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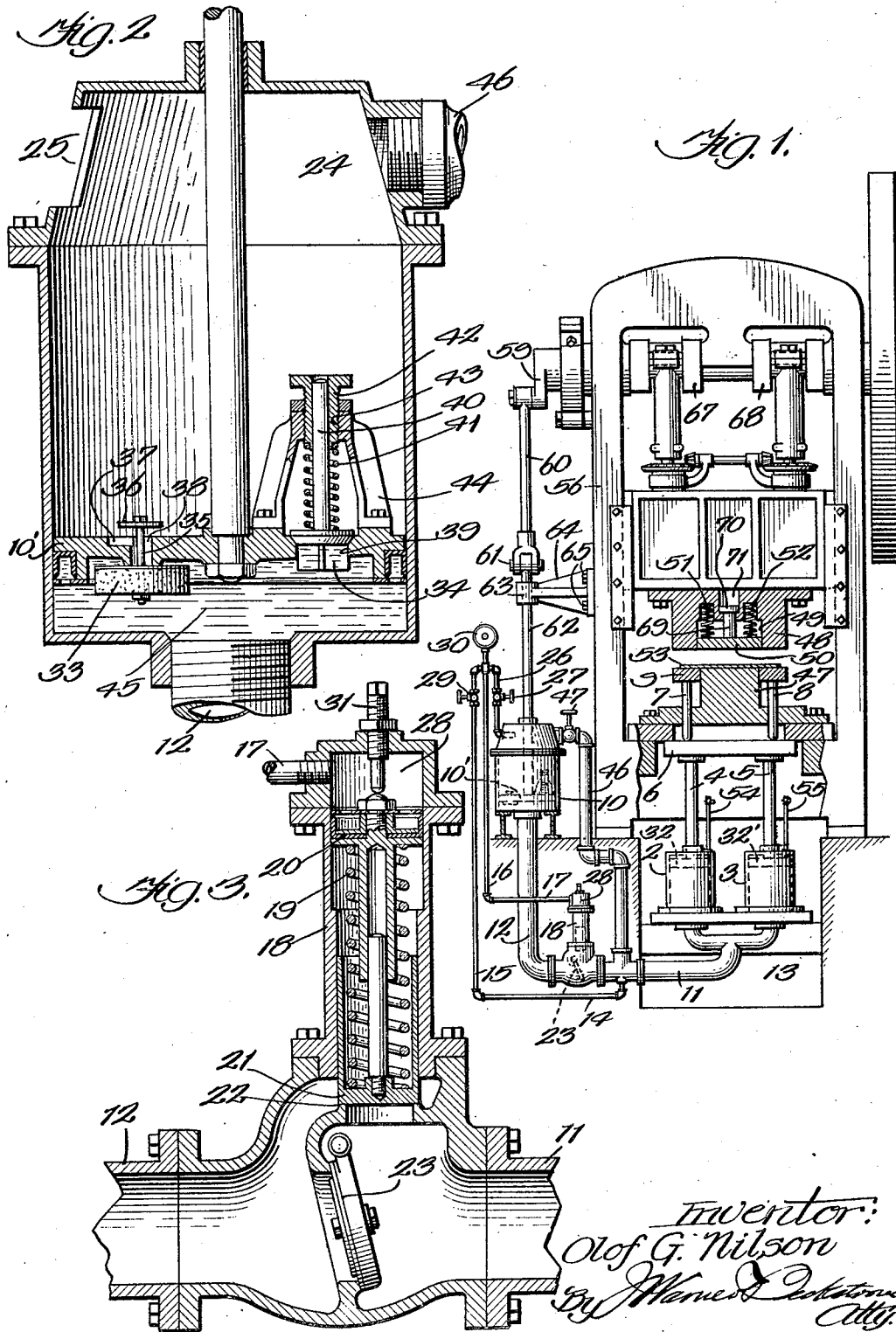
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O. G. NILSON

