April 1, 1969 AKIKAZU IBA ET AL 3,435,655

CLAMPING DEVICE FOR FORGING DIE IN PRESS

Filed March 22, 1966 Sheet 1 of 3

FIG.1.

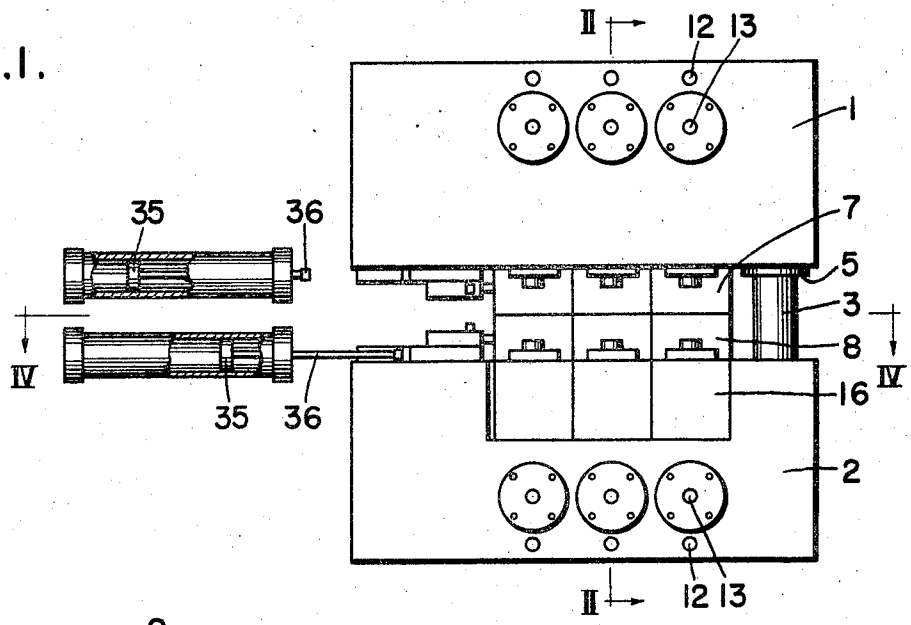
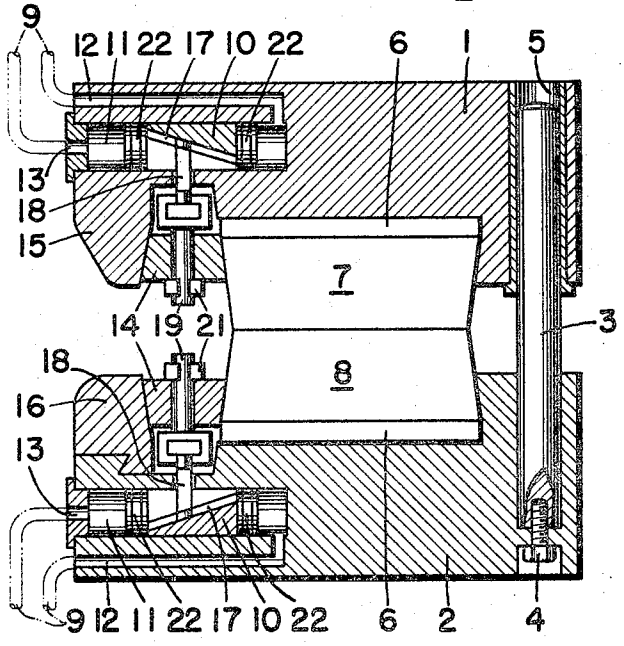


FIG.2.



