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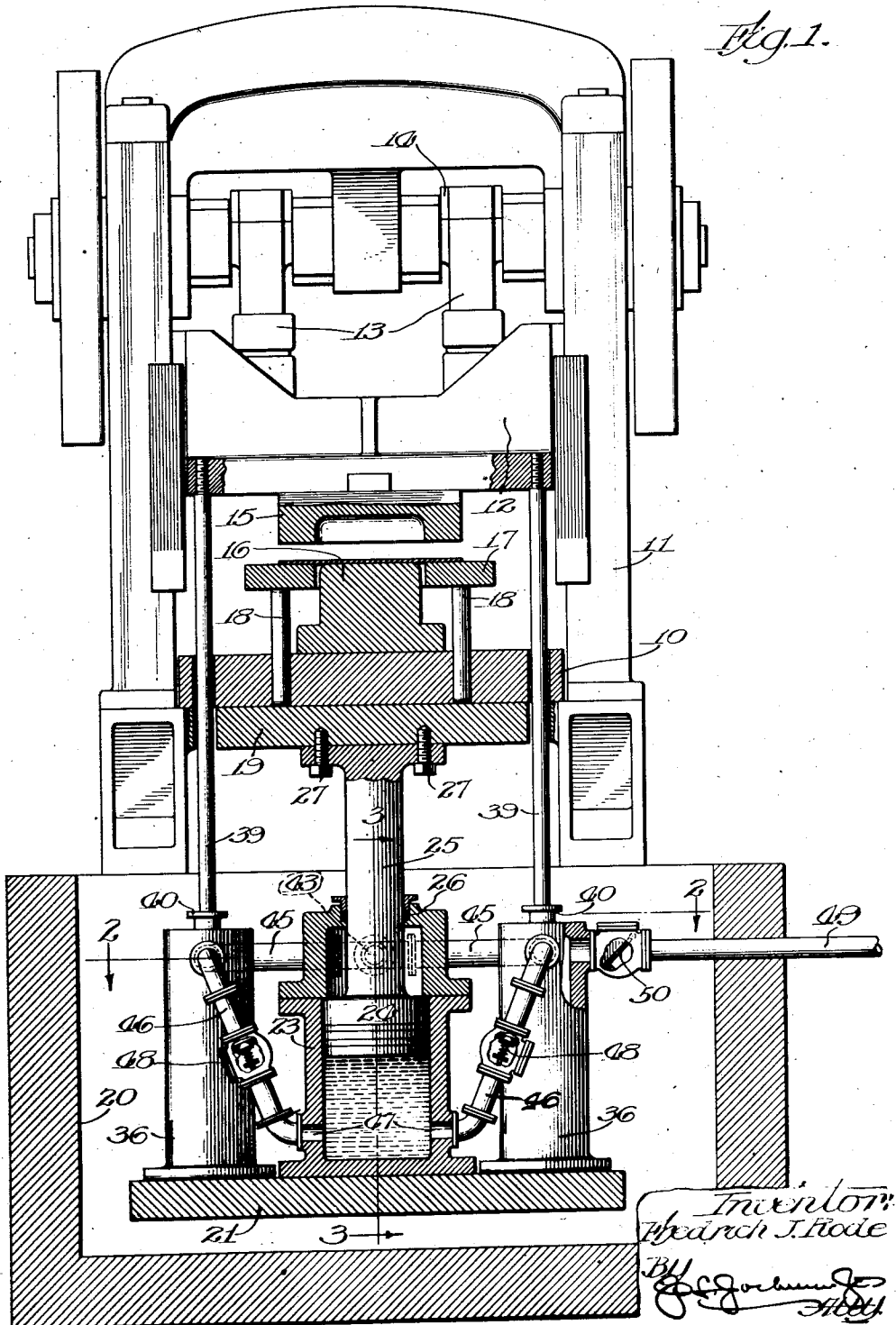
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F. J. RODE

HYDRAULIC CUSHION FOR SHEET METAL PRESSES

Filed April 15, 1927

4 Sheets-Sheet 1



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April 3, 1928.

