a hub 10 slidable on the bar B.

Slidable along the bar B is an adjustable clamping jaw means C comprising a hub portion 11 provided with integral spaced forward and rear wall portions 12 and 13 respectively suitably provided with alined holes 14 and 15 for the relative sliding therethrough of the bar B. The upper portion of the wall 12 constitutes a clamping jaw 16 having a clamping face 17. Between the walls 12 and 13 extend spaced integral reinforcing webs 18. The rear lower portion of the

hub 11 is provided with a transverse arcuate slot 19 and the upper portion of the hub 11 is provided with an elongated slot 20.

At the upper front part of the rear wall 13 is provided a depending lug 21 which acts as an anchoring element for the spring B shown in perspective in Fig. 7. This spring comprises a pair of convolutions 23 and 24 with the ends of the spring, in the convolution 24, spaced to provide a gap 25 for extension therein of the anchor lug 21, the ends of the spring bearing on both sides of the lug 21. The convolutions of the spring D surround the bar B with the convolution 24 lying against the front face of the wall 13 and the other convolution pressing forward to lie against the rear key of a series of locking keys E.

Each of the keys of the series of keys E is, in the illustrated embodiment, in the form of an elongated flat member comprising a loop portion 27 surrounding the bar B and with the lower end of the loop, which is the lower end of the key, located in the cross slot 19 so that such lower end, in the aggregate of the series, constitutes a bearing against which the thrust or abutment element presented rearwardly from the lower part of the hub 11 and forwardly of the cross slot 19, may rest and press in transmission of the load generated by the action of the clamping against the clamping jaw means and resisted by the locking key means.

The upper portion of the keys is in the form of extensions or arms which in the aggregate constitute a finger gripping portion 28 for the series E, these arms extending through the slot 20 and into the space between the webs 18.

The forward upper corner of the rear wall 13 constitutes a rear thrust or abutting element for the rearward contacting or abutting of the key assembly (see Fig. 4), when the key means is pressed rearwardly to both release the locking and to rearwardly move the slidable clamping jaw C by a single and simple rearward manual force. At such time, the lower end of the key means abuts the thrust element *m* and the rear of the finger gripping portion of the key means abuts the thrust element at the upper forward corner of the wall 13 as fully shown in Fig. 4.

The upper and lower edges of the openings in the keys, through which the bar B extends, constitute locking points for engagement with the upper and lower sides of the bar when the keys are canted as shown in Fig. 3, in which position or relation the keys lock and resist any rearward motion of the clamping jaw means C in response to any load by the action of clamping. It will be noted that these locking points are intermediate the ends of the keys with the upper locking points about midway thereof and the lower locking points proximate to the lower abutment end portion of the series.

In use the work or work-piece F is located in the space between the jaws 7 and 16 and in contact with the jaw face 8. Then the operator or workman slides the adjustable clamping jaw means C, the keys being in upright unlocked position, as shown in Fig. 4, along the bar toward and into contact with the rear end of the work F. He then either presses the finger grip portion 28 of the keys forwardly or, when the spring D is used, permits the loop or convolution 23 to automatically press the keys forward, so as to cant or tilt them toward the position shown in Fig. 3. This will effect at least a preliminary locking of the clamping jaw means C to the bar B. Then he operates the clamping screw to clamp home the clamping jaw 7 against the forward end of the work F. The clamping stress is effective via the work F, the jaw means C, the lower portion of the hub 11, and the thrust or abutment element *m* which forcibly acts against the lower end of the series of keys E, so as to determine the locking action. This effects final canting of the keys so that the locking points firmly engage with the lower and upper sides of the bar B, the lower locking points apparently biting into the bar with greater cutting or biting action than the opposing locking points.

The releasing of the work F may be effected in either of two ways. One by the operator operating the clamping screw 5 to unclamp the jaw 7, or by unlocking the jaw means C by manually moving the keys to upright position as shown in Fig. 4, and then sliding the means C rearwardly on the bar B. In either event, the unlocking or release is produced by the operator pressing rearwardly on the finger grip portion 28 to swing the series of keys about the lower locking points on the bar and to upright position, as shown in Fig. 4, after which the means C is easily slid rearwardly along the bar B. It will be noted that the direction of the force applied to the finger grip portion 28 is in the releasing direction of the jaw means C, or, in other words, in a counter-clamping direction.

While a spring is shown, in the illustrated embodiment, its use is not essential since the operator may manually cant the keys forwardly when moving or adjusting the clamping jaw means C to position, but a spring is convenient for automatically performing the same function as would otherwise be effected manually.

In the action of releasing the jaw for readjustment, the location of the "fulcrum" of the releasing leverage at a point farthest from that point where the releasing effort is applied, there is the advantage gained of having a long power arm without increasing the length of the key means. This increased leverage is not only advantageous for unlocking the key means, but includes the same advantages in leverage for opposing the counteracting force of the spring when a spring is used, not only in the action of unlocking the key means but also in retaining the key means in unlocked position during the period while the jaws are in movement for readjustment.

While the embodiment selected to illustrate the invention is shown with a series of key elements, it is to be understood that a single key element may be used, if desired. However, the use of a series of key elements has the advantage of distributing the needed locking force. With this view, the series of keys may be regarded as a single key element or means having the necessary spaced locking points for proper engagement with the bar.

While I have herein described and upon the drawing shown an illustrative embodiment of the invention, it is to be understood that the invention is not limited thereto but comprehends other constructions, details, arrangement of parts, features, or the like without departing from the spirit of the invention.

Having thus disclosed the invention, I claim:

1. In an adjustable type of clamping device having a bar, a clamping jaw means connected to an end portion of the bar and an adjustable clamping jaw means slidable along the body of the bar; the combination with said adjustable jaw means of a rearwardly presented abutting element adjacent to a side of said bar, a locking

key means having at an end thereof a finger gripping lever arm portion extending away from the opposite side of the bar and having locking points at the inner end portion of said lever arm portion engageable with said opposite side of said bar when said key means is forwardly canted with said lever arm portion thereof, and further having locking points at the other end of said key means and engageable with said first mentioned side of said bar when said abutting element bears rearwardly against said other end of said key means adjacent said further locking point for canting said key means whereby said further locking points are the more forceably locked with said first mentioned side of said bar when in locking position and about which further locking points said key means turns when said lever arm portion of the key means is moved rearwardly both to unlock said key means from said bar with the greatest possible lever advantage and to adjust said adjustable jaw means by a single application of force against said lever arm portion in a rearward direction.

2. In an adjustable type of clamping device having a bar and relatively movable clamping jaws of which one of said jaws is adjustable relative to said bar and is provided with a cross slot the forward edge of which constitutes a rearwardly presented thrust element adjacent to one side of said bar, a releasable locking key means having an end portion thereof located in said slot at said side of said bar and rearwardly of said thrust element to be engaged by said thrust element when said adjustable jaw is in clamping condition, said key means having a finger gripping portion at the other end thereof and at the opposite side of said bar from that where the thrust element is located, said key means having intermediate the end portions thereof spaced locking points which engage with opposite sides of the bar when the key means is so canted as to move said finger gripping portion forwardly in the clamping direction of said adjustable jaw, and when said thrust element is rearwardly forced against said end portion of said key means located in said slot, and which disengage from said bar when the finger gripping portion of the key means is moved rearwardly.

HARRY V. HOLMAN.