

Nov. 13, 1956

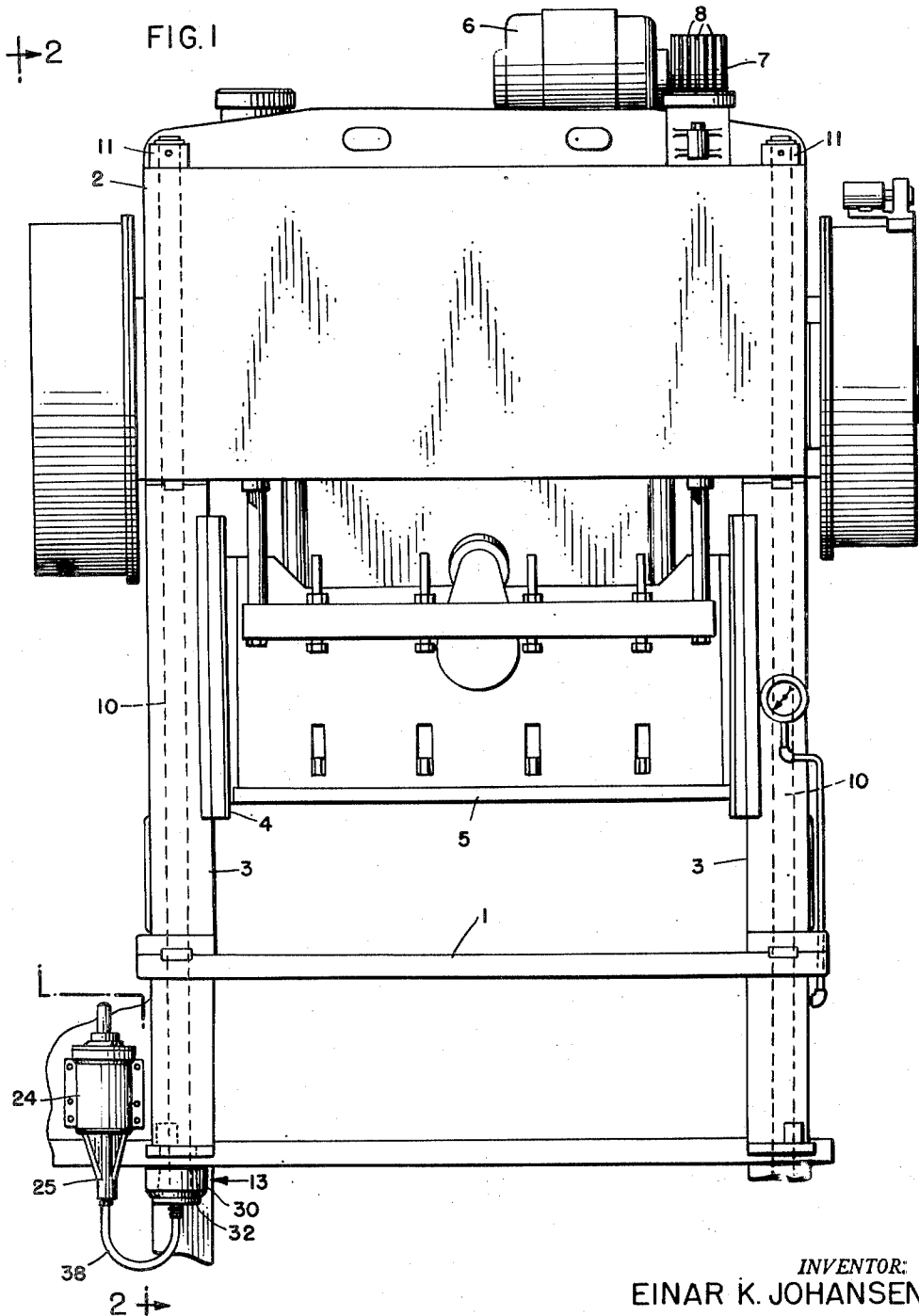
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OVERLOAD RELEASE ASSEMBLY FOR POWER PRESSES