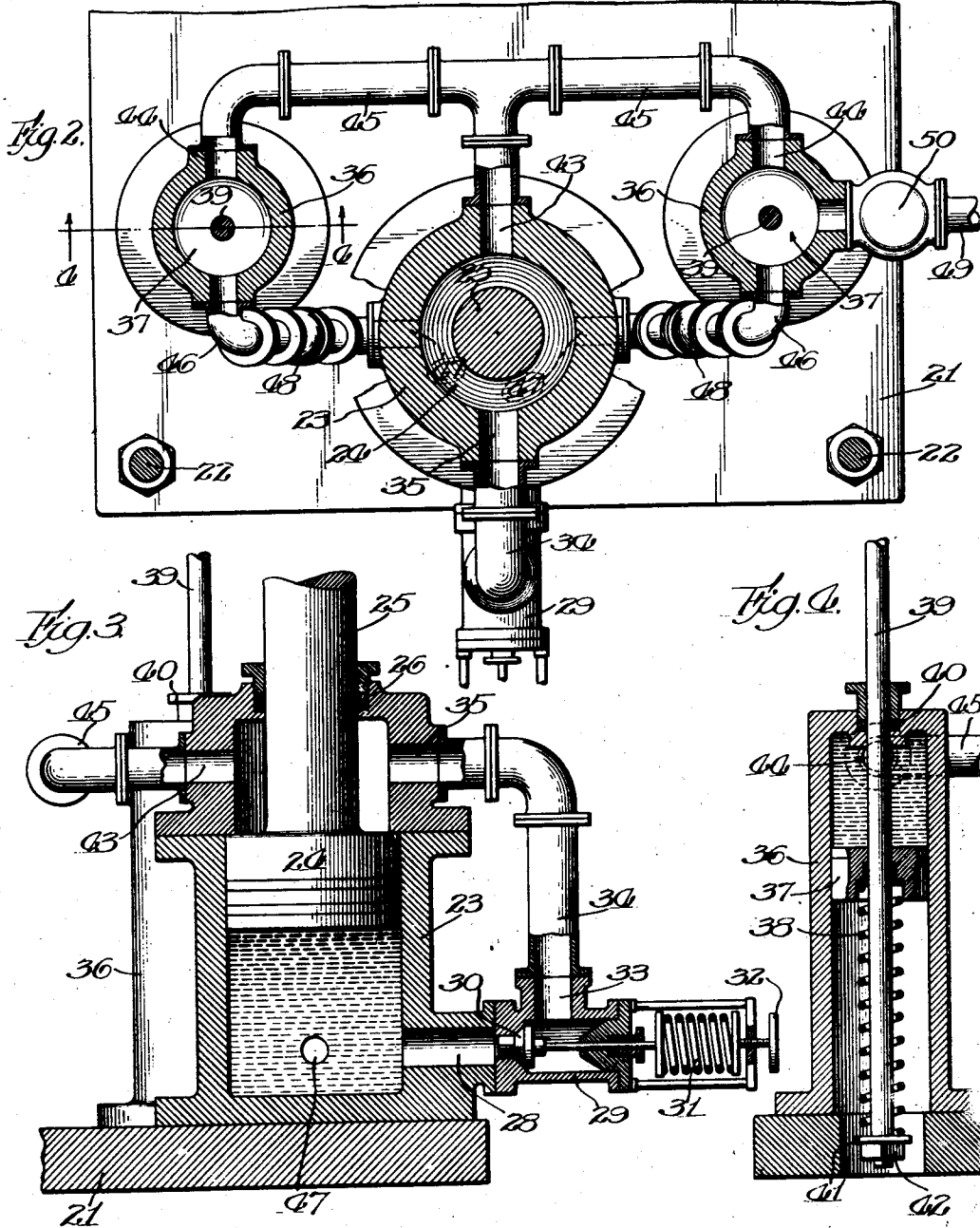
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HYDRAULIC CUSHION FOR SHEET METAL PRESSES

