F. PHELPS.

HYDRAULIC PRESS.

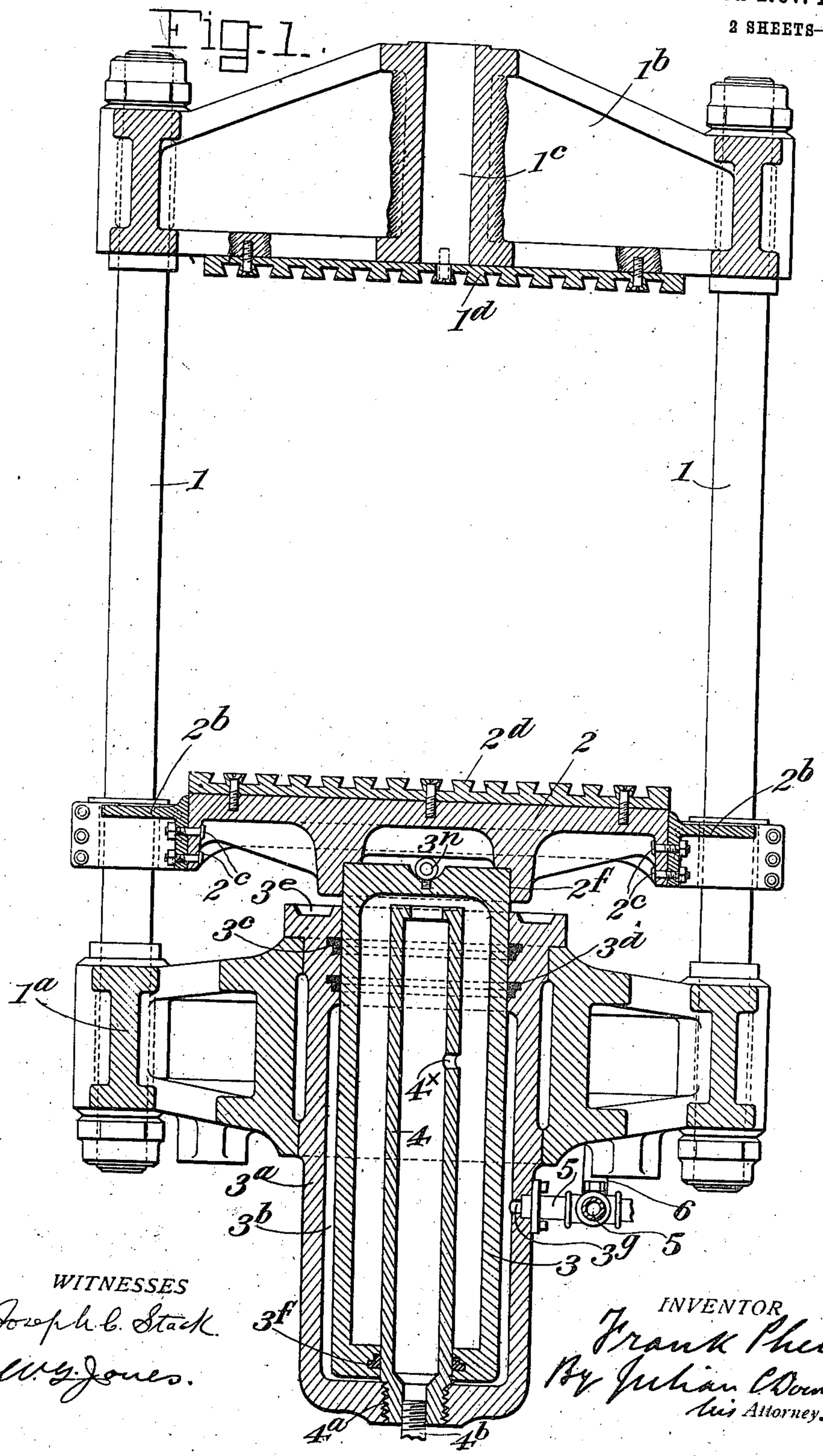
APPLICATION FILED JUNE 7, 1909.

