

April 16, 1946.

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2,398,658

WORK HOLDING DEVICE

Filed June 11, 1943

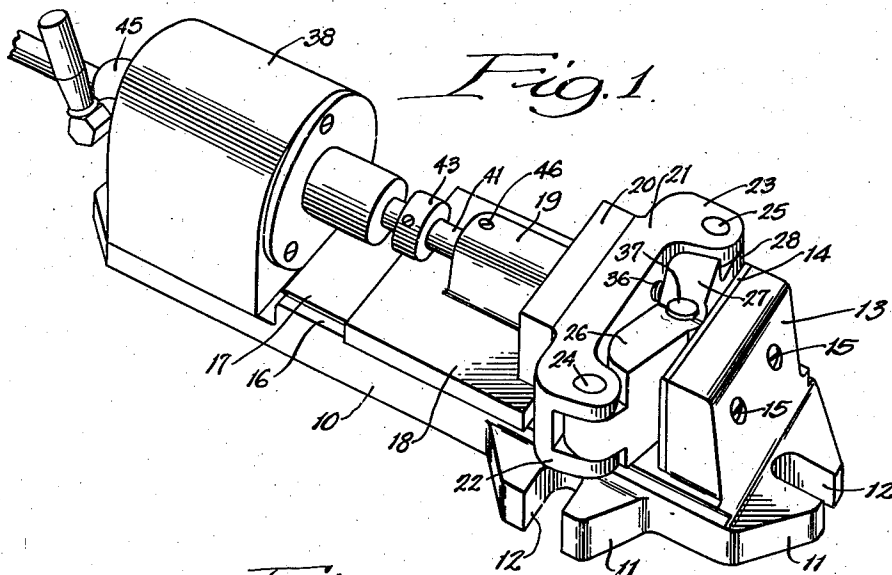


Fig. 2

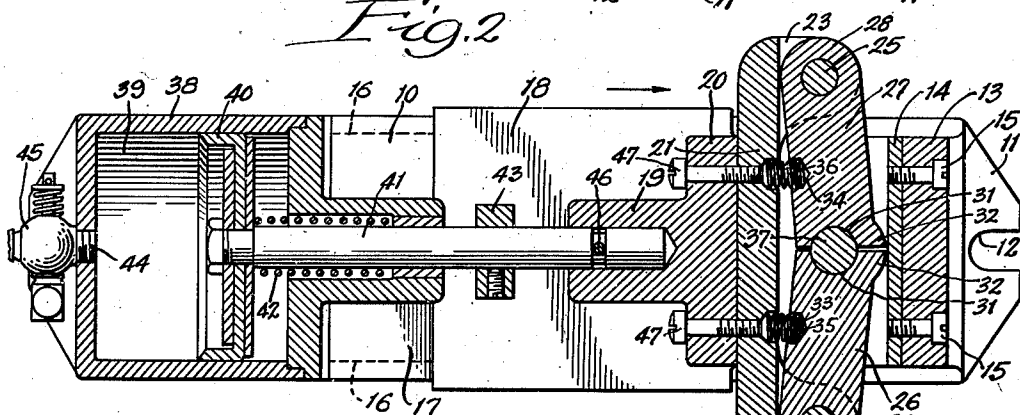


Fig. 3

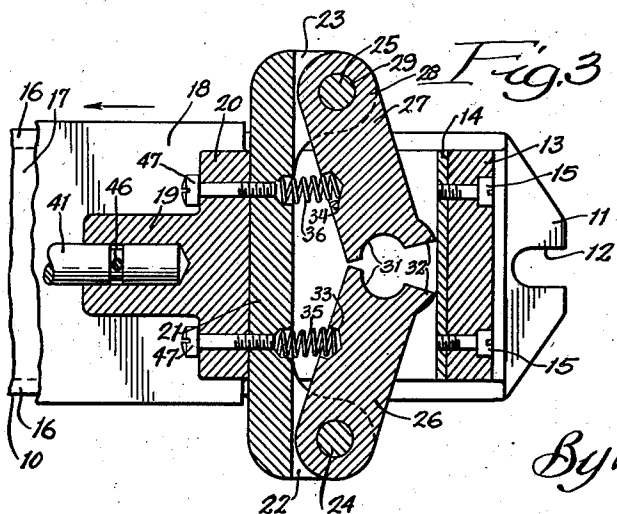
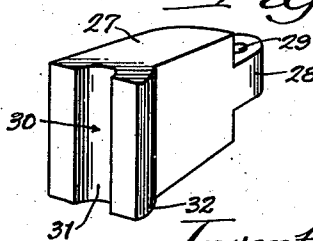


Fig. 4



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UNITED STATES PATENT OFFICE

2,398,658

WORK HOLDING DEVICE

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Application June 11, 1943, Serial No. 490,444

6 Claims. (Cl. 81-17)

This invention relates to a work holding device, and more particularly to a self-centering vise for gripping and holding pieces of work.