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4 Sheets-Sheet 2



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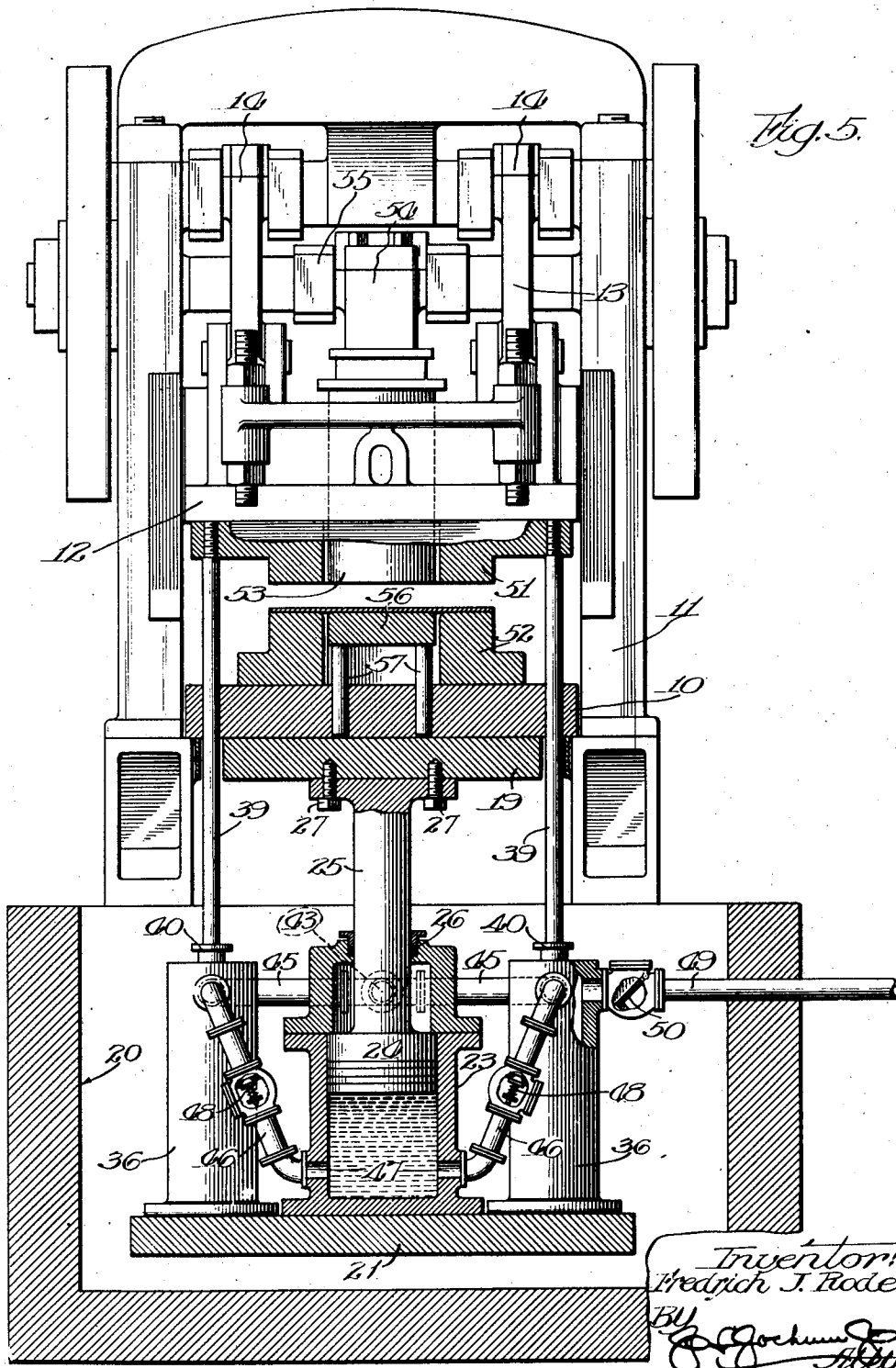
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HYDRAULIC CUSHION FOR SHEET METAL PRESSES

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HYDRAULIC CUSHION FOR SHEET METAL PRESSES.

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Fig. 6.