975,994.

Patented Nov. 15, 1910.

2 SHEETS—SHEET 1.

Fig. 1.



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2 SHEETS—SHEET 2.

Fig. 2.

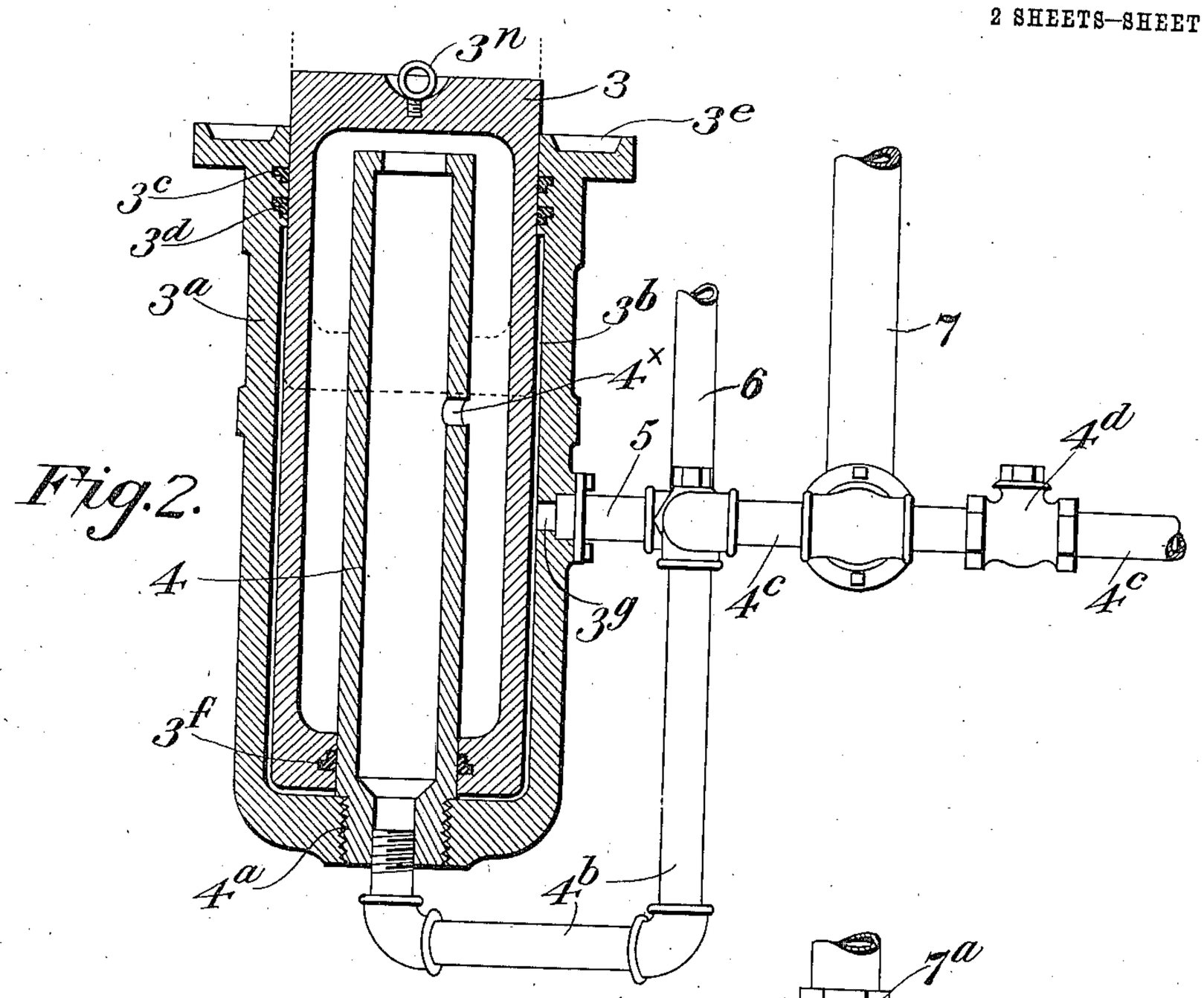
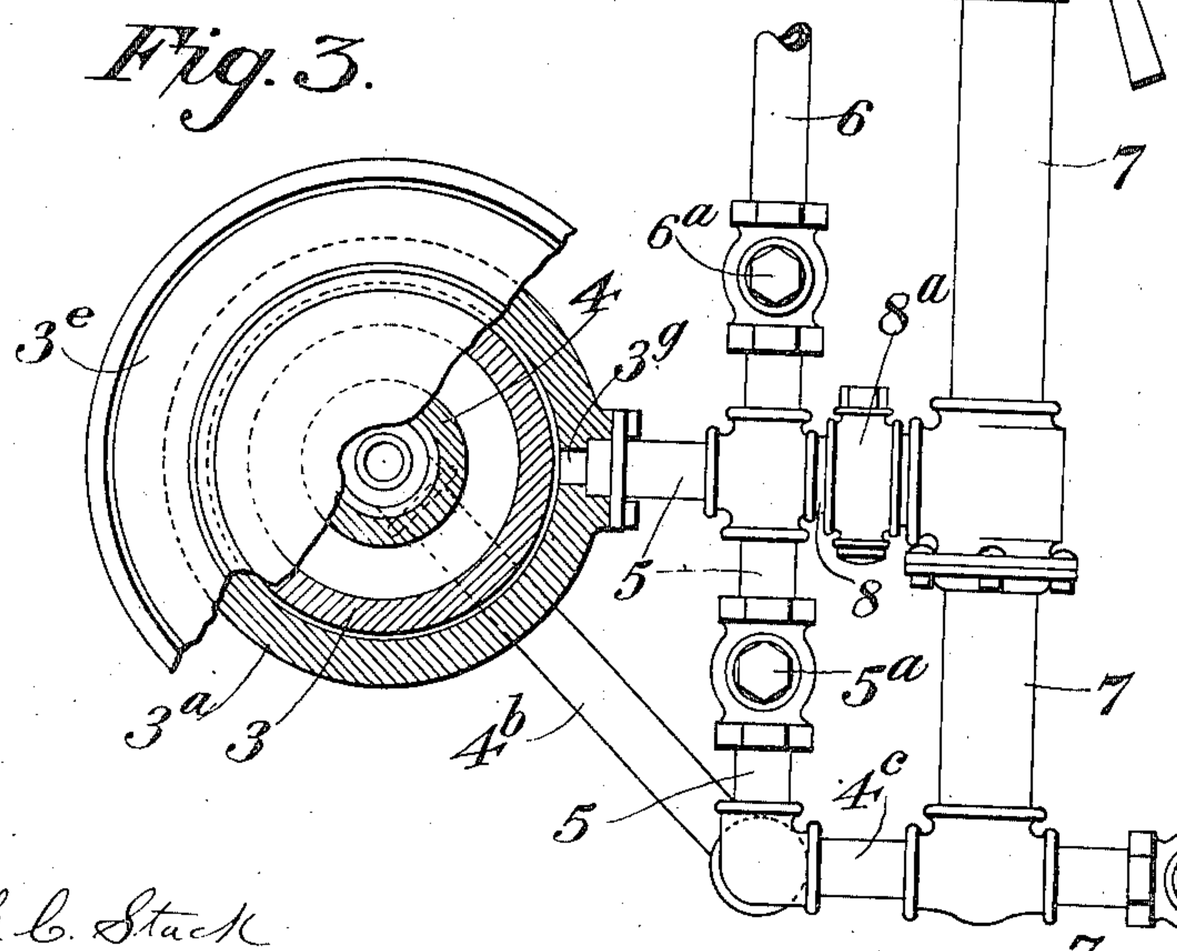


Fig. 3.



