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HYDRAULIC DIE PADS FOR PRESSES

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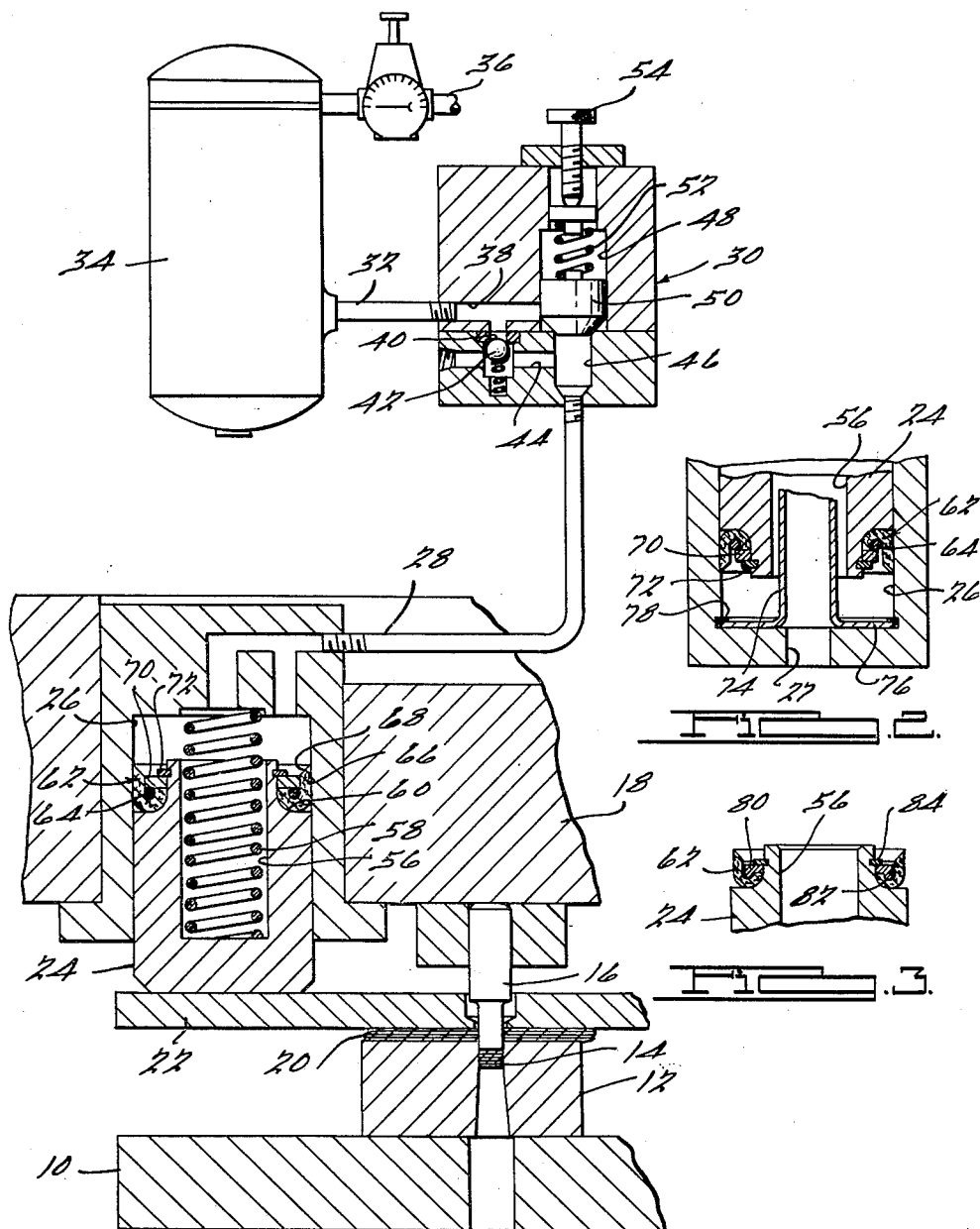


FIG. 1.

