Nov. 6, 1928. 1,690,457

G. A. PENNOCK

APPARATUS FOR PERFORMING PRESSING OPERATIONS

Filed May 10, 1923 2 Sheets-Sheet 1

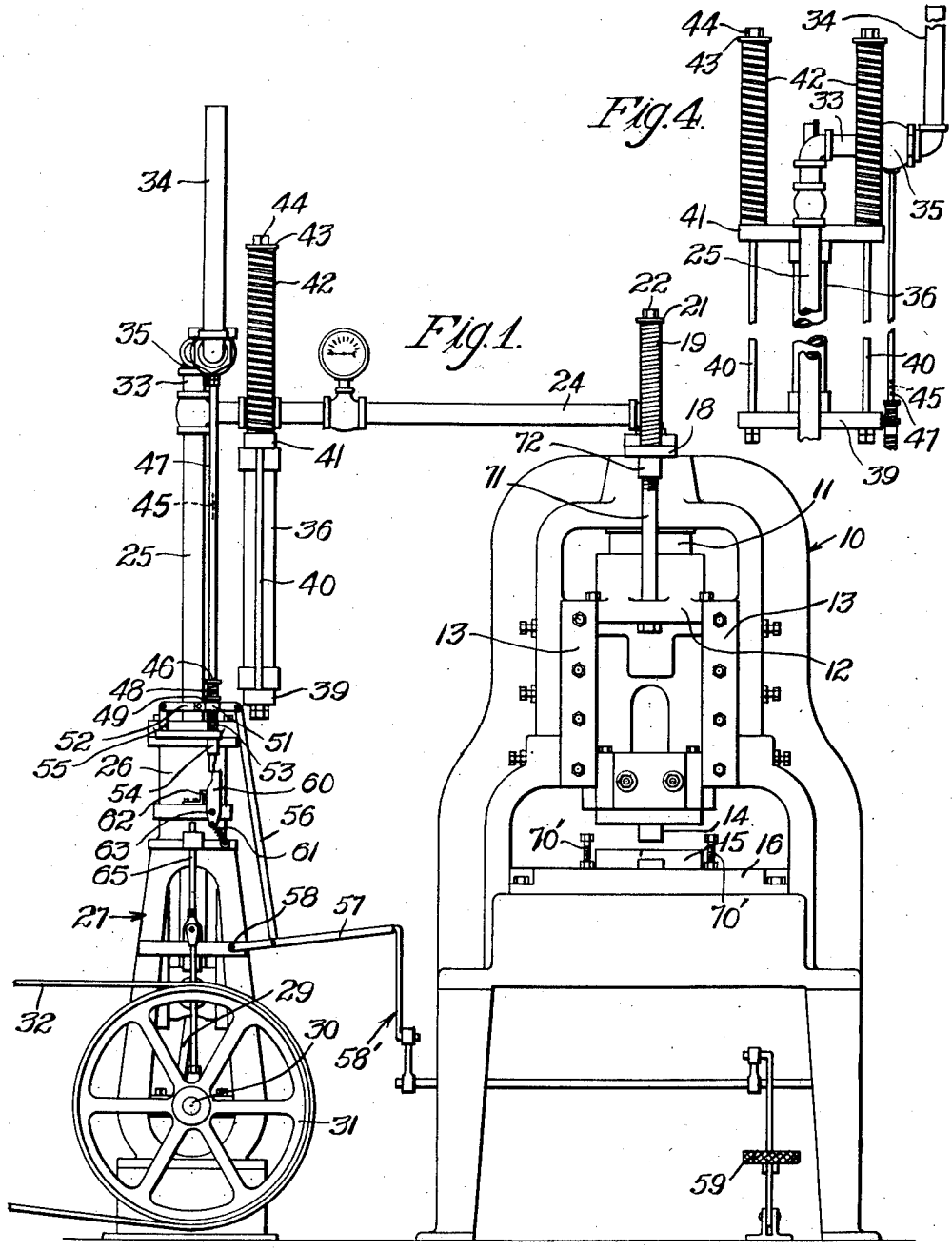


Fig. 1.

Fig. 4.

Inventor
George A. Pennock
by H. G. Patterson
Atty.

