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T. D. PHILLIPS

2,735,323

QUICK-SETTING VISE CLAMP

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Fig. 1

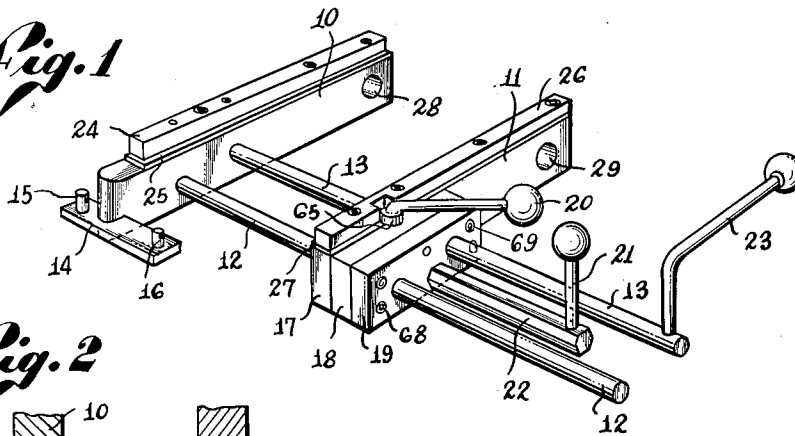


Fig. 2

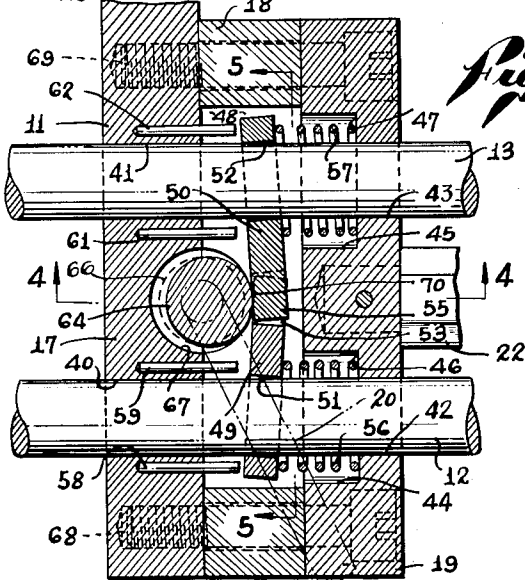
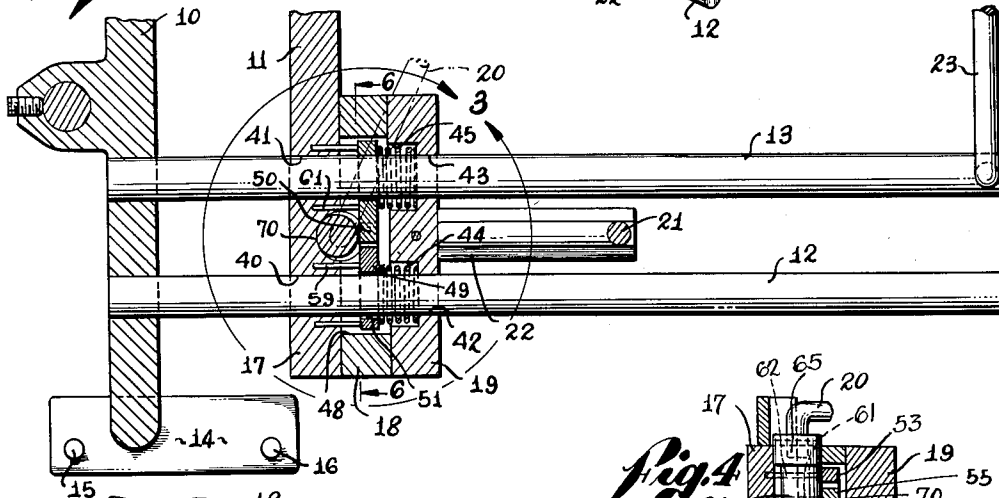


