Sept. 27, 1932. F. J. RODE 1,879,510

METAL WORKING PRESS

Filed Jan. 9, 1931 4 Sheets-Sheet 1

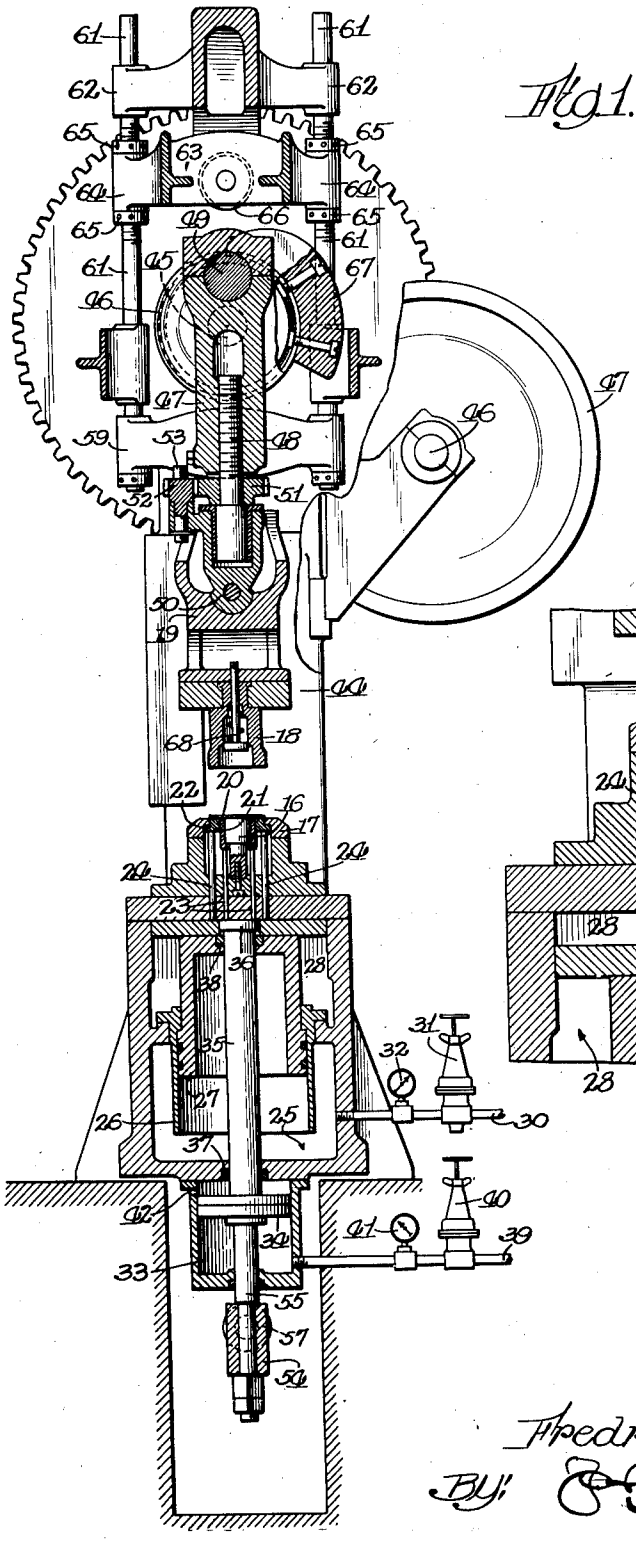


Fig. 1.

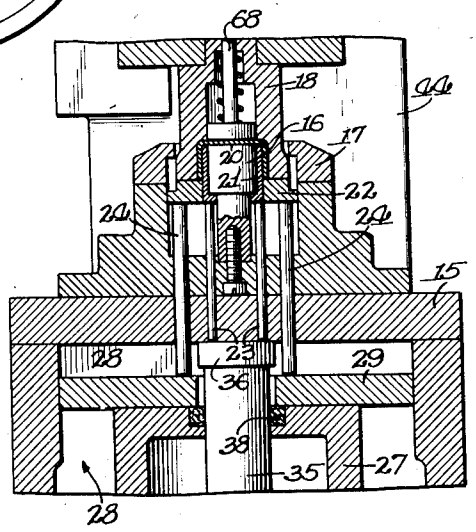


Fig. 2.

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METAL WORKING PRESS

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Fig 2.