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FRANK PHELPS, OF LITTLE ROCK, ARKANSAS.

HYDRAULIC PRESS.

975,994. Specification of Letters Patent. Patented Nov. 15, 1910.

Application filed June 7, 1909. Serial No. 500,725.

To all whom it may concern:

Be it known that I, FRANK PHELPS, a citizen of the United States, residing at Little Rock, in the county of Pulaski and State of Arkansas, have invented certain new and useful Improvements in Hydraulic Presses; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention is an improvement in varying power presses, for use in recompressing baled cotton, expressing cotton-seed oil, or for any purpose where a low quick pressure is required at the start and a greater pressure to complete the operation.

In hydraulic presses of this type, as previously constructed, the fluid pressure was introduced by separate pipe connections to the primary and secondary pressure chambers, and its admission to the latter was controlled by a valve.

In my present improved construction the fluid pressure is introduced into the secondary pressure chamber from the primary pressure chamber, and the change from low to full pressure is controlled by the movement of the ram which at a certain stage of its stroke opens a port or ports establishing communication between said chambers. Valve-controlled means is or may be provided, however, for introducing fluid-pressure separately to the secondary pressure chamber, so that the ram can be operated at slow speed with full pressure for all or any desired part of its stroke.

In the accompanying drawings, which form a part of this specification: Figure 1 is a sectional elevation of a cotton compress having a hydraulic motor embodying my invention. Fig. 2 is a sectional view of the hydraulic motor, with connections for supplying the motive fluid represented in elevation. The ram is shown at its initial or lowered position, and the dotted lines indicate its position at the beginning of the slower, high-pressure, portion of its stroke. Fig. 3 is a plan view of the subject-matter of Fig. 2, the hydraulic motor being shown part in cross section.

1 denotes the pillars or guide-rods of the press, rising from the base frame 1^a and connected by the upper press-head or top frame 1^b. The latter has a central opening 1^c for inserting a hoisting cable to withdraw the ram when it is desired to renew its packings; and to the under side of the press-head is secured the usual grooved pressplate 1^d.

2 is the movable press-head or follower, provided with a grooved press-plate 2^d, and bolted at 2^c to collars 2^b by which the follower is guided on the rods 1.

3 is the ram, in the form of a hollow piston, which works in the cylinder 3^a. The upper closed end of the ram fits in a socket 2^f on the under side of the follower 2, which is supported thereby. The cylinder 3^a is of slightly larger internal diameter than the external diameter of the ram, leaving an annular space 3^b; but the upper end of the cylinder has a reduced bore, in which the ram is slidably fitted, packings 3^c, 3^d being provided to make a water-tight joint. The upper end of the cylinder may be provided with an annular groove 3^e to catch any water or oil that may escape thereat.

4 is a tube secured at 4^a in the lower closed end of cylinder 3^a and extending into the ram 3. The lower end of the ram has a close sliding fit on the tube, a packing 3^f being provided to make a water-tight joint. The tube 4 is open at its upper end, and it has a port 4^x in its side at a predetermined distance below its upper end, through which port communication is established between the interior of the tube 4 and the interior of the cylinder 3^a when the ram has risen a sufficient distance to uncover said port, as indicated by dotted lines in Fig. 2. The tube 4 in conjunction with the space in the ram above it, constitutes a primary force chamber the effective working area of which is equivalent to the cross sectional area of the tube; while the cylinder 3^a constitutes a secondary force chamber, the effective working area is equivalent to the cross sectional area of the ram minus that of the tube; so that when the fluid pressure is let into both chambers the effective working area is the entire cross sectional area of the ram. I do not however restrict myself to any particular sizes and proportions of parts. At its lower end the inner cylinder or tube 4 is connected by pipe 4^b to a pipe 4^c leading from a force pump (not shown) or other supply of liquid under pressure. A check valve 4^d opening toward the ram prevents back flow of water to the pump.