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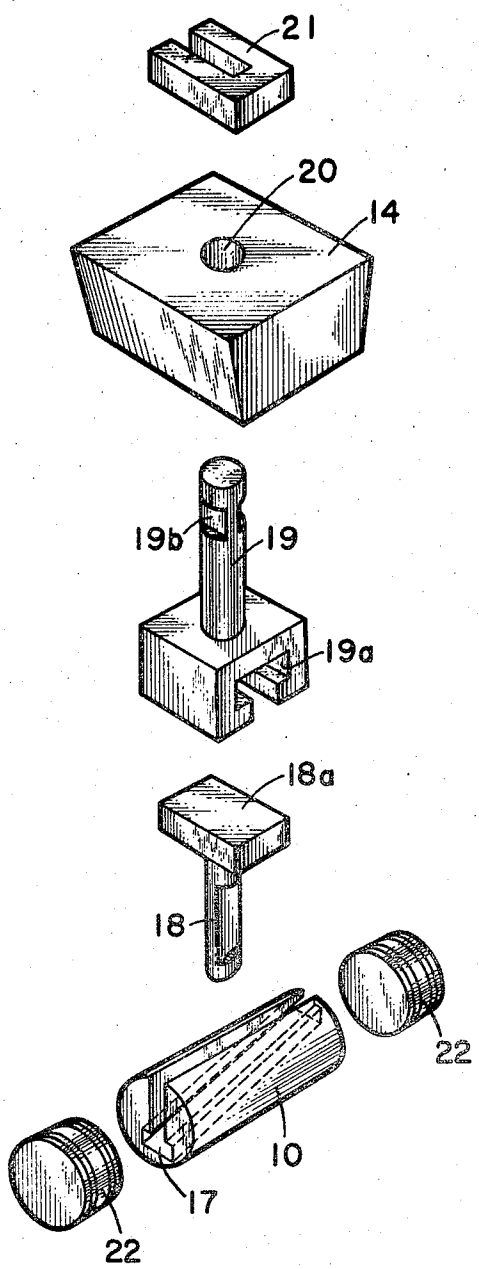
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FIG. 3.



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CLAMPING DEVICE FOR FORGING DIE IN PRESS

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FIG. 4.

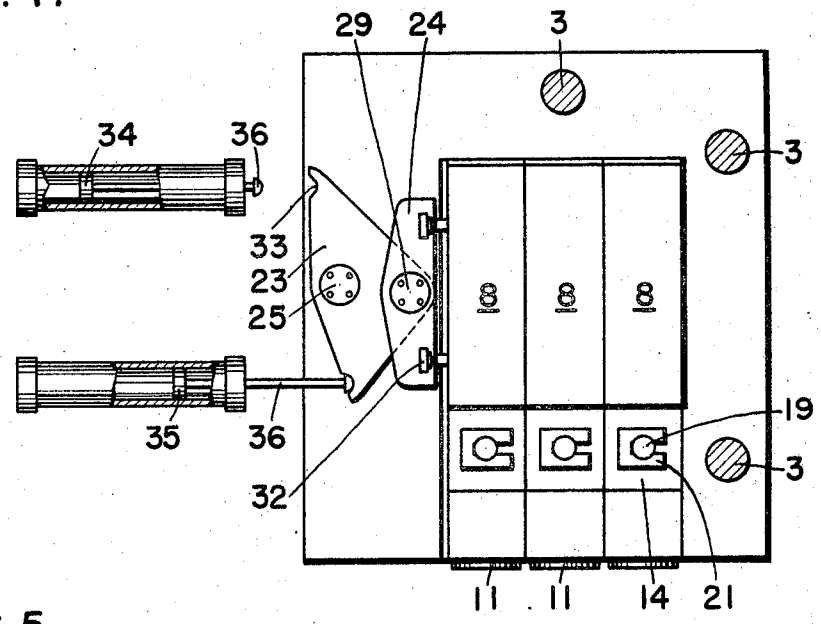


FIG. 5.

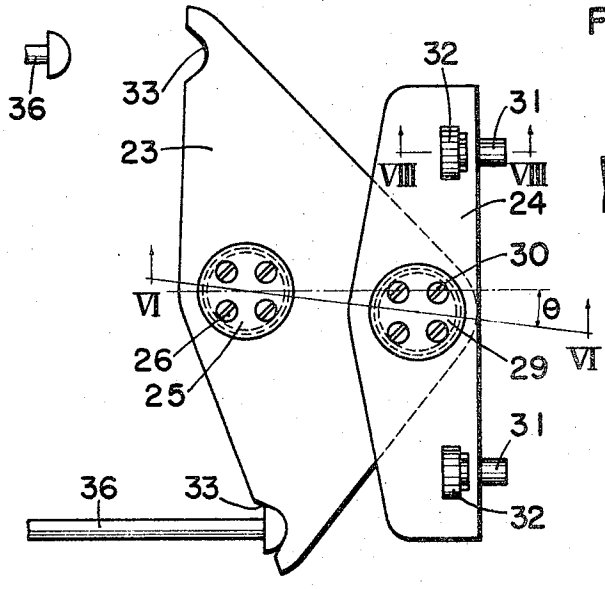


FIG. 6.

