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HYDRAULIC CUSHION FOR A PRESS

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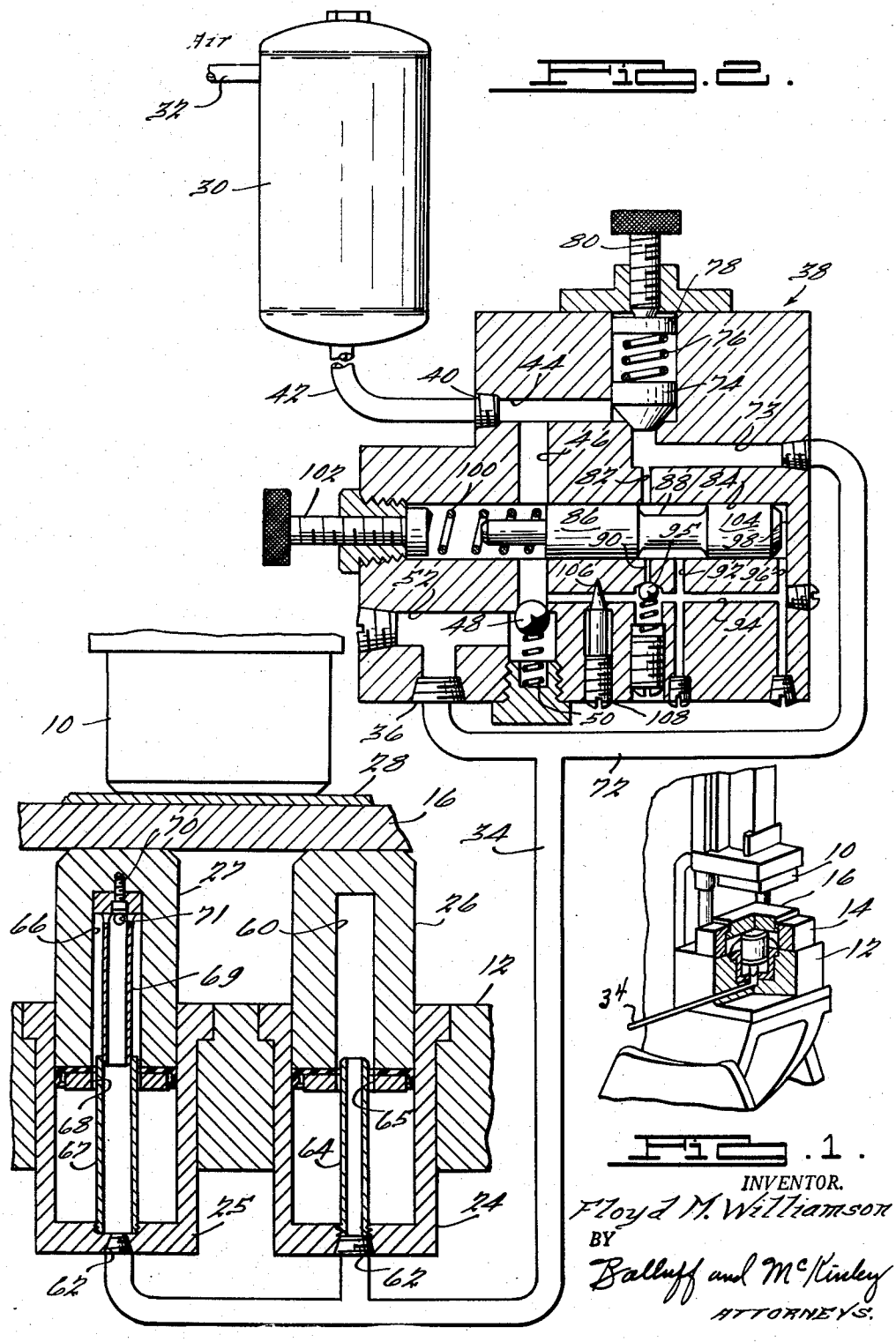



FIG. 2.




FIG. 1.