A pipe 5, connected to a pipe 6 coming from the supply tank or reservoir (not shown) leads to a port 3^g in the side of the

cylinder 3^a. A check valve 6^a in pipe 6 prevents back flow of water from pipe 5. The pipe 5 is also connected with the motive-fluid supply pipe 4^c, a check valve 5^a being provided between 6 and 4^c, which valve opens toward 4^c and prevents the flow of liquid from the pipe 4^c to the port 3^g through that branch of the pipe 5 having the check valve 5^a. Pipe 4^c is further connected, between 5 and 4^d, with a return pipe 7 leading to the supply tank, said pipe 7 being provided with a preferably manually-operable cock 7^a. A direct connection between pipes 5 and 7 can be established through pipe 8 provided with a cock 8^a which is normally closed.

The operation is as follows: Cocks 7^a and 8^a being closed, the working fluid is forced by the pump through pipes 4^c, 4^b (check 5^a closing) into the tube 4, causing the ram 3 to rise rapidly; and meanwhile water flows by gravity through pipes 6, 5 and port 3^g into the cylinder 3^a. As soon as the ram passes and uncovers the port 4^x, the working fluid is admitted thereby under the ram, closing by back pressure the check valve 6^a, and full pressure is obtained for the remainder of the stroke of the ram. To return the ram to starting position, the stop-cock 7^a is opened. The water then flows back through the tube 4 and pipe 4^b; also through port 3^g and pipe 5; and through pipes 4^c and 7 (checks 4^d and 6^a closing) back to the supply tank. By this means I can produce a press having the speed and power of a 12-inch piston during say the first thirty six inches of compression, and of a 24-inch ram for the remainder of the stroke; and a pump that will force a 24-inch ram its full stroke in one minute will move my ram its full stroke in about half the time. It would be an obvious reversal to have the fluid pressure introduced first into the outer force chamber and then into the inner force chamber after the ram has risen above the port 4^x. This would require connecting the pipe 5 with the tube 4, and connecting the pipe 4^b, with the port 3^g. Obviously also the principle might be extended by providing a number of inner pistons so that the ram would move very fast at the start and gradually slow down and increase in power toward the end of the stroke. The ram may also be used in connection with an accumulator.

As aforesaid the cock 8^a remains closed normally; but if in any case, as when compressing an extremely large bale of cotton the ram operated by fluid pressure in the primary force chamber has insufficient power to pass the port 4^x, then the cock 8^a may be opened and water under pressure, flowing through pipes 7, 8 and 5, would enter the cylinder 3^a at port 3^g, giving full power. Also, by means of the cock 8^a, the ram can be operated at slow speed with full pressure for all or any desired part of its stroke preceding the port 4^x.

The top of the ram is shown provided with an eye 3^n to be engaged by a hook on a hoisting cable let through the opening 1^c in the upper press-head when the follower or movable press-head 2 is detached from the collars 2^b and removed; but the structural part of the press, aside from the hydraulic motor herein described, forms no part of my present improvement but is the subject-matter of a divisional application filed Jan. 10, 1910, Serial No. 537,311.

It will be understood that the invention is not restricted to the particular construction and arrangement of parts illustrated, and can be applied to other kinds of presses. The pipe connections have been conventionally represented and the proportions and particular arrangement of pipes shown are not to be followed; but the relative arrangement of pipe connections and valves is correct.

I claim as my invention and desire to secure by Letters Patent:

1. In a hydraulic press, the combination with the ram and a plurality of constantly separate force chambers, of means for admitting fluid under pressure to a force chamber, and means controlled by the movement of the ram for establishing communication between said chambers, whereby the fluid pressure is introduced successively into said chambers for operating the ram at varying powers.

2. In a hydraulic press, the combination with the ram, of primary and secondary force chambers which are separate during the whole movement of the ram, means for admitting fluid under pressure to the primary chamber, means for maintaining the secondary chamber filled with fluid as the ram is moved by the fluid pressure in the primary chamber, and a port for establishing communication between said chambers adapted to be opened by movement of the ram for a part of its stroke, whereby fluid pressure is introduced into the secondary chamber for continuing the stroke of the ram at greater pressure.

