United States Patent

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[54] HYDRAULIC OVERLOAD BOLSTER
5 Claims, 5 Drawing Figs.

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[51] Int. Cl. B21j 9/02
[50] Field of Search 72/432, 453 100/53

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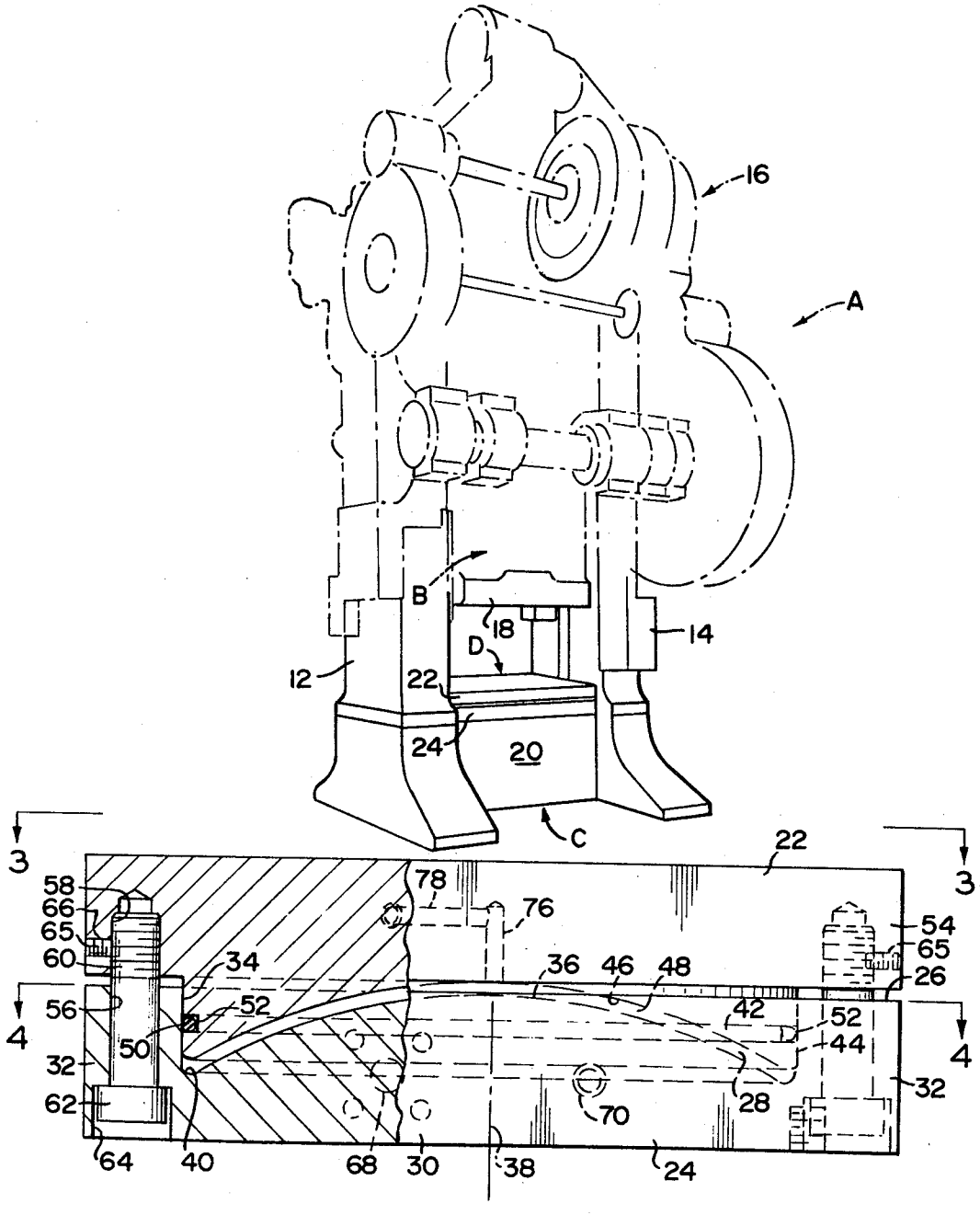
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ABSTRACT: An overload relief system is provided for a press bolster comprising a ram portion and a cylinder portion. The cylinder portion defines a cavity adapted to receive the ram portion, and the cylinder and ram portions together define a pressure chamber. The pressure chamber is sealed and pressurized, and the relief system functions to relieve the pressure in the chamber in the event of a press overload condition.



