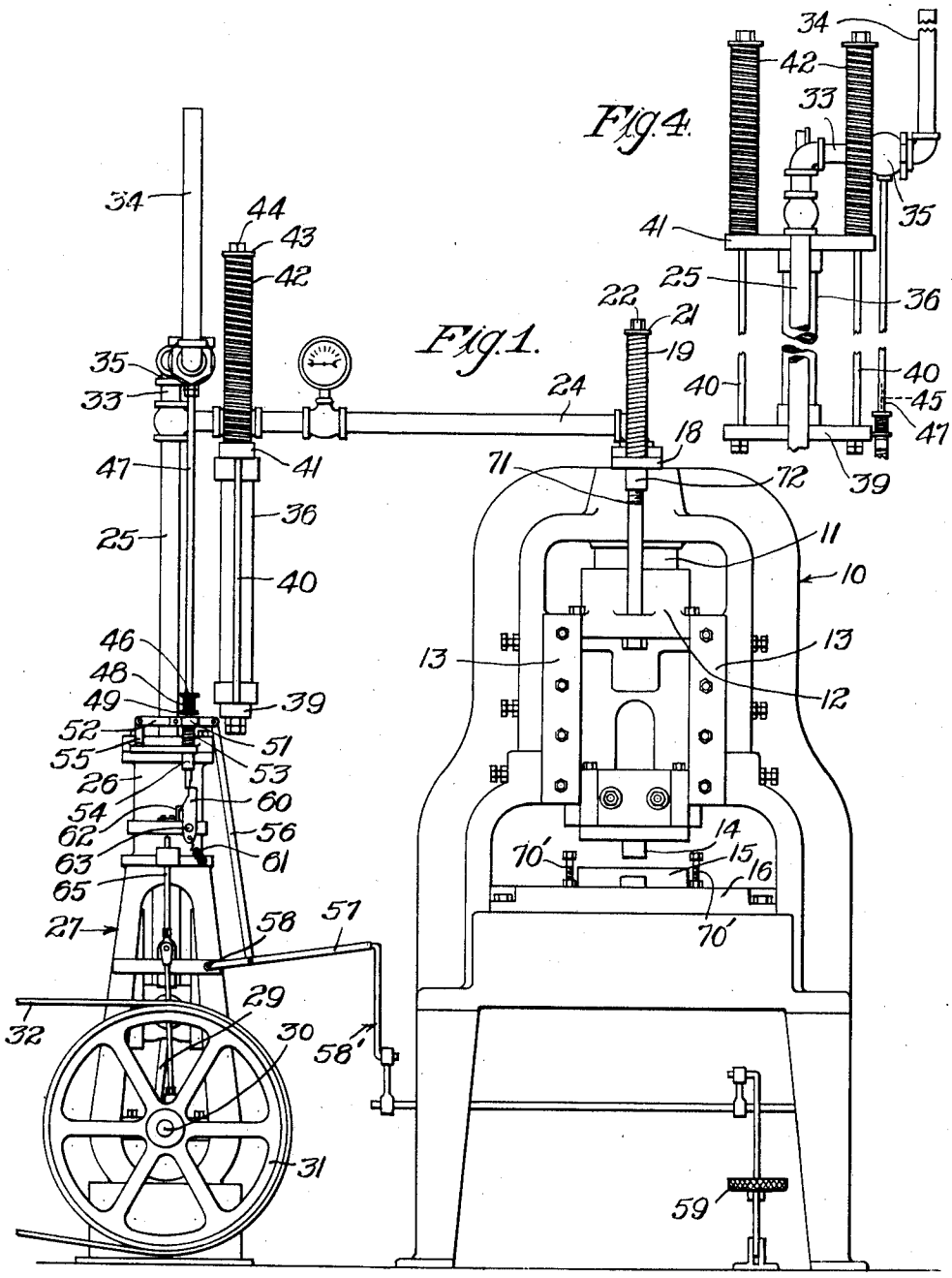
Nov. 6, 1928. 1,690,398

C. BOLLINGER

APPARATUS FOR PERFORMING PRESSING OPERATIONS

Filed May 10, 1923 2 Sheets-Sheet 1



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APPARATUS FOR PERFORMING PRESSING OPERATIONS

Filed May 10, 1923 2 Sheets-Sheet 2

Fig. 2.