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# HYDRAULIC CUSHION FOR A PRESS

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6 Claims. (Cl. 267—1)

This invention relates to a press of the ram type employing a die pad which is adapted to engage the work upon closing of the press, and has particular reference to a hydraulic cushion in the form of a hydraulically controlled piston for reacting against the die pad to resist movement thereof upon closing of the press and to return the die pad to its extended position upon opening of the press.

The presence of air in the cylinders of a system of hydraulically controlled pressure pads is very objectionable and may cause improper functioning of the system. Since the air is compressible, while the oil that is used in such a system is not compressible, the presence of air in the hydraulic cylinders will require that the pistons, and consequently the die pads which react against the pistons, move through a substantial part of their travel before the air is sufficiently compressed to build up the required pressures in the cylinders. Furthermore, air within the cylinders may cause an undesirable spring back of the pads when the pressure is reduced upon the beginning of the return stroke of the press. This latter objection is particularly undesirable in a system of this type employing a time delay in the return of the die pads to their extended position. The present invention is directed to the provision of means for bleeding off the air that may be present in the hydraulic cylinders to overcome the above-mentioned difficulties in systems of this type.

It is a principal object of the invention to provide a hydraulically controlled pressure pad system having means for bleeding air from the hydraulic cylinders employed in the system.

A further object of the invention is to provide a novel piston and cylinder construction for a hydraulically controlled pressure pad in a press.

Other and further objects of the invention will be apparent from the following description and claims and may be understood by reference to the accompanying drawing, which by way of illustration shows a preferred embodiment 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 claims.

In the drawing:

Fig. 1 is a fragmentary perspective view with parts broken away of a ram type press having a hydraulically controlled pressure pad; and

Fig. 2 is a schematic view illustrating the hydraulic cylinders forming a part of the invention and the hydraulic control circuit for the cylinders.

In Fig. 1 there is disclosed a portion of a press which includes a vertically reciprocable ram **10** and a fixed bed **12** provided with a die **14** and a die pad **16**. The die pad **16** is reciprocably mounted on the die **14** and its movement is controlled by one or more hydraulically controlled pistons.

In the illustrated embodiment of the invention, the die



shoe **12** has secured therein cylinders **24** and **25** having pistons **26** and **27** reciprocable therein. The pistons **26** and **27** engage the underside of the die pad **16** on which the workpiece **28** is supported for engagement by the ram **10** of the press. A supply tank **30** containing a body of oil therein is supplied with air under pressure through a line **32** so as to maintain the oil at a predetermined relatively low pressure.

Oil from the tank **30** is supplied to the cylinders **24** and **25** through a hydraulic pressure line **34** leading from the outlet **36** of a valve unit **38**. The valve unit **38** includes a valve body having an inlet **40** to which the line **42** is connected for delivering oil from the tank **30** to the valve **38**. The valve is provided with a passage **44** communicating with the inlet **40** and with a passage **46** leading to a check valve **48** seated against the lower end of the passage **46** by a spring **50**. A passage **52** leads from the lower end of passage **46** to the outlet **36**. Oil under the predetermined relatively low pressure provided by the compressed air within the tank **30** is supplied to the cylinders **24** and **25** through the line **42**, inlet **40**, passages **44** and **46**, past check valve **48**, and through passage **52** and outlet **36** to the high pressure line **34**.

The piston **26** is provided with a downwardly opening recess **60**, while the cylinder **24** has its inlet **62** disposed opposite the recess **60** in the piston **26**. The cylinder **24** is provided with a hollow tube **64** extending from its inlet **62** upwardly into the lower end of the recess **60** in piston **26**. An annular passage **65** is defined between tube **64** and piston **26**. Piston **27** has a recess **66** opposite the inlet **62** to cylinder **25**. A hollow tube **67** extends upwardly into recess **66** in spaced relation to the wall of piston **27** to define an annular passage **68**. A tube **69** is secured by a screw **70** to the end wall of piston **27** and is telescopically received within tube **67**. The tube **69** has one or more openings **71** at its upper end. Oil is discharged into the cylinder **24** through the upper end of the tube **64** and into cylinder **25** through the openings **71** in tube **69**. The oil under the predetermined pressure maintained within the tank **30** will hold the pistons **26** and **27** and die pad **16** in their extended positions.

