No. 882,045. PATENTED MAR. 17, 1908.

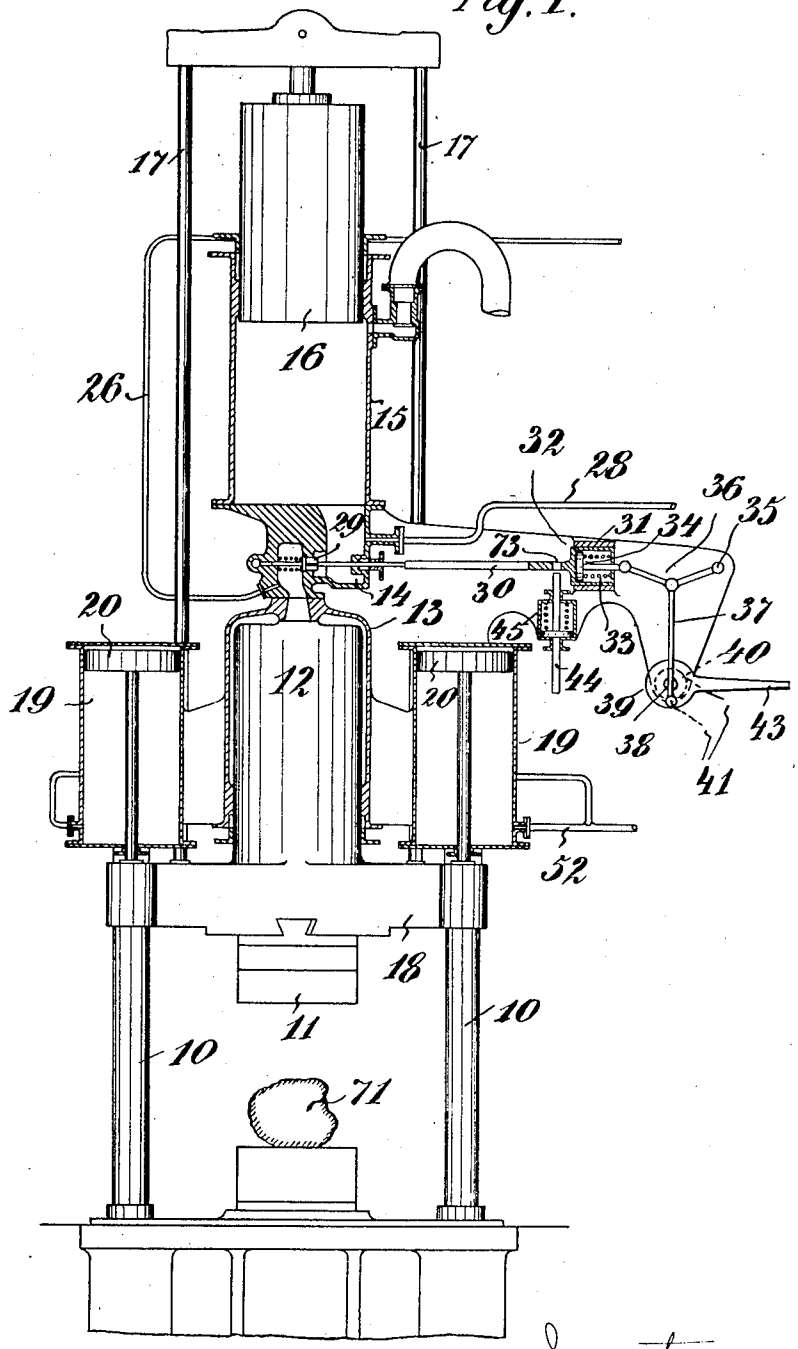
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6 SHEETS—SHEET 1.

Fig. 1.