An object of the invention is to provide a work holding device in which pieces of work are very tightly gripped and the force exerted on the pieces is greater than would be applied through the jaws of the conventional vise heretofore used. Another object is to provide a device in which a toggle action is utilized to increase the gripping force which is applied to the work. Still another object is to provide a work holding device in which a pair of toggle members is pivotally mounted with the jaw surfaces on the ends thereof in opposed relation and adapted to tightly grip a piece of work therebetween as the members are moved toward alignment with each other.

Another object of the invention is to provide a work holding device in which the work is automatically centered as it is gripped. Yet another object is to provide in a work holding device a stationary surface and means for centering the work at a predetermined distance from said surface. A further object is to provide a work holding device in which a toggle action is utilized to tightly grip the work and the work is simultaneously centered as it is gripped. Other features and advantages will appear from the following specification and drawing, in which—

Fig. 1 is a perspective view of the device; Fig. 2 is a plan view partly in section; Fig. 3 is a fragmentary detail plan view partly in section and showing the device in another position; and Fig. 4 is a perspective view of one of the toggle members used in the device.

The invention contemplates a work holding device in which a pair of pivotally-mounted toggle members equipped with jaw surfaces at their adjacent ends are adapted to receive between them a piece of work and to tightly grip the work while simultaneously centering the same.

In the specific embodiment of the invention described herein, a base 10 is equipped with bosses 11 provided with grooves 12 by which the base may be secured to a table.

At one end, the base 10 is equipped with an upwardly-extending wall or jaw 13 corresponding to the stationary jaw of a conventional vise. The stationary jaw 13 may be equipped with a wear plate 14 of hardened metal on one side thereof, the wear plate 14 being attached to the jaw 13 by bolts 15.

The base 10 is equipped with rails 16 and an upwardly-extending projection 17 between the rails. A plate 18 is slidably mounted on the rails

16 and is secured in position by a dovetail interlock with the projection 17. A boss 19 extends upwardly from the plate 18 and joins an upwardly-extending wall 20 to which is secured a bracket 21. The bracket 21 is equipped with bifurcated end portions 22 and 23 through which the vertical pivots 24 and 25 respectively extend. Toggle members 26 and 27 are secured to the pivots 24 and 25 respectively and received within the bifurcated portions 22 and 23 of the bracket 21.

Each of the toggle members, such as the toggle member 27 seen in Fig. 4, is provided with a reduced end portion 28 having a vertical aperture 29 extending therethrough, the aperture 29 being adapted to receive the pivot 25 for mounting the toggle member. The other end of the toggle member is provided with a jaw surface 30 for engaging one side of a piece of work to be received in the device. The jaw surface 30 is equipped with a concave recess 31 for receiving the piece of work and with an arcuate boss 32 at the forward side thereof, the boss 32 being adapted to engage the wear plate 14 of the stationary jaw of the vise. Preferably, the periphery of the boss 32 is circular and forms a portion of a circle, the center of which is also the center of the piece of work gripped between the two members. As seen particularly in Figs. 2 and 3, the toggle members 26 and 27 are provided on their rear surfaces with small recesses 33 and 34 respectively. Springs 35 and 36 are supported between the wall of the bracket 21 and the toggle members, the end of the spring 35 being received within the recess 33 and the end of the spring 36 being received within the recess 34. The springs continuously urge the toggle members forwardly toward the position shown in Fig. 3.

The engagement with the wear plate 14 limits forward movement of the toggle members and when the plate 18 and bracket 21 are advanced toward the wear plate 14, the toggle members are moved rearwardly from the position shown in Fig. 3 toward the position shown in Fig. 2. A piece of work 37, which is preferably circular in cross section shape, may be received between the jaw surfaces at the ends of the toggle members and tightly gripped by the toggle members. As the toggle members are moved toward the position shown in Fig. 2, the piece of work 37 is gripped more tightly between them.

Any suitable mechanism for advancing the plate 18 and the bracket 21 carried thereby may be provided. As illustrated, a reciprocating mechanism 38 may be mounted on the base 10. The reciprocating mechanism may include a cyl-

inder 39 and a piston 40 mounted therein. A piston rod or plunger 41 extends from the cylinder, and a spring 42 continuously urges the piston toward the rear end of the cylinder. A collar 43 on the plunger 41 limits the rearward movement of the plunger. The cylinder may be provided with an inlet 44 for introducing fluid under pressure into the cylinder. For example, compressed air may be introduced into the cylinder 39 through the inlet 44 to move the piston to forward position. A valve 45 of any suitable or conventional construction may be used to control the flow of fluid through the inlet 44. The plunger 41 may be received within the projection 19 and secured in position therein by means of the set screw 46.