PUNCH PRESS

Filed April 12, 1926

2 Sheets-Sheet 1



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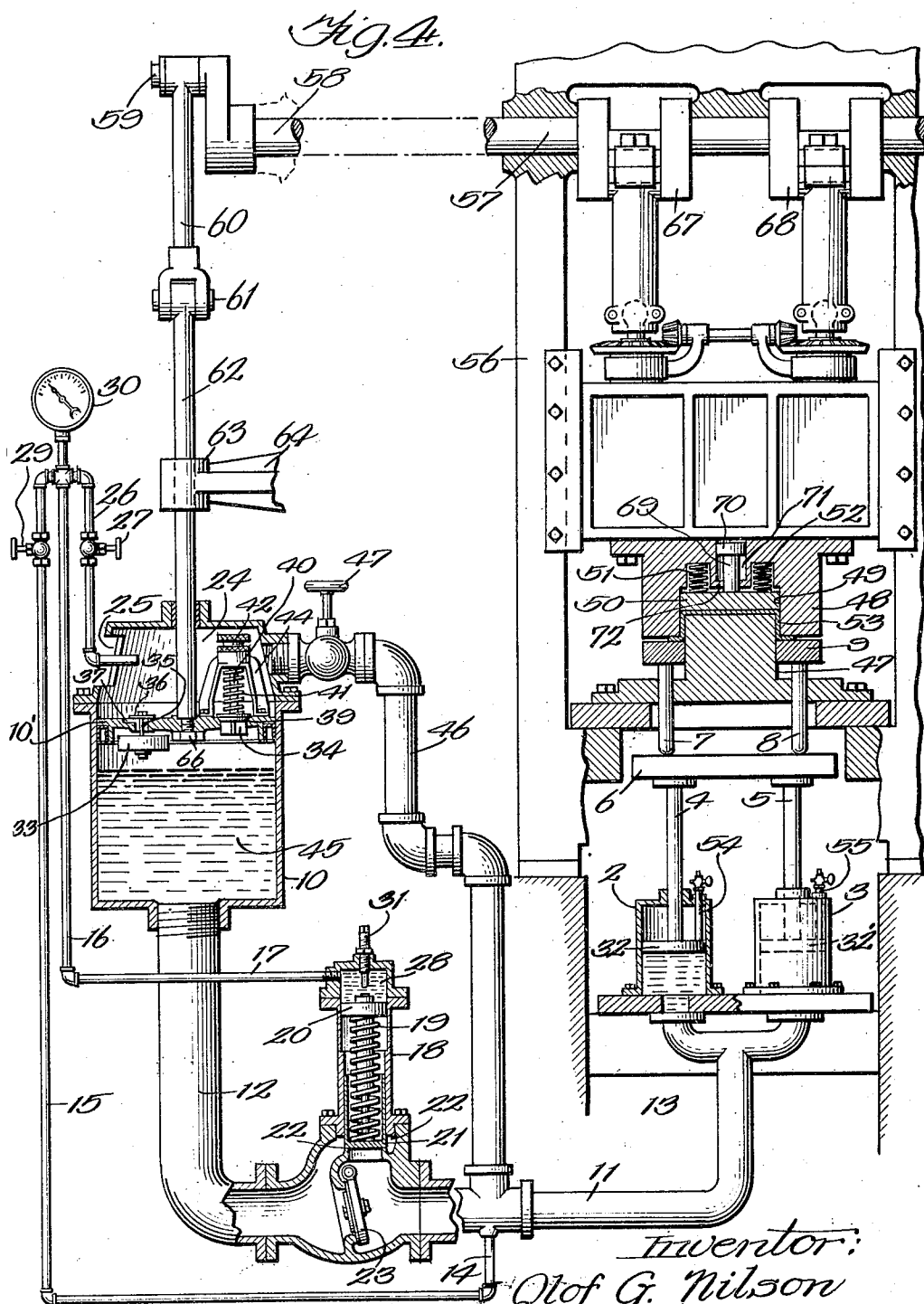
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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE.

OLOF G. NILSON, OF CHICAGO, ILLINOIS, ASSIGNOR TO PRESS CUSHION CO., A CORPORATION OF ILLINOIS.

PUNCH PRESS.

Application filed April 12, 1926. Serial No. 101,457.

My invention is an improvement in punch presses, and has particular reference to means which provide resistance to undue "creeping", and consequent wrinkling or deformation of the blank or work while it is being drawn or punched. The object of this invention is to make said resistance substantially uniform, constant and predeterminable for various weights or thicknesses of material, the attainment of which uniformity has been one of the ever present problems in this art, especially in connection with the drawing of shells, cups, etc. out of flat material or metal sheets.

