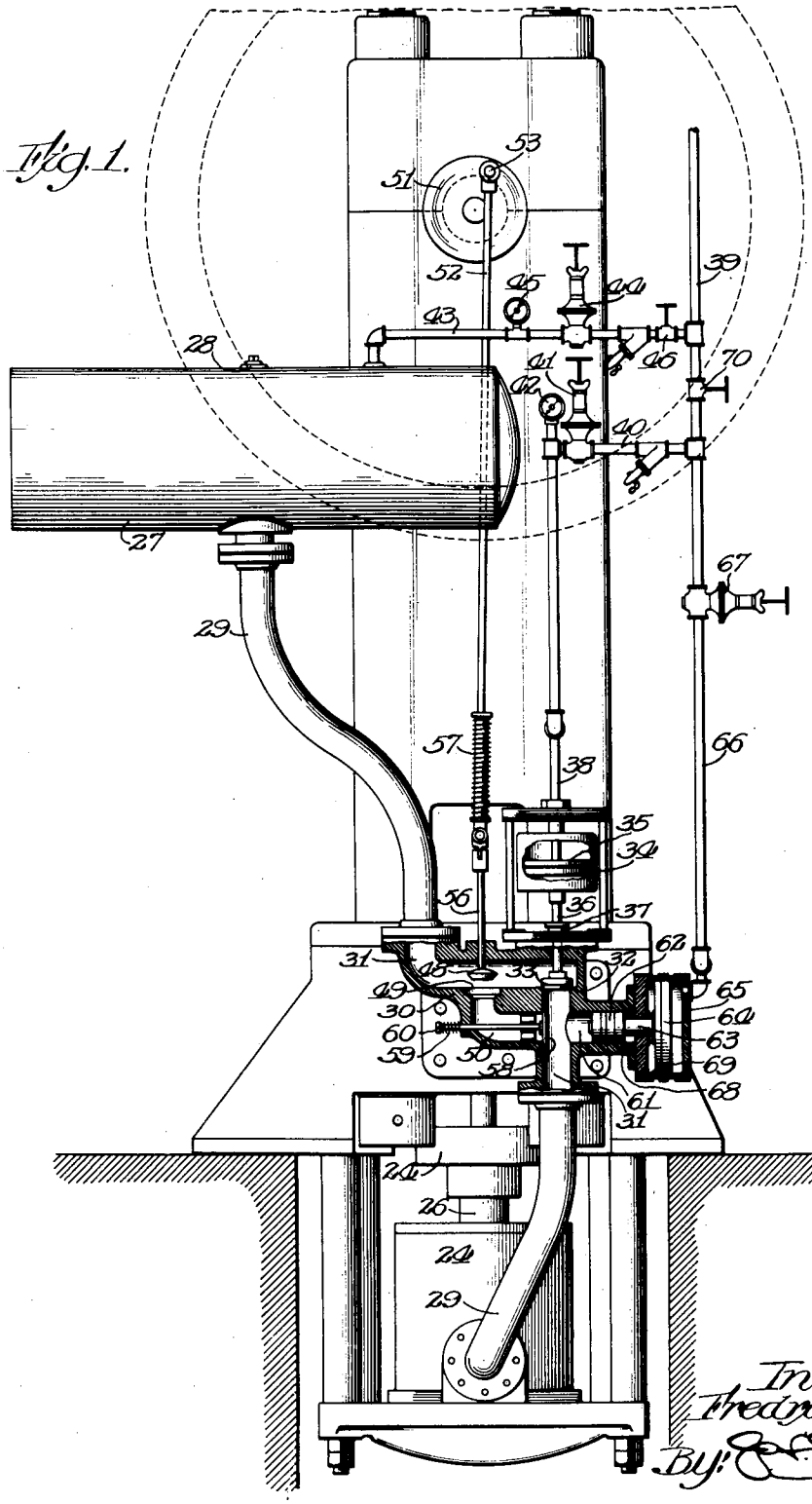
June 25, 1929. F. J. RODE 1,718,435

HYDRAULIC CUSHION FOR METAL PRESSES

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Fig. 1.



Inventor:
Fredrich J. Rode
By: [illegible]
Atty.