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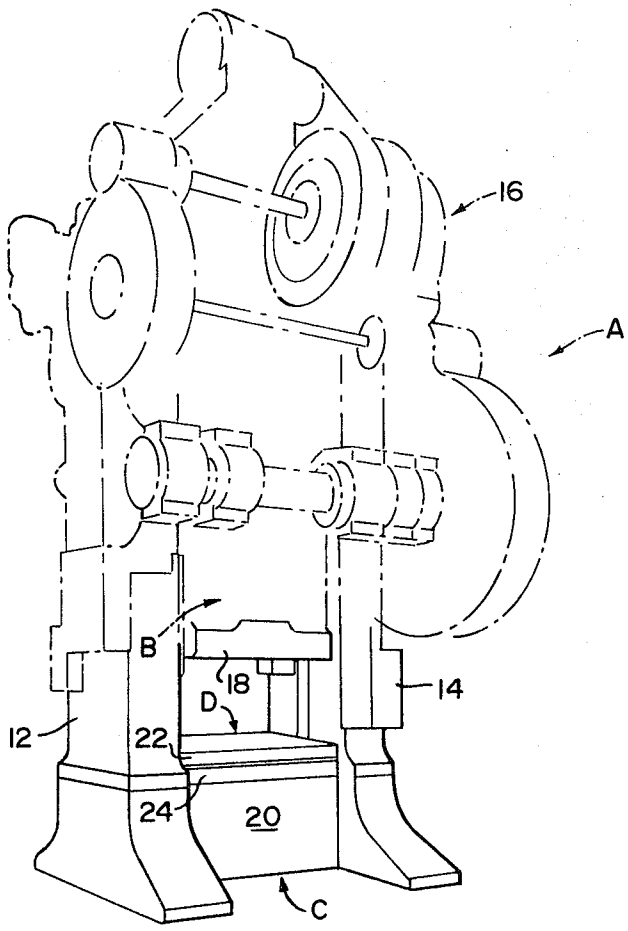