Another object of this invention is to overcome, without more or less expensive, involved and complicated machinery, the so called "backlash" or pressure against the punch during the up or return stroke of the press after each drawing operation, which backlash is always present when the force co-operating with the engine power for the press is a compressible fluid, springs, rubber, or other flexible material storing up power to be released and operative during the return, or release, stroke of the press, and primarily, for the referred to uniform grip upon the work, or material to be drawn or stamped into a new form.

In all mechanisms of this type it is highly desirable to maintain a uniform resistance against the pressure pad, or the well known "draw-ring", during the whole working operation, or drawing or punching operation of the press when the press is under a great strain. In drawing metal shells the best results are obtainable only by the nearest to uniform pressure applied to the blank throughout the entire movement which reshapes said blank, and a very important object of this invention is to attain this uniformity in a higher degree.

This invention, further, makes provision for visually registering the degrees of resistance during operations, and to make it possible to preserve the desired registry for future operations, or return operations, on like material. Such preservation would consist of recording on paper, or in a suitable book, the indicator readings which have proved correct for the various classes of work, such obviating the usual repetitions of

experimental adjustments, loss of time, spoilage of material, etc.

Owing to their vertical dimensions portions of draw presses are necessarily lowered into pits where adjustments are more or less inconveniently made and observed, and a still further object of this invention is to enable original adjustments and variations thereof at a gage or registering device operated by the press above the normal floor level, or above said pit, or at the operator's working height. Other objects and advantages will appear in the subjoined detail description, and, referring to the drawings, which show a punch press embodying my improvements—

Figure 1 shows the press in elevation partly broken away and in section.

Figure 2 is a greatly enlarged view showing a vertical section of the storage tank or receiving cylinder shown in the smaller scale in Figure 1, with pipe connections broken away or omitted.

Figure 3 is a similarly enlarged view of the by-pass control portion of the press broken away and in vertical section.

Figure 4 is substantially an enlarged view of Figure 1 showing the parts in a changed position with more parts broken away to show interior parts.

In the several views illustrating the present embodiment of my invention, I show immediately under the body of the press in Figures 1 and 4, a pair of oil or fluid-containing cylinders 2 and 3, whose piston-rods 4 and 5 carry on their upper ends a pressure pad, or table 6, against which the usual draw-ring, pins or legs—7 and 8—impinge in the well known way. These cylinders 2 and 3 will be referred to as the pressure pad cylinders and provide resistance, in conjunction with hereinafter referred to other parts, for the usual drawing—9. The cylinders 2 and 3 communicate with a storage tank or receiving cylinder 10 through a capacious conduit shown in two sections 11 and 12. This conduit is preferably located below the normal floor level, or in a pit,—13. In the conduit 11, 12 is interposed a variable resistance mechanism which includes an interrupted circuit of small pipes 14, 15, 16 and 17, the first of which—14—taps the main conduit section 11 while the last, or 17, enters the top of a cylinder 18 connected with

the section 12 and having therein a coiled spring 19 which surrounds a stem having on its upper end a piston 20 while its lower end bears against the closed lower end—21—of a cylindrical member telescoping the cylinder 18. The end 21 constitutes a valve which is normally closed and controls a by-pass 22 in the main conduit section 12 in which is a flap-valve 23 which closes the flow of oil in the direction of the receiving cylinder 10, and imposes upon such flow the work of overcoming the resistance of the spring 19. Above a piston 10' in the chamber 10 is a spill chamber 24 that is provided with a side opening 25, the latter being partly occupied by the outlet end of a pipe 26 branching off from the small pipes circuit 14 to 17 and provided with a valve 27. Above the piston 20 in the cylinder 18 is an oil trap chamber 28 which is in communication with the conduit section 11 through said circuit of small pipes, or on the pressure pad pistons side of said conduit, and in said circuit a globe valve 29 is arranged between a pressure gauge 30 at its top and its pit portion. During the first down stroke of the pistons 32—32' in the pressure pad cylinders 2 and 3, which movement should be made very slowly, the globe valve 29 is held open to allow the same pressure per square inch to be exerted on top of the spring-resisted piston 20 as is exerted on the exposed part of the similarly spring-controlled by-pass valve 21. As the piston 20 has the larger area it is impossible for the by-pass valve 21 to open until the liquid forced out of the pressure pad cylinders 2 and 3 is backed up against the piston 21 with sufficient force to overcome the spring 19. When a predetermined pressure is registered by the pressure gauge 30 the globe valve 29 is closed and the liquid between the piston 20 and the globe valve 29 is entrapped in the pipes 16 and 17 and oil trap 28, whereby a constant pressure is maintained on the by-pass valve 21. In order to effect a slight initial pressure on the spring 19 to insure a tight seating of the by-pass valve 21 before liquid is forced into the chamber 28 a set-screw 31 is provided in the top of the chamber 28 to be adjusted against the valve 20 to give proper tension to the spring 19. An outlet for the entrapped liquid into the spill chamber 24 is provided in the pipe 26 normally closed by the globe valve 27, and if the predetermined pressure on the by-pass valve 21 should prove to be higher than desirable the tension on the spring 19 can be relieved by opening the valve 27 and draining off the required amount of liquid into the spill chamber 24, or draining off sufficiently to bring the gauge 30 registration to the desired pressure.