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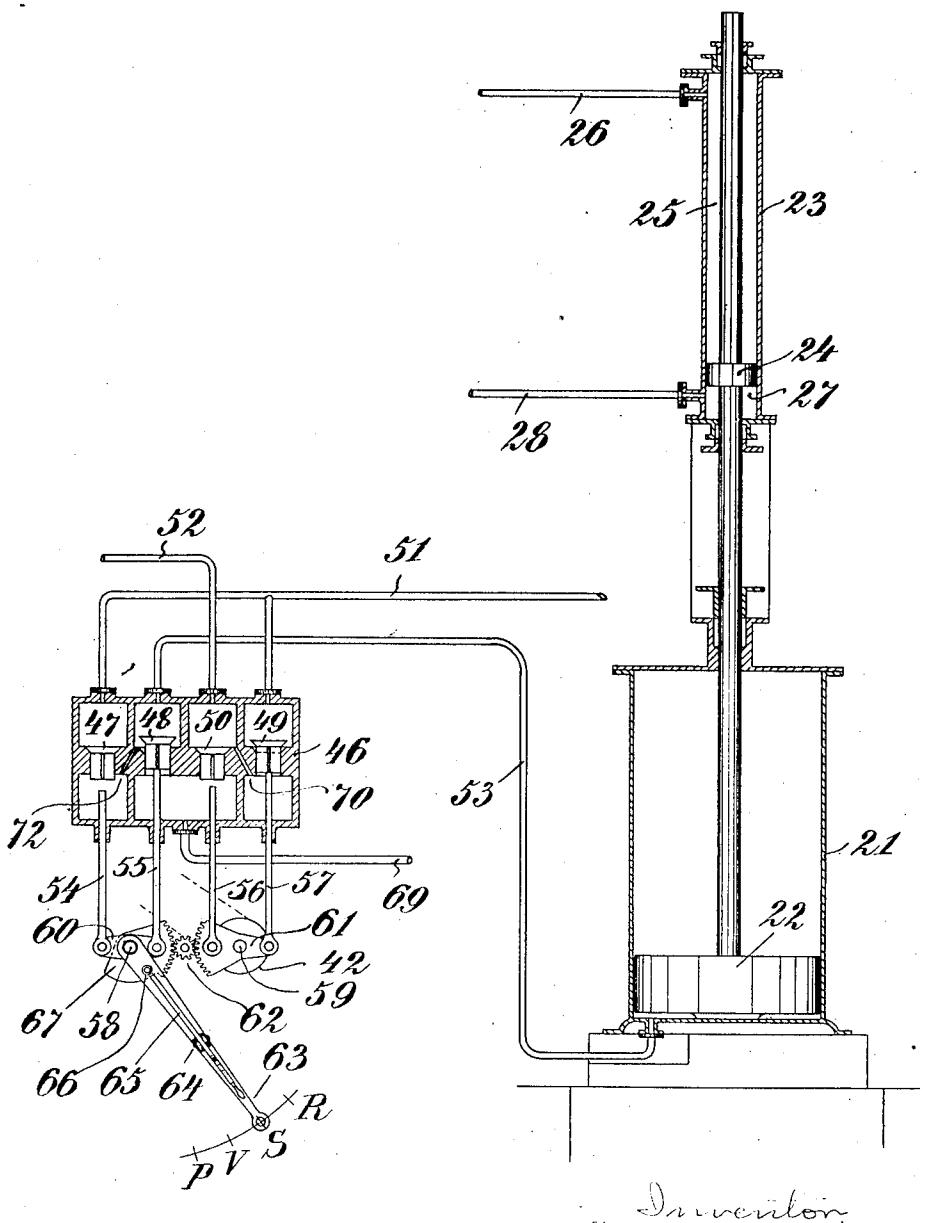
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6 SHEETS—SHEET 2.

Fig. 1a



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Fig. 4.