FIG. 1

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FIG. 2

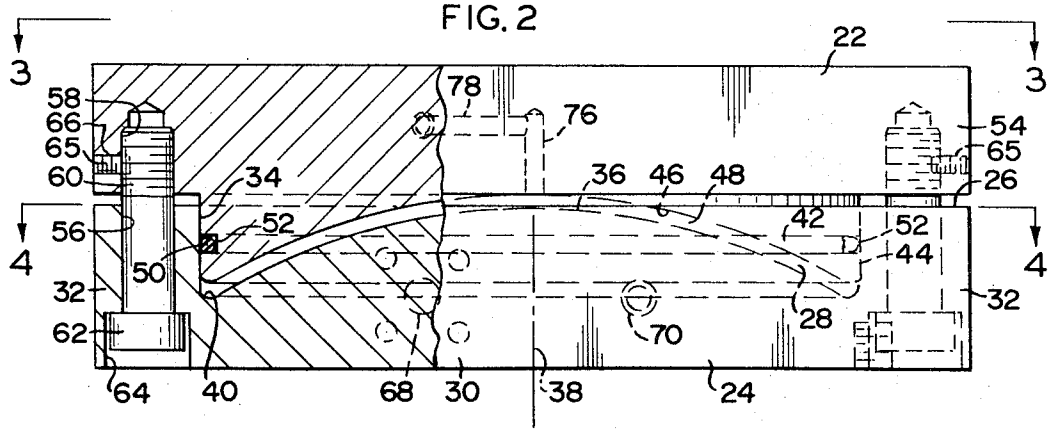


FIG. 3

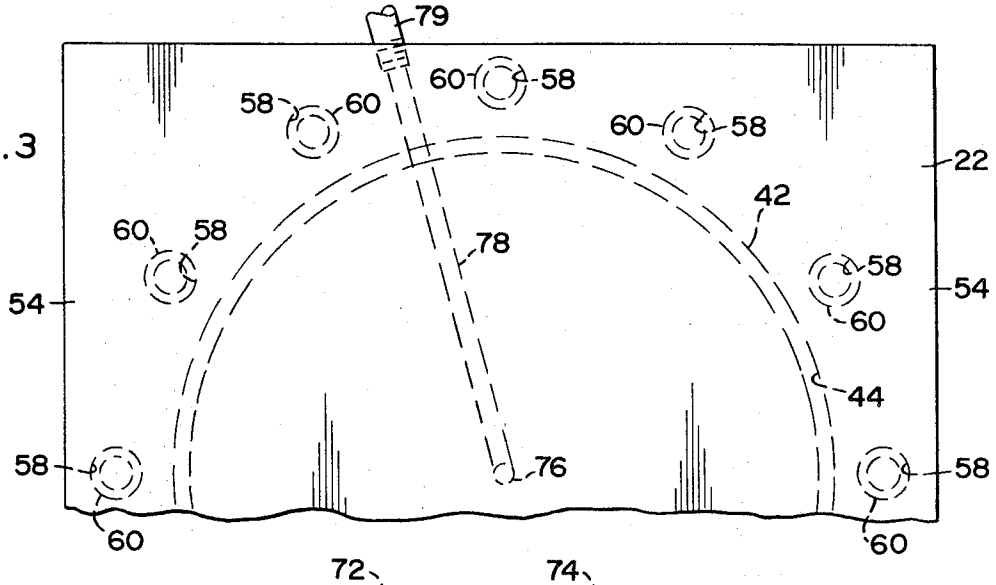
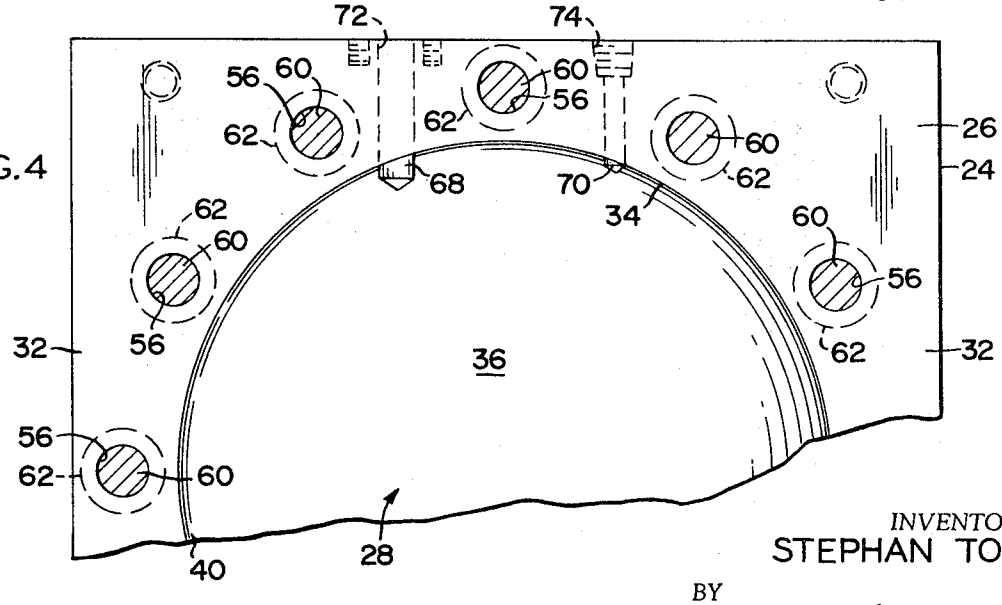