Through the piston 10' are two openings which are controlled by valves 33 and 34 which open and close in opposite directions. The valve 33 is a normally open float valve and floated to its closed position by the rise of

the oil in the receiving cylinder 10. The valve 34 is a species of safety valve which is opened by an excess of liquid over predetermined pressure in the cylinder 10, such excess being specifically provided for to insure complete operation. On the valve 33 is a stem 35 which carries on its upper end a disk 36 that supports the valve in its opened or lowered position. The excess liquid temporarily entrapped in the spill chamber is permitted to return to the space below the piston 10' through a lateral passage 37 therethrough, which is in communication with the bore 38 for the stem of the valve 33 and extends, as shown, beyond the periphery of the disk 36. The valve 34 is provided with an opening 39 through the piston 10' and is seated from above. The latter valve has a stem 40 within a coiled spring 41 which bears against an adjustable plug 42 and the valve and holds the latter normally closed. The plug—42—has threaded engagement with a bore 43 in the top of a valve-supporting bracket 44 secured to the upper side of the piston 10'. The plug 42 is therefore adjustable against the spring to vary its pressure upon the valve 34 and its resistance to pressure of oil or fluid—45—in the chamber 10.

The purpose of having a surplus amount of liquid in the receiving chamber 10 is to insure at all times that the pistons 32 and 32' in the pressure pad cylinders 2 and 3 are brought home, by the piston 10' continuing its downward stroke a short distance after the pressure pad pistons 32 and 32' have come to a rest. The spring pressure on the valve 34 is set to correspond with the liquid pressure per square inch necessary to lift the pressure pad pistons home.

The spill chamber 24 is connected with a large conduit 46 which leads into the main conduit section 11 and is provided with a valve 47. When for certain purposes it is desirable to drain the pressure pad cylinder or cylinders of oil (changing piston packings, cylinder packing or making repairs) the valve 47 is opened when the weight of the pressure pad and pistons forces the liquid through this passage 46 into the spill chamber 24 until the pistons 32 and 32' rest respectively on the bottoms of the cylinders 2 and 3.

In the female die-member, or punch, 48 operating on the blank or material placed on the male die member and draw ring 9 is a recess 49 which contains a movable plate 50 against which bears a pair of coiled springs 51 and 52. This plate 50 serves to push out the finished stamping from the punch 48 when the ram of the press is lifted off the plate or work—53. Through the tops of the cylinders 2 and 3 slidably pass pipes 54 and 55 that are anchored in and pass through the pistons 32 and 32' and have stop cocks on their upper ends. By opening the latter while filling the system with oil through the

opening 25, or otherwise, air in the system is permitted to escape and when the liquid is flowing through these cocks, or the system is filled, said cocks are closed and the machine ready for operation. On the up stroke of the press the hydraulic pressure of the elevated liquid—45—will force the pistons 32 and 32' to their raised positions and therewith the pressure pad 9 and the formed blank, or work, 53 as the work appears in Figure 4.

In connection with the conventional punch press—56—and its well known crank-shaft 57, I provide an extension 58 for the latter on which is a crank 59 that is pivoted to a connecting link 60. The latter is pivoted to the upper end, or at 61, to a piston rod 62 which reciprocates in a bearing 63 on a bracket arm 64 secured at 65 (Fig. 1) to the frame 56 of the press. The lower end of the rod 62 is bolted to the piston 10' at 66. The usual cranks—67 and 68—of the press have their throw in opposite direction to that of the crank 59. Hence the piston 10' is operated positively by the press in both directions while the pistons 32 and 32' are operated in one direction (upwardly) hydraulically. The work knock out plate 50 is suspended in its normal position of Fig. 1 on a bolt 69 having a head 70 movable up and down in a counterbore 71 of the bolt hole in the punch, which counterbore provides a rest or ledge 72 for said bolt head when in normal position.