Filed Feb. 1, 1954

4 Sheets-Sheet 1



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FIG. 2

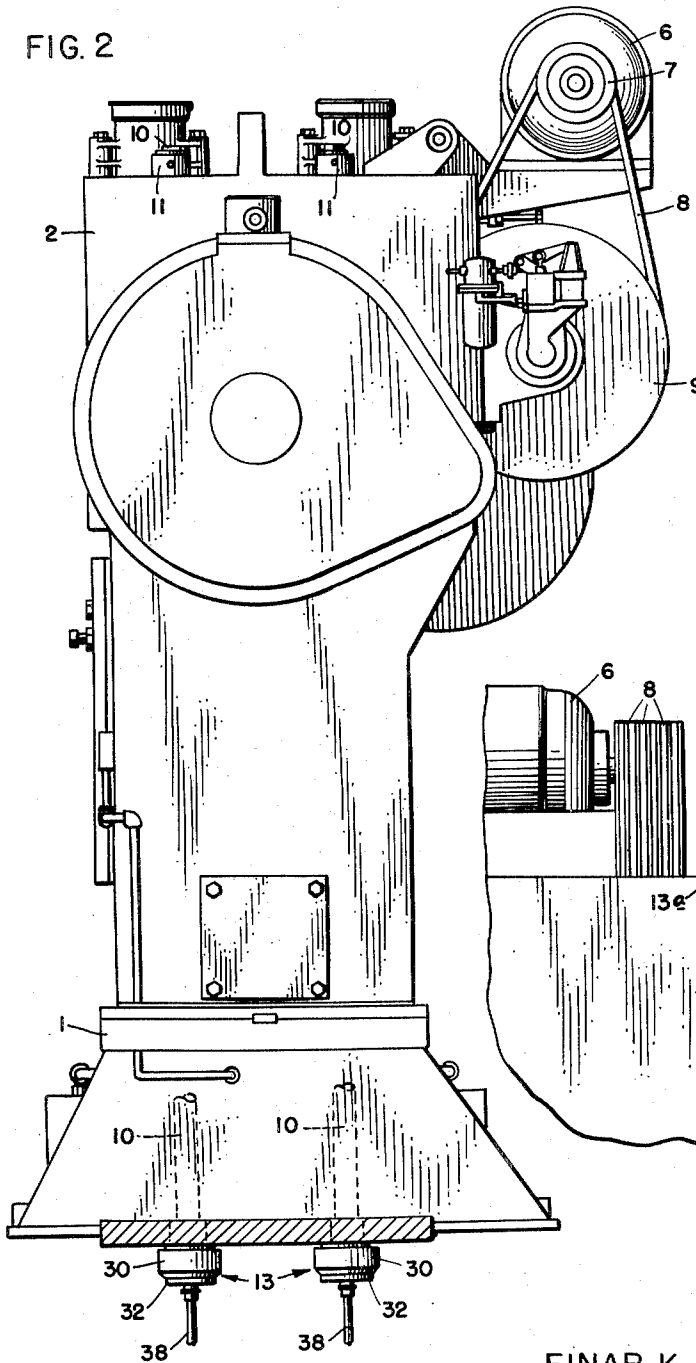
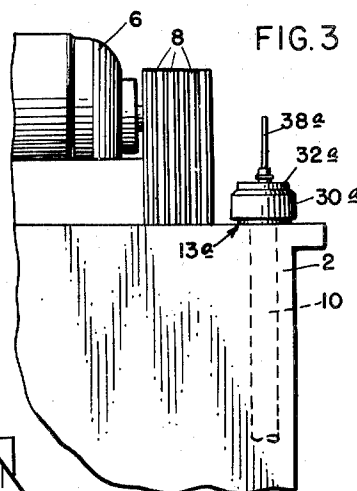


FIG. 3



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FIG. 4

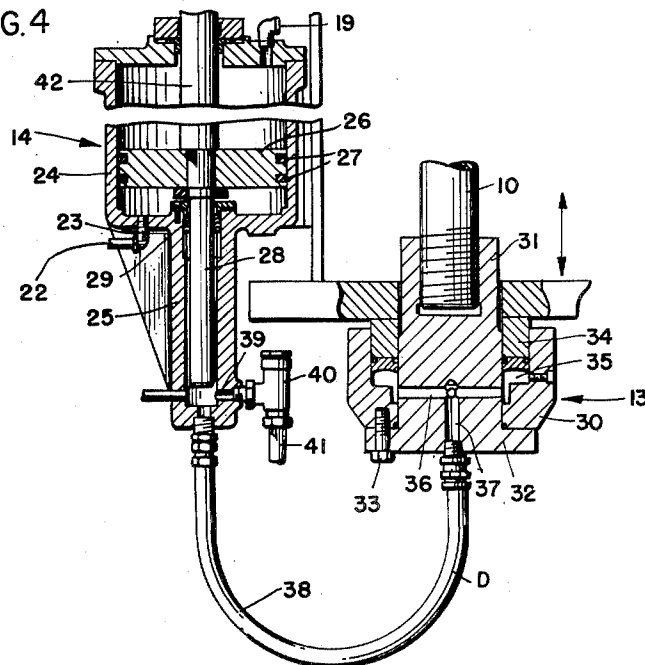
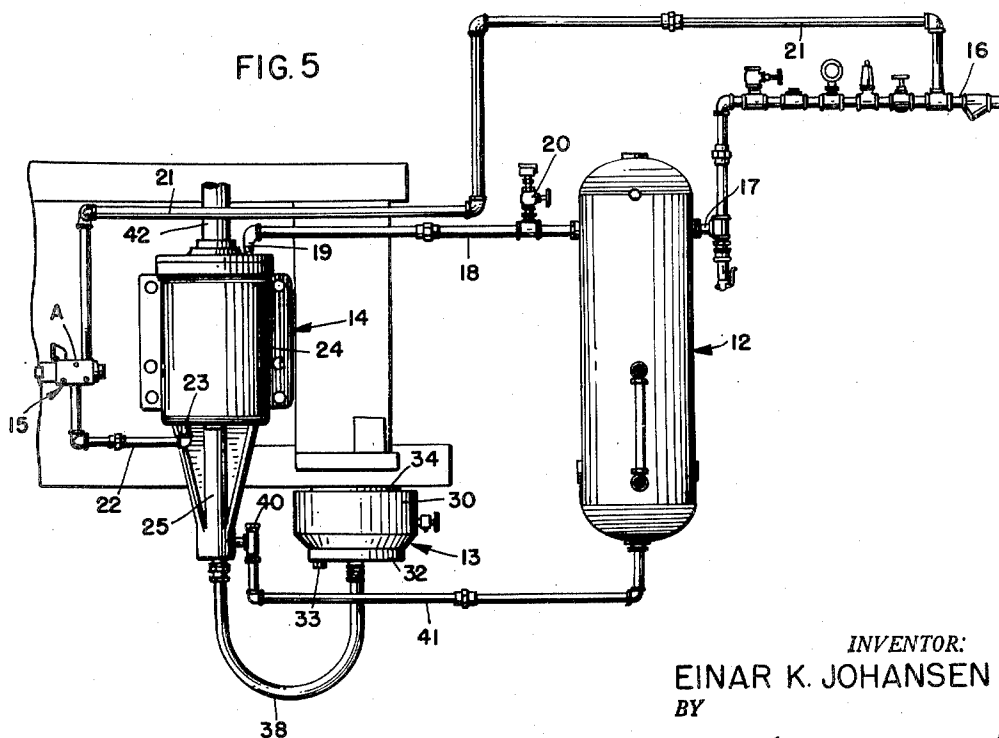