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1

3,124,341

HYDRAULIC DIE PADS FOR PRESSES

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1 Claim. (Cl. 267—1)

This invention relates to a hydraulically controlled die pad for a press of the type in which a piston reacts against a movable die pad and is reciprocable within a cylinder supplied with hydraulic fluid under pressure. The piston moves the die pad to its extended position when the press opens, and the pressure fluid trapped within the cylinder provides a predetermined resistance to movement of the die pad to its retracted position as the press closes. The trapped fluid escapes from the cylinder past a pressure relief valve which is set to open when a predetermined pressure is exceeded. After the press begins to open, the pressure fluid is returned to the cylinder past a check valve to return the die pad to its extended position. In many operations it is desirable to cause the die pad to strip the work from the die as the press opens, or to hold the work in position while a punch or other die member is withdrawn from the work as the press opens. The hydraulic fluid is normally maintained within a supply tank under a relatively low pressure which is insufficient to accomplish these desired objectives. The present invention is particularly directed to an arrangement in which the added stripping force or holding pressure may be provided by a spring located within a cavity in the piston without the necessity of employing a booster to increase the pressure in the system as the press opens. It has been found that the additional stripping pressure can be provided by a spring associated with the piston without increasing the over-all diameter of the piston, which is an important consideration in installations of the type in question. This is accomplished according to the present invention by a novel type of seal or packing for the piston which is adapted to effectively seal against the high pressures encountered in the closing of the press and which allows the spring to be placed within the piston while still providing a very compact arrangement.

A principal object of the invention is to provide a new and improved die pad for a press in which a compression spring is adapted to supplement the pressure provided by hydraulic fluid under the relatively low pressure available in the ordinary shop line for stripping the work from the die as the press opens.

Another object of the invention is to provide a hydraulically controlled die pad for a press consisting of a piston reciprocable within a cylinder and provided with an improved high pressure seal which permits the use of a spring located within a cavity in the piston to supplement the relatively low pressure supplied to the cylinder from a conventional source of fluid under pressure without increasing the piston diameter.

Other and further objects of the invention will be apparent from the following description and claim and may be understood by reference to the accompanying drawing, which by way of illustration shows preferred embodiments of the invention and what I now consider to be the best mode of applying the principles thereof. Other embodiments of the invention may be used without departing from the scope of the present invention as set forth in the appended claim.

In the drawing:

FIG. 1 is a sectional somewhat schematic view of a hydraulically controlled die pad for a press constructed according to the present invention;

2

FIG. 2 is a fragmentary sectional view of a modified form of the invention; and

FIG. 3 illustrates a further modified form of the invention.

In the drawing there is illustrated a portion of a press including a lower die shoe 10 having a die block 12 mounted thereon and provided with an opening 14 adapted to receive a punch 16 which is mounted on and vertically reciprocable with the upper die shoe 18 which is reciprocated by the ram (not shown) of the press. The workpiece 20 is adapted to be supported on the upper surface of the die block 12 so that the punch 16 or other tool or die member performs an operation on the work during each cycle of operation. A movable die pad 22 is carried by the upper die shoe 18 but is reciprocable relative thereto. The die pad 22 is adapted to engage the work 20 to clamp the work against the die block 12 as the press closes and is also adapted to hold the work firmly against the die block 12 as the punch 16 is withdrawn upon opening of the press.

The die pad 22 is engaged by one or more pistons 24 reciprocable within cylinders 26 carried by the upper die shoe 18. The cylinder 26 is connected by a line 28 to a valve unit 30 which is interposed between the line 28 and a line 32 leading from a tank 34 containing fluid such as oil. The oil is maintained under pressure within the tank 34 by means of air under pressure supplied through a line 36. The pressure normally maintained within the supply tank 34 is of the order of from 75 to 100 pounds per square inch. The valve unit 30 includes a passage 38 to which the line 32 is connected and a passage 40 intersecting the passage 38 and normally closed by a check valve 42. A passage 44 on the other side of the check valve 42 communicates with a passage 46 leading to the line 28 and to a valve chamber 48 containing a pressure relief valve 50 which normally closes the communication between the passages 46 and 38 under the force exerted by a spring 52. The force exerted by the spring 52 may be adjusted by an adjusting screw 54 so that the pressure relief valve 50 will open when a predetermined pressure in the cylinder 26 is exceeded.

When the press is opened the hydraulic fluid in the tank 34 is supplied through line 32 and passage 38 past check valve 42 to passages 44 and 46 and line 28 to the cylinder 26, thereby causing the piston 24 to move the die pad 22 to its extended position. The piston 24 is provided with a centrally disposed cavity 56 containing a spring 58 which also urges the piston 24 and the die pad 22 to their extended positions. As the press closes, the die pad 22 engages the work 20 to hold the work in position during the piercing or other forming operation being carried out by the press. The fluid trapped in the cylinder 26 as the press closes provides a predetermined resistance to movement of the die pad 22 and piston 24, thereby providing the required pressure on the work as the press closes. The fluid trapped in the cylinder 26 flows back through line 28 to the pressure relief valve 50 which opens when a predetermined pressure is reached, thereby returning the fluid through passage 38 and line 32 to the tank 34. As the press begins to open, the spring 58 will supplement the pressure fluid supplied past check valve 42 in moving the piston 24 to its extended position so as to hold the work 20 in place as the punch 16 is withdrawn.