Fig. 3

Fig. 4

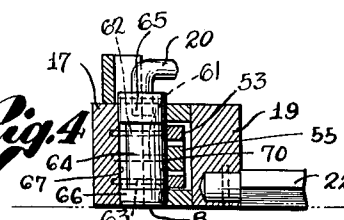


Fig. 5

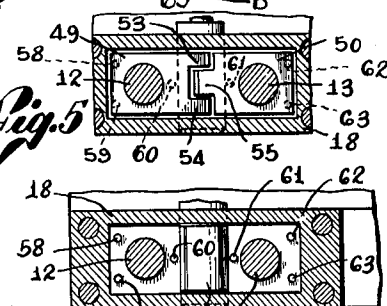
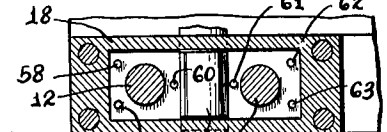


Fig. 6



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2,735,323

QUICK-SETTING VISE CLAMP

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3 Claims. (Cl. 81-17)

This invention relates to clamps and more particularly to a combination quick setting clamp and vise useful for holding fixtures and/or work pieces during machining operations. While the invention will be described primarily with respect to drilling operations, it is to be understood that its principles are applicable in other apparatus employed with different machines.

A primary object of the invention is to provide an improved combination clamp and vise which will accommodate different fixtures and/or work pieces varying greatly in their dimensions, and yet which may be rapidly operated to engage and disengage a work piece.

Another object is to provide in a clamp of the above type, clamping means for securely holding a work piece while such work piece is resting on its own base.

A further object in this regard is to provide means for compensating the uneven pressure set up in the clamp jaws, when the end portions thereof are engaging a work piece.

Still another object is to provide in a clamp of the above type, vise means for securing a work piece on hardened gibs with a maximum of clearance above a drill press table, whereby the drill may pass completely through the work piece without interference and without fear of drilling into the table.

Another object is to provide a combination clamp and vise incorporating a leveling means for insuring that the apparatus will remain level for all positions of its jaw members.

These and additional objects and advantages of the invention are attained by providing a combination clamp and vise comprising a pair of jaw members, one of which is transversely fixed to a pair of horizontally disposed parallel rods or guide means. The other jaw member is provided with bores receiving the rods whereby it may be rapidly moved towards or away from the fixed jaw member. The movable jaw member is provided with an interior recess through which the guide rods pass. Within this recess there are provided locking elements in the form of plates having openings encircling the rods. A cam means changes the orientation of the plates to cause the peripheral edges of the openings to frictionally engage the rods and thus lock the movable jaw member thereto. The engagement is such that as the elements are reoriented, the movable jaw member is urged against the work piece with considerable pressure. Release of the camming means initially retracts the movable jaw member and permits it to be pulled away from the work piece to free it in a minimum of time.

In accordance with an important feature of the invention, the locking mechanism is designed to engage one of the guide rods prior to the other whereby the jaw members are tightened in such a manner as to compensate for clearance necessary in the locking mechanism itself and to compensate for "give" set up in the jaw members when their extended end portions are engaging a work piece.

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A better understanding of the invention will be had by referring to the accompanying drawings, in which:

Fig. 1 is a perspective view of the combination clamp and vise;

Fig. 2 is a plan view, partly in section, of the clamp shown in Fig. 1 in unlocked position;

Fig. 3 is an enlarged plan view of that portion of the clamp enclosed by the circular arrow 3 in Fig. 2 and shows the clamp in locked position;

Fig. 4 is an elevational sectional view on a reduced scale, as taken along the line 4-4 of Fig. 3;

Fig. 5 is another elevational sectional view on a reduced scale, as taken along the line 5-5 of Fig. 3; and,

Fig. 6 is still another elevational sectional view on a reduced scale, as taken along the line 6-6 of Fig. 2.

Referring to Fig. 1, the preferred form of clamp is illustrated as comprising a pair of jaw members 10 and 11. The jaw member 10 is rigidly secured transversely to the ends of a pair of horizontal parallel guide rods 12 and 13. The jaw member 11 is movable along the rods, being provided with a pair of horizontal bores for receiving the same as shown.

The fixed jaw member 10 may be provided with a plate fastener 14 shown as secured to one end of the jaw member. This plate is provided in turn with two pivot pins 15 and 16 to which the arms of a torque compensator may be affixed.