FIG. 5



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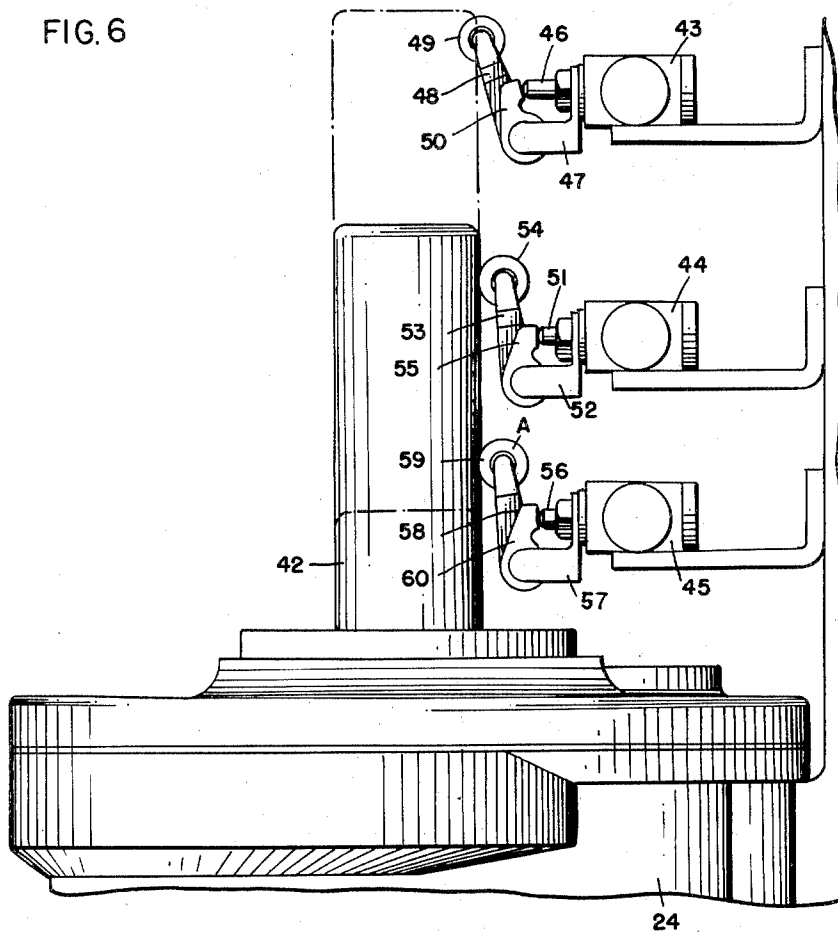
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OVERLOAD RELEASE ASSEMBLY FOR POWER PRESSES

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4 Sheets-Sheet 4

FIG. 6



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OVERLOAD RELEASE ASSEMBLY FOR POWER PRESSES

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10 Claims. (Cl. 192—150)

This invention relates in general to metal working and forming presses of the mechanical type and is directed particularly to a novel form of pressure control or overload device to prevent stalling or breaking of the machine when the press load reaches or exceeds a predetermined amount.

More specifically, the invention relates to a pressure control for metal working and forming presses which is hydraulically actuated to stop operation of the press when an overload occurs.

The invention is applicable primarily to the type of mechanical working press commonly known as a four-piece tie rod frame consisting generally of a crown, a bed, and a pair of uprights held together by plurality of tie rods. The tie rods extend between the crown and the bed at each corner of the frame. Customary procedure has been to preload the press frame by shrinking the tie rods to place them under stress.

During the preliminary steps of die setting it is not unusual for the die setter to set the die in the movable slide too low. When this occurs it will be apparent that when the die members come together the crank or eccentric which operates the slide will be unable to complete its full downward stroke or travel, possibly resulting in breakage of the press or in some cases the clutch might slip causing the press to stall at the bottom of its stroke. When press breakage occurs, not only costly repairs are incurred but also a one or two month delay in production may result during the necessary time for repair. When the press stalls it becomes necessary to unshrink the tie rods to relieve the stalled condition.

The present invention is directed to a novel form of overload device or pressure control which is hydraulically operated and which is designed to prevent the breakage or stalling of the press and which also acts to stop the press if the operator lowers the die beyond a predetermined point, thereby causing an overload of the press.

It is, therefore, one of the principal objects of the present invention to provide a novel form of hydraulic pressure control for metal working presses which will act automatically to prevent stalling and breakage of the press when the press load exceeds or reaches a predetermined amount.