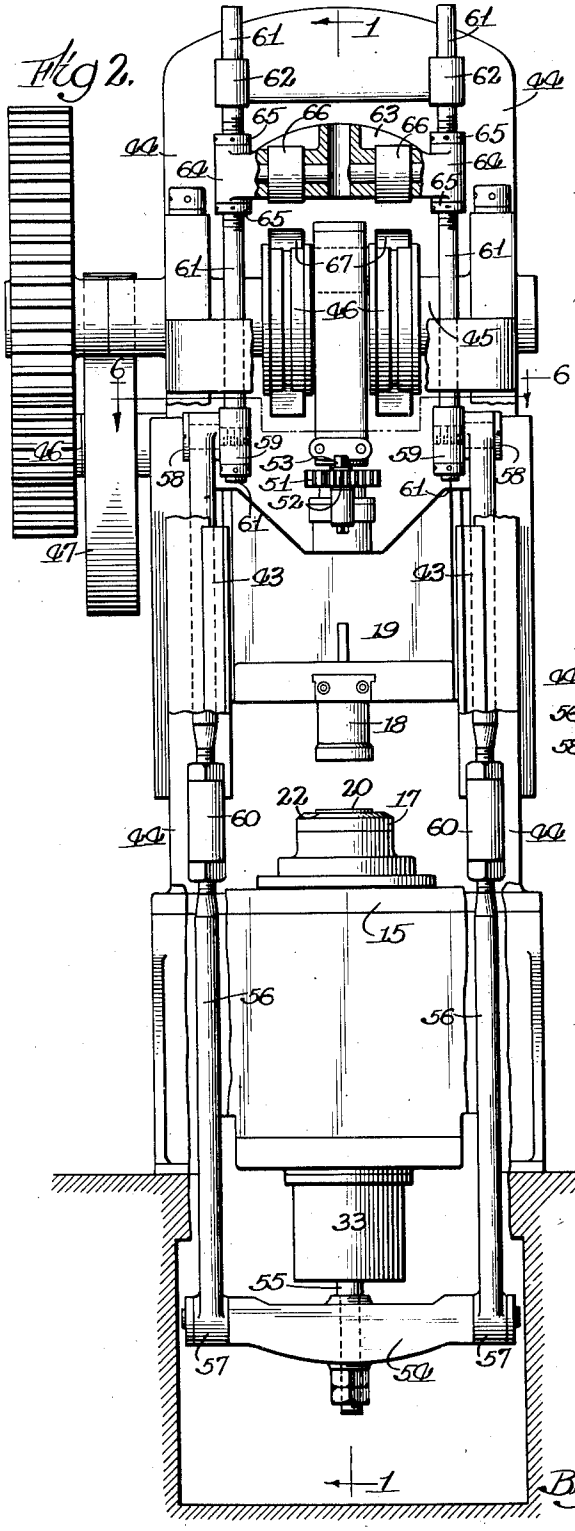


Fig.6.

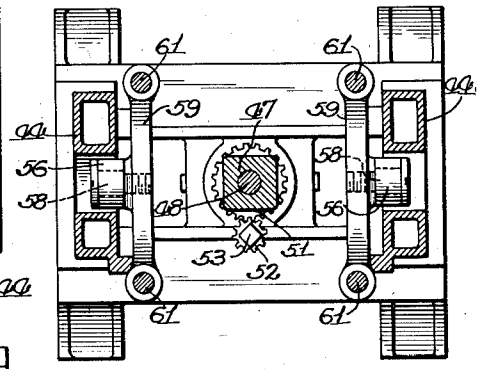


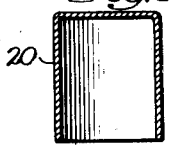
Fig.7.



Fig.8.



Fig.9.



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Fig. 3.