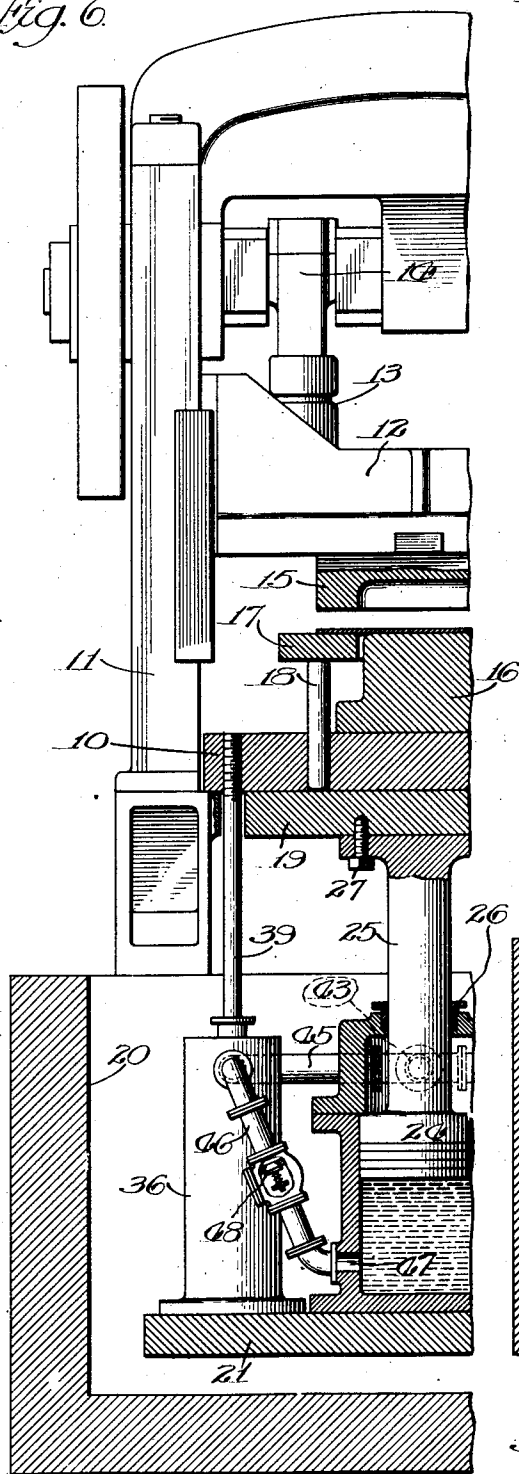
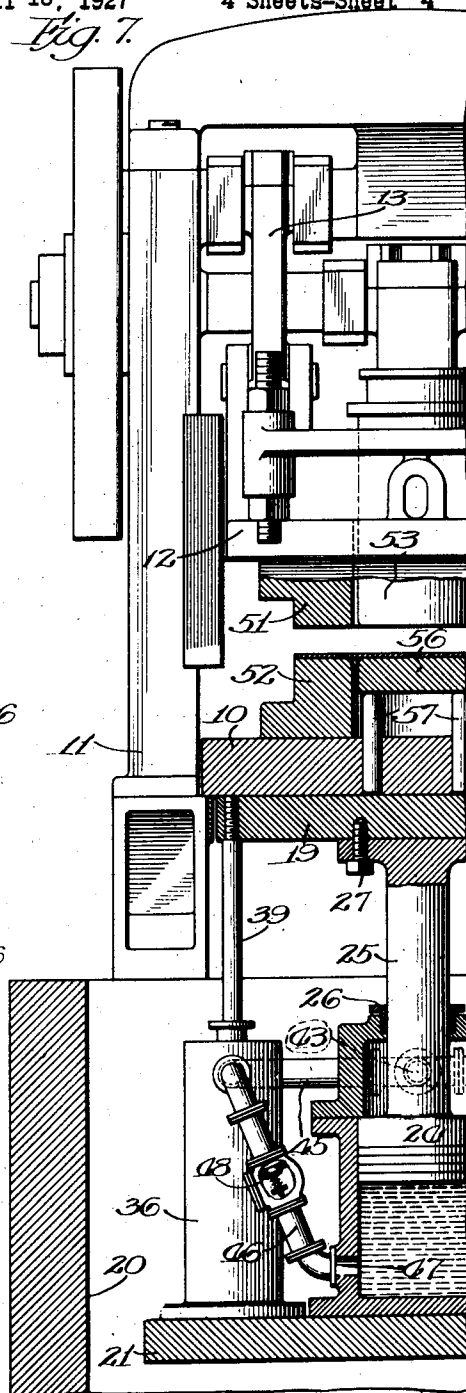


Fig. 7.



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Patented Apr. 3, 1928.

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UNITED STATES PATENT OFFICE.

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HYDRAULIC CUSHION FOR SHEET-METAL PRESSES.

Application filed April 15, 1927. Serial No. 184,070.

This invention relates to improvements in hydraulic cushions particularly adapted though not necessarily limited in its use for sheet metal presses, in which the metal is shaped by means of co-operating dies, one of which dies is reciprocable toward and away from the other, the work being clamped or held by means of a blank or work holding element that co-operates with a reciprocable die member, the blank or work holding element being resisted in its movement in one direction by the said cushion, and one of the objects of the invention is to provide an improved hydraulic cushion of this character in which a predetermined quantity of liquid is used in the cushion, the cushion embodying cylinder and piston members, the liquid being circulated from beneath the piston under predetermined conditions to relieve the resistance pressure.

A further object is to provide improved means for restoring the blank or work holder to its normal position.

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 view partly in elevation, partly in section and partly broken away of a single acting metal working press, having an hydraulic cushion constructed in accordance with the principles of this invention applied thereto.

Figure 2 is an enlarged detail horizontal sectional view taken on line 2—2, Figure 1.

Figure 3 is an enlarged detail vertical sectional view taken on line 3—3, Figure 1.

Figure 4 is a detail vertical sectional view taken on line 4—4, Figure 2.

Figure 5 is a view similar to Figure 1, showing the cushion applied to a double acting press.

Figure 6 is a view partly in elevation, partly in section and partly broken away of one side of a single acting press, showing another form of this invention.

Figure 7 is a view similar to Figure 6 of one side of a double acting press showing another form of the invention.

Referring more particularly to the draw-

ings and to the form of the invention shown in Figure 1, the numeral 10 designates the supporting base or bolster plate of a sheet metal working press. The press embodies uprights 11 having a reciprocating ram or member 12 operated by means of links 13 connected to a crank shaft 14, the latter being driven by any suitable source of power (not shown). Connected with the ram 12 is a die 15 which co-operates with a die 16 that is supported by the bed plate 10. A work holding member 17 encompasses the die 16 and is supported so that in its normal position its upper surface will be substantially flush with the upper surface of the die 16, by means of pins 18 that pass through the bed plate 10 and rest upon a pad or plate 19.