The positions of the parts in Figure 4 are at the ends of a punching or drawing operation, or when the blank 53 has been formed. In this position it will be noticed that there is a considerable space in the receiving tank 10 between the liquid 45 contained therein and the piston 10' so that there will be an absence in this invention of the usual intensified compression which has heretofore caused the so called "backlash" noise and wear and tear upon machinery, to partly relieve which has caused the invention of various kinds of machinery for this one purpose only. As the cranks 67 and 68, arranged at right angles to the crank 59, begin their upward swing from the Figure 4 position, there is no compressed force operating against the pressure pad 6 as the piston 10' starts to descend. Not until the piston 10' reaches the liquid 45 on the downward swing of the crank 59 will its force operate against the pressure pad 6, and then only gently and gradually, yet with absolute firmness, instead of with the usual "explosive" slam. Thus, in effect, for the usual extra room or pit space occupied by powerful air compression chambers, springs and the like which store up the force that causes said backlash this invention substitutes the small vacancy between the piston 10' and the liquid 45 and the means for making anti-backlash use of it. By the time the piston reaches the liquid 45 the upward movement of the ram, or upper portion of right hand

portion of Figure 4, is beyond the backlash period of upward movement of punch or ram. In other words, the piston 10' upon its return in the container 10 will not strike the top of the liquid 45 therein at the moment of its return, but will be delayed in contacting and forcing the column of liquid against the pistons 32 and 32' until after the ram and die 48 have returned partially to their normal or up positions.

The referred to usual storing up of force that causes said backlash also progressively increases the resistance to the ram or punch, and another object attained by the present improvement is to obviate such constantly increasing strain and to make the strain no greater at the end than at the beginning of the drawing or punching movement. This is accomplished by clearing the path for the upwardly moving liquid 45 through the piston connections with the crank 59 while the punch or die is moving downwardly and against the work or blank.

The above described means for saving wear and tear of machinery and eliminating its noise, also obviates the common danger from explosions or violent eruptions where compressed air, compressed rubber or springs are employed to store up the forces that lift the pressure pad, draw ring and work off the dies after each punching or drawing operation.

The pressure pad cylinders 2 and 3 need not occupy more than, say, one-third of the space required for the aforesaid usual flexible pressure pad resistance means of similar capacity.

The means which include the pipe 46 for relieving parts of the system to be repaired of the liquid therein, obviates removing from or spilling out of the system this force whether same be liquid, compressed air or gas.

I claim as my invention—

1. In combination, a punch press, a pressure pad moved in one direction by said press, separate means directly operated by the power which operates said press, for restoring said pressure pad to normal position, and means whereby the direct action of the restoring means itself will delay the operation of the said restoring means until the press has moved partly away from said pressure pad.

2. In combination, a punch press, a resisting pressure pad operated in one direction by said press, hydraulic resistance means opposing the movement of the pad by the press, means making said resistance uniform throughout the movement of said pad, mechanical means positively operating upon said resistance means to gradually and uniformly restore said pad to normal position when said press moves away from it, and means delaying the action of said mechanical

means upon the resistance means during the initial movement of the mechanical means against the hydraulic resistance means.

3. In combination, a punch press ram, a pressure pad operated by said ram, hydraulic resistance means which resists the movement of said pressure pad by said ram, mechanical means operating directly upon the resistance means after the ram has operated against said pressure pad, restore the latter to its normal position, and means rendering the operation of the said mechanical means upon the said hydraulic resistance means inoperative at the beginning of the operation of said mechanical means against the said hydraulic resistance means.

4. In combination, a punch press, a pressure pad moved by said press, cylinder and piston means opposing said press movement, a receiving chamber, a conduit between the latter and said cylinder and piston means through which fluid may be moved back and forth, an auxiliary conduit and chamber into which said fluid may be conducted and held to temporarily free other parts of the system from said fluid to enable repairs of the latter, and means for controlling at will the said auxiliary conduit.

5. In combination, a punch press, a pressure pad operated in one direction by said press, a piston and a cylinder therefore connected with said pressure pad to resist its movement under pressure of said press, a conduit leading from said piston cylinder into a receiving cylinder, the receiving cylinder, a piston in the latter arranged to move oppositely to the first mentioned piston, an adjustable pressure regulating device interposed in said conduit, and means automatically registering the degree of pressure to which said pressure regulating device has been adjusted.