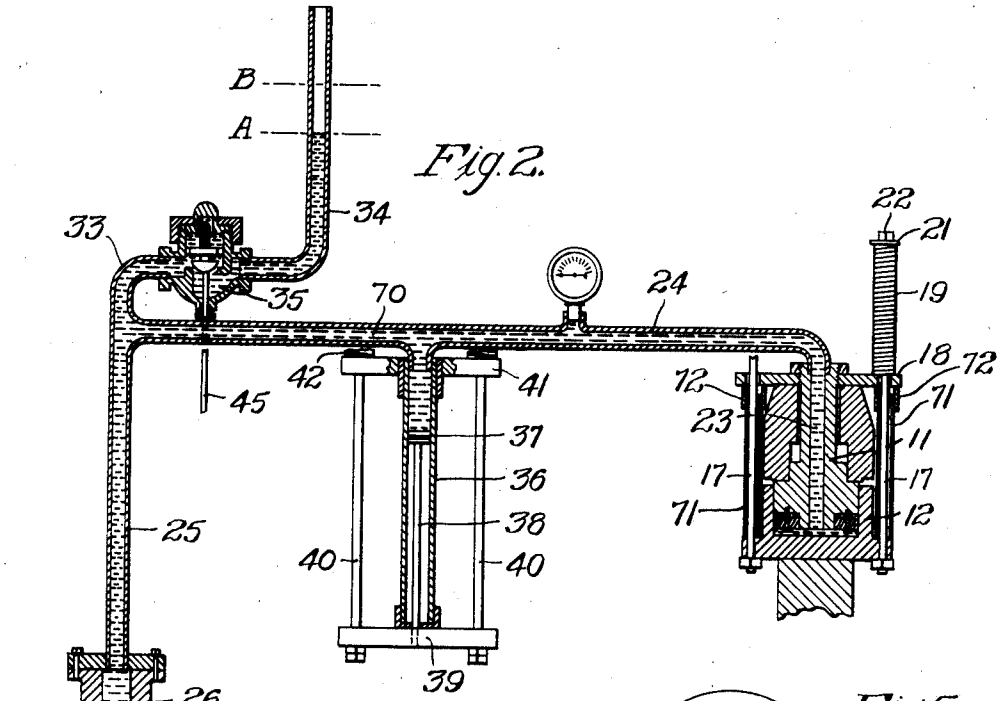


Fig. 3.

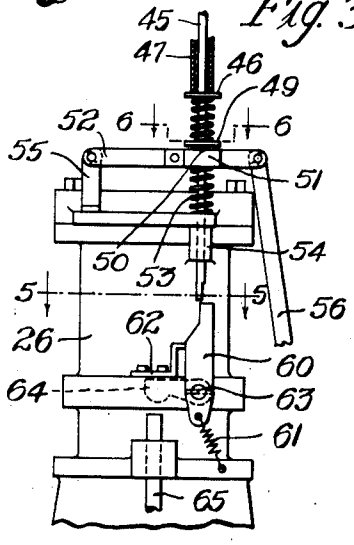


Fig. 5.

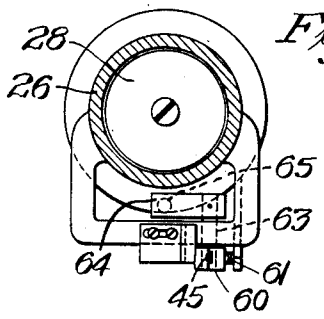
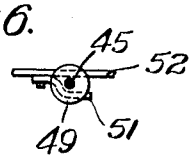


Fig. 6.



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UNITED STATES PATENT OFFICE.

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APPARATUS FOR PERFORMING PRESSING OPERATIONS.

Application filed May 10, 1923. Serial No. 637,971.

This invention relates to a method of and apparatus for performing pressing operations and relates more particularly to such a method and 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 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.