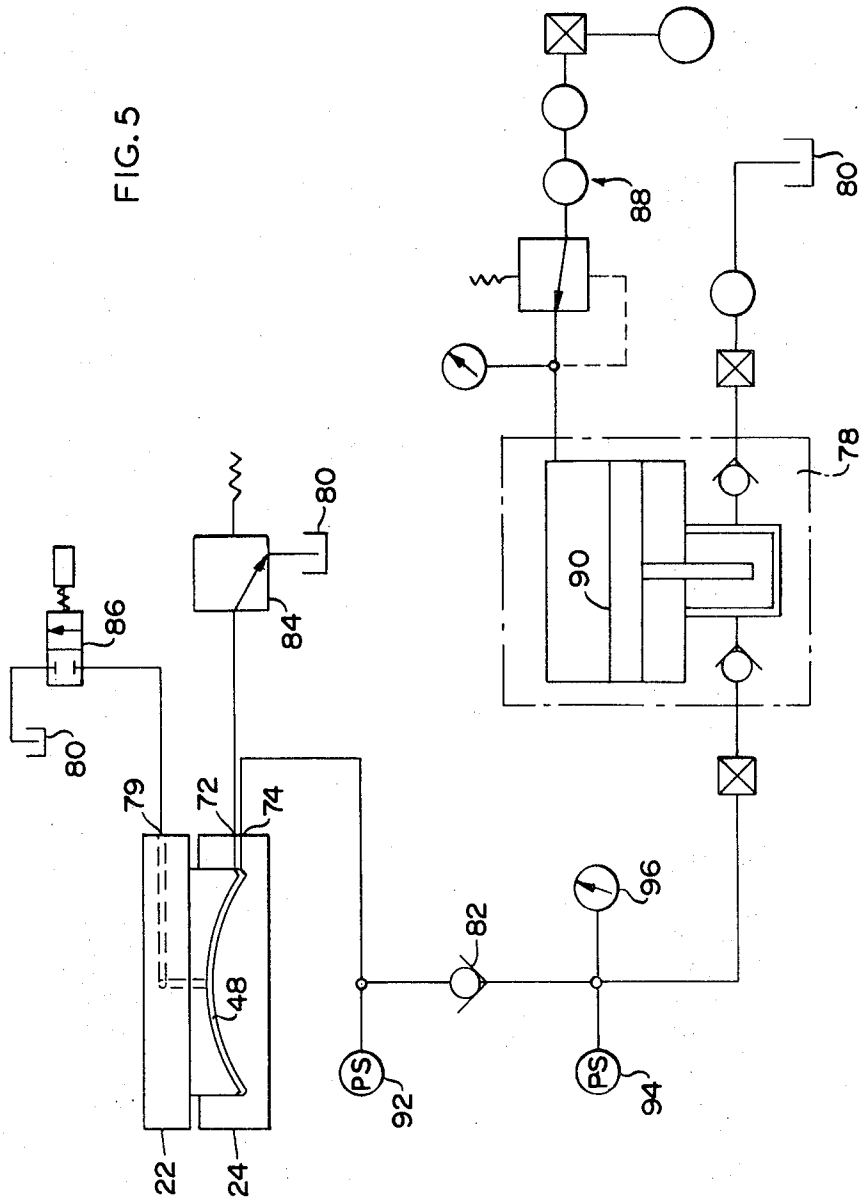
FIG. 4



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FIG. 5



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HYDRAULIC OVERLOAD BOLSTER

DESCRIPTION

The present invention relates to an overload relief system for presses, and in particular to a novel press bolster which has incorporated therein an overload relief device.