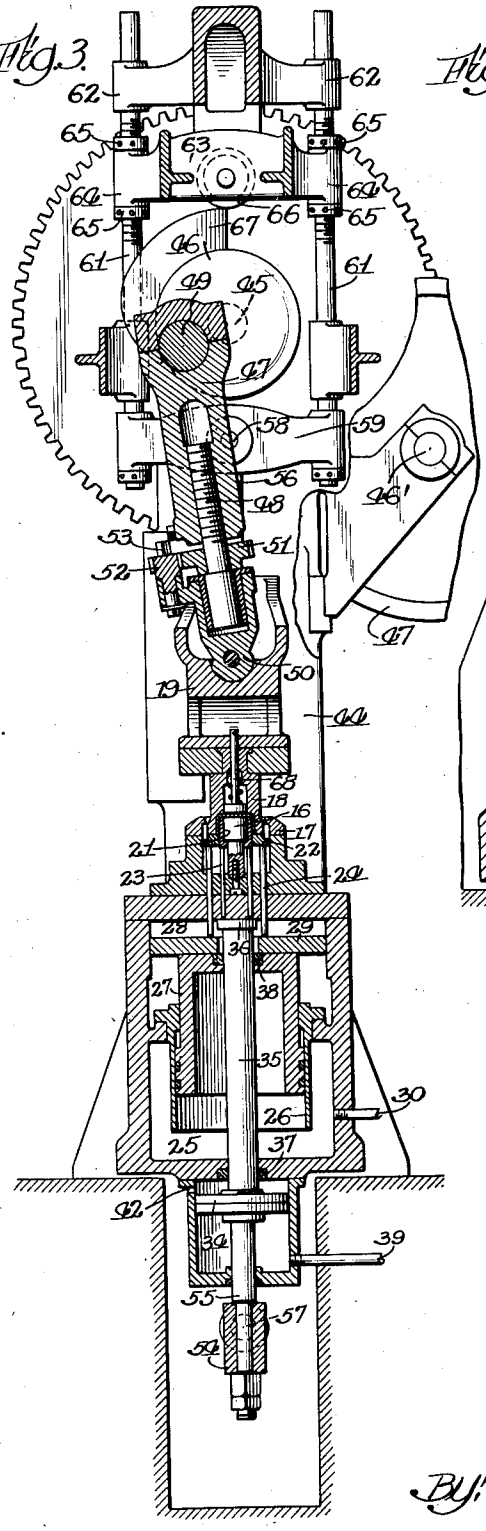
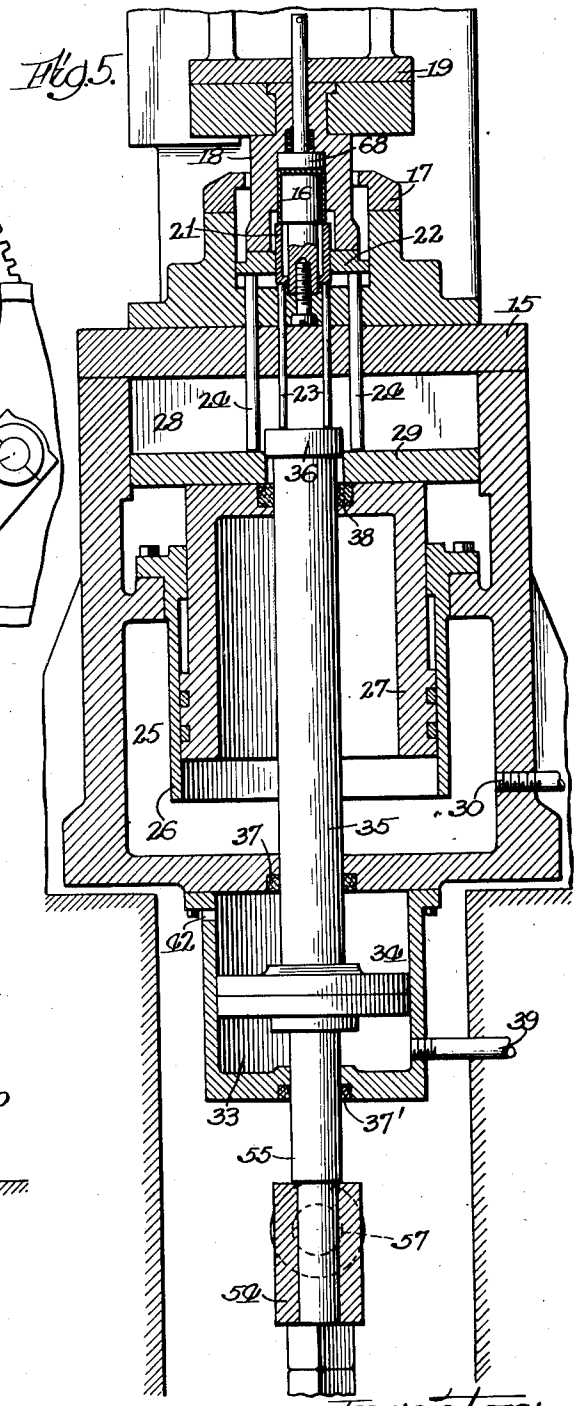


Fig. 5.