When compressed air is admitted to the cylinder 39 through the inlet 44, the piston is advanced to forward position, as seen in Fig. 2, and the plunger carried by the piston and the bracket 21 are moved to the position shown in Fig. 2 in which the toggle members 26 and 27 tightly grip between them the piece of work 37. When the fluid pressure within the cylinder 39 is released, the spring 42 moves the piston to rear position in which the bracket 21 is moved away from the wear plate 14 and the toggle members are moved to the position shown in Fig. 3.

The toggle members are pivotally mounted on the pivots 24 and 25 and extend inwardly toward each other, with the jaw surfaces on the ends thereof in opposed relation. Preferably, the toggle members are so arranged that when the piece of work is gripped therebetween, as seen in Figs. 1 and 2, the toggle members are disposed at an angle between approximately 3° and approximately 14° with respect to the plane which extends through the pivots 24 and 25. At any rate, the toggle members should be disposed at an acute angle with respect to this plane.

By reason of the toggle action which is utilized in the work holding device, the work piece 37 is more tightly gripped between the jaw surfaces of the toggle members than would be possible by merely supporting the work piece between the jaws 13 and 20 of the vise if the bracket and toggle mechanism were removed. In other words, the toggle action serves to increase the gripping force which is applied to the article.

Preferably, the bracket 21, as illustrated, is removably mounted on the jaw 20, bolts 47 being used for this purpose. With this construction, when the bracket 21 and the toggle mechanism carried thereby are removed from the jaw 20, the device may be used as a conventional vise, the material being gripped between the jaws 20 and 13. The bracket may be readily placed in position again when the toggle mechanism is to be used.

In operation, the piece of work is placed between the jaw surfaces at the ends of the toggle members 26 and 27 and within the concave recesses therein when the toggle members are in the position shown in Fig. 3. The valve 45 may be operated to permit compressed air to flow into the cylinder 39, advancing the piston 40 and the plunger 41 carried thereby. The sliding plate 18, jaw 20 and bracket 21 are then advanced toward the stationary jaw 13. The bosses 32 are continuously in engagement with the wear plate 14 on the jaws 13, and as the bracket 21 is advanced, the engagement causes the toggle members 26 and 27 to move rearwardly and approach alignment with each other along the plane extending through the pivots 24 and 25. As the toggle mem-

bers move rearwardly, the jaw surfaces 30 at the ends thereof approach each other more closely and tightly grip therebetween the piece of work 37. By reason of the circular periphery of the bosses 32, the surface of the bosses is always the same distance from the center of the piece of work, regardless of the angle at which the toggle members are disposed. Accordingly, the center of the piece of work is always the same distance from the wear plate 14, regardless of the size or shape of the piece of work. In this manner, the device not only holds the work and grips it tightly, but centers it with respect to the distance from the center of the piece of work to the wear plate 14.

By reason of the toggle action of the gripping members, the pressure exerted upon the piece of work by the recesses in the jaw surfaces 30 at the ends of the members is much greater than the pressure exerted between the sliding plate 20 and stationary jaw 13. As the angle at which the toggle members are disposed in gripping position with respect to the plane passing through the pivots for the toggle members decreases, the pressure exerted by the toggle members increases. However, as the angle becomes extremely small, there is danger of the toggle members reaching dead center if the piece of work should be undersized. Accordingly, I prefer to arrange the toggle members in gripping position at an angle of at least 3° with respect to the plane passing through the pivots of the members. When the angle of the disposition of the toggle members with respect to the plane passing through the pivots of the members exceeds 18°, the increase in pressure which is obtained is relatively slight and the toggle members do not effectively perform the function of gripping the piece of work more tightly than it would be gripped between the sliding plate 20 and stationary jaw 13. Accordingly, I prefer to arrange the toggle members at an angle less than 18° with respect to the plane passing through the pivots of the members.

In a specific embodiment of the invention, the approximate increase in pressure exerted on the piece of work by reason of the toggle action has been found to be that set forth in the table below. The pressure increase is given in proportion to the pressure which would be exerted between the sliding plate which carries the toggle members and the stationary jaw engaged by the members.

Angle of toggle members	Pressure increase
3°	10
3.2°	9
3.6°	8
4.1°	7
4.8°	6
5.5°	5
7°	4
9.4°	3
14.5°	2

Although the invention is illustrated in connection with the gripping of a piece of work which is circular in cross section, the device may be applied to work of different sizes and shapes. Preferably, the jaw surfaces of the toggle arms conform substantially in shape to the periphery of the piece of work which is to be engaged thereby.