June 25, 1929. F. J. RODE 1,718,435

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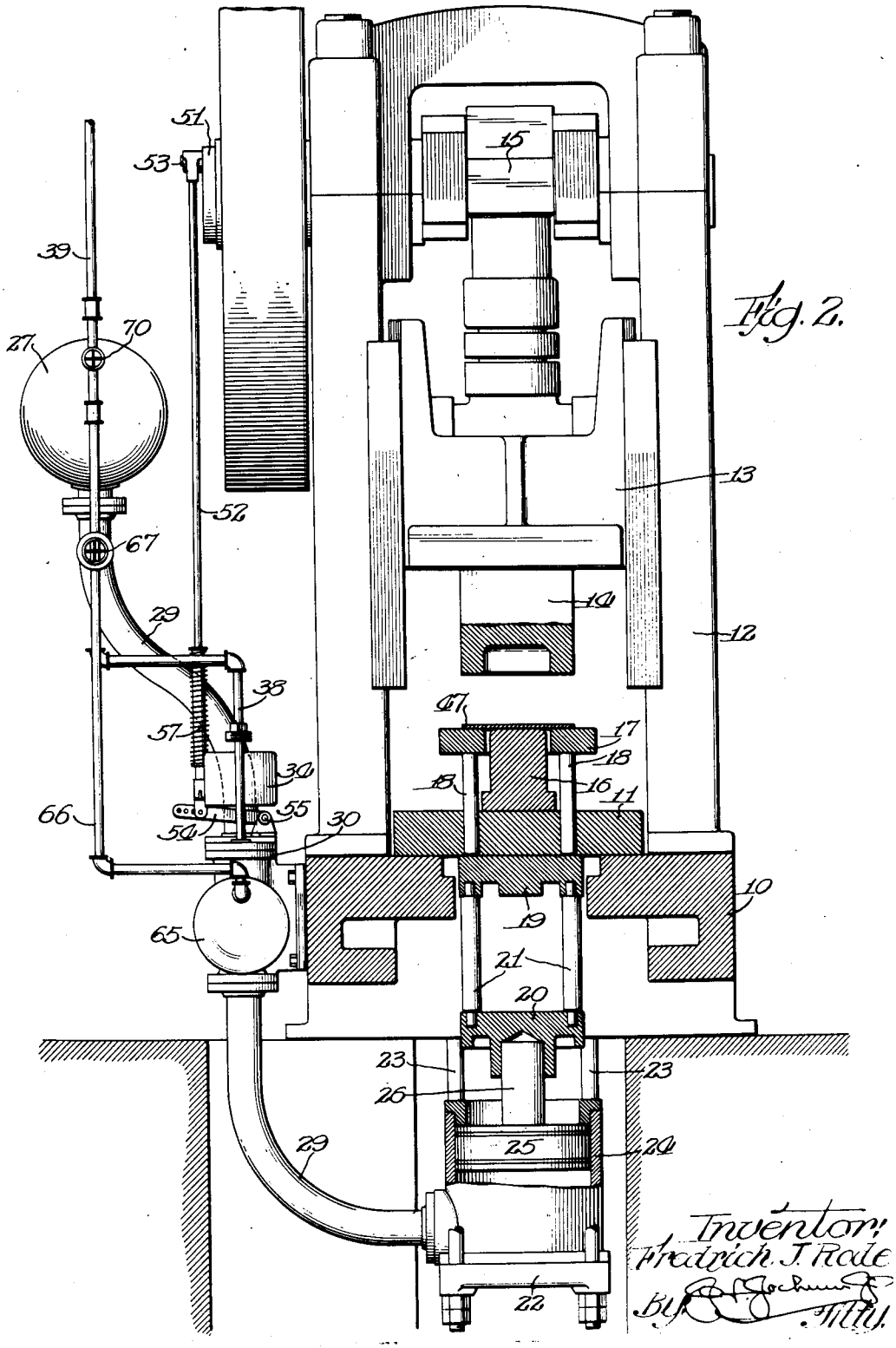


Fig. 2.