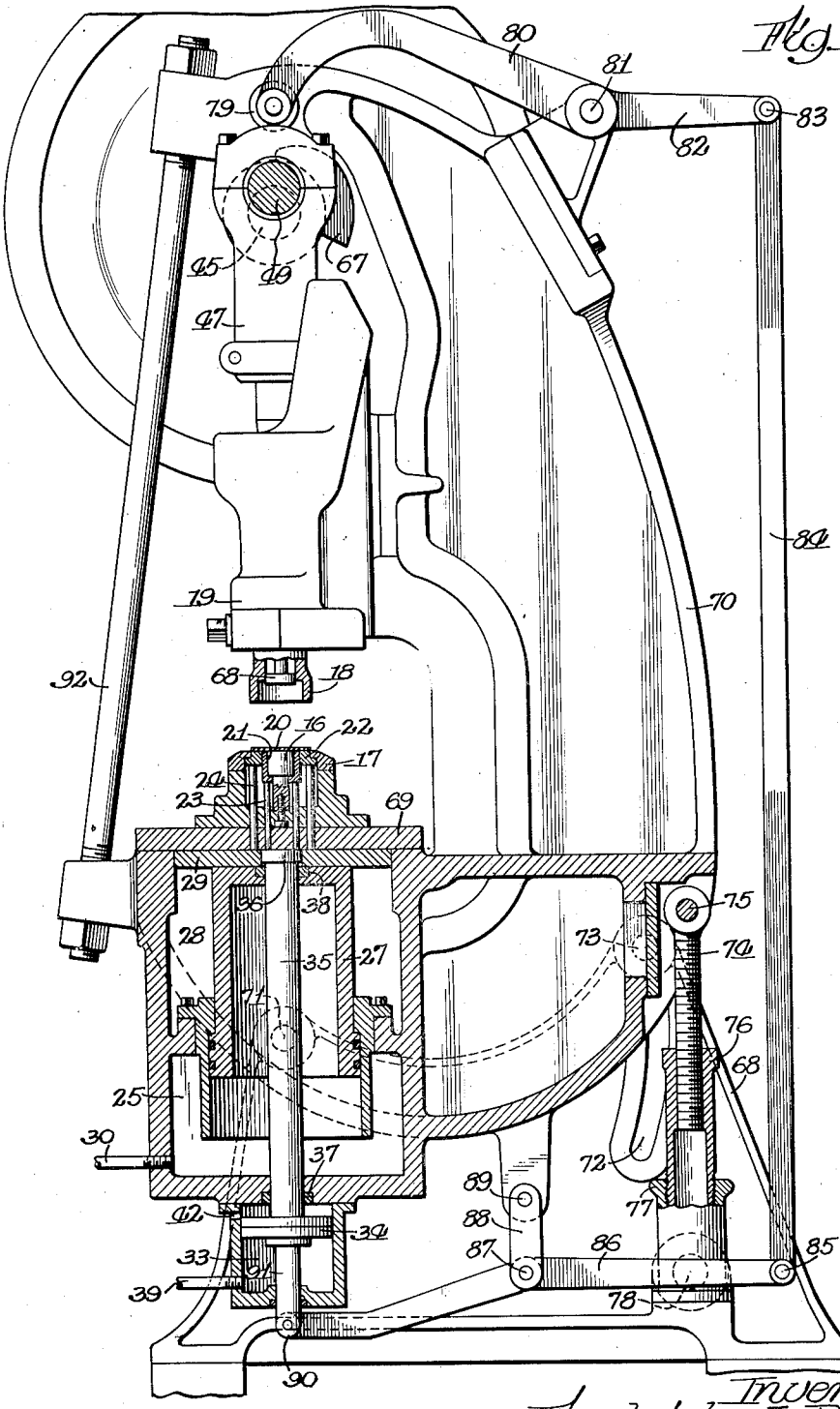
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METAL WORKING PRESS

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Fig. 10.



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Patented Sept. 27, 1932 1,879,510

UNITED STATES PATENT OFFICE

FREDRICH J. RODE, OF CHICAGO, ILLINOIS

METAL WORKING PRESS

Application filed January 9, 1931. Serial No. 507,543.

In presses of the character herein set forth there is provided a plurality of draw rings or blank holding means which co-operate with the respective dies, the work being held between the draw rings or work holding means and the ram during the forming or shaping of the articles.

These draw rings are usually arranged one within the other, both of the work holders being yieldingly resisted in their movement under the influence of the ram in one direction, one of the work holders being held against operation under such influence of the ram while the other work holder is moved during the first portion of the cycle of operation of shaping or forming the work over or by the stationary die and over the work holder.

After the completion of the first portion of the cycle of operation in forming or shaping the article, and during the cycle of operation of the press, the article is shaped over or formed by the second die, the work holder which co-operates with the latter being moved against the fluid pressure acting thereupon.