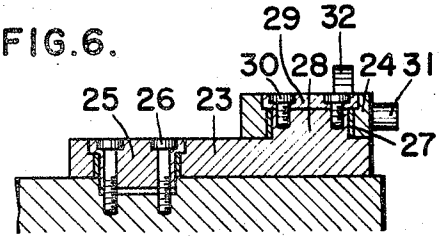


FIG. 7.

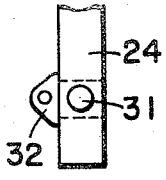
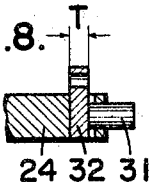


FIG. 8.



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United States Patent Office

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CLAMPING DEVICE FOR FORGING DIE IN PRESS

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Int. Cl. B21j *13/00*; B21d *37/14*
U.S. Cl. 72—462 10 Claims

ABSTRACT OF THE DISCLOSURE

A clamping means for retaining die members in a forging press, wherein the dies are held in one direction by a wedge-shaped block actuated by a fluid driven inclined cam surface, and held in a second direction by a different clamping structure comprising a fluid actuated lever system.

This invention relates to a clamping device and more particularly to a clamping device for clamping the forging dies of a forging press by means of fluid pressure such as oil pressure.

When a forging die is mounted on a forging press, it has been a practice heretofore to interpose a tapered clamp between the forging die and a bolster, to tighten the clamp by means of a bolt and to fix the die to the bolster by utilizing the wedge action of the clamp. When, however, dismounting of the clamp is desired in such a device by which the clamp is tightened by use of screw motion of the bolt, the screw motion of a separate bolt for dismounting the clamp must be used to push the clamp. Otherwise, it is difficult to remove the clamp which has been tightly secured to the bolster by wedge action. Stated differently, clamping of the forging die by means of a bolt as has been practised on the device of a conventional type takes a great deal of time in mounting and dismounting, and more over, clamping by the power of man poses difficulties in determining the moderate degree of clamping which greatly varies depending upon an individual operator. Consequently, bolts and bolt holes tend to be damaged and such damage sometime requires substantial repair in the form of possible reduction in the operation rate of the forging press.

This invention is designed to tighten the back and front sides of the forging die by means of the clamp to be tightened by fluid pressure and to tighten the lateral sides by a link type pressing means which is driven by the action of fluid pressure, thereby to fix the forging die to the forging press. Improvements have been introduced to eliminate the disadvantages inherent in the device of a conventional type.

An object of the invention is to make it possible to fix the forging die to the bolster in an easy, positive manner and within a short time by the predetermined power which can be imparted by use of fluid pressure such as oil pressure.

Another object of the invention is to provide a means for readily dismounting by means of fluid pressure the forging die thus securely fixed to the bolster.

Still another object of the invention is to provide a means for mounting and dismounting the forging die within a short time, thereby to improve the operation rate of the forging press.

In order to achieve the objects above referred to, the device according to the invention is constructed in such a manner that a block having an inclined groove is inserted in the fluid pressure cylinder incorporated into the bolster. A clamp for clamping the forging die is connected to a rod member which is fitted at one end in the inclined groove of the block. The backward and forward

sides of the forging die are fixed by a clamp type clamping means adapted to tighten said clamp by moving said block by the action of a piston. A lever having shoes at both ends thereof is supported by a shaft on the top portion of a triangular arm, which is in turn supported in the middle of the lower portion thereof by a shaft on the bolster, the arm being adapted to be rotated by the action of the fluid pressure piston. The lateral sides of the forging die are clamped by the clamp type clamping means by which the arm and lever can be stopped in a state of said shoes pressing the forging die.

The clamping device in accordance with the invention has the advantageous features of providing needed space to enable an operator to work freely in front of the forging press and hence it confines the protrusion of any member to a minimum. Furthermore in case there are provided a plurality of forging dies, provision of respective clamping means is needed and hence the clamping means must be compact, with the result that the backward and forward sides of the forging die are used for installing the clamp type clamping means which can be mounted within the bolster. The link type clamping means for tightening the lateral sides of the forging die affords a simpler mechanism than a clamping type clamping means and does not require protruding members that would constitute an obstruction to the operator.