6. In combination, a punch press ram, a pressure pad, hydraulic means embodying a column of liquid for resisting the movement of the said pad in one direction, mechanical means operable directly upon said column of liquid for restoring said pad, and means adapting said mechanical means for an initial movement with respect to the said column of liquid before creating a pressure thereupon to restore the said pad, thereby permitting the said ram to commence its return movement independently of and in advance of said pad.

7. In combination, a punch press ram, a pressure pad, hydraulic means embodying a column of liquid for resisting the movement of the said pad in one direction, mechanical means operable directly upon said column of liquid for restoring said pad, means adapting said mechanical means for an initial movement with respect to the said column of liquid before creating a pressure thereupon to restore the said pad, thereby permitting

the said ram to commence its return movement independently of and in advance of said pad, and means for varying at will the resistance pressure of the said column of liquid upon the said pad.

8. A punch press embodying a pressure pad, a plunger resisting the movement of said pad in one direction, a container, a liquid column operating upon the plunger to resist its movement in one direction and for returning the plunger to its normal position, said liquid column having communication with the container, means operable under a predetermined pressure upon the liquid for controlling the flow of the liquid into the container, and a piston in the container and operable upon its movement to force the liquid from the container and against the plunger, said piston having an initial movement independently of the liquid and before operating upon the liquid to force it from the container.

9. A punch press embodying a pressure pad, a plunger resisting the movement of said pad in one direction, a container, a liquid column operating upon the plunger to resist its movement in one direction and for returning the plunger to its normal position, said liquid column having communication with the container, means operable under a predetermined pressure upon the liquid for controlling the flow of the liquid into the container, means for varying at will the predetermined pressure under which the last recited means is operable, and a piston in the container and operable upon its movement to force the liquid from the container and against the plunger, said piston having an initial movement independently of the liquid and before operating upon the liquid to force it from the container.

10. A punch press embodying a pressure pad, a plunger resisting the movement of said pad in one direction, a container, a liquid column operating upon the plunger to resist its movement in one direction and for returning the plunger to its normal position, said liquid column having communication with the container, means operable under a predetermined pressure upon the liquid for controlling the flow of the liquid into the container, a piston in the container and operable upon its movement to force the liquid from the container and against the piston, said piston having an initial movement independently of the liquid and before operating upon the liquid to force it from the container, a by pass for the liquid around the first recited means and into the said container, and means for controlling at will the said by pass.

11. In combination, a punch press ram, a pressure pad, hydraulic means embodying a column of liquid for resisting the movement of the said pad in one direction, a container for receiving the liquid, fluid pressure con-

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trolled means disposed between said pad and container for controlling said column, a piston movable in the container for forcing the liquid against the pressure pad to return the pad, and a by pass for the said liquid column around the said fluid pressure controlled means.

12. In combination, a punch press ram, a pressure pad, hydraulic means embodying a column of liquid for resisting the movement of the said pad in one direction, a container for receiving the liquid, fluid pressure controlled means disposed between said pad and container for controlling said column, a piston operatively connected with a movable part of the press and movable in the container for forcing the liquid against the pressure pad to return the pad, and a by pass for the said liquid column around the said fluid pressure controlled means.

13. In combination a sheet metal working press embodying a power shaft, a ram operable by said shaft, a pressure pad, hydraulic means for resisting the movement of the pad in one direction, a container, a liquid column having communication with said container, means for causing said column to exert a resistance pressure upon said pad, and a plunger reciprocable in the container, said plunger being responsive in its movement to the operation of said shaft, said plunger operating during its movement in one direction to force the liquid against the said pad to return the pad to a normal position, said liquid being free from the active pressure of the plunger during a portion of its movement in the last recited direction whereby the operation of the liquid to restore the pressure pad will be delayed until after the ram of the press has started to raise.

14. In combination a sheet metal working press embodying a power shaft, a ram operable by said shaft, a pressure pad, hydraulic means for resisting the movement of the pad in one direction, a container, a liquid column having communication with said container, means for causing said column to exert a resistance pressure upon said pad, a plunger reciprocable in the container, said plunger being responsive in its movement to the operation of said shaft, said plunger operating during its movement in one direction to force the liquid against the said pad to return the pad to a normal position, said liquid being free from the active pressure of the plunger during a portion of its movement in the last recited direction whereby the operation of the liquid to restore the pressure pad will be delayed until after the ram of the press has started to raise, a by pass leading from said column to the container and around the said resistance pressure creating means, and means for controlling at will the said by pass.