It is not an unusual occurrence for a press to be subjected to an overload condition. This condition may occur where a press is employed to form metal blanks of a thickness in excess of capacity, or may result where several blanks of metal are inserted into the press simultaneously. An overload condition may also occur if the press is not properly adjusted to the operation being performed; or for a number of other reasons; for instance, the presence of tools inadvertently left in the press.

In the absence of an overload relief system, costly damage can occur to the press, for instance stressing the press tie rods, or damage to the press dies, resulting in downtime for the press in addition to the expense of necessary repair of the press.

Because of the serious consequences of overloading a press, the prior art has provided various types of overload devices which are designed to relieve the overload condition and also shut down the press when the overload condition occurs. Typically, these prior art devices have been incorporated either into the slide assembly of the press, the press tie rods, or into the bed of the press. They usually are of a hydraulic nature, comprising an hydraulic cylinder and piston defining an overload chamber, means to pressurize the chamber, and means to vent the chamber in the event of an overload condition. The latter comprises a relief valve, and means to actuate the valve when compression forces on the hydraulic fluid exceed a certain level, said means simultaneously deactivating the press drive.

Although the prior art overload devices are satisfactory for use in the construction of new presses, it is apparent that to add such devices to an already existing press, which does not have provisions for relief in the event of an overload condition, is an expensive proposition. For instance, if it is desired to provide a hydropneumatic overload relief bed, this clearly requires substantial modification and rebuilding of the press bed to accommodate the components of the overload system, including substantial redesign and modification of the press controls.

In addition, when an overload device is installed as an integral part of a press, it becomes difficult to maintain, and if resealing or remachining of components of the overload device is required, the entire press is down until the repairs are completed, involving not only the costs of the repairs, but in addition the expense resulting from loss of use of the press during the down period.

It is an object of the present invention to overcome the above disadvantages, and in particular to provide an overload relief system which is not an integral part of the press, but which provides the same overload relief protection obtained with a conventional overload relief system.

In particular, it is an object of the present invention to provide a relatively inexpensive overload relief system which can easily be added to an already existing press which has no provision for overload relief.

In accordance with the present invention, there is provided a press bolster which comprises a ram portion; a cylinder portion; said cylinder portion defining a cavity adapted to receive said ram portion; said cylinder and ram portions defining a pressure chamber therebetween; means to seal said pressure chamber; means to pressurize the chamber; and means to relieve the pressure in the chamber in the event of an overload condition.

Preferably, the lower cylinder portion defines an upwardly facing cylindrical cavity, the ram portion comprising a cylindrical piston member vertically slidable within the cavity, the cylinder portion comprising a bottom wall which has a curved dome shaped upper surface defining the bottom of said cavity and a maximum thickness aligned with the centerline of the cavity; the piston member comprising a lower curved surface which is complementary with and parallel to the cylinder portion bottom wall upper surface; the overload chamber being between said curved surfaces.

It will become apparent that the present invention provides a means by which an overload system can be inexpensively added to presses which have no overload protection arrangement.

The invention and advantages thereof will become apparent upon consideration of the following specification, with reference to the accompanying drawings, in which

FIG. 1 is a perspective view of a press in accordance with the invention;

FIG. 2 is a partial section view of a press bolster in accordance with the invention;

FIG. 3 is a section view taken along line 3–3 of FIG. 2;

FIG. 4 is a section view taken along line 4–4 of FIG. 3; and

FIG. 5 is a schematic view of the hydraulic system in accordance with the invention.

Referring now to the drawings, wherein the showings are for the purpose of illustrating the preferred embodiment of the invention only and not for the purpose of limiting the same, the Figures show a press A which includes a slide B and a press bed C, a bolster in accordance with the invention being designated as item D seated on the press bed C.

Referring specifically to FIG. 1, the press A is a straight sided mechanical press of conventional design comprising left- and right-hand uprights 12 and 14 including a drive mechanism generally indicated as item 16, and a vertically reciprocating press ram head 18 on slide B. The bed C of the press is comprised of parallel, spaced apart upstanding front and rear walls 20, on which the bolster D is seated. The purpose of the bolster and ram head are to hold dies (not shown) between which a part is formed or drawn.