Thus the forging die operated by the action of fluid pressure is simple and positive in being fixed to and removed from the bolster. Moreover, the fluid pressure is utilized only when the forging die is fixed and removed, and use of the fluid pressure is no more needed, once the die has been fixed.

The invention will be described below in more detail with reference to the accompanying drawings in which:

FIG. 1 is a front elevation of a preferred embodiment of the invention;

FIG. 2 is a longitudinal sectional view taken along line II—II of FIG. 1;

FIG. 3 is a perspective view of a clamp type clamping means of FIG. 2 with its parts broken apart;

FIG. 4 is a plan view taken along line IV—IV of FIG. 1;

FIG. 5 is an enlarged plan view of a link type clamping means;

FIG. 6 is a longitudinal sectional elevation taken along line VI—VI of FIG. 5;

FIG. 7 is a side elevation showing the end of the lever of FIG. 5; and

FIG. 8 is a longitudinal sectional elevation taken along line VIII—VIII of FIG. 5.

Referring now to the drawings, there is shown a forging press equipped with a clamp type clamping means provided longitudinally and a link type clamping means provided laterally, thereby to clamp a forging die from forward and left directions. The forging press is shown equipped with three forging dies i.e. a bending die, a blocking die, a finishing die fixed thereto.

In order to prevent a top bolster **1** and a bottom bolster **2** for fixing the forging die from being misaligned longitudinally and laterally, a guide post **3** is forced into the bottom bolster **2**, and fixed by a bolt **4**. As shown in FIG. 4, said guide post **3** is provided in several places and a guide bushing **5** is fitted into the top bolster **1** for each guide post, thereby to ensure that the guide post **3** is fitted properly into the bushing **5** so as to bring the top and bottom bolsters into exact meshing relationship. The upper die **7** and bottom die **8** of the forging die are inserted through a die plate **6** in the fitting recesses of the top bolster **1** and bottom bolster **2**, respectively, said die plate being inserted to adjust the height of the dies **7** and **8**.

The top bolster **1** and bottom bolster **2** are provided

inside the forward portions thereof with a cylinder **11** actuated by fluid pressure such as oil pressure. At both ends of the cylinder **11** are opened joints **12** and **13** of a pipe **9**. Since the top bolster **1** moves up and down, a flexible pipe is used for the pipe **9**, which is connected to the joints **12** and **13**. A clamp **14**, which is trapezoidal in section, is fitted between the upper die **7** and a protruded block **15** formed on the forward portion of the bolster **1** in the case of the top bolster **1** and between the bottom die **8** and a clamping block **16** detachably attached to the forward portion of the bolster **2** in the case of the bottom bolster **2**. In this case the opposing faces of the forging dies with respect to the protruded block **15** of the top bolster **1** and the clamping block **16** of the bottom bolster **2** respectively are inclined so as to form a space of V-shaped section. Consequently, the clamp **14** to be fitted into said space is formed so as to have the same inclined surface with said inclination. For instance, the surface in contact with the protruded block **15** or the clamping block **16** is inclined at an angle of 10° and the surface in contact with the forging die has an incline of 6°. Referring to FIGURE 3, means for clamping said clamp **14** is constructed in such a manner that a head portion **18***a* of a rod **18**, the lower portion of which is fitted in the T-slot **17** of a cylindrical block **10** having an inclined T-slot **17** and being inserted into a cylinder **11**, is fitted in the groove **19***a* of a clamp rod **19**, the head of the clamp rod **19** having a pair of opposng notches **19***b* is passed through the hole **20** of the clamp **14**, and a U-shaped clamp **21** is fitted into the notches **19***b*.

At both ends of the block **10** inside the cylinder are provided pistons **22**, said block being optionally moved back and forth by means of the pistons actuated by the fluid pressure fed through joints **12** and **13**. Experiments conducted by the invention show that the angle of inclination of the inclined T-slot **17** of said block **10** proved most suitable when the T-slot **17** had an angle of 18°.