The inner work holder must of necessity be held so that it will not be moved during the first portion of the formation of the article or work, with the result that during that portion of the cycle of operation of the press in which the inner work holder is moved, the ram must overcome the excess resistance or fluid pressure to complete the formation of the article. This results in a strain upon the crank shaft and clutches and reduces the capacity or scope of the press.

It is one of the objects of the present invention to overcome these difficulties and objections and to provide improved means whereby two operations can be performed in what is known as a regular double draw die, and is accomplished by providing improved means for positively locking in a fixed position one of the work holding members or draw rings while the other is being allowed to remain movable under the action of the ram, and which locking means is responsive in its operation to the operation of the crank shaft. This will result in a simple and efficient mechanism whereby complicated movable parts which have heretofore been necessary, such as toggle joints and other mechanisms, have been dispensed with, and at the same time provide a means for holding up or against movement one of the work holders, more rigidly than heretofore has ever been done, as the arrangement of the parts will be such as to permit of a construction of a size which otherwise cannot be provided for.

A further object is to provide improved means whereby adjustments may be made to compensate various depths of draw of the work, and to which means ready access may be had.

A further object is to provide improved mechanism of this character which will be simple and compact in arrangement, effective and efficient in operation, and by means of the use of which will result in a smoothness of operation of the press and all shock from the operation of the dies will be eliminated in the press.

To the attainment of these ends and the accomplishment of other new and useful objects as will appear, the invention consists in the features of novelty in substantially the construction, combination and arrangement of the several parts hereinafter more fully described and claimed and shown in the accompanying drawings illustrating this invention, and in which

Figure 1 is a vertical sectional view taken on line 1—1, Figure 2, of a press of this character constructed in accordance with the principles of this invention.

Figure 2 is a front elevation of Figure 1.

Figure 3 is a view similar to Figure 1, showing the parts in another position.

Figure 4 is an enlarged detail sectional view of the dies in the position shown in Figure 3.

Figure 5 is an enlarged detail sectional view of the dies and the cushioning means, showing the parts in the position which they will assume at the completion of the formation of the work.

Figure 6 is a sectional view taken on line 6—6, Figure 2.

Figures 7, 8 and 9 are detail sectional views showing the different shapes of the blank during the formation of the article.

Figure 10 is a view similar to Figure 1, of a modified form of the invention as applied to a tiltable press.

Referring more particularly to the drawings the numeral 15 designates the bed or bolster plate of a press having mounted thereon a stationary die member 16, with which a cutting member 17 co-operates.

Co-operating with the die 16 is another die 18 carried by a ram or movable member 19 and this die 18 also co-operates with the cutting member 17 to cut or shear the material 20 and is so shaped that it will pass between the die 16 and cutting member 17 to shape the material over the die 16, all in a manner as well known in this art.

Encompassing the die 16 are a plurality of draw rings 21—22, one arranged within the other, and these members 21 and 22 are respectively supported by means of pins 23—24 that pass loosely through the bed or bolster plate 15.

Supported below the plate 15 is a fluid controlled cushioning device, preferably embodying a cylinder 25 constituting an integral part of the bed of the press, and in which cylinder is arranged a tubular member 26 which extends through the top of the cylinder to form a housing in which a piston 27 is reciprocable. A chamber 28 is arranged in the press bed above the cylinder 25 and movable in the chamber 28 is a pressure pad 29 which rests upon the top of the piston 27 and upon which pressure pad 29 the pins 24 supporting the draw ring or work holder 22 rest.

Fluid pressure is supplied to the cylinder 25 at any predetermined pressure, from any suitable source preferably through a pipe 30 in which is arranged a pressure regulating valve 31 and a pressure indicating gauge 32.

Below the cylinder 25 is arranged another cylinder 33 preferably of a smaller diameter and out of communication with the cylinder 25.

Reciprocable in the cylinder 33 is a piston 34, connected to which is a piston rod 35 that passes through the cylinder 25 and is preferably provided at its upper end with a cap or bearing plate 36 constituting a pressure pad, upon which the pins 23 which support the draw ring or work holder 21 rest.

Suitable packing material 37—38 is provided at the points where the piston 35 passes through the cylinder wall and one of the walls of the piston 27.

Fluid pressure is supplied to the cylinder 33 on one side of the piston 34 through a suitable pipe 39 from any suitable source, and arranged in the pipe 39 is a pressure regulating valve 40 and a pressure indicating gage 41.

The cylinder 33 is provided with a vent opening 42 on the opposite side of the piston 34.