As the ram **10** of the press engages the work **28** the pistons **26** and **27** will resist downward movement of the die pad due to the hydraulic pressure within the cylinders **24** and **25**. As the pistons move downwardly within their cylinders as the ram **10** is lowered, the oil within the cylinders will be forced back through the line **34** and the line **72** into a passage **73** in the valve unit **38**. Communication between passage **73** and passage **44** is normally closed by a pressure relief valve **74** which is held on its seat by a spring **76** confined between the relief valve **74** and a washer **78**. An adjusting screw **80** is provided for adjusting the compression of spring **76** to provide an adjustment of the pressure at which the valve **74** will open. A passage **82** communicates with passage **73** and intersects a valve bore **84** having a time-delay valve **86** therein. The valve **86** is provided with a reduced portion **88** so that oil returning from the cylinders through lines **34** and **72** and passages **73** and **82** will flow past the reduced portion **88** of the valve **86** into passages **90** and **92**. Oil will flow from passage **92** into passage **94** and through passage **90** past check valve **95** into passage **94**, from which the oil flows to passage **96** into the pocket **98** at the end of the valve bore **84** to react against the right-hand end of the valve **86**. The flow of oil into the right-hand end **98** of the valve bore **84** will force the valve **86** to the left against the force of spring **100** which is confined between the valve **86** and an adjusting screw **102** for adjusting the compression of the spring **100**. Continued movement of the pistons **26**

and 27 will build up the pressure in the lines 34 and 72 and passage 73 until the predetermined pressure at which the pressure relief valve 74 is set is attained, whereupon the valve 74 will open to return the oil to the supply tank 30 through the passage 44 and line 42.

After the ram 10 has completed its working stroke and begins to raise, the pressure within the cylinders 24 and 25 will be reduced so that the pressure relief valve 74 will close. However, the valve 86 provides a time delay for the refilling of the cylinders since the passage 46 is closed by the the valve 86 until the pressure within the end 98 of the valve bore 84 is reduced sufficiently for the spring 100 to return the valve 86 to its right-hand position. With the vale 86 in its left-hand position the portion 104 thereof closes off the passage 92 so that the oil at the right-hand end of the valve can only escape through passages 96 and 94 past a bleeder valve 106 which restricts flow through the passage 94. The valve 106 is provided with an adjusting screw 108 to regulate the flow of oil through passage 94.

As soon as the valve 86 moves to its right-hand position, oil will again be supplied to the cylinders 24 and 25 through passages 44 and 46 past check valve 48 and through the outlet 36 from the valve body to the line 34. The valve arrangement described provides a time delay for return of the pad 16 to its extended position.

The cylinders 24 and 25 are provided with means for bleeding air therefrom and returning such air to the supply tank 30 during the working stroke of the press. The air bleed arrangement for the cylinder 24 comprises the tube 64. As the piston 26 moves downwardly within the cylinder 24, oil will be forced at high velocity through the annular passage 65 and recess 60 and deflected into tube 64. Any air in the cylinder will be forced with the oil into the upper end of the tube 64 and discharged therethrough as the piston 26 continues its downward movement. The air bleed arrangement for the cylinder 25 is similar in principle and operation to that described in connection with the cylinder 24. The air within cylinder 25 will be forced ahead of the oil discharged from the cylinder through passage 68 and will pass through the series of openings 71 at the upper end of tube 69 and through tubes 69 and 67 to line 34. It will be apparent that any air that might be present in the cylinders will be forced ahead of the oil into the line 34 as the pistons move downwardly with the working stroke of the ram. The air will be forced ahead of the oil through the lines 34 and 72 into the passage 73 and past the pressure relief valve 74 when such valve is opened upon continued movement of the pistons 26 and 27. The air will in this manner be forced ahead of the oil back to the supply tank 30 where it will rise to the compressed air space above the level of the oil in the tank 30.