The block **10** and rod **18** of said clamping means are assembled and incorporated into the cylinder **11** on the forward portion of the bolster. When the upper die **7** and the bottom die **8** are fixed to the bolsters, the groove **19***a* of the clamp rod **19** is engaged with the head portion **18***a* of the rod **18** thereby to attach the clamp rod **19** to the rod **18**. The head portion of the clamp rod **19** is passed through the hole **20** of the clamp **14** and the clamp **21** is fitted in the notch **19***b* of the clamp rod **19**. Thus the clamping means is assembled and then pressurized fluid such as oil is fed through the joint **13** thereby to move the block **10** backward (to the right side of the position shown in FIG. 2). When the block **10** is moved backward, the rod **18** of the top bolster **1** is drawn upward and that of the bottom bolster **2** is drawn downward. In other words, the clamp **14** connected to the rod **18** is in turn drawn upward or downward, so that the upper die **7** and the bottom die **8** are clamped by the wedge action of slopes formed on both sides of the clamp **14** and are fixed to the bolsters. Even when the supply of the pressurzide fluid is stopped and fluid pressure is reduced in the clamped condition as described above, the block **10** is not moved and consequently the forging die can be tightened without the actuation of the piston being continued. When the piston of said cylinder **11** is actuated by use of oil pressure, experiments show that a proper pressure is within the range of 70–100 kg./cm.^{2}.

When the upper die or the bottom die is removed, the pressurized fluid is fed from the joint **12** to the cylinder **11**, thereby to cause the block **10** to move forward (to the left side of the position shown in FIG. 2), then the rod **18** of the top bolster **1** is lowered and the rod **18** of the bottom bolster **2** is moved upward and the clamps **14** of the bolsters **1** and **2** are loosened, respectively. If thereafter the clamps **14** are moved laterally, the clamp rod **19** and the rod **18** are disengaged from each other thereby making it possible for the upper die **7** or the bottom die **8** to be removed after the clamps **14** have been drawn out.

As shown in FIG. 4, the forging die is provided on the sides thereof with a link type clamping means so as to tighten the right and left sides of the forging die. This means comprises supporting the middle of the bottom of a triangular arm **23** by a shaft on the bolster and connecting a lever **24** to the top of the arm **23**. That is to say, a headed shaft **25** is fitted into the shaft hole bored in the middle of the bottom of the arm **23** and is implanted at its end into the bolster, a plurality of bolts **26** being implanted into said shaft **25**, thereby to fix the shaft to the bolster. In the middle of the lever **24** is bored a shaft hole having a bushing **27**. The shaft **28** protrudedly formed on the top portion of the arm **23** is fitted into said shaft hole. A cover plate **29** is put on the shaft hole. Said cover plate **29** is fixed to said shaft **28** by means of a plurality of bolts **30**. Shoes **31** are fitted into the holes formed on the forward portion of both ends of the lever **24**. An adjustable plate **32** is inserted rearwardly of said shoes. By changing the thickness T of the adjustable plate the length of the protruded portion of the shoes **31** may be adjusted. Furthermore, on both sides of the bottom of the arm **23** is formed a grove **33**, into which are adapted to extend the ends of the piston rods **36** of the pistons **34** and **35**. As described above, the arm **23** and lever **24** mutually supported by a shaft can be rotated freely. Moreover, one end of the cover plate is pressed and moved by one of the piston rods and can be brought to a standstill with the shoes **31** of the lever **24** placed in a state of being in contact with the sides of the forging dies. The adjustment of an angle θ formed by the center line linking the center of rotation of the arm **23** with that of the lever **24** and by a perpendicular with respect to the contact surface of the shoe **31** is made by changing the thickness of the adjustable plate **32**. Experiiments conducted by the inventor show that the angle θ is suitable when it is within the range of 3 to 7 degrees and that when the piston is actuated by oil pressure, a suitable pressure is within the range of 70 to 100 kg./cm.^{2}.

The aforesaid clamping means is provided in the top bolster **1** and the bottom bolster **2** respectively. When the upper die and the bottom die are fixed by this means, pressing and moving of the arm **23** by means of the piston rod **36** actuated by piston **35** in a counterclockwise direction from the position shown in FIGS. 4 and 5 will fix the arm **23** and lever **24** with the forging die kept in a state of being pressed. Consequently, when the forging dies are in a state of being clamped, this state of clamping can be maintained without actuating the piston **35**.