15. In combination a power press including a power shaft, a pair of co-acting dies, a die

cushioning apparatus embodying cylinder and piston members, one of said members operating upon a blank holder, a container communicating with said cylinder and providing for a liquid column movable under the action of one of said members, means for resisting the said movement of said column, and a plunger movable in the container and operating during its active stroke upon the liquid column to force the latter against the last said member to restore the latter to a normal position, said liquid column being free from the action of the plunger during a portion only of its active stroke whereby the operation of the restoring means will be delayed until after the ram of the press has returned partly to its normal position.

16. In combination a power press including a power shaft, a pair of co-acting dies, a die cushioning apparatus embodying cylinder and piston members, one of said members operating upon a blank holder, a container communicating with said cylinder and providing for a liquid column movable under the action of one of said members, means for resisting the said movement of said column, means for controlling and varying at will the said resisting means, and a plunger movable in the container and operating during its active stroke upon the liquid column to force the latter against the last said member to restore the latter to a normal position, said liquid column being free from the action of the plunger during a portion only of its active stroke whereby the operation of the restoring means will be delayed until after the ram of the press has returned partly to its normal position.

17. In combination a power press including a power shaft, a pair of co-acting dies, a die cushioning apparatus embodying cylinder and piston members, one of said members operating upon a blank holder, a container communicating with said cylinder and providing for a liquid column movable under the action of one of said members, means for resisting the said movement of said column, a plunger movable in the container and operating during its active stroke upon the liquid column to force the latter against the last said member to restore the latter to a normal position, said liquid column being free from the action of the plunger during a portion only of its active stroke whereby the operation of the restoring means will be delayed until after the ram of the press has returned partly to its normal position, a by pass leading from said liquid column to the container and around the said resistance creating means, and means for controlling at will the said by pass.

18. In combination a power press including a power shaft, a pair of co-acting dies, a die cushioning apparatus embodying cylinder and piston members, one of said members op-

erating upon a blank holder, a container communicating with said cylinder and providing for a liquid column movable under the action of one of said members, a plunger movable
 5 in the container and operable upon the liquid column to move it against the last said member to restore the latter, means for controlling the first recited movement of said liquid column to create a resistance pressure of the
 10 column to the said member operating thereupon, and means for varying at will the said resistance pressure.

19. In combination a power press including a power shaft, a pair of co-acting dies, a
 15 die cushioning apparatus embodying cylinder and piston members, one of said members operating upon a blank holder, a container communicating with said cylinder and providing for a liquid column movable under the
 20 action of one of said members, a plunger movable in the container and operable upon the liquid column to move it against the last said member to restore the latter, an operative connection between the plunger and said
 25 shaft, means for controlling the first recited movement of said liquid column to create a resistance pressure of the column to the said member operating thereupon, and means for varying at will the said resistance pressure.

20. In combination a power press including a power shaft, a pair of co-acting dies, a
 30 die cushioning apparatus embodying cylinder and piston members, one of said members operating upon a blank holder, a container communicating with said cylinder and providing for a liquid column movable under the
 35 action of one of said members, a plunger movable in the container and operable upon the liquid column to move it against the last said
 40 member to restore the latter, and means whereby a portion only of said liquid column may be employed to create a resistance to the first recited movement of the liquid column by the said member operating thereupon, independently of said liquid column.

21. In combination a power press including a power shaft, a pair of co-acting dies, a
 45 die cushioning apparatus embodying cylinder and piston members, one of said members operating upon a blank holder, a container communicating with said cylinder and providing for a liquid column movable under the
 50 action of one of said members, a plunger movable in the container and operable upon the liquid column to move it against the last
 55 said member to restore the latter, means whereby a portion only of said liquid column may be employed to create a resistance to the first recited movement of the liquid column by the said member operating thereupon, independently of said liquid column, and means for varying at will the fluid controlled resistance creating means.