Another object of the invention is to provide a hydraulic pressure control for a metal working press wherein hydraulic fluid is used to preload the press by forcing it under pressure against an end of each tie rod of the press and wherein the hydraulic fluid is used also to operate an overload device when the press load reaches a predetermined amount to prevent stalling or breaking of the press.

A further object of the invention is to provide a hydraulic pressure control for metal working presses wherein hydraulic fluid under air pressure maintains a preload condition of the press so that an overload of the press will act upon the hydraulic fluid to operate switch means for stopping operation of the press.

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A still further object of the invention is to provide a hydraulic pressure control for metal working presses wherein a preload condition of the press is maintained by hydraulic pressure against the press tie rods and an overload device which includes a cylinder and piston arrangement connected with the hydraulic fluid has a piston rod associated therewith which is moved by the fluid upon an overload to operate switch means and stop operation of the press.

Still another and more specific object of the invention is to provide a hydraulic pressure control for metal working presses wherein an overload device operable by hydraulic fluid under pressure has means associated therewith for automatically recharging the device's hydraulic fluid upon the loss of a predetermined amount of fluid which may be caused by bleeding or loss during operation of the machine.

Other objects and advantages of the invention will become apparent by reading the following description taken in connection with the accompanying drawings, in which

Fig. 1 is a front elevational view of a metal working press illustrating one form of the invention as applied thereto;

Fig. 2 is a side elevational view of the press shown in Fig. 1;

Fig. 3 is a fragmentary elevational view showing a portion of the upper part of the press illustrating the invention as it may be applied to the upper, rather than to the lower, ends of the tie rods;

Fig. 4 is an enlarged vertical sectional view through the hydraulic pressure control embodying the present invention;

Fig. 5 is a schematic illustration of the hydraulic and pneumatic piping arrangement for operating the device of Fig. 4, and

Fig. 6 is an enlarged fragmentary elevational view illustrating the various switches actuated at different times under varying conditions of the control device embodying the present invention.

The metal working press illustrated in the drawings is a mechanical type which is operated by means of cranks or eccentrics to reciprocate the slide or slides therein. The general construction and arrangement in the press is well known to those skilled in the art and includes in general a bed 1 and a crown 2 at the upper part thereof together with uprights 3 at each side of the press which separate the crown 2 from the bed 1. These parts constitute the press frame and each of the uprights 3 is provided with a guideway 4 for the purpose of guiding the slide 5 in its reciprocating movement. The slide 5 is caused to reciprocate in its movement toward and away from the bed 1 by suitable and well known mechanism as mentioned above.

This slide actuating mechanism is operated by means of a motor 6 which drives a gear train by means of a pulley 7 on the motor shaft, one or more belts 8 and a driven wheel 9. The particular type of mechanism operating the slide may be any one of a number of different specific forms all well known in the art and it need not be specifically described herein inasmuch as it forms no part of the present invention. It is sufficient for present purposes to point out that the mechanism reciprocates the slide 5 toward and away from the bed 1. The bed and slide may each have a die mounted thereon so that when the two dies come together a sheet of metal may be stamped into a predetermined form.

A plurality of tie rods 10 may be suitably located in the frame of the press and in this instance a tie rod 10 is located at each corner of the press frame. It is necessary that the tie rods 10 be acted upon to draw the crown 2 and bed 1 toward each other against the

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uprights so that each tie rod is placed under stress. Heretofore it has been common practice to shrink the tie rods in order to draw the crown and bed toward each other. It will be noted in Figs. 1 and 2 that each tie rod is provided with a nut 11 at the top thereof which bears downwardly at the upper side of the crown. The usual practice heretofore has been to provide a similar nut at the opposite end of each tie rod adapted to bear upwardly against the underside of the bed. Thus, when the tie rods were shrunk and placed under stress the nuts at each end of the tie rods would bear against the upper and lower sides of the crown and bed respectively.

After the press is thus preloaded by placing the tie rods under a predetermined stress load, the next step in readying the press for use is to have the operator set the dies. The slide 5 which carries the upper die is adjustable in any customary and well known manner so that the correct amount of pressure will be exerted by the upper die against the lower die at the moment the upper die reaches the lowermost extent of its movement. During the die setting preliminaries it is not unusual for the machine operator to become careless and set the upper die too low. When this occurs in presses having the customary construction, the die members will come together before the crank or eccentric which drives the upper die reaches its extreme lowermost position. An overload of the press then results and the press will either break or stall due to slippage of the clutch.

Another occurrence which is not uncommon during the operation of the press is for an operator to feed more than one blank to the press at one time. Thus, if the dies are set to exert a predetermined pressure on one sheet of metal when it is being drawn, then the pressure exerted or reached when two thicknesses of metal are in place on the bed will be greatly increased and will become excessive. Again, when this occurs in the former well known type of construction, the press might break or stall.

As stated hereinabove, the overload device of the present invention is a hydraulic pressure control and is adapted to be associated with each of the tie rods of the press so that such an overload condition will be prevented and the press will neither break nor stall. When an excessive overload occurs, the press will be stopped automatically.

The details of construction of the preferred form of the invention are illustrated in Figs. 4, 5 and 6. Briefly described, the invention involves the use of an oil or hydraulic fluid tank 12 wherein hydraulic fluid under pressure is maintained. A piston and cylinder arrangement 13 is associated with each of the tie rods 10 and an intensifier or overload device 14 is associated therewith. A three-way valve 15 is positioned in an air line for a purpose which will be explained more fully hereinafter.