When the forging dies are removed, pressing and moving of the other end of the arm **23** in a clockwise direction from the position shown in FIGS. 4 and 5 by actuation of a piston **34** disposed opposite the above piston **35** through the piston rod **36** will release pressure from the shoe **31**.

As described above, this invention is designed to clamp and fix the forging dies to the bolsters by pressurized fluid actuated piston and hence mounting and dismounting operation of the forging dies can be carried out by the invention in a shorter time and with more ease than by the clamping means of a conventional type by which mounting and dismounting operation is carried out by tightening of screws. Furthermore, the invention makes it possible not only to allow for the degree of clamping at will but also to maintain the state of clamping without the use of pressurized fluid, once the forging dies have been in a state of clamping.

Since the device provided by this invention has no screw means, it follows that the means includes no member which is subject to damage, but has an advantage or relieving an operator of the trouble to repair and improves the operation rate of the forging press. Further-

more, the invention is not limited to use for forging but may be used in clamping of other press dies.

What is claimed is:

1. Apparatus for retaining die members, comprising:
a support for mounting said die members,
means mounted to said support for clamping a die member in a fixed position,
means for actuating the clamping means to secure said die member,
the clamping means including an element slidably mounted to said support, said element including an inclined surface,
the clamping means further including a block contacting said die member and a portion of said support, said block being connected to said inclined surface, and
said actuating means moving said slidable element to cause said block to exert a retaining force on said die member.

2. Apparatus according to claim 1 wherein said inclined surface has a slope of substantially 18°

3. Apparatus according to claim 1 wherein said block has a wedge-shaped cross-section and two sloping surfaces, said die member includes a surface opposing one of said sloping surfaces in abutting relationship therewith, said contacting portion of said support being shaped to engage the other of said sloping surfaces, said actuating means moving said slidable element in a direction to cause said sloping surfaces to be wedged between said die member and said portion of said support.

4. Apparatus according to claim 3 wherein said inclined surface is in the form of a keyed aperture, the clamping means includes a connecting member slidably received in said keyed aperture and connected to said block.

5. Apparatus according to claim 4 wherein said connecting member includes first and second cylindrical rod members, said first cylindrical member including a keyed shank engaging said keyed aperture and a key at opposite ends thereof, said second cylindrical rod member including a notched slot, said key engaging said notched slot, said block including means for receiving the free end portion of said second cylindrical rod member, and said second cylindrical rod member including means for securing said free end portion to said block.

6. Apparatus for retaining die members, comprising:
a support for mounting said die members,
a lever arm rotatably mounted to said support about a first axis,
a member mounted to said lever arm on a second axis to engage said die member,
means for rotating said lever arm in either a clockwise or a counterclockwise direction about said first axis,
said second axis being displaced from said first axis so that rotation of said lever arm in one direction causes said member to apply pressure to said die member to retain it on said support and rotation of said lever arm in the opposite direction causes said member to be withdrawn from said die member.

7. Apparatus according to claim 6 wherein said member includes spaced shoes for engaging said die member, and said means for rotating includes power driven shafts, at least one of said power driven shafts being mounted to said lever arm on opposite sides of said first axis.

8. Apparatus according to claim 6 wherein the angle of rotation of said lever arm for engaging said member with said die member is between 3 and 7 degrees.

9. Apparatus according to claim 8 wherein said block includes spaced shoes and adjustable plates for mounting said shoes to vary said angle of rotation.

10. Apparatus for retaining die members, comprising:
a support for mounting said die members,
first means mounted to said support for clamping each of said die members in a first direction in a fixed position,
means for actuating said first means,
said first means including an element slidably mounted to said support, said element including an inclined surface,
said first means further including a block contacting said die member and a portion of said support, said block being connected to said inclined surface,
said actuating means moving said slidable element to cause said block to exert a retaining force on said die member,
a lever arm rotatably mounted to said support about a first axis,
a member mounted to said lever arm on a second axis to engage said die member,
means for rotating said lever arm in either a clockwise or counterclockwise direction about said first axis,
said second axis being displaced from said first axis so that rotation of said lever arm in one direction causes said member to apply pressure to said die member in a second direction orthogonal to said first direction to retain it on said support in a fixed position, and
rotation of said lever arm in the opposite direction causes said member to be withdrawn from contact with said die member.

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U.S. Cl. X.R.

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