Inventor:
Fredrich J. Rode
By

June 25, 1929. F. J. RODE 1,718,435

HYDRAULIC CUSHION FOR METAL PRESSES

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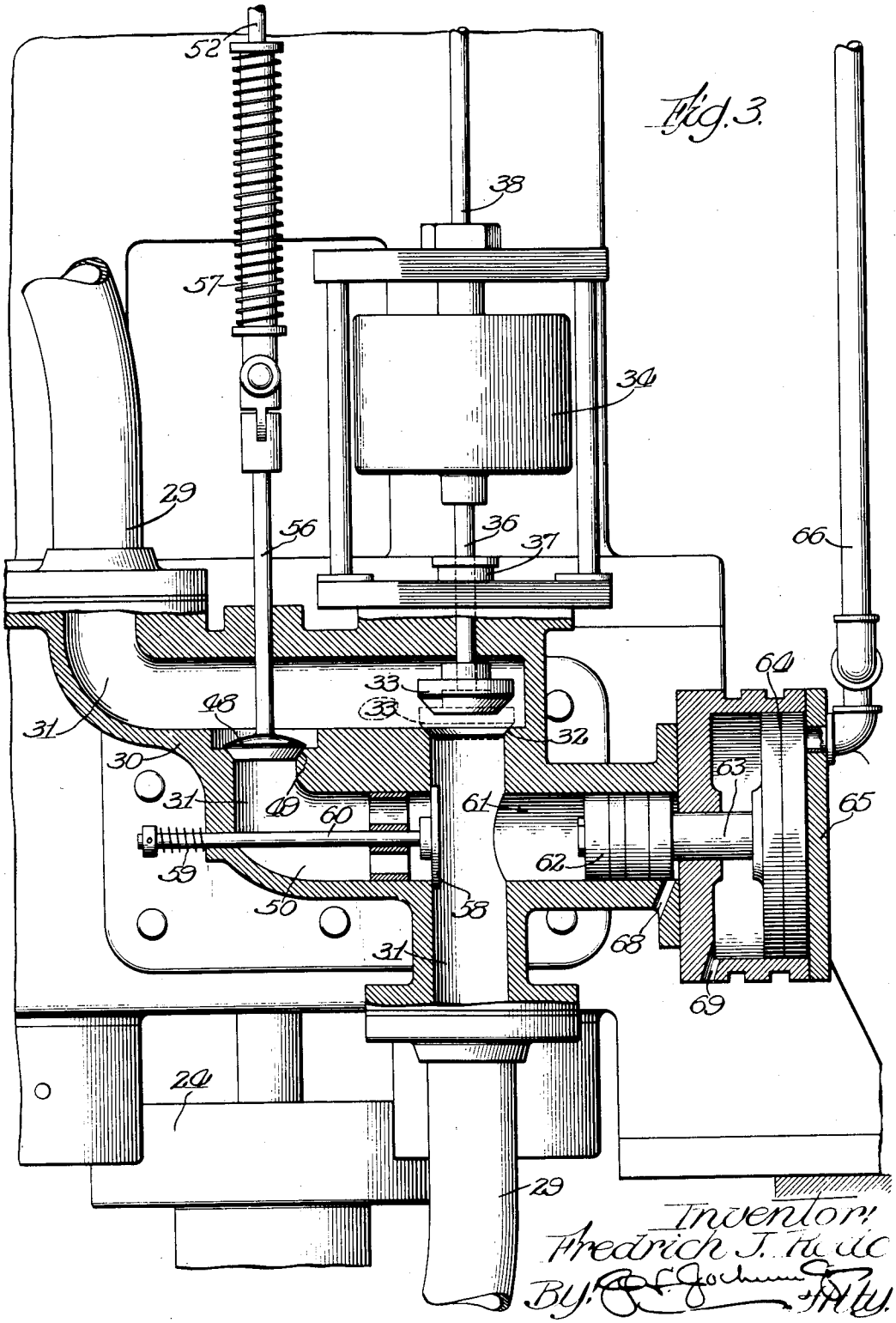


Fig. 3.

Inventor:
Fredrich J. Rode
By: F. J. Rode Atty.

Patented June 25, 1929. 1,718,435

UNITED STATES PATENT OFFICE.

FREDRICH J. RODE, OF CHICAGO, ILLINOIS, ASSIGNOR TO MARQUETTE TOOL & MFG. CO., OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

HYDRAULIC CUSHION FOR METAL PRESSES.

Application filed April 7, 1928. Serial No. 268,325.

In hydraulic cushioning devices for presses of the character 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 the reciprocable die member, and the blank or work holder element being resisted in its movement in one direction by the said cushion, it has been found that when the piston in the cushioning device starts to move against the stress or resistance of the liquid, and especially when said liquid is non-compressible, there is a severe shock imparted to the machinery before the liquid starts to move under the stress or action of the piston. This shock is undesirable and detrimental as it strains the parts of the press, oftentimes resulting in considerable injury.

It is one of the objects of the present invention to overcome these difficulties and objections and to provide in a cushion of this character improved means for automatically eliminating or relieving the parts of the press and machine from such shocks or strains.