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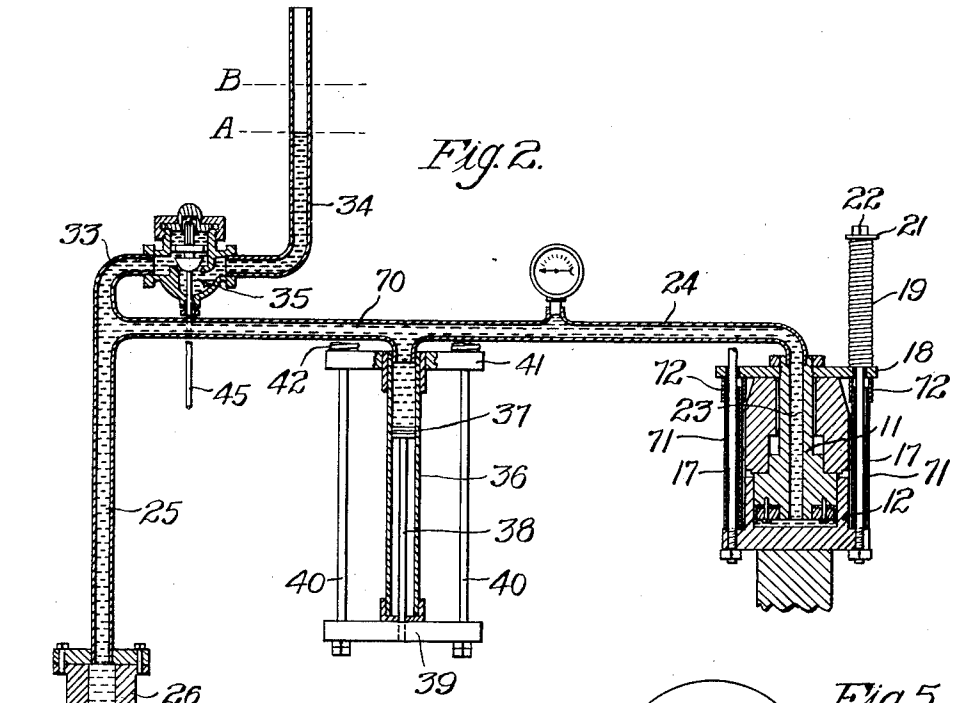


Fig. 2.

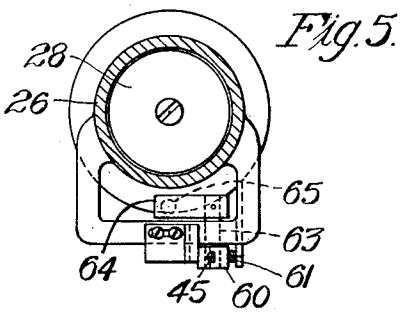


Fig. 5.

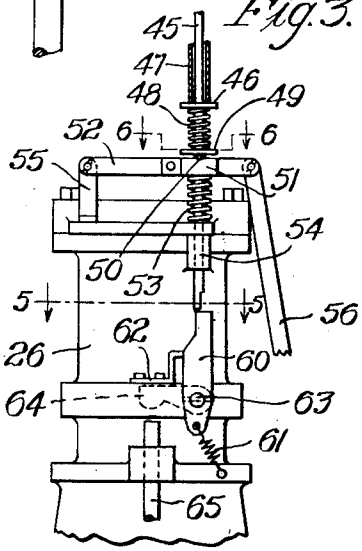


Fig. 3.

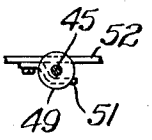


Fig. 6.

Inventor
George A. Pennock
by H. A. Patterson
Atty.

Patented Nov. 6, 1928. 1,690,457

UNITED STATES PATENT OFFICE.

GEORGE ALGER PENNOCK, OF OAK PARK, ILLINOIS, ASSIGNOR TO WESTERN ELECTRIC COMPANY, INCORPORATED, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

APPARATUS FOR PERFORMING PRESSING OPERATIONS.

Application filed May 10, 1923. Serial No 637,972.

This invention relates to an apparatus for performing pressing operations and relates more particularly to an apparatus which utilizes fluid under pressure as an operating medium.

An object of the invention is to provide a fluid operated pressing apparatus which is very much more rapid than apparatus of this type now in use and one which may be operated at speeds substantially equal to those attained by crank shaft presses. To this end a fluid actuated pressing mechanism is provided with a mechanically actuated pump, capable of operation at high speeds, the fluid medium being pocketed between the pump piston and the movable element of the pressing mechanism whereby valves in the pump and press are dispensed with and each reciprocation of the pressing mechanism is directly responsive to each reciprocation of the said pump.