Although different presses will have widely different configurations, it is conventional for the press bed to be hollow and generally rectangular comprised of parallel front and rear walls, or parallel sidewalls, or both, which support the bolster, the bolster spanning the space between the walls. The bolster must be capable of absorbing the shock of the press ram without significant deflection, and for this reason, must be massive and thick, seated or resting on the bed sides or front walls.

In accordance with the present invention, the bolster D is an assembly in the form of an upper half or ram member 22 and a lower half or base member 24 (also referred to herein as ram and cylinder portions respectively), the particular design of the bolster being illustrated in more detail in FIG. 2. The bolster lower half or base member is in the form of a rectangular flat block which is bored or hollow from the top surface 26 downwardly so that it is cup-shaped defining a cavity 28, the latter having a base or bottom wall 30 and an annular encompassing sidewall 32 extending upwardly from the periphery of the bottom wall; the sidewall defining an inner cylindrical surface 34. The depth of the bore or cavity 28 is not uniform, the bottom wall being of variable thickness and having an upper surface 36 which is dome-shaped, so that the bottom wall is thickest in the centermost or axial portion 38 thereof and thinnest beneath the outermost circumference 40 of the cavity 28. In that the axis of the cavity 28 is aligned with the vertical centerline of the lower half, the center portion of the bolster lower half being unsupported, this configuration offers maximum strength for the lower half.

The upper ram member 22 is provided with a center piston 42 which is reciprocable or slidable up-and-down within cavity 28, having an annular cylindrical surface 44 guided by and engaged by the sidewall inner surface 34 of the base member or lower half 24. The piston member lower face 46 is concave and parallel to or conforming generally with the dome shape of the surface 36. In this way, the surface 36 and face 46 are opposed and complementary to each other, the piston and base member thereby together defining a curved pressure

chamber 48 of substantially uniform depth. This chamber is sealed by an O-ring seal 50 positioned in a slot 52 which is disposed in the annular surface 44 of the piston, facing the inner cylindrical surface 34 of the base member or lower half 24.

The ram member is T-shaped in cross section further comprising an outwardly extending peripheral shoulder portion 54 which lies above and is substantially coextensive with the annular wall 32 of the base member. To limit the upward travel of the ram member with respect to the base member, a plurality of vertical, spaced apart, circumferentially arranged holes 56 are drilled through the base member annular wall 32, aligned with a plurality of spaced apart circumferentially arranged threaded sockets 58 in the shoulder of the ram member. A plurality of bolts 60 extend through the holes 56 screwed into the sockets 58. The heads 62 of the bolts are seated in countersunk recesses 64 of the holes 56, the bolts being threaded into the sockets 58 and having a length sufficient to permit a limited amount of travel of the ram member relative to the base member. For this purpose the bolts slide within the holes 56 through which they extend, upward travel of the ram member being limited by the bolt heads 62, downward travel of the ram member occurring on release of pressure within the pressure chamber 48.

To secure the bolts 60 into the upper ram member, setscrews 65 are threaded into a plurality of radial openings 66 so as to engage the bolts.

In the sidewall 32 of the lower base member, two openings 68 and 70, FIG. 4, are tapped through the wall communicating with the pressure chamber 48 (FIG. 2) between the bolster halves. The openings are provided with connections 72 and 74, these connections being for the hydraulic system, which will be described in detail.

Also communicating with the hydraulic chamber 48 is an upwardly extending passageway 76 drilled upwardly along the axis of the upper ram member from the piston lower face 46, the passageway extending for only a short distance upwardly and then at right angles (portion 78) radially to the outside of the ram member. This passageway is provided with a connection 79 the purpose of which will also be described.