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 side elevation, partly in section, with parts broken away and with parts omitted of a sheet metal press having a cushioning means constructed in accordance with the principles of this invention applied thereto, showing the position which the parts will assume when the ram or movable die member is substantially at the limit of its upward movement.

Figure 2 is a view in side elevation of Figure 1 with parts omitted, parts broken away and parts in section.

Figure 3 is an enlarged view partly in elevation, partly in section and partly broken away and with parts omitted, showing the position of the parts when the ram or plunger is at the limit of its lowermost movement.

Referring more particularly to the drawings the numeral 10 designates generally the support of the press upon which the bed plate 11 rests, uprights 12 being provided and along which uprights the ram or plunger 13 carrying the movable die member 14 is reciprocable by means of a crank shaft 15 journaled in the uprights, and which shaft is rotated in a manner usual in presses of this character.

Mounted upon the bed plate 11 is a die 16 with which the reciprocating die co-operates. Encompassing the die 16 is a blank or work holding member 17, the latter being supported by means of pins 18 which pass loosely through the bed plate 11 and have contact with and are supported by means of a pressure plate or pad 19, all as usual in presses of this character.

As shown in Figure 2 of the drawing, the pressure pad 19 constitutes an extension of a pad or plate 20, through the medium of supporting pins 21.

Arranged beneath the press and mounted upon a suitable support 22, which latter may be held in position by means of hanger members 23, is a cushioning device consisting preferably of a cylinder 24 having a piston 25 reciprocable therein, the piston rod 26 being connected in any suitable manner with the pad or plate 20 so that when liquid is in the cylinder 24 beneath the piston 25 and the pressure pad 19 is lowered, the piston 25 will be yieldingly resisted in its downward movement by the liquid in the cylinder.

Supported in any suitable manner and in any convenient place, is a tank or container 27 which is preferably arranged at an elevation and is provided with a predetermined supply of liquid through a suitable fill opening 28.

Leading from the tank is a pipe 29 which has communication with the bottom of the cylinder 24 beneath the piston 25.

Arranged in the pipe 29 and at any suitable point is a valve containing element designated generally by the reference numeral 30. This element has a passage 31 therethrough, which when open will permit the liquid to flow from the tank 27 through the upper portion of the pipe 29 and into the

lower portion of the pipe 29 to be delivered to the cylinder.

This passage 31 is provided with a valve seat 32 with which a valve 33 co-operates for opening and closing the passage to permit or interrupt the flow of liquid therethrough.

The valve 33 is adapted to be controlled in any suitable manner so as to yieldingly hold the same upon the seat 32 and to that end there may be provided a cylinder 34 within which is a piston 35 that is connected to the valve stem 36, the cylinder being held in position in any suitable manner so that the valve stem 36 will pass through a suitable guide 37.

Communicating with the top of the cylinder 34 and on the upper side of the piston is a pipe 38 which delivers fluid, such as air to the cylinder from any suitable source through a pipe 39, and from which pipe a branch pipe 40 leads that connects with the pipe 38. A pressure regulating valve 41 may be provided in the branch 40 and a gauge 42 may also be provided in the pipe. When the fluid flows into the cylinder 34 the valve 33 will be moved against the seat 32 and the degree of pressure with which the valve 33 is held seated by the fluid pressure may be controlled in any suitable manner and varied by means of the regulating valve 41.

Fluid which is supplied through the pipe 39 is also delivered to the tank or receiver 27 by means of a branch pipe 43 leading to the tank and in which branch pipe is a pressure controlled valve 44 by means of which the pressure may be varied, a gauge 45 and a valve 46, by means of which latter the supply of fluid to the tank or receiver 27 may be cut off.

The valve 33 and valve seat 32 are so arranged that the pressure within the tank or receiver 27 will tend to seat the valve so that it will not be unseated by such pressure but is adapted to be unseated by the pressure exerted upon the liquid in the cylinder 24 beneath the piston 25. That is when the die 14 operates upon the work 47 to shape the same and depress the pad 19, the valve 33 will be maintained seated until the pressure upon the liquid in the cylinder 24 exceeds the pressure in the cylinder 34 which holds the valve 33 seated. When the pressure in the cylinder 34 is overcome the valve 33 will be unseated and the liquid from the cylinder 24 will flow back through the pipe 29 to the receiver 27.