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 cylinder 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.

Another object of the invention is to provide an apparatus like that described with a relief mechanism of such character that the pump or other pressure device may be actuated without causing an actuation of the movable element of the press but when it is desired to operate the said movable element it is actuated directly responsive to the pressure mechanism. With such a construction it is possible to have a constantly operating pump which may be caused to actuate the press when desired. To this end an apparatus similar to that described in the preceding paragraph may be provided with a stand pipe or other suitable receptacle which is in communication through a suitable valve mechanism with the pipe containing the inert body of oil. The valve may be normally open so that as the pump or other pressure mechanism operates, the fluid when placed under the pressure will follow the line of least resistance and be forced into the stand pipe or other receptacle and will not exert a pressure upon the movable element of the press sufficient to cause an operation thereof. When it is desired to cause an actuation of the press, the said valve may be allowed to close so that the pressure applied to the inert body of oil by the pump or other pressure mechanism will be exerted directly upon the movable element of the press to cause an actuation thereof.

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. Should the press be subjected to a heavier load than that to which it is adjusted, 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 bed 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 ppe 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 vertica'ly 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 41 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 normally 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 position as shown in Fig. 3, the spring 53 and arm 52 serve to hold the valve stem 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 number 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 positioned 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 26 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. When it is desired 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 26 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 35 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 desirable 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 displacement caused 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 movable element, a valveless pressure mechanism, a body of fluid connecting said movable element and 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 means associated with said fluid and operable independently thereof to counteract the development of pressure by said pressure mechanism.

2. In an apparatus for performing pressing operations, a pressing mechanism having a movable element, a pressure mechanism, a body of fluid connecting said movable element and said pressure mechanism, and means associated with said fluid and operable independently thereof to counteract the development of pressure by said pressure mechanism, said means being controlled by said pressure mechanism.

3. In an apparatus for performing pressing operations, a pressing mechanism having a movable element, a reciprocating valveless pump, a pipe connecting said movable element with the piston of said pump, a chamber communicating with said pipe, fluid within said pipe, the pump being 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, a valve mechanism adapted to open or close communication between said chamber and said pipe, means for actuating said valve, and means for operating said pump.

4. In an apparatus for performing pressing operations, a pressing mechanism having a movable element, a valveless reciprocating pump, a pipe connecting said movable element with the piston of said pump, a chamber communicating with said pipe, fluid within said pipe, the pump being 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, a valve mechanism adapted to open and close communication between said chamber and said pipe, means for normally holding said valve open, means for closing said valve, and means for operating said pump.

5. In an apparatus for performing pressing operations, comprising a pressing mechanism having a movable element, a valveless pressure mechanism, a body of fluid connecting said movable element and 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 a chamber associated with said fluid adapted when open to counteract the development of pressure by said pressure mechanism.

6. In an apparatus for performing pressing operations, a pressing mechanism having a movable element, a valveless reciprocating pump, a pipe connecting said movable element with the piston of said pump, means for retaining said movable element normally in an unoperated position, a chamber communicating with said pipe, fluid within said pipe, the pump being 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, a valve mechanism adapted to open and close communication between said chamber and said pipe, means for normally holding said valve open, independent means for closing said valve, and means for operating said pump.

7. 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 movable element and with 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 said movable element, mechanism operable to counteract the development of excess pressure by said pressure mechanism, and means associated with said fluid operable to counteract the development of substantially all pressure by said pressure mechanism.

8. In an apparatus for performing pressing operations, a mechanism having a movable element, a pressure mechanism, a pipe connecting said movable element with said pressure mechanism, a chamber communicating with said pipe, fluid within said pipe, a valve mechanism adapted to open and close communication between said chamber and said pipe, means for normally holding said valve open, means for closing said valve, and mechanism controlled by said pressure mechanism for preventing an operation of said

valve closing means until said pressure mechanism is prepared to cause its maximum displacement of the fluid, and means for operating said pressure mechanism.