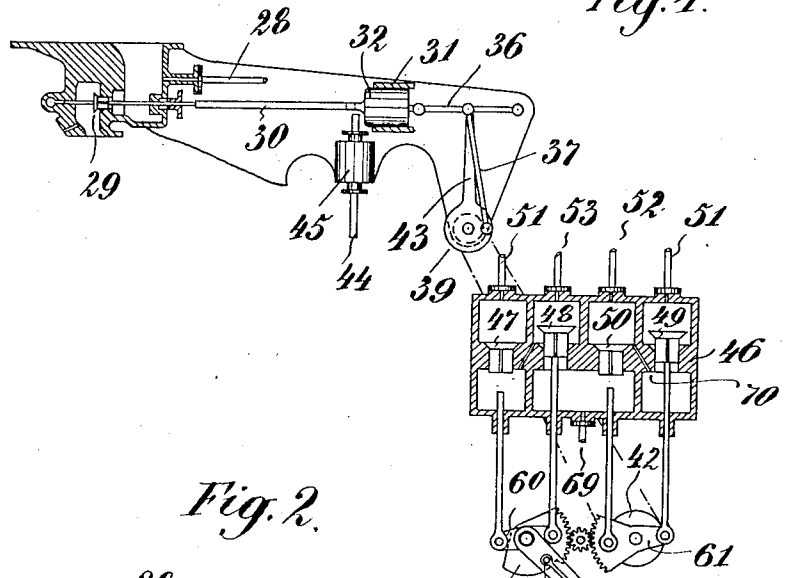
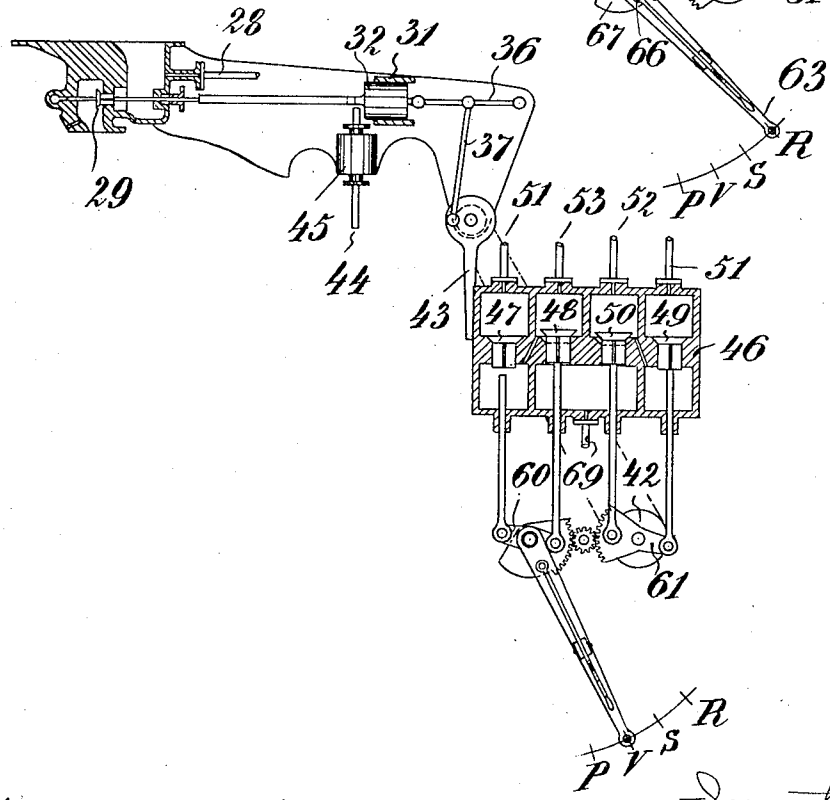


Fig. 2.



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Fig. 3.