While the air bleed arrangements for the cylinders 24 and 25 have been illustrated as being somewhat different in construction, it will be apparent that either of the arrangements shown may be used in each of the cylinders.

The valve unit 38 disclosed herein forms the subject matter of my copending application Serial No. 703,667 filed December 18, 1957, now United States Patent No. 2,901,238.

While I have illustrated and described a preferred embodiment of my invention, it is understood that this is 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 claims.

I claim:

1. In a ram type press having a die pad engaged by the work upon closing of the press, a hydraulic cushion for said die pad adapted to resist movement of the die pad upon closing of the press and to return the die pad to its extended position upon opening of the press, said hydraulic cushion comprising a work cylinder having a piston therein reacting against said die pad, an oil supply tank, means for maintaining the oil in said tank under a predetermined pressure, a hydraulic pressure line for supplying oil at said predetermined pressure to said work cylinder, a check valve in said line past which oil is supplied to said cylinder, a by-pass passage around said check valve and through which oil is returned from said cylinder to said supply tank, a pressure relief valve in said by-pass passage set to open to return oil to the tank when the pressure in said cylinder is increased substantially above said predetermined pressure, said cylinder having a tube therein through which oil is supplied to and exhausted from said cylinder, said piston having a recess into which said tube is received upon movement of said piston into the cylinder, said piston and tube defining a restricted passage therebetween through which oil flows into and out of said cylinder, said tube being arranged to bleed off air in said cylinder with the oil forced through said tube by said movement of said piston whereby such air is returned with the oil to said supply tank through said pressure relief valve.

2. In a ram type press having a die pad engaged by the work upon closing of the press, a hydraulic cushion for said die pad adapted to resist movement of the die pad upon closing of the press and to return the die pad to its extended position upon opening of the press, said hydraulic cushion comprising a work cylinder having a piston therein reacting against said die pad, an oil supply tank, means for maintaining the oil in said tank under a predetermined pressure, a hydraulic pressure line for supplying oil at said predetermined pressure to said work cylinder, a check valve in said line past which oil is supplied to said cylinder, a by-pass passage around said check valve and through which oil is returned from said cylinder to said supply tank, a pressure relief valve in said by-pass passage set to open to return oil to the tank only when the pressure in said cylinder is increased substantially above said predetermined pressure, a time-delay valve responsive to said increased pressure for closing said hydraulic pressure line between said tank and said check valve to delay refilling of said cylinder after opening of the press, spring means urging said time-delay valve to its open position, a bleeder valve for bleeding off the pressure applied to said time-delay valve to allow the same to be opened by said spring means after a predetermined time delay, thereby to allow oil at said predetermined pressure to flow past said check valve to said cylinder to return said die pad to its extended position, said cylinder having an axially extending tube therein connected to said hydraulic pressure line and through which oil is supplied to and exhausted from said cylinder, said piston having a recess therein into which said tube is received upon movement of said piston into said cylinder, said piston and tube defining an annular passage therebetween for the flow of oil into and out of said cylinder, said tube being arranged to bleed off air in said cylinder with the oil forced through said tube by movement of said piston into said cylinder whereby such air is returned with the oil to said supply tank through said pressure relief valve.

3. In a ram type press having a die pad engaged by the work upon closing of the press, a hydraulic cushion for said die pad comprising a work cylinder having a piston therein reacting against said die pad, an oil supply tank, a hydraulic pressure line for supplying oil from said tank to said work cylinder to move said piston to its extended position and through which oil is returned to said supply tank upon closing of the press, said cylinder having an axially extending tube therein connected to said hydraulic pressure line and through which oil is supplied to and exhausted from said cylinder, said piston having a recess therein into which said tube is received upon movement of said piston into said cylinder, said piston and tube defining an annular passage therebetween for the flow of oil into and out of said cylinder,

said tube having an opening therein within said recess to bleed off the air in said cylinder with the oil forced through said opening into said tube whereby such air is returned with the oil to said supply tank through said hydraulic pressure line.