Another object of the invention is to provide a pressing apparatus of this type which is simple, involving a small number of moving parts, and one that has low initial cost and is inexpensive to maintain.

Another object of the invention is to provide an apparatus of the type above described with mechanism actuatable at will for making the pump effective to actuate the pressing mechanism.

An apparatus made in accordance with the invention may comprise a pressing mechanism of any suitable type having either a movable ram or cylinder operable by fluid, preferably oil or water, under pressure. Communicating with the ram is a pipe or other suitable communicating means which is connected at its other end to a pressure mechanism, preferably a pump of the reciprocating type. An inert body of fluid, preferably oil, is disposed within the pipe and is in contact both with the piston of the pump and the movable element of the press. The pump is actuated by any suitable continuously operating means, each compression stroke of the pump exerting pressure upon the inert body of oil which will transmit the pressure applied thereto directly against the movable element of the press, causing an actuation thereof. As the pump makes its intake stroke the pressure on the body of fluid will be relieved and the movable element of the press may be returned to its normal position by means of springs or other suitable devices.

Still another object of the invention is to provide a pressing mechanism of the type herein described with a safety device which will, in the event the press is overloaded, prevent damage to the press or associated pressure apparatus. To this end an apparatus like that heretofore described may be provided with a chamber communicating with the pipe containing the inert body of oil. Disposed within this chamber is a piston or other suitable device which acts against a spring or other suitable medium which may be so adjusted that more pressure is required to actuate the said piston than is required to operate the movable element of the press to perform a pressing operation. Should the press be subjected to a heavier load than that for which it is designed, as for instance should more than one thickness of the running stock be inserted between the dies of the press, the excess pressure exerted upon the body of fluid will be absorbed by the piston in the chamber and will not damage the operating parts of the press, the pump, or associated apparatus.

Still another object of the invention is to provide a fluid actuated pressing mechanism so designed that both the length, region and pressure of the stroke of its movable element may be readily adjusted.

Other objects and advantages of the invention will more fully appear in the following description and will be particularly pointed out in the appended claims.

The expressions "pressing operations", "press", and "pressing mechanism" used in the specification and claims are intended to define and include various other operations and mechanisms of this general nature, such as stamping operations, stamping presses, punching operations, punch presses, shearing operations, shearing machines, printing operations, printing presses, embossing operations, embossing presses, forging operations, forging presses, etc.

In the accompanying drawings,

Fig. 1 is a front elevation of an apparatus showing one embodiment of the invention;

Fig. 2 is a fragmentary schematic view in vertical section of the mechanism shown in Fig. 1;

Fig. 3 is a fragmentary enlarged detailed

view in front elevation showing the devices for operating the relief mechanism;

Fig. 4 is a fragmentary side elevation of the safety mechanism;

Fig. 5 is a horizontal sectional view taken on the line 5—5 of Fig. 3, and

Fig. 6 is a horizontal sectional view taken on the line 6—6 of Fig. 3.

Referring now to the drawings in detail in which like reference numerals designate similar parts throughout the several views, 10 represents a pressing mechanism of the fluid actuated type.

This mechanism comprises essentially a fixed ram 11 and a cylinder 12 which is vertically movable within suitable gibs or guideways 13 and has attached to its lower end the punch or male die 14, co-operating with which is a female die 15 supported by the bolster plate 16 of the press, Figs. 1 and 2. Connected to the cylinder 12 are rods 17 which project through openings made in a plate 18 supported by the framework of the press. Compression springs 19 are mounted on the rods 17 and when the cylinder moves downwardly these springs are compressed between the plate 18 and washers 21 mounted on the rods 17 and held in place by nuts 22. The springs 19 serve to normally hold the cylinder at the limit of its upward stroke, as shown in Fig. 2, and provide a means for returning the cylinder after each downward stroke thereof.

The ram 11 is provided with a central passageway 23 communicating with one end of a tube 24 which is connected with a pipe 25. This pipe is in communication with the cylinder 26 of a pump 27 which is of the reciprocating type. The passageway 23 constitutes the inlet and outlet for the cylinder of the press, while the pipe 25 constitutes a common inlet and outlet for the cylinder 26 of the pump 27, Fig. 2. The piston 28 of the pump is actuated through the usual pitman 29, crank shaft 30, and pulley 31 which is driven by a belt 32 connected with any suitable source of power (not shown), Fig. 1.