Although the invention has been described in connection with a specific embodiment, it will

be apparent that various changes and modifications may be made without departing from the spirit and scope of the invention.

I claim:

1. A work holding device of the character described, comprising a frame, a slide carried by said frame for longitudinal movement with respect thereto, a pair of spaced pivots supported by said slide, a pair of toggle members pivotally mounted respectively on said pivots and extending toward each other from the pivots and forwardly at acute angles of less than 18° with respect to the plane of the pivots, the adjacent ends of the members being in opposed relation and having jaw surfaces with recesses therein for receiving therebetween a piece of work to be secured in said device, a stationary surface for engaging the forward side of the adjacent ends of said members at points directly forward of work within said recesses, and means for moving said slide toward said stationary surface whereby the adjacent ends of the members are urged toward said plane and the jaw surfaces are moved toward each other to tightly grip said piece of work within said recesses.

2. A work holding device of the character described, comprising a pair of pivotally-mounted toggle members extending toward each other from the pivots and forwardly at acute angles of less than 18° with respect to the plane extending through the pivots, the adjacent ends of the members being in opposed relation and having jaw surfaces for receiving therebetween a piece of work to be secured in said device, each of said jaw surfaces having a recess therein for engaging the surface of the piece of work to grip the same, a boss on the forward side of each of said members adjacent said end thereof, the distance from the periphery of the boss to the center of a piece of work gripped between said jaw surfaces being substantially constant, a stationary surface for engaging the periphery of each of said bosses, and means for urging said members forwardly whereby the engagement of the stationary surface with the bosses causes the adjacent ends of the members to be moved toward said plane and the jaw surfaces to be moved toward each other to grip said piece of work within said recesses.

3. A work holding device of the character described, comprising a frame, a slide mounted on said frame for longitudinal movement with respect thereto, a pair of spaced pivots carried by said slide, a pair of toggle members respectively mounted on said pivots and extending toward each other from the pivots and forwardly at acute angles of less than 18° with respect to the plane passing through said pivots, the adjacent ends of the members being in opposed relation and having recessed jaw surfaces for receiving therebetween a piece of work to be secured in said device, each of said members having a boss on the forward side and adjacent said end thereof, the periphery of the boss being in the shape of an arc of a circle having as its center the center of a piece of work gripped between said jaw surfaces, a stationary surface for engaging the forward side of each of said bosses, and reciprocating mechanism for moving said slide toward and

away from said stationary surface whereby when the slide is moved forwardly the engagement of the surface with the periphery of the bosses causes the adjacent ends of the members to be moved toward said plane and the jaw surfaces to be moved toward each other to grip said piece of work in the recesses of said jaw surfaces.

4. A work holding device of the character described, comprising a frame, a slide carried by said frame for longitudinal movement with respect thereto, a pair of spaced pivots supported by said slide, a pair of toggle members pivotally mounted respectively on said pivots and extending toward each other from the pivots and forwardly at acute angles of less than 18° with respect to the plane of the pivots, the adjacent ends of the members being in opposed relation and having jaw surfaces for receiving therebetween a piece of work to be secured in said device, a stationary surface for engaging the forward side of the adjacent ends of said members at points directly forward of work within said jaws, and means for moving said slide toward said stationary surface whereby the adjacent ends of the members are urged toward said plane and the jaw surfaces are moved toward each other to tightly grip said piece of work.

5. A work holding device of the character described, comprising a pair of pivotally mounted toggle members extending toward each other from the pivots and forwardly at acute angles of less than 18° with respect to the plane extending through the pivots, the adjacent ends of the members being in opposed relation and having jaw surfaces for receiving therebetween a piece of work to be secured in said device, a boss on the forward side of each of said members adjacent said end thereof, the distance from the periphery of the boss to the center of a piece of work gripped between said jaw surfaces being substantially constant, a stationary surface for engaging the periphery of each of said bosses, and means for urging said members forwardly whereby the engagement of the stationary surface with the bosses causes the adjacent ends of the members to be moved toward said plane and the jaw surfaces to be moved toward each other to grip said piece of work.

6. A work holding device of the character described, comprising a frame, a pair of pivotally mounted toggle members extending toward each other from the pivots and forwardly at acute angles of less than 18° with respect to the plane extending through the pivots, the adjacent ends of the members being in opposed relation and having jaw surfaces for receiving therebetween a piece of work to be secured in said device, spring means normally urging said jaw surfaces toward open position to receive the work, a stationary surface for engaging the forward side of the adjacent ends of said members at points directly forward of work within said jaw surfaces, and means for moving said members toward said stationary surface whereby the adjacent ends of the members are moved toward said plane and the jaw surfaces are moved toward each other to tightly grip said piece of work.

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