All of the above referred to parts are of the ordinary and well known construction.

Arranged beneath the press, preferably within a pit 20 is a support 21 which is in turn supported by means of suitable supports or hanger members 22 from any stationary part of the press.

Arranged upon the support 21 is a cylinder 23 having a piston 24 reciprocable therein, and connected with the piston is a piston rod 25 which passes through a suitable stuffing box 26 in the end of the cylinder. The end of the piston rod 25 contacts with the pad or plate 19 and may, if desired, be secured thereto by means of suitable fastening devices 27.

Leading from the cylinder 23 adjacent the bottom thereof is a passage 28, which has communication with a valve casing 29, in which a valve 30 is arranged. A spring 31 is provided for holding the valve 30 seated, and means such as a screw device 32 is also provided for varying the tension of the spring 31. The valve 30 is adapted to be unseated so as to let the liquid flow from the cylinder 23 out of the passage 28, by the pressure exerted upon the liquid in the cylinder by the piston 24 and the spring 31 is adjusted to produce the desired resistance pressure against which it is necessary to unseat the valve 30 to open the passage 28.

By means of the adjusting device 32 the resistance pressure of the valve 30 may be varied.

Leading from the valve casing 29 is a passage 33 which has communication with a conduit 34, and this conduit preferably

discharges through an opening 35 into the top of the cylinder 23 on the other side of the piston 24.

Mounted also upon the support 21 are cylinders 36, any number of which may be provided, but in the present exemplification of this invention, two are shown and as the construction and operation of each of these cylinders 36 is the same the description of one will apply equally as well to both.

The cylinder 36 has a piston 37 reciprocable therein, and a resilient member 38 such as a coil spring is provided, which tends normally to move the piston 37 in one direction.

The spring 38 is supported preferably by means of a rod 39 that is anchored to the reciprocating ram of the press. The rod passes through a suitable stuffing box 40 in the top of the cylinder 36 and through the piston 37. The spring 38 is coiled about the rod 39, one end of the spring resting against the piston 37 and the other end against a washer 41 carried by a nut 42 threaded on the lower end of the rod. The rod 39 moves with the cam 12 and energy sufficient to discharge the liquid from the cylinder 36 will not be stored in the spring 38 until the piston 37 is moved downwardly by the admission of liquid into the top of the cylinder, as the lowering of the rods 39 serves to loosen or relieve the springs of their stress. The energy of the springs serves to restore the piston 37 and thereby force the liquid out of the cylinder 36, in a manner to be described.

Leading from the top of the cylinder 23 is a passage 43 which has communication with a passage 44 in the top of the cylinder 36 by means of a conduit 45, which passage 44 is located on the side of the piston 37 opposite to the side on which the spring 38 is located.

Leading also from the cylinder 36 and from the same side of the piston 37 is a conduit 46 which has communication with the cylinder 23 on the pressure side of the piston 24 as at 47.

A check valve 48 is located in the conduit 46 and is arranged to open so as to allow the liquid to flow from the pressure side of the piston 37 in the cylinder 36 into the cylinder 23 on the pressure side of the piston 24, but will close so as to prevent the liquid from flowing back through the conduit 46 into the cylinder 36.

Liquid may be supplied to the cylinders from any suitable source, preferably through a pipe 49 in which is located a check valve 50 so that when a predetermined amount of liquid has been supplied to the cylinders the valve 50 will close so that the liquid will be confined within the cylinders.

In the form of the invention shown in Figure 5, the cushion is applied to a double

acting press and in which press the ram 12 is connected by means of links 13 with the crank shaft 14 and carries a blank holding member 51 which co-operates with a die or blank holding member 52 mounted upon the bed plate 10 of the press. A punch 53 is connected by means of a suitable link 54 with a crank shaft 55 and reciprocates through the die or blank holder member 51. This punch 53 co-operates with a work holding member 56 that is supported by means of pins 57 that pass loosely through the bed plate 10 and engage and rest upon the pad or pin plate 19.

In this form of the invention the rods 39 are connected with the blank holding member 51 and pass loosely through the bed plate 10 so that as the ram descends the rods 39 will be lowered and the springs 38 will not be compressed until the liquid is forced into the top of the cylinders 36 to lower the pistons 37. This will not occur until after the blank holding member 51 contacts with the work to grip the work in connection with the blank holding member 52. This will provide a lift out for the work at a predetermined time in the operation of the press. The pressure of the springs increases only slightly on the down stroke.

In these two forms of the invention the stress of the springs 38 will not be increased until after the commencement of the operation of shaping the work over or with respect to the dies.