4. In a ram type press having a die pad engaged by the work upon closing of the press, a hydraulic cushion for said die pad adapted to resist movement of the die pad upon closing of the press and to return the die pad to its extended position upon opening of the press, said hydraulic cushion comprising a work cylinder having a piston therein reacting against said die pad, an oil supply tank, means for maintaining the oil in said tank under a predetermined pressure, a hydraulic pressure line for supplying oil at said predetermined pressure to said work cylinder, a check valve in said line past which oil is supplied to said cylinder, a by-pass passage around said check valve and through which oil is returned from said cylinder to said supply tank, a pressure relief valve in said by-pass passage set to open to return oil to the tank when the pressure in said cylinder is increased substantially above said predetermined pressure, said cylinder having an axially extending tube therein through which oil is supplied to and exhausted from said cylinder, said piston having a recess therein into which said tube is received upon movement of said piston into said cylinder, said piston and tube defining a restricted passage therebetween for the flow of oil into and out of said cylinder, and an air bleed tube secured to said piston and arranged within the recess in said piston, said air bleed tube being telescopically related to the tube in said cylinder and having an opening therein within said recess to bleed off the air in said cylinder with the oil forced through said opening into said tube upon movement of said piston into said cylinder whereby such air is returned with the oil to said supply tank through said pressure relief valve.

5. In a ram type press having a die pad engaged by the work upon closing of the press, a hydraulic cushion for said die pad adapted to resist movement of the die pad upon closing of the press and to return the die pad to its extended position upon opening of the press, said hydraulic cushion comprising a work cylinder having a piston therein reacting against said die pad, an oil supply tank, a hydraulic pressure line for supplying oil to said work cylinder to hold said piston in its extended position and through which oil is returned to said supply tank upon closing of the press, said cylinder having an axially extending tube therein through which oil is supplied



to and exhausted from said cylinder, said piston having a recess therein into which said tube is received upon movement of said piston into said cylinder, said piston and tube defining an annular passage therebetween for the flow of oil into and out of said cylinder, and an air bleed tube secured to said piston and arranged within the recess in said piston, said air bleed tube being telescopically related to the tube in said cylinder and having an opening therein within said recess to bleed off the air in said cylinder with the oil forced through said opening into said tube whereby such air is returned with the oil to said supply tank through said hydraulic pressure line.

6. In a ram type press having a die pad engaged by the work upon closing of the press, a hydraulic cushion for said die pad adapted to resist movement of the die pad upon closing of the press and to return the die pad to its extended position upon opening of the press, said hydraulic cushion comprising a work cylinder having a piston therein reacting against said die pad, said piston having an oil supply and exhaust port therein communicating with said cylinder, an oil supply tank, means for maintaining the oil in said tank under a predetermined pressure, a hydraulic pressure line connected to said port for supplying oil at said predetermined pressure to said work cylinder, a check valve in said line past which oil is supplied to said cylinder, a by-pass passage around said check valve and through which oil is returned from said cylinder to said supply tank, a pressure relief valve in said by-pass passage set to open to return oil to the tank when the pressure in said cylinder is increased substantially above said predetermined pressure, said cylinder having a port therein communicating with said by-pass passage through which oil is exhausted from said cylinder, and means cooperable with said port in said piston upon movement of said piston into said cylinder for entraining air in the oil as it is expelled from said cylinder through said port so as to bleed off air from said cylinder upon each stroke of the press.

**References Cited** in the file of this patent

UNITED STATES PATENTS

| | | |
|---|---|---|
| 933,010 | Wilzin | Aug. 31, 1909 |
| 1,787,996 | Rode | Jan. 6, 1931 |
| 1,848,383 | Rode | Mar. 8, 1932 |
| 2,300,162 | Maude | Oct. 27, 1942 |
| 2,842,357 | Williamson | July 8, 1958 |