The ram 19 is reciprocable in guides 43 on uprights 44 of the press and receives its motion from a crank shaft 45, the latter being rotated in any suitable manner such as from a shaft 46, to which a pulley 47 is connected and to which pulley power is applied. A suitable gear connection is provided between the shaft 46 and the crank shaft 45.

Connected to the crank shaft 45 are crank members or discs 46, to which the ram is connected through the medium of a link consisting of two members 47—48. The member 47 is pivotally connected with a crank pin 49 and the member 48 is pivotally connected as at 50 with the ram. The members 47 and 48 are adjustable with respect to each other so as to vary the set position of the ram 19 with respect to the axis of the shaft 45. To that end the member 48 is rotatably mounted and is threaded into the member 47. A gear 51 is splined or otherwise connected to the member 48 so as to permit the latter to move in a direction lengthwise of its axis with respect to the gear. A gear 52 meshes with the gear 51 and connected with the gear 52 is a projection 53 which is angular in cross section, for the reception of a wrench or operating tool through the medium of which latter the gear 52 may be rotated, and this in turn will rotate the gear 51 to rotate the member 48 and cause the same to be threaded into or out of the member 47 according to the direction of rotation of the gear 51.

In order to hold the draw ring or work holder 21 against operation while the blank 20 is being formed over the die 16 and the draw ring or work holder 21, and in the position in which the parts are shown in Figure 1, during such portion of the operation of the press, means are provided for holding the draw ring 21 against operation under such pressure of the ram.

To that end there is provided a cross member 54 which is secured to an extension 55 from the piston rod 35. Connected to the ends of the member 45 are uprights or links 56, one end of each of which is pivotally connected as at 57 with the member 54, and the other ends of the links are pivotally connected as at 58 with cross heads 59. These uprights or links 56 are preferably sectional in construction and are provided with turn buttons or adjustable sections 60 by means of which the length of the links or uprights 56 may be varied.

Connected to the ends of the cross heads 59 are rods 61 which pass through suitable guides or bearings 62 supported by the uprights 44 of the press. A cross head 63 is adjustably connected with the respective pairs of uprights 61 in any suitable manner, but preferably by means of the rods 61 passing through bearings 64 on the cross head, and

the cross head is held in position with respect to these rods preferably by means of nuts or collars 65 having threaded engagement with the respective rods on opposite ends of the bearings 64. Thus, by adjusting the nuts or collars 65 the position of the cross head 63 on the rods 61 may be varied.

Journaled in the cross head 63 are rollers 66 and adjustably mounted upon the crank members 46 are cams 67 which are adapted to engage the respective rollers 66 on the cross head 63 at a predetermined time in the cycle of operation of the press and thereby hold up the draw ring or work holding member 21, so that it will not be moved under the stress of the ram 19.

As the crank shaft rotates the cams 67 will engage the respective rollers 66 and thereby through the medium of the cross head 63, the rods 61, the uprights or links 56 and cross member 54 connected with the piston 35, will lock or hold the draw ring or work holding member 21 against depression.

The cams 67 are so shaped and are so positioned that during a predetermined portion of the cycle of rotation of the crank shaft 51, the draw ring or work holder 21 will be locked against depression, but at the completion of the shaping of the blank or work 20, or when the parts assume the position as shown in Figures 3 and 4, the cam 67 will pass out of engagement with the rollers 66. In Figure 3 of the drawings the parts are shown in the position which they will assume just before the draw ring or work holder 21 is released or unlocked. A further movement of the crank shaft 45 in the direction indicated by the arrow in Figure 3 and from such position, will cause the cam 67 to pass out of engagement with the roller 66, and the draw ring or work holder 21 will then be held in its raised or elevated position or the positions as shown in Figures 1, 3 and 4, by means of the fluid pressure exerted in the cylinder 33 beneath the piston 34.

As the ram further descends the draw ring or work holder 21 will be depressed by the die 18 against the fluid pressure in the cylinder 33.

The movement of the draw ring or work holder 22 will be yieldingly resisted by the fluid pressure in the cylinder 25.

It is thought that the operation of the mechanism will be fully understood from the foregoing, but briefly stated it is as follows.

The normal position of the parts is as shown in Figures 1 and 2, that is the draw ring or work holders 21 and 22 will be flush, or substantially flush with the upper surface of the cutting member 17 to form a support for the blank 20 placed thereupon, and will be respectively held in this position by the fluid pressure in the cylinders 25 and 33.

When the ram descends the die 18 will contact with the work and the draw ring or work holder 22 will co-operate therewith to grip and hold the work.

Just before the die 18 contacts with the work 20, or at any other predetermined time in the cycle of operation of the press, the cams 67 will contact with the rollers 66 on the cross head 63 and thereby lock or hold the draw ring or work holder 21 against depression.