The upper end of the piston 24 is provided with an annular groove 60 on its peripheral surface. A seal consisting of an annular leather packing 62 wrapped around an O-ring 64 is located within the groove 60 and provides a high pressure seal between the piston 24 and the cylinder 26. The leather packing 62 is generally U-shaped in cross section, as shown, and includes an outer leg 66 provided with a bevel 68 on its inner surface so that the

pressure fluid in the cylinder 26 will force the outer leg 66 into tight sealing engagement with the wall of the cylinder 26. The resiliency of the O-ring 64 forces the inner leg of the packing 62 into tight sealing engagement with the radius portion of the groove 60 in the piston 24. An annular metal retaining ring 70 is fitted over the end of the piston 24 and engages the O-ring 64 and the packing 62. The retaining ring 70 is locked in place by a split locking ring 72 which is located within an annular groove in the upper end of the piston 24.

The seal arrangement described herein provides a very efficient high pressure seal but at the same time takes up very little space and eliminates the need for the conventional end cap secured on the end of the piston by screws or the like for retaining the seal in position. This makes it possible to utilize a spring located within a central cavity in the piston to provide the required additional stripping pressure without increasing the over-all diameter of the piston.

In the form of the invention shown in FIG. 2 the piston and its packing are the same as shown in FIG. 1. However, in this instance the piston 24 may be reciprocable within a cylinder 26 carried by the lower stationary die shoe so that the hydraulic fluid is supplied to and exhausted from the cylinder 26 at the lower end thereof through a passage 27 connected to the line 28. The seal arrangement described in connection with FIG. 1 may also be used in installations wherein an additional stripping pressure is not required but in which it may be desirable to provide a bleeder tube like that shown at 74 in FIG. 2 for bleeding air out of the cylinder 26. The bleeder tube 74 has a flange 76 on its lower end engaging the end wall of the cylinder 26 and is retained in position by a split washer 78. The interior of the tube 74 communicates with the line 28 and extends to the upper end of the cavity 56 in the piston 24 so that any air in the cylinder 26 which rises to the upper end of the cavity 56 will be returned to the supply tank 34 as the hydraulic fluid is exhausted from the cylinder 26 upon closing of the press. By means of the sealing arrangement described, the bleeder 74 may be employed without increasing the diameter of the piston 24.

FIG. 3 illustrates a modified type of seal in which the piston 24 may be of the same construction previously described. In this form of the invention the leather packing 62 is also of the same form but the O-ring is replaced by an annular metal retaining ring 80 having an annular bead 82 on its underside about which the leather packing 62 is fitted. The retaining ring 80 is locked in position against the packing 62 by a split ring 84.

While I have illustrated and described preferred embodiments of my invention, it is understood that these are capable of modification, and I therefore do not wish to be limited to the precise details set forth but desire to avail myself of such changes and alterations as fall within the purview of the following claim.

I claim:

In a press having a movable die pad engaged by the work upon closing of the press and a hydraulic cushion for said die pad for resisting movement of the die pad upon closing of the press and for returning the die pad to its extended position to strip the work from the die upon opening of the press, said hydraulic cushion comprising a cylinder having a piston reciprocable therein and reacting against the die pad, a source of hydraulic fluid under relatively low pressure remote from said cylinder, a fluid connection between said fluid pressure source and said cylinder located at the end wall thereof and through which hydraulic fluid is supplied to said cylinder under the low pressure at said source, and a pressure relief valve in said connection providing a predetermined resistance to return flow of hydraulic fluid from said cylinder to said source due to movement of the die pad to its retracted position; the improvements comprising an axially extending cavity in said piston opening from one end thereof, the open end of said piston having an annular laterally and axially extending groove on its outer periphery, a seal in said groove comprising a flexible annular packing ring of U-shaped cross section with the ends of said packing ring extending toward said end wall of said cylinder, the outer leg of said packing ring lying against the cylinder side wall and having a bevel in its inner periphery whereby the fluid in said cylinder exerts a force on said bevel normal to the cylinder side wall to maintain said outer leg of said packing ring in sealing engagement against said cylinder side wall, the inner leg of said packing ring sealingly engaging said groove in said piston, an O-ring seated at the bottom and between the legs of said packing ring, an annular collar secured within said groove at the open end of said piston engaging said packing ring and said O-ring for forcing the packing ring into sealing engagement with said piston, means for retaining said collar against said seal; and a coil spring disposed within said cavity in said piston and reacting against said end wall of said cylinder and the closed end of said piston to supplement the fluid under said low pressure in returning said piston and die pad to their extended position upon opening of the press.

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