Air under pressure is utilized in the tank 12 to pressurize the hydraulic fluid therein and is also used in the overload device 14 to exert a pressure therein in a direction opposite to the force exerted by the hydraulic fluid under pressure.

Fig. 5 is a schematic illustration of the piping which of course may be varied to suit particular conditions. For purposes of illustration, however, it will be seen that there is an air supply line 16 which has suitable valves, pressure gauges and pressure regulators associated therewith. The air under pressure is piped as at 17 into the upper part of the tank 12 thereby to place the hydraulic fluid therein under a predetermined pressure. A pipe 18 leads from the tank 12 and is connected as at 19 to the upper part of the overload device 14. A suitable valve 20 in pipe 18 may be provided to regulate the amount of air under pressure reaching the overload device.

Another pipe 21 carries air under pressure from the supply line 16 to the three-way valve 15. A pipe 22

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leads from the valve 15 and into the bottom of the cylinder of the overload device 14 as at 23.

The preferred details of construction of the overload device 14 are illustrated in Fig. 4 to which reference will now be made. This device includes an air cylinder 24 and a hydraulic cylinder 25 which is of less diameter and which extends downwardly from the bottom thereof. An air piston 26 is positioned for reciprocating movement within the cylinder 24. Suitable packing 27 is applied to the piston 26 to prevent the escape of air from one side thereof to the other.

A hydraulic piston or ram 28 is fixed at its upper end to the air piston 26 and extends downwardly through the hydraulic cylinder 25. Again, suitable packing 29 is arranged around the hydraulic piston 26 at the bottom of the air cylinder 24 to prevent leakage of hydraulic fluid into the air cylinder.

The details of the piston and cylinder arrangement 13 are also illustrated in Fig. 4 and in this construction is fixed to the lower end of each tie rod 10 in place of the customary nut. The cylinder is made up of two parts consisting of an outer cylindrical member 30 and an inner supporting member 31 which is threadedly secured to the end of tie rod 10 and supports the outer cylindrical member 30 by means of the flange 32. The members 30 and 31 are secured together to act as a unit by suitable fastening means such as the bolts 33 which pass through the flange 32.

The piston 34 surrounds the cylindrical member 31 and is disposed within the cylindrical member 30 to occupy the annular space 35 provided between the members 30 and 31. A transverse passageway 36 extends between opposite sides of the annular space 35 and communicates with an axially extending passageway 37 through the outer end of the inner member 31. The passageway 37 communicates with a flexible hose 38 which is connected at its opposite end to the lower end of the hydraulic cylinder 25. A passageway 39 extends from within the hydraulic cylinder 25 to a check valve 40 where a conduit 41 extends from the valve to the tank 12.

The hydraulic fluid under pressure from tank 12 will be forced through the check valve 40 and into the hydraulic cylinder 25 as well as through the flexible hose 38 so that it will normally fill the annular chamber 35 and passageways 36 and 37. To initially set the control mechanism for normal operation of the press, air will be exhausted through the upper part of air cylinder 24 through pipe 18 by proper manipulation of valve 15. Simultaneously, air will be admitted into air cylinder 24 below the piston 26 through pipe 22 thereby to raise the piston and allow the hydraulic fluid to flow under pressure through the check valve 40 to completely fill the hydraulic cylinder 25, flexible hose 38, passageways 37 and 36, and the annular chamber 35. When the piston 26 reaches its proper position, valve 15 will be operated to cause air under pressure from pipe 18 to be admitted into air cylinder 24 above piston 26. The pressure of the air above piston 26 will be regulated so that it is substantially equalized with the pressure of the hydraulic fluid in hydraulic cylinder 25 and below piston or ram 28 thus maintaining the pneumatic and hydraulic pressures in substantial equilibrium.

Pressures are thus applied to preload the press so that during the normal operation thereof when the slide is reciprocating and performing its metal drawing operation, the required pressure of the slide against the bed may be reached during each cycle of operation so that the press will continue to function in the proper manner as long as the load does not become excessive. When, however, a load is applied in excess of the pressure for which the press was designed, whether this pressure occurs during the die setting operation or during normal operation of the press, there will be an upward pressure exerted against the crown and a downward pressure exerted

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against the bed. The composite cylinder arrangement consisting of members 30 and 31 are in effect connected to the crown through the tie rod 10. Also, the piston 34 may be said to be connected to the bed 1. The downward pressure on the bed and the upward pressure against the crown will cause a relative movement between cylinder 30 and piston 34, the end result of which will be to move the piston 34 downwardly and force the hydraulic fluid in chambers 35, passageways 36 and 37, and flexible hose 38 against the hydraulic piston or ram 28. This resulting hydraulic pressure then being greater than the air pressure above the air piston 26 will cause the piston 26 to move upwardly against such air pressure. Thus, a yielding action occurs which, if the pressure is not an excessive overload, will permit the crank or eccentric drive mechanism for the slide to complete its stroke without stalling.

If the pressure exerted by the slide creates an excessive overload, then the upward movement of the air piston 26 against the air pressure will actuate a switch which will disengage the clutch and stop operation of the press. In this connection reference will now be made to Fig. 6 of the drawings.