The delivery of the liquid from the receiver 27 into the cylinder 24 is controlled by means of another valve 48 which co-operates with a valve seat 49 arranged in a by-pass 50 in the passage 31, and the valve 48 is adapted to be actuated from some movable part of the press preferably by means of a crank 51 connected to the crank shaft 15.

To that end a crank rod 52 is connected by one end as at 53 with the crank 51 and by its other end to a lever 54 fulcrumed as at 55, the lever being connected to the stem 56 of the valve 48, a yieldable section 57 being preferably provided in the rod 52 to prevent injury to the parts.

Thus during a predetermined time in the cycle of operation of the press or at the time when the ram 13 is approaching the limit of its upward movement, the crank 51 will begin to unseat the valve 48 so that by the time the crank is at the highest point the valve 48 will be completely unseated to permit the liquid in the tank or receiver 27 to be delivered under the influence of the air or fluid pressure upon the liquid, through the pipe 29, passage 31, by-pass 50, and the lower section of the pipe 29 to the bottom of the cylinder 24 beneath the piston 25. While the liquid is thus flowing into the cylinder 24 the valve 33 will be seated. When the valve 48 is seated the liquid will be trapped in the lower section of the pipe 29 and the bottom of the cylinder 24 and will be delivered back to the receiver 27, through the passage 31 when the valve 33 is unseated by such pressure.

A valve 58 is provided for controlling the by-pass 50 and is held normally against its seat by means of a spring 59 encompassing the stem 60, the valve 58 being arranged to open to permit the liquid to flow from the receiver through the by-pass 50 when the valve 48 is unseated and to close automatically so as to prevent the liquid from flowing through the by-pass 50 in a direction to unseat the valve 48 when pressure is exerted upon the liquid in the cylinder 24 by the piston 25.

When the liquid is thus trapped in the cylinder 24 and when the piston 25 is lowered by depressing the pressure pad 19, at the instant when the piston 25 acts against the pressure of the liquid in the cylinder 24, the piston is suddenly interrupted in its movement which causes a considerable stress or strain to be exerted upon the crank shaft 15 and other parts of the mechanism, if some means is not provided to relieve such a shock.

Therefore to overcome this detrimental and sudden shock, means are provided for enlarging a portion of the space in which the trapped liquid is contained. In the present exemplification of this invention a portion of the passage 31 in the valve containing element 30 is enlarged and this is accomplished by forming or providing an extension 61 which has communication with the passage 31. Within this extension 61 is arranged a piston 62 having a piston rod 63 connected with a piston 64 that operates in

a cylinder 65. The supply pipe 39 for conducting fluid to the cylinder 34 and the tank or container 27 may be connected with the cylinder 65 by means of an extension 66 and arranged within this connection is a fluid pressure regulating valve 67 of any desired and suitable form.

The pressure of the fluid in the cylinder 65 is such that the piston 64 will be so positioned that it will prevent any appreciable amount of the liquid from entering the extension 61 and the normal tendency of the fluid pressure in the cylinder 65 behind the piston 64 is to hold the piston 62 in such a position.

When, however, the piston 25 acts upon the trapped liquid in the cylinder 24 and the lower portion of the pipe 29 and the adjacent portion of the passage 31, it will cause some of the trapped liquid to flow under a considerable pressure into the extension 61 to move the pistons 62 and 64 against the fluid pressure in the cylinder 65, thereby overcoming such pressure and permitting the space within which the trapped liquid is confined, to be temporarily and slightly enlarged, with the result that the sudden shock or stress upon the crank shaft 15 and other portions of the press will be overcome.

As soon as the pressure upon the liquid in the cylinder 24 is increased sufficiently to overcome the pressure exerted upon the valve 33, the latter will be unseated and the liquid will flow back to the tank or receiver 27. As soon as the pressure of the fluid upon the pistons 64 and 62 is greater than the pressure upon the liquid, the pistons 64 and 62 will be moved from the position shown in Figure 3, back to the position shown in Figure 1.

Ports or passages 68 and 69 may be provided respectively in the cylinders 65 and extension 61 to permit the escape of air and thereby not interfere with the operation of the pistons 62 and 64.

If desired a control valve 70 may be provided at any convenient point in the pipe 39 or extension 66.

By means of the control valves 41 and 67 the respective pressures in the cylinders 34 and 65 may be varied at will.

While the preferred form of the inventon 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. In combination, a pressure pad, hydraulic means for resisting the movement of the pad in one direction, said means embodying a liquid and a piston element operable upon the liquid and means operating automatically at the time the piston starts to move against the stress of the liquid, to eliminate the shock to the actuating mechanism which would be caused by the sudden resistance of the liquid to the movement of the piston.