In the form of the invention shown in Figure 6, the rods 39 are connected to a stationary part of the press, such as the bed plate 10. With this arrangement the rods 39 are at all times stationary so that when the liquid is forced into the top of the cylinders 36 above the pistons 37, the pistons will be lowered by the pressure and the stress of the springs 38 will be increased during the lowering movement, but the stress thus created or energy stored in the springs 38 is only sufficient to eject the liquid from the cylinders 36 to force the same back into the cylinder 23 and thereby raise the piston 24.

In the form of the invention shown in Figure 7 the rods 39 are connected with another movable part of the press such as the pad or pin plate 19, with the result that the rods 39 will not commence to lower until the pad or pin plate 19 is lowered through the medium of the pins 57 which will not occur until the blank or work is being shaped by the dies. The lowering movement of the rods 39 will not tend to relieve any stress upon the springs 38 but the stress remains constant while the rods are descending, as the volume of liquid in the cylinders above the pistons is equal. Energy will be stored in the spring 38 by the pressure of the liquid upon the pistons 37 and which liquid is

forced into the cylinders 36 by the lowering of the piston 24.

In all forms of the invention it will be manifest that there is the same volume of displacement on the top side of the piston 24 as on the top side of the pistons 37 and this will cause the springs 38 to maintain the same tension, with the exception of the form of the invention shown in Figure 7, and in which form the tension of the spring is increased by the forcing of the liquid into the cylinders 36 due to the fact that the rods 39 are maintained stationary.

In starting this cushion in operation the cylinders are first filled with liquid and the springs 38 are then adjusted to the desired tension. The operation of all forms of the invention with respect to the return of the pin plate or blank holding member is the same, but the operation will be described in connection with the form of the invention shown in Figure 1.

Assuming the parts to be in the position shown in Figure 1, a predetermined quantity of liquid will be contained in the cylinder 23 and the pistons 24 and 37 will be at the limit of their upward movement.

When the ram 12 descends the rods 39 will be lowered and when the die 15 engages the work a further lowering movement of the ram will cause the blank or work holding member 17 to be forced downwardly. The pins 18 will then force the pin plate or pad 19 downwardly and the piston 24 will be lowered in the cylinder 23, against the resistance of the liquid in the cylinder 23 and which resistance pressure may be predetermined by adjusting the spring 31 so as to maintain the predetermined resistance pressure upon the valve 30 and against which latter pressure the valve 30 must be unseated before the liquid will be forced from the cylinder 23 by the piston 24.

When the piston 24 exerts a predetermined pressure upon the liquid in the cylinder 23 the valve 30 will be unseated against the stress of the spring 31 and the liquid will be forced from the cylinder 23 through the passage 28, through the conduit 44 and into the top on the other side of the cylinder 23 on the side of the piston, out of the passage 43, through the conduit 45 and passage 44 into the top of the cylinder 36. A continued movement of the piston 24 downwardly will continue to force the liquid from the cylinder 23 into the cylinder 36.

As the liquid flows into the cylinders 36 against the pistons 37 the pressure thus created upon the liquid by the piston 24 will cause the pistons 37 to move downwardly to store energy in the springs 38. The energy thus stored in the springs 38 will be negligible as a resistance pressure against the resistance pressure to the piston 24.

After the piston 24 has reached the limit

of its downward movement or at the end of the stroke of the press, the upward stroke of the press will then commence. This will relieve the pressure upon the piston 24 and will raise the rods 39. At this time the energy in the springs 38 will operate upon the pistons 37 in the cylinders 36 to return these pistons. Upon the return movements of the pistons 37 the liquid in the cylinders 36 will be forced from the cylinders 36, through the conduits 46. The valves 48 will then be unseated and the liquid will flow into the cylinder 23 on the pressure or lower side of the piston 24 and thereby raise the piston 24 to restore the pin plate or pad 19.

The pressure exerted upon the liquid by the springs 38 and pistons 37 in returning the piston 24 is only sufficient to restore the pin plate or pad 19.

Upon the next downward stroke of the piston 24 the liquid will be forced back into the cylinders 36 when the resistance pressure of the valves 30 has been overcome.

With this invention it will be manifest that the hydraulic pressure may be controlled at any time during the cycle of operation of the press by the adjustment of the resiliently yielding element or spring 31 and by such adjustment the degree of pressure necessary to unseat the valve 30 will be controlled at will.

While the preferred form of the invention has 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 sheet metal working machine embodying a work holding element, an hydraulic cushion for resisting the movement of said element in one direction, said cushion embodying cylinder and piston members one of which is acted upon by said element, a conduit for leading the liquid from one side to the other side of the piston, a valve for controlling the conduit, variable resistance pressure means acting upon the valve and against which pressure the valve is adapted to be opened by pressure upon the liquid by the movement of the said element, means for restoring the work holding element, the last said means embodying cylinder and piston members, means whereby the liquid will be forced from the first to the second said cylinder when the said valve is opened, and means for forcing the liquid from the second said cylinder back into the first said cylinder to thus restore the work holding element.