Connecting with the pipes 24 and 25 is a pipe 33 which may be thrown into and out of communication with a stand pipe 34, by means of a valve 35. The upper end of the stand pipe 34 is open to the air. This construction comprises a relief device, the purpose and operation of which will be hereinafter described.

Also in communication with the pipe 24 is a cylinder 36 containing a piston 37 having a connecting rod 38 to which a vertically reciprocable head 39 is attached. Connected to the head 39 are rods 40 vertically movable through a plate 41. Mounted upon the rods 40 are compression springs 42 which are strained between the plate 41 and washers 43 mounted on the rods 40 and held in place by nuts 44. The springs 42 serve to normally hold the reciprocable head 39 and piston 37 in their uppermost positions as shown in Fig. 2. This mechanism comprises a safety device, the purpose and operation of which will be hereinafter described.

Connected with the valve 35 is a valve stem 45, Figs. 2 and 3, upon which a spacing tube 47 is disposed which extends between the valve casing and a washer 46. Encircling the valve stem 45 is a coil spring 48 positioned between the washer 46 and a washer 49 which engages a transverse pin 50 secured in the valve stem, this pin resting upon the forked portion 51 of an arm 52, Figs. 3 and 6. This arm is normally held in the position shown in Fig. 3 by means of a coil spring 53, also encircling the valve stem 45 and strained between the forked portion of the arm 52 and a tubular boss 54 formed on the pump cylinder 26 constituting a bearing for the valve stem 45. With the parts in their positions as shown in Fig. 3, the spring 53 and arm 52 serve to hold the valve tem in its uppermost position in which the valve 35 is open, establishing communication between the stand pipe 34 and the pipes 33, 24, and 25. The arm 52 is pivotally mounted at one end upon a standard 55 attached to the pump cylinder and at its other end is pivotally connected with a link 56, Figs. 1 and 3. This link is pivoted at its lower end to an arm 57 pivoted at a point 58 to the framework of the pump and connected with a leverage system indicated by the reference letter 58′. The leverage system 58′ is connected with a foot treadle 59 in such manner that a depression of the foot treadle causes the arm 57 to be rotated clockwise about its pivot 58, causing a downward movement of the link 56 and arm 52 against the action of the spring 53. A downward movement of the arm 52 permits the spring 48 to expand and move the valve stem 45 downwardly a distance sufficient to close the valve 35, provided the lower end of the valve stem is not blocked by a trigger 60 in the manner shown in Fig. 3. This trigger is normally held in a vertical position by means of a spring 61 which holds the said trigger against an adjustable stop 62. The trigger 60 is fastened upon a shaft 63 to which is also secured a rocker arm 64. This rocker arm is so position as to be engaged by a push rod 65 actuated by the crank shaft 30 of the pump. When the piston of the pump is in its lowermost position, the push rod 65 will have been moved upwardly a distance sufficient to engage the rocker arm 64 and rotate it clockwise. This movement of the rocker arm 64 causes a clockwise rotation of the trip 60 a distance sufficient to move it from beneath the lower end of the valve stem 45 and thereby permit the said valve stem to be moved downwardly under the action of the spring 48 to close

the valve 35 as previously described. Since the trip 60 is actuated by the push rod 65 it will be understood that the valve 35 can only be closed at a time when the piston 28 of the pump 27 is at the limit of its downward stroke, at which time the pump is prepared to make a complete compression stroke and thereby cause its maximum displacement.

A body of fluid 70, preferably oil is disposed within the cylinders 12, 36, and 26, and pipes 24, 25, 33, and 34 as shown in Fig. 2. This fluid body normally has the level indicated by the dotted line A.