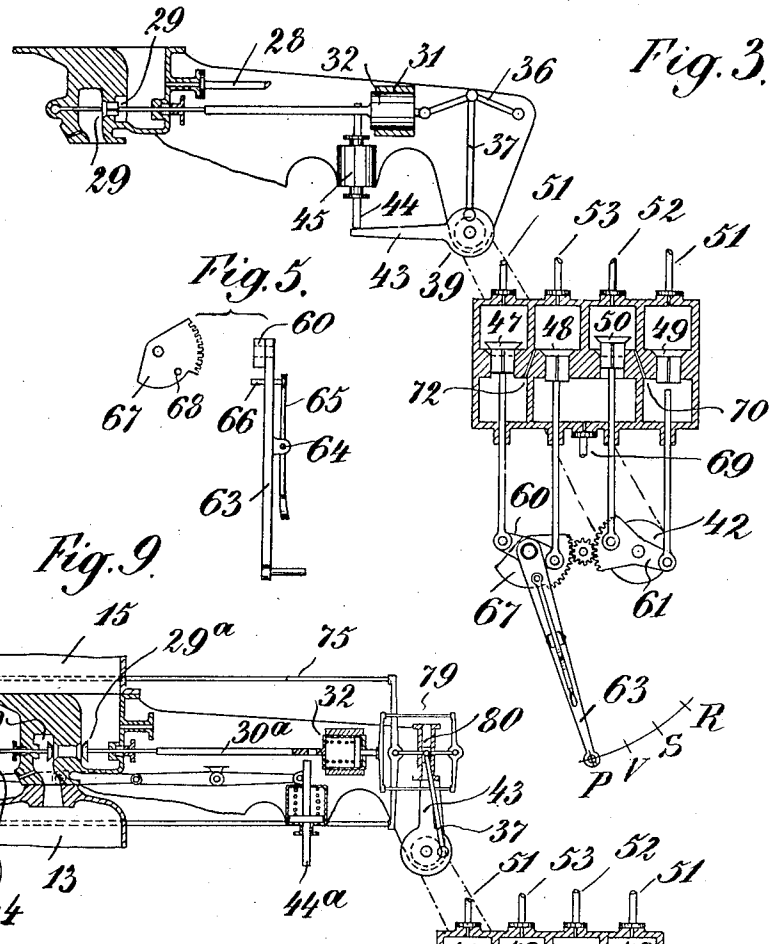
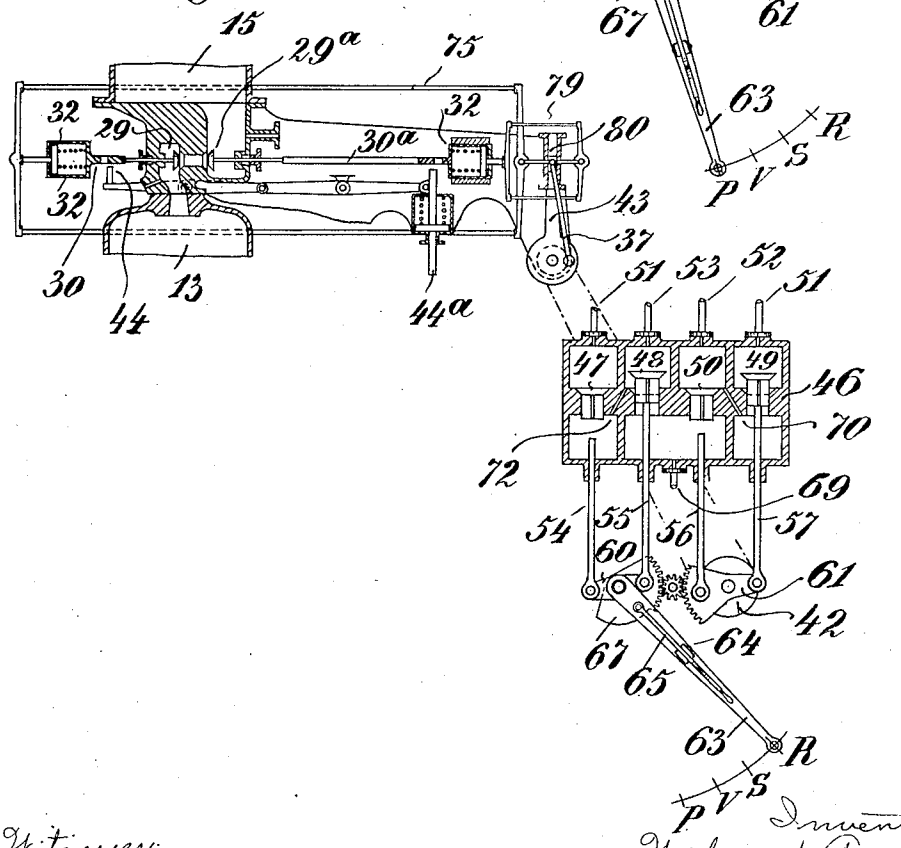


Fig. 5.

Fig. 9.



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Fig. 6.

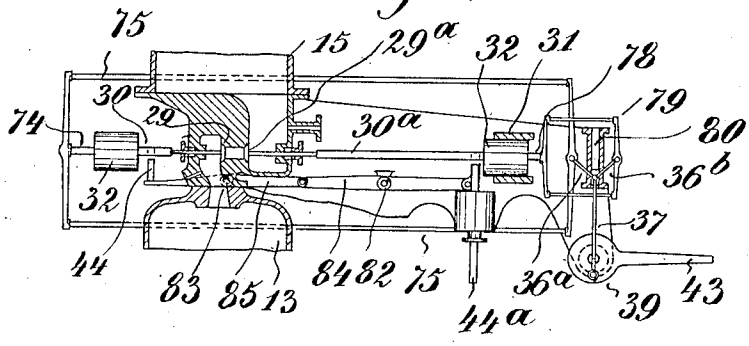


Fig. 7.