2. In a sheet metal working machine a work holding element, an hydraulic cushion for resisting the movement of said element in one direction, said cushion embodying cyl-

inder and piston members, a conduit for leading the liquid from one side to the other side of the piston, a valve for controlling the conduit, variable resistance pressure means acting upon the valve and against which pressure the valve is adapted to be opened by pressure upon the liquid by the movement of said element, a second cylinder, a conduit leading from the pressure side of the piston in the first said cylinder into the second cylinder, a valve for controlling the second recited conduit, and means in the second said cylinder for forcing the liquid therefrom and back into the first said cylinder at a predetermined time in the cycle of operation of the press and on the said pressure side of the piston therein to restore the said work holding element.

3. In a sheet metal working machine a work holding element, an hydraulic cushion for resisting the movement of said element in one direction, said cushion embodying cylinder and piston members, a conduit for leading the liquid from one side to the other side of the piston, a valve for controlling the conduit, variable resistance pressure means acting upon the valve and against which pressure the valve is adapted to be opened by pressure upon the liquid by the movement of said element, a second cylinder, a conduit leading from the pressure side of the piston in the first said cylinder into the second cylinder, a valve for controlling the second recited conduit, and means in the second said cylinder adapted to be acted upon by the entrance of liquid into the second cylinder for forcing the liquid from the second cylinder back into the first said cylinder at a predetermined time in the cycle of operation of the press to restore the said work holding element.

4. Hydraulic cushioning means for a sheet metal working press embodying cylinder and piston members, one of which is operated upon by a work holding element, a conduit for leading the liquid from one to the other side of the piston, a valve for controlling the conduit, variable resistance pressure means acting upon the valve, a second cylinder, a conduit for leading the liquid from the pressure side of the piston in the first said cylinder into the second cylinder, a valve for controlling the last said conduit, a piston in the second said cylinder, and means for moving the last said piston in a direction to force the liquid from the second cylinder through the last said conduit back into the first said cylinder at a predetermined time in the cycle of operation of the press to restore the work holding element, energy being created in the last said means by the discharge of the liquid into the second said cylinder from the first said cylinder.

5. Hydraulic cushioning means for a sheet

metal working press embodying cylinder and piston members, one of which is operated upon by a work holding element, a conduit for leading the liquid from one to the other side of the piston, a valve for controlling the conduit, variable resistance pressure means acting upon the valve, a second cylinder, a conduit for leading the liquid from the pressure side of the piston in the first said cylinder into the second cylinder, a valve for controlling the last said conduit, a piston in the second said cylinder, and resilient means for moving the last said piston in a direction to force the liquid from the second said cylinder back into the first said cylinder at a predetermined time in the cycle of operation of the press to restore the work holding element and against the stress of which resilient means the liquid is forced into the second cylinder from the first said cylinder.

6. Hydraulic cushioning means for a sheet metal working press for resisting the movement of a blank holding element in one direction and embodying cylinder and piston members, one of said members being acted upon by the said element, a second cylinder and piston, means tending normally to move the last said piston in a direction to eject the liquid from the second said cylinder, a conduit for leading the liquid from the pressure side of the piston in the first said cylinder into the second cylinder against the piston therein to move the last said piston against the stress of the last said means, a valve for controlling the said conduit, variable resistance pressure means acting upon the valve, a second conduit for leading the liquid from the second said cylinder back into the first said cylinder to restore the work holding element at a predetermined time in the cycle of operation of the press, and a valve for controlling the last said conduit.

7. Hydraulic cushioning means for a sheet metal working press for resisting the movement of a work holding element in one direction and embodying cylinder and piston members one of which is acted upon by the work holding element, a second cylinder and piston, a conduit leading from the pressure side of the piston in the first said cylinder to the pressure side of the piston in the second cylinder, variable resistance means for closing said conduit and operable by the pressure created upon the liquid in the first said cylinder to open the conduit, means for moving the piston in the second said cylinder in a direction to discharge liquid therefrom and which means is rendered active by the liquid delivered into the second cylinder, a second conduit for leading the liquid from the pressure side of the piston in the second cylinder to the pressure side of the piston in the first recited cylinder to restore the

last said piston, and a valve for controlling the last said conduit.