The drawings illustrate the various parts of the mechanism in their unoperated positions. When it is desired to operate the press 10, the pump 27 is first set in motion by means of the source of power connected with the belt 32. Each upward movement of the piston 28 of the pump 27 will displace a portion of the oil 70, but since the valve 35 is open, the displaced oil will be forced into the stand pipe 34, lifting the level of the oil 70 from the dotted line position A to the dotted line position B. Since the displaced oil is forced into the stand pipe it will cause no actuation of the press cylinder 12. Each downward movement of the piston 28 will lower the level of the oil 70 in the stand pipe back to its normal level as indicated by dotted line A. To cause an actuation of the press cylinder 12 the foot treadle 59 is depressed which, through the leverage system previously described, will cause the arm 52 to be moved downwardly so that as soon as the piston 28 of the pump 27 is at the limit of its downward movement, the push rod 65, will through the rocker arm 64, move the trip 60 out of the path of the valve stem 45 and permit the said stem to be moved downwardly under the action of the spring 48 to close the valve 35. As the piston 28 moves upwardly it will exert pressure on the oil 70 in the pipes 25, 33, and 24. The oil will transmit the pressure applied by the piston 28 directly against the cylinder 12, causing it to be moved downwardly and perform a pressing operation. As the piston 28 of the pump 27 makes its downward stroke, the oil fed into the cylinder 12 will be withdrawn therefrom and the said cylinder returned to its normal position by means of the springs 19. As long as the foot treadle is depressed the valve 45 will be closed at each down stroke of the piston 28 of the pump and at each upward stroke of said piston the press cylinder 12 will be actuated.

It is essential that the pump 27 displace an amount of the oil 70 sufficient to actuate the press cylinder 12 for performing a normal punching operation. Rather than adjust the pump so that it will accurately displace exactly the amount of oil required for a pressing operation and no more, it has been found convenient to provide a pump which will displace more oil than that necessary to perform a normal pressing operation, and then provide a mechanism which will absorb the surplus oil displaced by the pump. In the present apparatus this mechanism comprises the piston 37 mounted within the cylinder 36, the piston being held in its uppermost position by means of the springs 42. The force of these springs is so adjusted that they exert a pressure upon the piston 37 slightly greater than the pressure necessary to perform the normal pressing operation. As a consequence all excess oil displaced by the pump over and above that necessary to perform a pressing operation will be absorbed by the piston 37 and will not be exerted against the pump cylinder. By adjusting the force of the springs 42 the amount of resistance offered by the piston 37 may be adjusted which will control the amount of pressure exerted on the work by the cylinder 12 of the press. This mechanism also constitutes a safety device should the press be abnormally overloaded, due to the insertion of too heavy stock between the dies of the press, or to other causes which would shorten the normal stroke of the press and tend to exert damaging strains therein, the excess oil 70 displaced occasioned by the shortened stroke of the press being absorbed by the piston 37.

Means is provided for adjusting both the length and region of the stroke of the cylinder 12. This means comprises a plurality of adjustable stops 70′ attached to the bolster plate 16 and sleeves 71 surrounding each of the rods 17, these sleeves having collars 72 threaded thereon. By adjusting the collars 72 the limit of the upward stroke of the cylinder may be lengthened or shortened, and by adjusting the stops 70′ the downward movement of the said cylinder may be made longer or shorter. By adjusting the collars 72 a greater distance than the stops 70′, or vice versa, the stroke of the cylinder may be lengthened or shortened. If the collars 72 and stops 70′ are both adjusted equal distances, the length of the stroke of the cylinder 12 is maintained the same, but the region of its stroke is either raised or lowered, dependent upon the manner in which the said collars and stops are adjusted.

What is claimed is:

1. In an apparatus for performing pressing operations, a pressing mechanism having a ram, a valveless pressure mechanism, a body of fluid connecting the ram and said pressure mechanism in such a manner that each actuation of the ram is directly responsive to each actuation of the pressure mechanism, said pressure mechanism operable throughout its effective compressing stroke to produce a working pressure upon

the ram and capable of supplying a pressure in excess of that required to complete the pressing operation of the ram, and a mechanism for diverting a portion of the fluid and maintaining the continuity of the fluid body to counteract the development of excess pressure by the pressure mechanism.

2. In an apparatus for performing pressing operations, a pressing mechanism having a ram, means for retaining the ram normally in an unoperated position, a valveless pressure mechanism, a body of fluid connecting said ram with said pressure mechanism, said pressure mechanism operable throughout its effective compressing stroke to produce a working pressure upon the ram and capable of supplying a pressure on said fluid in excess of that required to complete the pressing operation of the ram, and a mechanism to counteract the development of excess pressure by the pressure mechanism, said mechanism comprising a movable element and means for normally retaining said movable element in an unoperated position, said means being stronger than that required to retain the ram of said pressing mechanism in its normally unoperated position.