A rod or switch actuating member 42 is secured at one end thereof to the air piston 26 and extends upwardly through the top of the air cylinder 24. This rod 42 will reciprocate with the air piston 26 between the upper and lower limits of movement thereof and during this travel thereof will actuate certain switches in its path of movement under certain circumstances for purposes which will be pointed out hereinafter. In the preferred embodiment of the invention there are three limit switches mounted adjacent the rod 42 on a suitable part of the machine frame. These switches may be identified as the top limit switch 43, the intermediate limit switch 44, and the bottom limit switch 45.

The top limit switch 43 includes a plunger arm 46 which, when moved inwardly, will actuate the switch to disengage the clutch and stop operation of the press. A bracket 47 on the switch pivotally supports an arm 48 having a roller 49 at its outer end and an actuating arm 50 connected therewith. As may be seen in Fig. 6, when the rod 42 has been moved upwardly to the uppermost position thereof shown by the dot-dash lines, it will have contacted the roller 49 thereby moving the arms 48 and 50 in a clockwise direction, whereupon the actuating arm 50 will operate the plunger arm 46 to stop operation of the press. It will thus be seen that when an excessive overload of the press occurs by reason of excessive pressure of the slide against the bed, the movement of piston 34 will act on the hydraulic fluid to elevate the air piston 26 and rod 42 to a point where the rod will contact the operating parts of switch 43 to stop operation of the press. When the overload condition is relieved and there is no longer any pressure on the bed, then the pressure of the hydraulic fluid against the hydraulic piston 28 will be removed and the air pressure above the air piston 26 will return the piston and the rod 42 back to their positions for normal operation of the press.

In such a hydraulic system as this, bleeding and loss of oil in operation will occur. Whatever the reason may be, it will be apparent that when there is a loss of hydraulic fluid, the air pressure above piston 26 will gradually force the piston downwardly and a point will eventually be reached where an excessive overload would not move the piston 26 and rod 42 upwardly a sufficient distance to actuate switch 43 to stop operation of the press. When this point is reached, it is necessary to recharge the hydraulic cylinder and this recharging operation is performed herein as a part of the invention by operation of the switches 44 and 45.

These two switches are preferably similar in construction to switch 43 above described, wherein switch 44 is operated by the plunger arm 51 and which has associated therewith a bracket 52 pivotally supporting an arm

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53 on the outer end of which is a roller 54. The actuating arm 55 moves with arm 53 either to force the plunger arm 51 inwardly or to permit it to be moved outwardly.

Switch 45 likewise has a plunger arm 56 and a bracket 57 on which the arm 58 is pivotally mounted for rotation by contact of the rod 42 with roller 59 on the outer end thereof. The actuating arm 60 rotates with the arm 58 to close or open the switch.

Both switches 44 and 45 are normally open in their positions shown in Fig. 6. These switches remain open at all times during the normal operation of the press as well as during the period of overload when switch 43 is operated to disengage the clutch.

As bleeding or leakage of the hydraulic fluid occurs, the air pressure above piston 26 will cause it to move downwardly and carry with it the rod 42. When rod 42 has been moved downwardly to a point below the roller 54, the switch 44 will close. This will set the electric circuit for recharging but the recharging operation will not take place until rod 42 reaches a position below the roller 59 of switch 45, as illustrated by the dot-dash line in Fig. 6.

As soon as switch 45 is closed by outward movement of the plunger arm 56, an electric circuit will be closed whereupon the three-way valve 15 will be actuated to exhaust the air from above piston 26 and admit air below piston 26 through pipe 22. This action will then force the piston 26 upwardly while the air pressure in tank 12 will force the hydraulic fluid back into the hydraulic cylinder 25 and recharge it.

When rod 42 has been moved upwardly to its normal position shown in Fig. 6 where switch 44 is open, the recharging cycle will be completed and the press is again ready for its normal operation. During the recharging operation the hydraulic fluid is forced under pressure through the check valve 40 which closes as soon as the recharging operation is completed.

In the foregoing description wherein reference has been made specifically to Figs. 1, 2, 4, 5, and 6, the overload device 14 has been described as being mounted at a suitable location adjacent the bottom of the press and the cylinder and piston arrangement 13 was described as being fixed to the lower end of each of the tie rods 10. Fig. 3 illustrates a modified form of the invention wherein the cylinder and piston arrangement may be fixed to the upper end of each tie rod 10.

Referring to Fig. 3, the outer portion 30a of the cylinder is shown as being above the crown 2 in place of the nut 11 at the upper end of the tie rod 10. The inner part of this cylinder will threadedly engage the upper end of the tie rod 10 in a manner similar to that shown in Fig. 4 and the upper end 32a thereof will be flanged outwardly and secured to the cylinder 30a.

The overload device shown at 14 in Figs. 4 and 5 will then be applied to the upper part of the press frame and will be connected to the cylinder and piston 13a by means of a flexible hose 38a. The operation of the device when at the top of the press will be identical with that which occurs when the device is at the bottom of the press.

In operation the overload device 14 will be initially charged as explained above by admitting air to the air cylinder 24 below the air piston 26, whereupon the hydraulic fluid under pressure from tank 12 will pass through pipe 41 and check valve 40 into the hydraulic cylinder 25. This fluid will also pass through the flexible hose 38 and into the hydraulic chamber 35 and passageways 36 and 37. Air under pressure will then be admitted to air cylinder 24 above the air piston 26 whereupon pressure will be maintained in substantial equilibrium during normal operation of the press.