The movable jaw member 11 includes a block made up of three plate members 17, 18, and 19, the purpose of which will become clear as the description proceeds. A suitable operating handle 20 is provided projecting upwardly and outwardly from the block. This handle is for locking the movable jaw member to the rods 12 and 13 when the jaw member has been set in a selected position. A further handle 21 projects up from a slide bar 22. As shown, this slide bar is secured at one end to the block plate 19, its underside being flush with the underside of the movable jaw. The other end of the slide bar is secured to the handle 21. The handle 21 in cooperation with the slide bar 22 permits the movable jaw to be easily set in any position along the rods 12 and 13 without danger of the operator's hands being injured.

Another handle 23 may be provided extending upwardly and outwardly from the guide rod 13 as shown for convenient positioning of the entire clamp, for example, on the surface of a drill press table.

The fixed jaw member 10 may be provided with an off-set stop or plate 24 mounted on a hardened gib 25 upon which a work piece may rest. Similarly, the movable jaw member 11 may be provided with an off-set plate 26 mounted on a gib 27 for supporting the work piece. With this arrangement, the clamp is operating as a vise to support the work piece well above the surface of the drill press table whereby a bore hole may be drilled entirely through the work piece without fear of damaging the clamp or table.

To insure that the jaw members 10 and 11 will remain parallel when employing the apparatus as a vise, one or more floating rods (not shown) may be passed through aligned bores, such as the two bores 28 and 29, the floating rod thus being parallel to the guide rods 12 and 13.

When the apparatus is employed as a clamp, such floating rods are removed whereby the extended end portions of the jaws 10 and 11 may engage a work piece resting on its own base.

Referring now to Figs. 2 and 3, the construction of the movable jaw member is shown in greater detail. The plate 17 which may form an integral extension of the jaw engaging portion 11, is provided with spaced horizontal bores 40 and 41 through which the rods 12

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and 13 pass. Similarly, the plate 19 is provided with bores 42 and 43 registering with the bores 40 and 41 respectively; counterbores 44 and 45, respectively, drilled into the inner side of the plate 19 affording annular shoulders 46 and 47 as best seen in Fig. 3. The center plate 18 is provided with a recess 48 within which are disposed a pair of locking plate elements 49 and 50 provided with openings 51 and 52 for receiving the guide rods 12 and 13 respectively. The openings 51 and 52 are dimensioned to permit easy sliding of the rods there-through when the elements are in the position shown in Fig. 2, and also tilting of the plates relative to the rods, as shown in Fig. 3. In the position of Fig. 2 these plate elements are in their unlocked state and lie in a plane substantially normal to the guide rods.

As shown in greater detail in Fig. 5, the plate elements are arranged to overlap by the provision of end projections or ears 53 and 54 on the upper and lower end portions of the element 49, and the provision of a tongue 55 projecting from the center end portion of the element 50 between the two projections of element 49. The arrangement permits the two elements to be sequentially moved to locking position by a single vertical elongated camming surface urged against the overlapping portions as will be come clear as the description proceeds.

Referring again to Fig. 3, the counterbores 44 and 45 in the plate member 19 house compression coil springs 56 and 57, respectively, the inner ends of these springs being seated on the annular shoulders 46 and 47, respectively, and their opposite ends engaging the plate elements 49 and 50 and tending to bias these elements into their unlocked position shown in Fig. 2. The elements in this position are supported by pin means comprising a series of three pins 58, 59, and 60 (Fig. 6) projecting into the recess 48 in a direction normal to the plane of the elements for providing a three-point seating support for element 49, and a second series of three pins 61, 62, and 63 similarly projecting into the recess and providing a three-point seating support for the element 50. The positioning of these pins is clearly shown in Fig. 6 and it will be seen that one of the three pins in each set is out of alignment with the other two whereby their ends mark the vertices of a triangle. The ends of these pins are carefully machined so as to lie in the same plane and thus support the associated elements in cooperation with the compression springs in a position substantially normal to the guide rods when in unlocked position. Because of the fact that the elements are so supported in a plane normal to the guide rods, movement of the movable jaw member is easily executed, the rods sliding freely through the openings in the elements.