3. In an apparatus for performing pressing operations, a pressing mechanism having a ram, a valveless pressure mechanism, a body of fluid connecting the ram and said pressure mechanism in such a manner that each actuation of the ram is directly responsive to each actuation of the pressure mechanism, said pressure mechanism operable throughout its effective compressing stroke to produce a working pressure upon the ram and capable of supplying a pressure in excess of that required to complete the pressing operation of the ram, a mechanism to counteract the development of excess pressure by said pressure mechanism, said mechanism comprising a cylinder and piston mounted therein for diverting a portion of the fluid and maintaining the continuity of the fluid body, and means for normally holding said piston in an unoperated position.

4. In an apparatus for performing pressing operations, a pressing mechanism having a ram, means for retaining said ram normally in an unoperated position, a valveless pressure mechanism, a body of fluid connecting said ram with said pressure mechanism in such a manner that each actuation of the ram is directly responsive to each actuation of the pressure mechanism, said pressure mechanism operable throughout its effective compressing stroke to produce a working pressure upon the ram and capable of supplying a pressure in excess of that required to complete the pressing operation of the ram, and mechanism to counteract the development of excess pressure supplied by the pressure mechanism, said mechanism comprising a movable element, and means for normally retaining said movable element in an unoperated position, said means being stronger than that required to retain the ram of the pressing mechanism in a normally unoperated position.

5. In an apparatus for performing pressing operations, a pressing mechanism having a movable element, a valveless pressure mechanism, a body of fluid associated with the pressure mechanism and movable element in such a manner that each actuation of said movable element is directly responsive to each actuation of the pressure mechanism, said pressure mechanism operable throughout its effective compressing stroke to produce a working pressure upon the movable element and capable of supplying a pressure in excess of that required to complete the pressing operation of the movable element, and means for adjusting the extent of movement of said movable element.

6. In an apparatus for performing pressing operations, a press having a framework, movable element and a bolster plate, a pressure mechanism, a body of fluid associated with the pressure mechanism and said movable element in such a manner that each actuation of said movable element is directly responsive to each actuation of said pressure mechanism, said pressure mechanism operable throughout its effective compressing stroke to produce a working pressure upon the movable element and capable of supplying a pressure in excess of that required to complete the pressing operation of the movable element, and adjustable stop devices carried by said framework and bolster plate for limiting the extent and region of the movement of the movable element.

7. In an apparatus for performing pressing operations, a pressing mechanism having a ram, a valveless reciprocating pump, a body of fluid connecting the ram with the pump, said pump operable throughout its effective compressing stroke to produce a working pressure upon the ram and capable of supplying a pressure in excess of that required to complete the pressing operation of the ram, and a mechanism for diverting a portion of the fluid and maintaining the continuity of the fluid body to counteract the development of excess pressure supplied by said pump.

8. In an apparatus for performing pressing operations, a pressing mechanism having a ram, a valveless reciprocating pump, a body of fluid connecting said ram and said pump, said pump operable throughout its effective compressing stroke to produce a working pressure upon the ram and capable of supplying a pressure in excess of that required to complete the pressing operation of the ram, and adjustable mean for diverting a portion of the fluid to counteract the de-

velopment of excess pressure by said pump.

9. In an apparatus for performing pressing operations, a pressing mechanism having a ram, a valveless pressure mechanism, a passageway forming a communication between the ram and the pressure mechanism, a body of fluid in said passageway, said pressure mechanism operable throughout its effective compressing stroke to produce a working pressure upon the ram and capable of supplying a pressure in excess of that required to complete the pressing operation of the ram, and a mechanism in the passageway for diverting a portion of the fluid and maintaining the continuity of the fluid body to counteract the development of excess pressure by the pressure mechanism.

10. In an apparatus for performing pressing operations, a pressing mechanism having a ram, a valveless pressure mechanism, a reciprocable fluid body connecting the ram and the pressure mechanism, the movement of the entire fluid body being directly responsive to each actuation of the pressure mechanism, said pressure mechanism operable throughout its effective compressing stroke to produce a working pressure upon the ram and capable of supplying a pressure in excess of that required to complete the counteract the development of pressing operation of the ram, and a mechanism for diverting a portion of the fluid and maintaining the continuity of the fluid body to counteract the development of excess pressure by the pressure mechanism.

In witness whereof, I hereunto subscribe my name this 2nd day of May, A. D. 1923.

GEORGE ALGER PENNOCK.