8. Hydraulic cushioning means for a sheet metal working press for resisting the movement of work holding element in one direction and embodying cylinder and piston members one of which is acted upon by the work holding element, a second cylinder and piston, a conduit leading from the pressure side of the piston in the first said cylinder to the pressure side of the piston in the second cylinder, variable resistance means for closing said conduit and operable by the pressure created upon the liquid in the first said cylinder to open the conduit, mechanical means for moving the piston in the second said cylinder in a direction to discharge liquid therefrom and which means is rendered active by the liquid delivered into the second said cylinder, means for conveying the liquid from the pressure side of the piston in the second said cylinder to the pressure side of the piston in the first said cylinder at a predetermined time in the cycle of operation of the press to restore the first said piston, and means operating automatically to control the last said means.

9. Hydraulic cushioning means for a sheet metal working press for resisting the movement of a work holding element in one direction and for restoring said element, said cushion embodying a cylinder and piston members one of which is operated upon by the said element, a second cylinder and piston member, contractible and expansible means operating upon the second recited piston and tending normally to move the latter in a direction to discharge the liquid from the second said cylinder, means embodying a conduit for leading the liquid from the pressure side of the piston in the first said cylinder to the pressure side of the piston in the second cylinder to create energy in the said expansible means to render the latter active, variable resistance means for controlling said conduit and operable by the pressure created upon the liquid in the first said cylinder, means embodying a conduit for leading the liquid from the pressure side of the piston in the second said cylinder back to the pressure side of the piston in the first said cylinder to restore the last said piston, and an automatically operating valve for controlling the last said conduit.

10. Hydraulic cushioning means for a sheet metal working press for resisting the movement of a work holding element in one direction and for restoring the said element, said means embodying cylinder and piston members one of which is acted upon by the said element, a second cylinder and piston, a resilient element tending normally to relatively move the last recited cylinder and piston in a direction to discharge the liquid

from the last said cylinder, means embodying a conduit for leading the liquid from the pressure side of the piston in the first cylinder to the pressure side of the piston in the second cylinder to compress the said resilient element to render the latter active, variable resistance means for controlling the conduit, means including a passageway for leading the liquid from the pressure side of the piston in the second cylinder back to the pressure side of the piston in the first said cylinder to restore the piston therein and also the said work holding element, and valve mechanism for permitting the liquid to flow in one direction only through the said passageway.

11. In a sheet metal working machine a work holding element, an hydraulic cushion for resisting the movement of said element in one direction and embodying cylinder and piston members, a second cylinder and piston members, a conduit for leading the liquid from the pressure side of the piston in the first said cylinder to the pressure side of the piston in the second said cylinder to move the piston in the latter, resiliently yielding means for resisting the last said movement of the last said piston, variable resistance pressure means for controlling said conduit, a conduit for leading the liquid from the pressure side of the piston in the second said cylinder back to the pressure side of the piston in the first recited cylinder to restore the last said piston, and valve mechanism for controlling the last said conduit.

12. In a sheet metal working machine a work holding element, an hydraulic cushion for resisting the movement of said element in one direction and embodying cylinder and piston members, a second cylinder and piston members, a conduit for leading the liquid from the pressure side of the piston in the first said cylinder to the pressure side of the piston in the second said cylinder to move the piston in the latter, resiliently yielding means for resisting the last said movement of the last said piston, means connected with a movable part of the press for controlling the last said means, variable resistance pressure means for controlling said conduit, a conduit for leading the liquid from the pressure side of the piston in the second said cylinder back to the pressure side of the piston in the first recited cylinder to restore the last said piston, and valve mechanism for controlling the last said conduit.

13. In a sheet metal working machine a work holding element, an hydraulic cushion for resisting the movement of said element in one direction and embodying cylinder and piston members, a second cylinder and piston members, a conduit for leading the liquid from the pressure side of the piston

- in the first said cylinder to the pressure side of the piston in the second said cylinder to move the piston in the latter, resiliently yielding means for resisting the last said movement of the last said piston, a member connected with a movable part of the press and between which last said member and the last said piston the said resiliently yielding means is disposed, said resiliently yielding means being controlled by the movement of the said movable part in one direction, variable resistance pressure means for controlling said conduit, a conduit for leading the liquid from the pressure side of the piston in the second said cylinder back to the pressure side of the piston in the first recited cylinder to restore the last said piston, and valve mechanism for controlling the last said conduit.
14. In a sheet metal working machine a work holding element, an hydraulic cushion for resisting the movement of said element in one direction and embodying cylinder and piston members, a second cylinder and piston members, a conduit for leading the liquid from the pressure side of the first said piston to the pressure side of the second said piston to move the latter, means for moving the last said piston in the opposite direction to force the liquid back to the pressure side of the other piston to restore the latter, variable resistance pressure means for controlling said conduit, the first said means embodying a rod upon which the piston slides, a shoulder on the rod, resiliently yielding means carried by the rod and abutting the piston thereon and said shoulder, and means anchoring the rod to a movable part of the press.
- In testimony whereof I have signed my name to this specification March, A. D. 1927.
- FREDRICH J. RODE.