9. An apparatus for performing pressing operations, comprising mechanism having a movable element, pressure mechanism, a body of fluid associated with said movable element and said pressure mechanism, relieving means associated with said fluid and operable independently thereof normally to counteract the development of substantially all pressure by said pressure mechanism, and means controlled by said pressure mechanism for preventing the operation of said relieving means during the actuation of the movable element.

10. An apparatus for performing pressing operations, comprising mechanism having a movable element, pressure mechanism, a body of fluid associated with said movable element and said pressure mechanism, relieving means associated with said fluid operable normally to counteract the development of substantially all the pressure by said pressure mechanism, means for preventing the operation of said relieving means, and devices controlled by said pressure mechanism for permitting the operation of said preventing means only when said pressure mechanism is prepared to cause its maximum displacement of the fluid.

11. In an apparatus for performing pressing operations, a pressing mechanism having a movable element, a pressure mechanism, a body of fluid connecting said movable element and said pressure mechanism, relieving means associated with said fluid operable to counteract the development of pressure by said pressure mechanism, and mechanism for permitting an operation of said means only when said pressure mechanism is prepared to cause its maximum displacement.

12. In an apparatus for performing pressing operations, a pressing mechanism having a movable element, pressure mechanism, a body of fluid connecting said movable element and said pressure mechanism, relieving means associated with said fluid operable to counteract the development of pressure by said pressure mechanism, mechanism for permitting an operation of said means only when said pressure mechanism is prepared to cause its maximum displacement, said means being controlled by said pressure mechanism.

13. In an apparatus for performing pressing operations, a pressing mechanism having a movable element, a valveless reciprocating pump, a body of fluid connecting said movable element and said pump, and relieving means associated with said fluid and operable independently thereof to counteract the development of pressure by said pump, said means being controlled by said pump.

14. In an apparatus for performing pressing operations, a pressing mechanism having a movable element, a valveless reciprocating pump, a body of fluid connecting said movable element with said pump in such manner that each actuation of said movable element is directly responsive to each actuation of said pump, and means associated with said fluid and operable independently thereof to counteract the development of pressure by said pump, said means being controlled by said pump.

15. In an apparatus for performing pressing operations, a pressing mechanism having a movable element, a pressure mechanism, a body of fluid associated with said movable element and with said pressure mechanism in such 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 said movable element, mechanism operable to counteract the development of excess pressure by said pressure mechanism, and means associated with said fluid operable to counteract the development of substantially all pressure by said pressure mechanism.

16. In an apparatus for performing pressing operations, a pressing mechanism having a movable element, a valveless reciprocating pump, a body of fluid connecting said movable element and said pump, means associated with said fluid operable independently thereof to counteract the development of pressure by said pump, and mechanism for permitting an operation of said means only when said pump is prepared to cause its maximum displacement.

17. In an apparatus for performing pressing operations, a pressing mechanism having a movable element, a pressure mechanism, a body of fluid connecting said movable element and said pressure mechanism in such manner that each actuation of said movable element is directly responsive to each actuation of said pressure mechanism, means associated with said fluid operable to counteract the development of pressure by said pressure mechanism, and mechanism for permitting an operation of said means only when said pressure mechanism is prepared to cause its maximum displacement.

18. In an apparatus for performing pressing operations, a pressing mechanism having a movable element, a pressure mechanism, a body of fluid connecting said movable element and said pressure mechanism in such manner that each actuation of said movable element is directly responsive to each actuation of said pressure mechanism, means associated with said fluid operable to counteract

the development of pressure by said pressure mechanism, and mechanism for permitting an operation of said means only when said pressure mechanism is prepared to cause its maximum displacement, said means being controlled by said pressure mechanism.

19. In an apparatus for performing pressing operations, a pressing mechanism having a movable element, a valveless reciprocating pump, a body of fluid connecting said movable element and said pump, means associated with said fluid operable to counteract the development of pressure by said pump, and mechanism for permitting an operation of said means only when said pump is prepared to cause its maximum displacement, said means being controlled by said pump.

In witness whereof, I hereunto subscribe my name this 1st day of May, A. D., 1923.

CHARLES BOLLINGER.