22. In combination a power press including a power shaft, a pair of co-acting dies, a

die cushioning apparatus embodying cylinder and piston members, one of said members operating upon a work holder, a container communicating with said cylinder and providing for a liquid column movable under the
 70 action of one of said members, a valve in said communication, means for confining a portion only of the liquid of said column independent of the column, under a predetermined pressure to operate upon said valve, a
 75 piston in the container, and means for positively moving the piston in the container against the column of liquid to restore the said work holder, while the fluid pressure upon the said valve remains constant.

23. In combination a power press including a power shaft, a pair of co-acting dies, a
 80 die cushioning apparatus embodying cylinder and piston members, one of said members operating upon a work holder, a container communicating with said cylinder and providing for a liquid column movable under the
 85 action of one of said members, a valve in said communication, means for confining a portion only of the liquid of said column independent of the column, under a predetermined pressure to operate upon said valve, the last said means embodying means whereby the first recited action of the said member
 90 of liquid will separate a portion of the liquid from the column and create a predetermined resistance pressure upon such separated portion, a piston in the container, and means for positively moving the piston in the container
 95 against the column of liquid to restore the said work holder, while the fluid pressure upon the said valve remains active.

24. In combination a power press including a power shaft, a pair of co-acting dies, a
 100 die cushioning apparatus embodying cylinder and piston members, one of said members operating upon a work holder, a container communicating with said cylinder and providing for a liquid column movable under the
 105 action of one of said members, a valve in said communication, means for confining a portion only of the liquid of said column independent of the column, under a predetermined pressure to operate upon said valve, a
 110 piston in the container, means for positively moving the piston in the container against the column of liquid to restore the said work holder, while the fluid pressure upon the said valve remains active, and means whereby the
 115 operation of the plunger in said container upon the column of liquid to restore the work holder will be delayed until after the ram of the press has returned partly to its normal position.

25. A die cushion operating mechanism embodying a cushion piston cylinder, a liquid container having communication with said cylinder through a conduit, a valve closing said conduit against movement in one di-
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reaction of liquid passing therethrough, a by pass for return of liquid in the last said direction, a valve normally closing said by pass, and means for trapping and confining a portion only of the said liquid to establish and maintain a predetermined and independent liquid pressure upon the said by pass valve for yieldingly holding the latter closed.

26. A die cushion operating mechanism embodying a cushion piston cylinder, a liquid container having communication with said cylinder through a conduit, a valve closing said conduit against movement in one direction of liquid passing therethrough, a by pass for return of liquid in the last said direction, a valve normally closing said by pass, means for trapping and confining a portion only of the said liquid to establish and maintain a predetermined and independent liquid pressure upon the said by pass valve for yieldingly holding the latter closed, and means for controlling at will the liquid pressure upon the said by pass valve.

27. In combination a power press including a power shaft, a die cushion operating mechanism including a cushion piston cylinder, a liquid container having communication with said cylinder through a conduit, a valve closing said conduit against movement in one direction of liquid passing therethrough, a by pass for return of liquid in the last said direction, a valve normally closing said by pass, means for causing a portion only of the liquid to establish and maintain a predetermined liquid pressure upon said by pass valve for yieldingly holding the latter closed, a piston in the container, and means for delaying the action of the last said piston upon the liquid column until the press ram has returned partially to its normal position.

28. In combination a power press including a power shaft, a die cushion operating

mechanism including a cushion piston cylinder, a liquid container having communication with said cylinder through a conduit, a valve closing said conduit against movement in one direction of liquid passing therethrough, a by pass for return of liquid in the last said direction, a valve normally closing said by pass, means for causing a portion only of the liquid to establish and maintain a predetermined liquid pressure upon said by pass valve for yieldingly holding the latter closed, a piston in the container, means for delaying the action of the last said piston upon the liquid column until the press ram has returned partially to the normal position, a by pass leading from the said communication to the container and around the said by pass, and means for controlling at will the last said by pass.

29. In combination a power press including a power shaft, a die cushion operating mechanism including a cushion piston cylinder, a liquid container having communication with said cylinder through a conduit, a valve closing said conduit against movement in one direction of liquid passing therethrough, a by pass for return of liquid in the last said direction, a valve normally closing said by pass, means for causing a portion only of the liquid to establish and maintain a predetermined liquid pressure upon said by pass valve for yieldingly holding the latter closed, a piston in the container, means for delaying the action of the last said piston upon the liquid column until the press ram has returned partially to its normal position, and means for varying at will the said predetermined liquid pressure upon the said by pass valve.

In testimony whereof I have affixed my signature.

OLOF G. NILSON.