3. In a hydraulic press, the combination of concentric cylinders, a hollow ram telescoping with said cylinders, means for supplying fluid under pressure to one cylinder and for filling the other cylinder with fluid as the ram is moved at low pressure, and a port for establishing communication between said cylinders which is opened by movement of the ram for a certain part of its stroke, the ram continuing throughout its reciprocations in telescopic relation with the concentric cylinders.

4. In a hydraulic press, the combination of the cylinder, a fluid-pressure supply tube

extending longitudinally thereinto, and a hollow or bored ram working on the tube and in the cylinder, the tube being provided with a lateral port which is uncovered by movement of the ram through a part of its stroke, the ram working on the tube throughout its entire reciprocatory movement.

5. In combination, a cylinder having a plurality of constantly separate force chambers, a tubular ram telescoping with the walls of said chambers, and means controlled by movement of the ram for establishing communication between said force chambers, with means for admitting fluid under pressure to one force chamber and supplying fluid to fill the other force chamber, whereby the ram is moved rapidly until the fluid pressure is introduced into both force chambers for continuing the stroke at increased pressure.

6. In combination, a cylinder having a plurality of constantly separate force chambers and a port, controlled by the ram, for establishing communication between said chambers, with a ram, and means for admitting fluid under pressure to one force chamber to move the ram rapidly until it causes the opening of said port, whereupon the stroke is continued by the operation of fluid pressure in both chambers.

7. The combination of a cylinder, a tube within the cylinder provided with a lateral port, a hollow or bored ram working in said cylinder and on said tube, the ram when retracted covering said port, and means for admitting fluid to the tube and cylinder and supplying the fluid under pressure to one of them, whereby the ram is moved quickly with low pressure until it uncovers said port and its stroke is then continued with greater pressure, the ram working on said tube at all times.

8. In combination, a cylinder having a plurality of force chambers, a ram, pipe-connections for supplying fluid to both chambers and means for supplying the fluid under pressure to one of them, means controlled by the ram for establishing communication between said chambers, and means whereby the fluid pressure can be introduced into both chambers before such communication is established.

9. The combination with the ram and primary and secondary force chambers, and means controlled by the ram for establishing communication between said chambers, of a fluid-pressure supply pipe leading to the primary chamber, a fluid supply pipe leading to the secondary chamber, said pipes having check-valves 4^d and 6^a for preventing back flow and having a connection between said check-valves, which connection is provided with a check 5^a to prevent flow from the fluid-pressure supply pipe to said fluid supply pipe, and a return pipe provided with a cock extending from the fluid-pressure supply pipe between check-valves 4^d and 5^a.

10. The combination with the ram and primary and secondary force chambers, and means controlled by the ram for establishing communication between said chambers, of a fluid-pressure supply pipe leading to the primary chamber, a fluid supply pipe leading to the secondary chamber, said pipes having check-valves 4^d and 6^a for preventing back flow and having a connection between said check-valves, which connection is provided with a check valve 5^a to prevent flow from the fluid-pressure supply pipe to said fluid supply pipe, and a return pipe provided with a cock extending from the fluid-pressure supply pipe between check-valves 4^d and 5^a, and a valve-controlled connection 8, between said return pipe and said fluid supply pipe, which connection is between the fluid pressure supply pipe and said cock, substantially as and for the purposes described.

11. In a hydraulic press, the combination of concentric cylinders, a hollow ram telescoping with said cylinders, means for supplying fluid under pressure to one cylinder, there being a port for establishing communication between said cylinders which is opened by movement of the ram for a certain part of its stroke, the ram continuing throughout its reciprocations in telescopic engagement with the concentric cylinders.

In testimony whereof I affix my signature, in presence of two witnesses.

FRANK PHELPS.

Witnesses:
H. A. BABBITT,
J. J. ABLES.