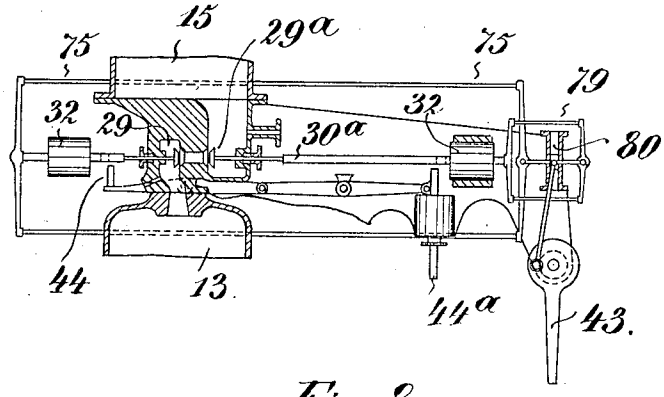
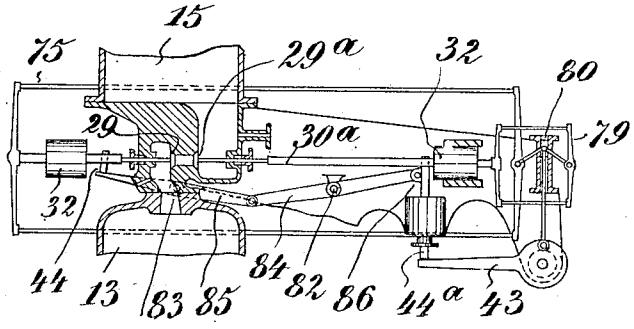


Fig. 8.



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UNITED STATES PATENT OFFICE.

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HYDRAULIC PRESS.

No. 882,045. Specification of Letters Patent. Patented March 17, 1908.

Application filed October 14, 1907. Serial No. 397,318.

To all whom it may concern:

Be it known that I, WILAND ASTFALCK, engineer, a subject of the German Emperor and resident of 21 Schloss strasse, Tegel, near Berlin, Germany, have invented certain new and useful Improvements in Hydraulic Presses, of which the following is a specification.

This invention relates to improvements in hydraulic presses.

In the case of the hydraulic press described in the specification of my United States Letters Patent No. 860958 and my application for patent Serial No. 368476, the water for filling the pressure cylinder or cylinders is taken directly from a separate filling or supply cylinder coupled with the hydraulic press-piston, and is subsequently conducted back to the pump. When the press-piston is lowered the water is sucked from the filling or supply cylinder by the said piston and is also forced out of the said cylinder by the pump piston, and during the ascent of the press piston the pump-piston sucks water out of the pressure-cylinder and the press-piston forces the water to the pump-cylinder. It is, however, obvious that when the stamp has been placed on the work and the press-cylinder is filled the pressing operation can only be started by introducing water under high pressure into the pressure cylinder; also that during the pressing operation the pump piston must take part in the movement of the press piston and expel an additional quantity of water from the filling or supply cylinder. This additional quantity cannot, however, enter the pressure-cylinder, owing to the high pressure in the latter, and in the case of my previous specifications cited this water is forced into a return conduit.

The present invention consists in applying the principle of my prior invention to steam-hydraulic presses, so that the water expelled from the filling or supply cylinder during the pressing operation is not uselessly discharged but is introduced into the pump connected to the so-called pressure-intensifier, so that there is a closed water-path between the latter and the press.

Another feature of the invention resides in the fact that all the valves are positively controlled from a central position, and certain valves can be so operated as to cause the press to make a series of short, rapid strokes, as required for some classes of work.

The invention is illustrated in the annexed drawing, in which

Figures 1 and 1ª show the steam-hydraulic press partly in elevation and partly in section. Figs. 2 to 4 show the controlling mechanism in various positions, in section, and Fig. 5 shows a detail of this mechanism. Figs. 6 to 9 illustrate a modification of part of the controlling mechanism.

In Figs. 1 and 1ª, 10 is the frame, 11 the stamp, 12 the press-piston, 13 the pressure cylinder connected by a duct 14 to the filling-pump cylinder 15, and 16 the piston of the filling pump, connected by rods 17 to the cross-head 18 of the press-piston.

19, 19 are withdrawing or return cylinders, the pistons 20 of which are connected to the cross-head 18.