Upon a further movement of the ram in the same direction the draw ring or work holder 22 will be depressed and the blank will be trimmed or cut by the cutting member 17, after which it will be forced into the position shown in Figures 3 and 4. That is, the blank will be partially shaped as shown in Figures 3, 4 and 8. During this shaping of the blank the draw ring or work holder 21 is locked against movement.

Upon completion of the first step of the operation of shaping the blank as shown in Figure 8, the cams 67 will pass out of engagement with the rollers 66 to release or unlock the draw ring or work holder 21 whereupon, and upon further movement of the ram 18 in the same direction, the draw ring or work holder 21 will be depressed as will also the draw ring or work holder 22, to the position shown in Figure 5, thereby forming the blank into the shape as shown in Figure 9.

As the ram starts to ascend the fluid pressures in the cylinders 25 and 33 will return their respective draw rings or blank holders to normal position.

The blank will be removed from the die 18, which is preferably a female die, by means of a spring controlled kick out device 68.

In Figure 10 there is shown a form of tiltable press to which this invention is applied, and which press consists essentially of a base or support 68 to which the press embodying the bed 69 and upright 70 is pivotally connected as at 71. Guide slots 72 are provided for a bar or cross member 73 for assisting in holding and guiding the tiltable portion of the press.

The press is adjusted about the pivot 71 in any suitable manner preferably by means of a screw 74 pivotally connected as at 75 to the press and the screw is threaded into a member 76, which in turn may be threaded into a collar 77 pivotally supported as at 78. A portion of the periphery of the member 76 may be angular in cross section to permit of the application of a wrench or adjusting tool.

In this form of the invention the cam 67 engages a roller 79 which is carried by an arm 80 connected to a rock shaft 81. An arm 82 projects from the shaft 81 and has pivotally connected thereto by one end as at 83 a link or rod 84. The other end of the rod or link 84 is pivotally connected as at 85 to a lever 86. This lever is pivotally connected intermediate its ends as at 87 with a link 88, the latter being pivotally connected as at 89 with a portion of the press bed.

The other end of the lever 86 is pivotally connected as at 90 with an extension 91 of the piston rod 35, to which the piston 34 that is reciprocable in the cylinder 33 is connected.

The operation of this form of the invention is the same as that described in connection with the form of the invention shown in Figures 1 to 9, but with the provision of the link connection between the roller 79 and the piston rod 35, it will be manifest that the press body 70 may be swung about the pivot 71 without interfering with the operation of the press.

The usual bracing rods 92 may be provided for bracing the super-structure.

While the preferred forms of the invention have been herein shown and described, it is to be understood that various changes may be made in the details of construction and in the combination and arrangement of the several parts, within the scope of the claims, without departing from the spirit of this invention.

What is claimed as new is:—

1. A metal working press including a plunger and crank shaft for operating the same, a plurality of work holding means adapted to successively co-operate with the plunger to hold the work, means operable to positively lock one of the work holding means against operation during the operation of the other work holding means, the said locking means embodying an operative connection with the said crank shaft, and means embodying a cam device secured to and adjustable about the axis of the crank shaft for varying the time in the cycle of operation of the crank shaft at which the said locking means will become effective.

2. A metal working press including a plunger, a plurality of work holding means adapted to successively co-operate with the plunger to hold the work, fluid pressure cushioning means individual to said work holding means for yieldingly resisting them in their movement in one direction, and means operable to positively lock one of the work holding means against operation during the operation of the other work holding means, the said locking means being disposed above the bed of the press.

3. A metal working press including a plunger, a plurality of work holding means adapted to successively co-operate with the plunger to hold the work, fluid pressure cushioning means individual to said work holding means for yieldingly resisting them in their movement in one direction, and means operable to positively lock one of the work holding means against operation during the operation of the other work holding means, the said locking means being disposed above the bed of the press and operatively connected with a movable part of the press.

4. A metal working press including a plunger, a crank shaft for actuating the same, a plurality of work holding means adapted to successively co-operate with the plunger to hold the work, means operable to positively lock one of the work holding means against operation during the operation of the other work holding means, the said locking means embodying a member for holding one of the parts of the first said work holding means against movement, a cam connected with said crank shaft, an operative connection between the said member and the said cam, and means adapting said cam for rotative adjustment with respect to said shaft for varying the time in the cycle of operation of the shaft at which the said locking means becomes effective and ineffective.