2. In combination, a pressure pad, hydraulic means for resisting the movement of the pad in one direction, said means embodying a liquid and a piston element operable upon the liquid, variable resistance means for controlling the resistance pressure exerted by the piston upon the liquid, and means operating automatically at the time the piston starts to move against the stress of the liquid, to eliminate the shock to the actuating mechanism which would be caused by the sudden resistance of the liquid to the movement of the piston.

3. In combination, a pressure pad, hydraulic means for resisting the movement of the pad in one direction, said means embodying a liquid and a piston element operable upon the liquid, and fluid controlled means operable automatically at the time the piston starts to move against the stress of the liquid, to eliminate the shock to the actuating mechanism which would be caused by the sudden resistance of the liquid to the movement of the piston.

4. In combination, a pressure pad, hydraulic means for resisting the movement of the pad in one direction, said means embodying a liquid and a piston element operable upon the liquid, variable resistance means for controlling the resistance pressure exerted by the piston upon the liquid, and fluid controlled means operable automatically at the time the piston starts to move against the stress of the liquid, to eliminate the shock to the actuating mechanism which would be caused by the sudden resistance of the liquid to the movement of the piston.

5. In combination, a pressure pad, hydraulic means for resisting the movement of the pad in one direction, said means embodying a liquid and a piston element operable upon the liquid, fluid pressure controlled means automatically operable at a predetermined time in the cycle of operation of the said pad to eliminate the shock to the movement of the pad which would be caused by the sudden resistance of the liquid to the movement of said piston, and means for varying at will the said fluid pressure.

6. In combination, a pressure pad, hydraulic means for resisting the movement of the pad in one direction, said means embodying a non-compressible liquid and a piston element operable upon the liquid, fluid pressure controlled means automatically operable at a predetermined time in the cycle of operation of the said pad to

eliminate the shock to the movement of the pad which would be caused by the sudden resistance of the liquid to the movement of said piston, and means for varying at will the said fluid pressure.

7. In combination, a pressure pad, hydraulic means for resisting the movement of the pad in one direction, said means embodying a container for the liquid and a piston operable upon the liquid, and means operable automatically to increase the liquid containing area in the said container, at a predetermined time in the cycle of operation of the piston, to overcome the shock which would be caused by the sudden resistance of the liquid in said container to the movement of the piston.

8. In combination, a pressure pad, hydraulic means for resisting the movement of the pad in one direction, said means embodying a container for the liquid and a piston operable upon the liquid, and fluid pressure controlled means operable automatically to increase the liquid containing area in the said container, at a predetermined time in the cycle of operation of the piston, to overcome the shock which would be caused by the sudden resistance of the liquid in said container to the movement of the piston.

9. In combination, a pressure pad, hydraulic means for resisting the movement of the pad in one direction, said means embodying a container for the liquid and a piston operable upon the liquid, fluid pressure controlled means operable automatically to increase the liquid containing area in the said container, at a predetermined time in the cycle of operation of the piston, to overcome the shock which would be caused by the sudden resistance of the liquid in said container to the movement of the piston, and means for varying at will the said fluid pressure.

10. In combination, a pressure pad, hydraulic means for resisting the movement of the pad in one direction, said means embodying a container for the liquid and a piston operable upon the liquid, and means operable automatically to increase the liquid containing area in the said container, at a predetermined time in the cycle of operation of the piston, to overcome the shock which would be caused by the sudden resistance of the liquid in said container to the movement of the piston, the last said means also operating automatically at a predetermined time in the cycle of operation of the piston to restore the said container to the normal liquid containing area.

11. In combination, a pressure pad, hydraulic means for resisting the movement of the pad in one direction, said means embodying a liquid and a piston element operable upon the liquid, and means operating to eliminate the shock to the actuating mechanism which would be caused by the sudden resistance of the liquid to the movement of the piston.

12. In combination, a pressure pad, hydraulic means for resisting the movement of the pad in one direction, said means embodying a liquid and a piston element operable upon the liquid, and means operating at the time the piston starts to move against the stress of the liquid, to eliminate the shock to the actuating mechanism which would be caused by the sudden resistance of the liquid to the movement of the piston.

In testimony whereof I have signed my name to this specification, on this 29th day of March, A. D. 1928.

FREDRICH J. RODE.