21 is the steam cylinder of the pressure intensifier, 22 the piston therein, 23 a press-pump cylinder and 24 the steam operated piston movable therein and connected to the piston 22. The space 25 above the piston 24 is connected by a conduit 26 to the pressure cylinder 13, and the space 27 below it is connected by a conduit 28 to the filling or supply cylinder 15. When the pressure intensifier is operated after the pistons 12 and 16 have been lowered the presspump piston 24 forces the water under pressure in 25 into the pressure cylinder 13, and the space 27 is refilled with water expelled from the filling pump cylinder 15. When the steam piston recedes, *i. e.* descends in the construction illustrated, the space 25 is filled from the pressure cylinder 13 and the water expelled from the space 27 returns to the pump cylinder. When the press is at rest and the pump piston 24 is returning, the pump chamber 25 is filled from the space 27 by the conduits 26 and 28.

The arrangement of the control is as follows. In the conduit 14 between the cylinders 15 and 13 there is a valve 29, the rod 30 of which is provided with an expansion link guided in the frame part 31. This link consists of a cylinder 32 on said valve-rod 30, and a piston 34 acted on by a spring 33. The piston is connected to a link 36 pivoted at 35 to the frame. A rod 37 connects the link 36 to a crank disk 39 rotatable about a shaft 38, said crank disk being connected to a

chain-drum 42, for example by means of a chain drum and chain 40 41 respectively; other means of connection can, however, be used. The crank disk is provided with an arm 43 the purpose of which is to displace a spring-pressed pin 44 guided in the casing 45 to prevent displacement of the controlling lever 63 from V to P, so that there is no pressure in the cylinder 13 until the valve 29 is closed, otherwise said pin 44 cannot enter the hole 73 in the rod 30 and the lever 63 cannot move further. At the same time the effect is obtained of locking the valve-rod 30 to prevent accidental opening of the valve during the pressing operation.

The steam may be distributed in the known manner by means of slide valves, piston valves or the like. In the construction illustrated the valves are arranged in a casing 46. The valve 47 is in communication with the steam cylinder 21 of the pressure intensifier, to supply live steam thereto and the valve 48 is the exhaust-valve. The valve 49 supplies live steam to the withdrawing or return cylinders 19 and the valve 50 is the exhaust-valve. 51 is the steam pipe. The pipe 52 connects the cylinders 19 to the valve-case and the pipe 53 connects the latter to the cylinder 21. The pipe 69 leads the dead steam from the valve box 46. The opening of the valves 47 to 50 is effected by thrust rods 54, 55, 56 and 57 connected in pairs to double armed levers 60 61 pivoted at 58 and 59 respectively. The lever 61 is toothed and the lever 60 can be coupled with a toothed segment 67 pivoted at 58. The lever 63 is also pivoted at 58 but is fixed to the lever 60 and can be coupled to the toothed segment 67 by means of a pin 66 and lever 65 carried by the lever 63 and pivoted thereto at 64. For this purpose the pin 66 enters a hole 68 as shown in Fig. 5.

For clearness of illustration the valves 47 to 50 are shown side by side, but they may be arranged in pairs one behind the other, in which case the axes 58 and 59 would coincide.

The action of the press and controlling mechanism is as follows: When the controlling lever is in the position S shown in Fig. 1[a] the press is at rest, since steam from 51 can only pass through valve 49 duct 70 and pipe 52 to the withdrawing cylinder 19, in which it holds the piston 20 in the uppermost position. The pressure piston 12 and pump piston 16 are thus also held in their uppermost positions. For the pressing operation the controlling lever 63 is moved to position V, Fig. 2, so that the valve 49 is closed and valve 50 opened. The valve 47 remains closed and valve 48 open, but the crank disk 39 rotates through 90 degrees and the joint 36 is extended and the valve 29 opened. Steam from cylinder 19 flows through the open valve 50 and pipe 69, so that the piston 12, cross-head 18 stamp 11 piston 20 and piston 16 are moved downwards till the stamp abuts on the work 71 and thus meets resistance. The water expelled by the piston 16 passes through the duct 14 and valve 29 into the cylinder 13. The lever 63 is then moved into position P, Fig. 3. The rotation of the crank disk 39 flexes the joint 36 and closes the valve 29 and also moves the pin 44 upwards so that it enters the hole 73 and locks the valve-rod 30 before the lever 63 reaches position P and closes valve 48 and opens valve 47. While the valve 29 is open the lever 63 cannot, therefore, be moved into the position in which the steam piston 24 ascends, acts on water in the chamber 25, and forces said water into the cylinder 13 through pipe 26. It must be noted that after the valve 29 has been closed and locked, the crank 39 takes part in the further movement of the lever 63 and moves the knuckle of the joint 36 into its uppermost position. In order that this can be effected without movement of the valve 29 the expansion link 32 34 is provided. When the valves 47 and 48 have been moved into the positions shown in Fig. 3 live steam can flow through the duct 72 and pipe 53 to the space below the piston 22 and thrust the latter upwards, with the pump piston 24. Pressure is thus exerted on the water in the space 25 of the pump cylinder, and this water is forced through the pipe 26 into the pressure cylinder 13 and causes the piston 12 to perform the pressing operation. The water expelled from the cylinder 15 during this operation passes through the duct 28 into the cylinder space 27, that is to say there remains a continuous stream of water between the pump cylinders 15 and 23 and the pressure cylinder 13.