5. A metal working press including a plunger, a crank shaft for actuating the same, a plurality of work holding means adapted to successively co-operate with the plunger to hold the work, and means operable to positively lock one of the work holding means against operation during the operation of the other work holding means, the said locking means embodying a member for holding one of the parts of the first said work holding means against movement, a cam connected with said crank shaft, and an operative connection between the said member and the said cam, said crank shaft and said cam being disposed above the bed of the press.

6. A metal working press including a plunger, a crank shaft for operating the plunger, a plurality of work holding means adapted to successively co-operate with the plunger to hold the work, one of said work holding means embodying fluid pressure controlled means for yieldingly resisting the movement of the former in one direction and embodying a relatively movable piston and cylinder, one of which latter is stationary, mechanism for holding the last recited work holding means against operation during the operation of the other work holding means, the said mechanism embodying a member operatively related to the movable one of the cylinder and piston elements, a cam on said crank shaft, a reciprocable cross head to be engaged and moved by the cam, and connections between said cross head and said member.

7. A metal working press including a plunger, a crank shaft for operating the plunger, a plurality of work holding means adapted to successively co-operate with the plunger to hold the work, one of said work holding means embodying fluid pressure controlled means for yieldingly resisting the movement of the former in one direction and embodying a relatively movable piston and cylinder, one of which latter is stationary, mechanism for holding the last recited work holding means against operation during the operation of the other work holding means,

the said mechanism embodying a member operatively related to the movable one of the cylinder and piston elements, a cam on said crank shaft, a reciprocable cross head to be engaged and moved by the cam, connections between said cross head and said member, and means for varying the fixed position of the said cross head and the said member with respect to each other.

8. A metal working press including a plunger, a crank shaft for operating the plunger, a plurality of work holding means adapted to successively co-operate with the plunger to hold the work, one of said work holding means embodying fluid pressure controlled means for yieldingly resisting the movement of the former in one direction and embodying a relatively movable piston and cylinder, one of which latter is stationary, mechanism for holding the last recited work holding means against operation during the operation of the other work holding means, the said mechanism embodying a member operatively related to the movable one of the cylinder and piston elements, a cam on said crank shaft, a reciprocable cross head to be engaged and moved by the cam, connections between said cross head and said member, and means securing said cam to said crank shaft for rotative adjustment with respect to the shaft.

9. A metal working press including a plunger, a crank shaft for operating the plunger, a plurality of work holding means adapted to successively co-operate with the plunger to hold the work, one of said work holding means embodying fluid pressure controlled means for yieldingly resisting the movement of the former in one direction and embodying a relatively movable piston and cylinder, one of which latter is stationary, mechanism for holding the last recited work holding means against operation during the operation of the other work holding means, the said mechanism embodying a member operatively related to the movable one of the cylinder and piston elements, a cam on said crank shaft, a reciprocable cross head to be engaged and moved by the cam, and connections between said cross head and said member, said cross head and said crank shaft and cam being disposed above the bed of the press.

10. A metal working press including a plunger, a crank shaft for operating the plunger, a plurality of work holding means adapted to successively co-operate with the plunger to hold the work, one of said work holding means embodying fluid pressure controlled means for yieldingly resisting the movement of the former in one direction and embodying a relatively movable piston and cylinder one of which latter is stationary, and mechanism for holding the last recited work holding means against operation during the operation of the other work holding means, the said mechanism embodying a cam connected with said shaft, and means operatively connected with the movable one of the cylinder and piston elements and adapted to be engaged by the cam at a predetermined time in the cycle of operation of said shaft for holding the cylinder and piston elements against relative movement.

11. A metal working press including a reciprocable ram, a crank shaft, an adjustable connection between the crank shaft and the ram, a plurality of work holding means adapted to successively co-operate with the ram to hold the work, means operable to positively lock one of the work holding means against operation during the operation of the other work holding means, the said locking means embodying a member for holding one of the parts of one of the work holding means against movement, and a cam connected with the crank shaft and adjustable about the axis of the shaft and adapted to engage said member.

12. A metal working press including a reciprocable ram, a crank shaft, an adjustable connection between the crank shaft and the ram, a plurality of work holding means adapted to successively co-operate with the ram to hold the work, means individual to the work holding means for yieldingly resisting the movement thereof in one direction, means operable to positively lock one of the work holding means against operation during the operation of the other work holding means, the said locking means embodying a member for holding one of the parts of one of the work holding means against movement, and a cam connected with the crank shaft and adjustable about the axis of the shaft and adapted to engage said member.

In testimony whereof I have signed my name to this specification, on this 10th day of December, A. D. 1930.

FREDRICH J. RODE.