Within the recess 48 there is provided an eccentric member 64 having enlarged coaxial heads 65 and 66 fitted within a vertical bore 67 communicating with the recess 48 as clearly shown in Fig. 4. This member is of cylindrical shape, having a reduced diameter center portion eccentrically positioned with respect to the vertical axis of the cylinder. The eccentric member 64 is positioned to lie adjacent the plate elements 49 and 50, said member passing down between the pin means. As shown in Fig. 4, the bottom peripheral portion of the bore 67 may be peened inwardly to form an annular seat B for the head 66 of the eccentric member for supporting the same. The upper head 65 is rigidly secured to the operating handle 20, this handle serving as a means for rotating the eccentric member in the bore 67.

It will be noted in Figs. 2, 3, and 4, that the eccentric member is so positioned with respect to the plate elements 49 and 50, that in one position as shown in Fig. 2, the plate elements are in substantially the same plane and are seated on the pin means. When the eccentric member 64 has been rotated approximately 180 degrees, the surface 70 thereof will have cammed the two elements to the positions shown in Fig. 3.

The three plates 17, 18, and 19 are held together as

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an integral unit by bolts 68 and 69 as shown in Fig. 3. This arrangement permits easy assembly of the three plates, roll pins being used at the opposite corners to insure perfect alignment as shown in Fig. 1.

Operation

The operation of the clamp will be clear from the above description. Initially the jaw members 10 and 11 are separated to permit a fixture and/or work piece to be properly positioned between the jaws, either on the gibs 24 and 27 or in a position resting directly on the drill press table. The operator then simply slides the movable jaw member 11 along the rods 12 and 13 by means of the handle 21 and cooperating slide bar 22 towards the fixed jaw 10 to engage the work.

In the event the work is of relatively narrow dimensions whereby the jaws are relatively close together, the slide bar 22 insures that the clamp will always remain in a level position. As shown in Fig. 1, the slide bar 22 extends a certain distance in a lateral direction from the movable jaw. Since the undersurfaces of the slide bar and jaws are flush, the various members cooperate to provide a flat base and insure that the apparatus remains level regardless of the relative positions of the jaws.

The clamping apparatus may be conveniently secured to a torque compensating device by means of the pivot pins 15 and 16 on plate 14, thereby eliminating additional fixtures for holding the clamp against rotation during a drilling operation.

With the two jaws set into engagement with the work, the operating handle 20 is swung around in a counter-clockwise direction as viewed in the drawings to bring the camming surface 70 of the eccentric member 64 into engagement first with the plate element 49 and then with both the plate elements 49 and 50. Thus, the element 49 will be moved out of its plane prior to the element 50. Movement of these elements will cause the peripheral edges of their openings to frictionally engage the guide rods 12 and 13 to securely lock the movable jaw member to these rods. Because the element 49 is moved prior to the element 50, it will engage rod 12 before element 50 engages rod 13. During the interval that the plate member 50 remains free to slide on the guide rod 13, the eccentric 64 will react against the fixed plate member 49, to slightly rock the jaw 11 in a counter-clockwise direction, thereby tending to toe in the extended end portion of the jaw 11 with respect to the jaw 10. This action compensates for the "give" inherent in the jaws due to their lateral length.

Referring to Fig. 1, it will be seen that when the device is employed as a clamp to hold a work piece resting on the table, tightening of the jaws will tend to spring out the extreme end portions thereof. The initial "toeing in" effect described above, compensates for this "give" and insures a substantially even clamping pressure along the whole lateral work engaging portions of the jaws when in finally tightened position.

As shown clearly in Fig. 3, when the camming surface 70 has been swung around into final locking position, both the elements 49 and 50 are evenly engaged and both are in symmetrical positions whereby the final securing forces of the movable jaw member to each rod 12 and 13 are substantially equal. The provision of a locking element for each rod provides a doubly strong clamping pressure as compared to clamps employing only a single locking rod. Further, the provision of spaced horizontal rods to which the movable jaw is locked, permits a greater clamping pressure to be exerted at the lateral end portions of the jaws since such pressure is exerted along a line substantially parallel to and in the same horizontal plane as the rods.