Turning now to FIG. 5, the hydraulic system in accordance with the invention will be described. Basically the system consists of a small hydraulic pump 78 leading from a reservoir 80, adapted to force oil under pressure through a check valve 82 leading to the connection 74 of the overload chamber. Also connected to the overload chamber, through the lower cylinder block and connection 72, is a solenoid-actuated relief valve 84 adapted to return oil to the reservoir 80 when open. The connection 79 in the upper ram member is connected with a bleedoff valve 86 which in turn leads to the oil reservoir 80. Pressurization of the overload chamber 48 is accomplished by actuation of the pump 78, using a variable pressure source of air from air system 88 acting on piston surface 90 of the pump 78. By virtue of a continued pumping rate and controlled bleed through valve 86, the pressure in the chamber 48 is maintained at a desired level.

Controlling relief valve 84 is a pressure switch 92 responsive to the pressure within chamber 48, so that if this pressure exceeds a predetermined value, for instance that value at which deflection in the bolster begins to occur, the switch is closed opening the relief valve.

In operation, after the power is turned on, and the oil pump 78 is started, the bolster chamber is preloaded to a set pressure, for instance, about 500 pounds per square inch. The pump is turned on and off by means of a pressure switch 94 which senses the pressure on the upstream side of the check valve 82, this pressure being recorded by pressure gauge 96.

On each downstroke of the press ram, the pressure in chamber 48 will exceed 500 pounds, which because of check valve 82, will not be sensed by switch 94. However, if the pressure in chamber 48 drops below 500 pounds, this will be sensed by switch 94 and the pump will be turned on. In the event the press is subjected to an excessive load resulting from a double blank accidentally placed in the die, or because of adjustment of the ram too far downwardly, or some other reason, the overload pressure switch 92 closes and sends a signal to the overload relief valve 84 which unbalances the relief valve relieving the pressure between the two halves of the bolster. At the same time, this overload pressure switch signal disengages the clutch and sets the press brake, in a conventional manner.

It is apparent that the design in accordance with the present invention is such that it may be adapted to any stamping, coining or forming press where overload protection is required, without the necessity of making alterations to existing equipment. It simply replaces existing bolsters and is fastened to the bed in the usual manner. The device can be adapted to large presses simply by providing additional ram-base member combinations and thereby distributing work load over the entire bolster.

Although the invention has been described with respect to a specific embodiment, it is understood that variations within the scope of the following claims will be apparent to those skilled in the art.

What I claim is:

1. A press bolster comprising

a ram portion;

a cylinder portion, said cylinder portion defining a cavity adapted to receive said ram portion;

said cylinder and ram portions defining a pressure chamber therebetween;

means for sealing said pressure chamber;

means for pressurizing the chambers; and

means to relieve the pressure in the chamber in the event of an overload condition;

said cylinder portion defining an upwardly facing cavity comprising a bottom wall and an annular sidewall, said bottom wall comprising a dome-shaped upper surface so that the maximum thickness of the bottom wall is aligned with the axis of said cavity; the ram including a piston having a downwardly shaped concave face generally parallel with the cylinder portion dome-shaped upper surface.

2. The bolster according to claim 1 wherein said pressurizing means comprises pump means, first connection means connecting said pump means to the pressure chamber, a check valve in said connection means, first pressure switch means on the side of said check valve remote from said pressure chamber adapted to set the preload pressure for said pressure chamber, second pressure switch means on the side of said check valve adjacent said pressure chamber adapted to actuate said means to relieve the pressure in the chamber, said last-mentioned means being connected directly with said chamber.

3. The bolster according to claim 2 wherein the connections leading to said pressure chamber penetrate one or more walls of the bolster.

4. The bolster according to claim 3 further including bleeder valve means connected to said pressure chamber through said ram portion.

5. The bolster according to claim 1 wherein said ram portion has a T-shaped cross section elevation view comprising an annular shoulder portion encompassing said piston and defining with the piston the bolster upper surface.