The slide 5 is designed to exert a predetermined pressure against the bed 1 for a drawing operation. During the operation of setting the dies as well as during operation of the press an excessive pressure exerted by the

slide will cause a movement of the piston 34 within the annular chamber provided by the cylinders 30 and 31, thereby transmitting this pressure by means of the hydraulic fluid in flexible hose 38 to the hydraulic piston 28 in cylinder 25. Such pressure being greater than the air pressure above piston 26 will urge piston 26 and rod 42 upwardly. When the pressure is sufficiently in excess to result in an overload condition, the piston 26 and rod 42 will be moved upwardly a sufficient distance to move arm 48 and actuating arm 50 of switch 43 to actuate the switch and stop operation of the press. When the overload condition has been relieved, the pressure on the hydraulic fluid in flexible hose 38 will also be relieved, whereupon the air pressure above piston 26 will move the piston and the rod 42 connected therewith downwardly to the normal position thereof thereby causing switch 43 to be actuated to again engage the clutch of the press.

The recharging of the overload device has been explained above and it will be necessary at this point merely to mention that the loss of hydraulic fluid due to leakage or bleeding will allow the air pressure above piston 26 to move the piston and rod 42 downwardly. When the rod reaches a position low enough where both switches 44 and 45 will have been closed, then the electrical circuit in which these switches are located will energize a solenoid to operate the three-way valve 15 to exhaust the air from above the piston 26 and admit air therebelow, thus elevating the piston and allowing the hydraulic fluid under pressure in tank 12 to again enter the hydraulic cylinder 25 through check valve 40.

From the foregoing it will be apparent that a novel form of overload device for use with mechanical metal working presses has been devised wherein hydraulic fluid under pressure is used for responding to the excessive pressure of the press slide to relieve the pressure and stop operation of the press when the overload pressure is reached. The device is simple in its operation and can be applied readily to any press of the general nature which includes a slide movable toward and away from the press bed.

The nature of hydraulic fluid being such that bleeding or leakage may take place, it is necessary to provide some means for maintaining sufficient fluid in the device so that it will be certain to operate whenever necessary. This situation has been solved in the present instance by automatically recharging the device with hydraulic fluid whenever the air piston reaches a predetermined low point.

Changes may be made in the form, construction and arrangement of parts from those disclosed herein without in any way departing from the spirit of the invention or sacrificing any of the attendant advantages thereof, provided, however, that such changes fall within the scope of the claims appended hereto.

The invention is hereby claimed as follows:

1. In a mechanical metal working press having a frame including a crown, a bed, uprights, tie rods connecting the crown with the bed, and a reciprocating slide, a hydraulic pressure control mechanism comprising, an overload device including a reciprocable member, hydraulic fluid pressure means normally urging said member in one direction, pneumatic pressure means normally urging said member in the opposite direction, said pressures being substantially equal during normal operation of the press, means operatively associated with the tie rods and connected with said hydraulic fluid pressure means to increase the hydraulic pressure when excessive pressure is exerted by the slide, thereby to move said member against the pneumatic pressure and relieve the overload condition, and means responsive to a predetermined reduction in hydraulic pressure, to reduce said pneumatic pressure and return said hydraulic pressure to normal.

2. In a mechanical metal working press having a frame including a crown, a bed, uprights, tie rods connecting the crown with the bed, and a reciprocating slide, a hydraulic pressure control mechanism comprising, an

overload device including a reciprocable member, hydraulic fluid under pressure normally urging said member in one direction, yieldable pressure means normally urging said member in the opposite direction, said pressures being substantially equal during normal operation of the press, means operatively associated with the tie rods and in communication with said hydraulic fluid to increase the hydraulic pressure against said member when excessive pressure is exerted by the slide, thereby to move said member in said one direction against the force of said yieldable means and relieve the overload condition, and means responsive to a predetermined reduction in hydraulic pressure, to reduce the pressure exerted by said yieldable pressure means and return said hydraulic pressure to normal.

3. In a mechanical metal working press having a frame including a crown, a bed, uprights, tie rods connecting the crown with the bed, and a reciprocating slide, a hydraulic pressure control mechanism comprising, an overload device including a reciprocable member, hydraulic fluid under pressure normally urging said member in one direction, yieldable pressure means normally urging said member in the opposite direction, said pressures being substantially equal during normal operation of the press, switch means adapted to be actuated by movement of said member a predetermined distance in said one direction to stop operation of the press, means operatively associated with the tie rods and in communication with said hydraulic fluid to increase the hydraulic pressure against said member when excessive pressure is exerted by the slide, thereby to move said member in said one direction against the force of said yieldable means to actuate said switch means, and other switch means operable by movement of said member in the opposite direction in response to a predetermined reduction in hydraulic pressure, to reduce the pressure exerted by said yieldable pressure means and return said hydraulic pressure to normal.

4. In a mechanical metal working press having a frame including a crown, a bed, uprights, tie rods connecting the crown with the bed, and a reciprocating slide, a hydraulic pressure control mechanism comprising, an overload device including a reciprocable member, hydraulic fluid pressure means normally urging said member in one direction, pneumatic pressure means normally urging said member in the opposite direction, said pressures being substantially equal during normal operation of the press, switch means adapted to be actuated by movement of said member in said one direction a predetermined distance to stop operation of the press, means operatively associated with said hydraulic fluid pressure means to increase the hydraulic pressure against said member when excessive pressure is exerted by the slide, thereby to move said member against the pneumatic pressure in said one direction to actuate said switch means, and other switch means operable by movement of said member in the opposite direction in response to a predetermined reduction in hydraulic pressure, to reduce said pneumatic pressure and return said hydraulic pressure to normal.