It should be noted in Fig. 3 that the initial movements of the elements 49 and 50 result in the edges of their peripheral openings engaging the rods in such a manner as to urge the movable jaw towards the fixed jaw, or to

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the left as viewed in Fig. 3, thereby exerting a final tightening or clamping pressure on the work once the jaws have been set into engagement therewith. This action renders the apparatus particularly useful as a vise, since the final tightening of the jaws is quite sufficient to support a work piece in any desired position.

To release the work, the handle 20 is simply swung in the opposite direction permitting the springs 56 and 57 to return the plate elements 49 and 50 to their unlocked position against the pin support means. The seating arrangement comprising the three point pin support for each element insures proper alignment of the elements notwithstanding the possibility of foreign matter working its way into the mechanism. The chances of foreign matter working its way between one of the pin ends and the associated element is extremely remote.

As the camming surface 70 swings away from the elements in a clockwise direction, the element 50 will be released prior to the element 49 resulting in an unlocking of the jaw from the rod 13 prior to its release from rod 12. This is the reverse of the tightening operation described above and is important when the apparatus is employed as a vise supporting a work piece near the extending end portions of the jaws 10 and 11 above the drill press table. The "give" in the jaws is compensated for by this action resulting in the work being relieved of pressure along its engaged portions in a substantially even manner, whereby its tendency to rotate upon loosening of the jaws is minimized.

It is seen accordingly that the present invention has provided a combination clamp and vise which is not only extremely simple to operate, but may be operated with great rapidity resulting in enormous savings in time and labor during machining operations. Further, since the locking mechanism is incorporated in the movable jaw, a maximum opening of the jaws may be realized without an appreciable addition to the overall length of the clamp.

Various modifications within the scope of the invention will occur to those skilled in the art.

The invention accordingly is not to be thought of as limited to the precise embodiment chosen for illustrative purposes.

I claim:

1. A clamp comprising in combination: a pair of parallel guide rods; a fixed jaw secured to said guide rods; a movable jaw having bores slidably receiving said guide rods; a block fixed to said movable jaw and having a recess therein through which said guide rods pass; a locking plate within said recess having an aperture loosely passing one of the guide rods; a second locking plate within said recess having an aperture loosely passing the other guide rod; means normally positioning said locking plates in a plane normal to said guide rods; and cam means mounted on said block for engaging and camming said locking plates to grip said guide rods, said cam means being positioned to engage one of said plates prior

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to the other whereby said one plate will be gripped to its rod prior to the gripping of the other plate to its rod, so that, while said other plate remains free to slide on its rod, said cam means will react against said first gripped plate to slightly rock said movable jaw, and after both plates are gripped to said rods, said cam means will react simultaneously against both gripped plates to slidably advance said movable jaw.

2. In a clamp having a fixed jaw secured to a pair of horizontal parallel rods and a movable jaw having spaced horizontal bores therethrough receiving said rods in sliding engagement whereby the distance between the jaws may be adjusted by moving the movable jaw along the rods, a locking means for securing the movable jaw to the rods in any selected position, comprising: a block forming a part of said movable jaw and having a recess therewithin through which said rods pass; a plate element in said recess having an opening loosely passing one of the rods; another plate element in said recess having an opening loosely passing the other rod, each plate element, when said locking means is in unlocked position, lying substantially in a vertical plane normal to the rods, said movable jaw having a vertical bore communicating with said recess; a cylindrical member mounted for rotation in the bore and lying adjacent said elements, said cylindrical member having an eccentric central portion forming a camming surface that engages said elements when the cylindrical member is rotated and that moves said elements out of said vertical plane to a position in which the peripheral edges of the openings in the elements frictionally engage the rods thereby to lock the movable jaw to the rods; said eccentric control portion being movable so that its camming surface will engage and lock one of the elements to its rod prior to engaging and locking the other element, and, while said other element remains unlocked, will react against said one locked element to slightly rock said movable jaw, continued movement of said eccentric central portion causing said camming surface to engage and lock said other element, so that said eccentric central portion will then react simultaneously against both locked elements to slidably advance said movable jaw.

3. A clamp according to claim 2, including an elongated slide bar secured at one end to said movable jaw and having its undersurface flush with the undersurface of the movable jaw, said slide bar extending substantially parallel to and below said rods; and handle means secured to the other end of said slide bar.

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