5. In a mechanical metal working press having a frame including a crown, a bed, uprights, tie rods connecting the crown with the bed, and a reciprocating slide, a hydraulic pressure control mechanism comprising, an overload device including an air cylinder, a piston in said cylinder, hydraulic pressure means to apply pressure on one side of said piston, pneumatic pressure means to apply pressure on the other side of said piston, said pressures being normally in substantial equilibrium, actuating means associated with the press bed and connected with said hydraulic pressure means to operate said overload device when excessive pressure is exerted by the slide, means adapted to be actuated by operation of said overload device to stop operation of the press, and means operable in response to a predetermined reduction in

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hydraulic pressure, to reduce said pneumatic pressure and return said hydraulic pressure to normal.

6. In a mechanical metal working press having a frame including a crown, a bed, uprights, tie rods connecting the crown with the bed and a reciprocating slide, a hydraulic pressure control mechanism comprising, an overload device including an air cylinder, a piston in said cylinder, hydraulic pressure means to apply pressure on one side of said piston, pneumatic pressure means to apply pressure on the other side of said piston, said pressures being normally in substantial equilibrium, a second cylinder mounted on an end of a tie rod, a piston in said second cylinder fixed to a part of the press bed, a hydraulic fluid chamber in said second cylinder at one side of the piston therein, a conduit connecting the hydraulic fluid pressure means in said air cylinder with said hydraulic fluid chamber in said second cylinder, whereby excessive pressure exerted by the slide against the bed will move the piston in said air cylinder against the pneumatic pressure thereon to relieve the excessive pressure, and means operable in response to a predetermined reduction in hydraulic pressure, to relieve the pneumatic pressure and return said hydraulic pressure to normal.

7. In a mechanical metal working press having a frame including a crown, a bed, uprights, tie rods connecting the crown with the bed, and a reciprocating slide, a hydraulic pressure control mechanism comprising, an overload device including an air cylinder, a piston in said cylinder, a rod connected with said piston, hydraulic pressure means to apply pressure on one side of said piston, pneumatic pressure means to apply pressure on the other side of said piston, said pressures being normally in substantial equilibrium, a second cylinder mounted on an end of a tie rod, a piston in said second cylinder fixed to a part of the press bed, a hydraulic fluid chamber in said second cylinder at one side of the piston therein, a conduit connecting the hydraulic fluid pressure means in said air cylinder with said hydraulic fluid chamber in said second cylinder, whereby excessive pressure exerted by the slide against the bed will move the piston and rod in said air cylinder against the pneumatic pressure thereon, switch means adapted to be operated by said rod upon movement thereof a predetermined distance for stopping operation of the press, and other switch means adapted to be operated by said rod upon movement thereof in the opposite direction in response to a predetermined reduction in hydraulic pressure, to relieve the pneumatic pressure and return the hydraulic pressure to normal.

8. In a mechanical metal working press having a frame including a crown, a bed, uprights, tie rods connecting the crown with the bed, and a reciprocating slide, a hydraulic pressure control mechanism comprising, an overload device including a movable member having air pressure on

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one side thereof and hydraulic fluid pressure on the opposite side thereof, means operable upon the hydraulic fluid in response to excessive pressure exerted by the slide to move said member against the air pressure, thereby to relieve said excessive pressure, and means operable in response to a predetermined drop in hydraulic pressure to reduce said air pressure below said hydraulic pressure to charge said overload device with hydraulic fluid and return the pressure thereof to normal.

9. In a mechanical metal working press having a frame including a crown, a bed, uprights, tie rods connecting the crown with the bed, and a reciprocating slide, a hydraulic pressure control mechanism comprising, an overload device including a movable member having air pressure on one side thereof and hydraulic fluid pressure on the opposite side thereof, a source of fluid under pressure connected to said opposite side of said member, means operable upon the hydraulic fluid in response to excessive pressure exerted by the slide to move said member against the air pressure, thereby to relieve said excessive pressure, valve means adapted to be operated to exhaust said air pressure from said one side of said member and to admit air under pressure to said opposite side thereof, thereby to charge said overload device with hydraulic fluid under pressure from said source, and switch means operable by said member in response to a predetermined drop in hydraulic pressure to operate said valve means.

10. In a mechanical metal working press having a frame including a crown, a bed, uprights, tie rods connecting the crown with the bed, and a reciprocating slide, a hydraulic pressure control mechanism comprising, an overload device including a movable member having air pressure on one side thereof and hydraulic fluid pressure on the opposite side thereof, a source of fluid under pressure connected to said opposite side of said member, means operable upon the hydraulic fluid in response to excessive pressure exerted by the slide to move said member against the air pressure, switch means operable by the movement of said member to stop operation of the press, valve means adapted to be operated to exhaust said air pressure from said one side of said member and to admit air under pressure to said opposite side thereof, thereby to charge said overload device with hydraulic fluid under pressure from said source, and other switch means operable by said member in response to a predetermined drop in hydraulic pressure to operate said valve means.

References Cited in the file of this patent

UNITED STATES PATENTS

1,844,250	Hawkins	Feb. 9, 1932
2,522,450	Johansen	Sept. 12, 1950
2,616,543	Danly	Nov. 4, 1952