When the stamp is to be withdrawn the lever 63 is moved into position R, Fig.4, so that the valve-rod 30 is unlocked, and the valve 29 opened, the steam valves 47 and 50 being closed and 48 and 49 being opened. Steam flows from the cylinder 21 through pipe 53 valve 48 and pipe 69, and live steam flows through pipe 51, valve 49, duct 70 and pipe 52 into the cylinder 19 and thrusts the piston 20 upwards. The water expelled by the pistons 12 and 24 flows into cylinders 15 and 25.

When the controlling lever 63 is moved back to the position S the joint 36 is flexed downwards, the valve 29 closed, and the steam valves change their positions but not their functions.

For tapping or smoothing with the stamp the lever 63 is placed in the position shown in Fig. 1[a] and disconnected from the segment 67 by withdrawing the pin 66 from the hole 68. Then the lever 63 is moved to a position between V and P, so that the steam cylinder 21 alternately communicates with the live steam pipe and exhaust and consequently causes a rapid succession of strokes to be delivered,

which are transmitted by the water in the cylinder 23 to the piston 12. The water expelled by the piston 16 during this operation flows directly through the pipe 28 into the cylinder space 27, and back.

In order that the cylinder 19 need not be permanently under pressure while the press is at rest the valve 29 may be constructed as a double-valve, as shown for example in Figs. 6 to 9. The valve-rod 30 is in this case placed towards the left, but also provided with an expansion link consisting of a cylinder 32 with a spring and piston. The piston rod 74 of this expansion link is connected to a frame 75 passing round the cylinders 13 and 15 but guided in the pressframe, said frame 75 being connected to the link members or joint 36^a. The second valve 29^a is connected to the valve-rod 30^a, which also has an expansion link 32, guided in the frame part 31. The piston rod 78 of this expansion link is connected by the frame 79 to a second link part 36^b. The parts 36^a and 36^b are connected to the rod 37 as in the construction shown in Fig. 1, but the rod 37 is guided at 80, so that on rotation of the disk 39 and extension of the joint the frame 79 and valve 29^a are moved to the right, and the frame 75 and valve 29 to the left (Figs. 7 and 9) whereas vice-versa on the flexing of the joint downwardly or upwardly the two frames are moved in the opposite directions, *i. e.* towards each other, and the two valves are closed (Figs. 6 and 8). When the joint is in the upper position the valve rods 30 and 30^a are locked, the rod 30^a by the pin 44^a actuated by the arm 43, and the rod 30 by the pin 44, which may be connected to the pin 44^a by any suitable means.

In the example illustrated there are two double-armed levers 84 and 85 pivoted at 82 and 83 respectively and connected to each other, the lever 84 being also connected at 86 to the pin 44^a, and the lever 85 carrying the pin 44.

The other parts of the controlling mechanism may be exactly as shown in Figs. 1 to 5. For clearness of illustration the steam valve controlling gear is only shown in Fig. 9. Fig. 6 corresponds, as regards the positions of the parts, with Fig. 1, Fig. 7 with Fig. 2, Fig. 8 with Fig. 3 and Fig. 9 with Fig. 4. If, in this form of construction, the pressure acting in the cylinders 19 from below is cut off by cutting off the steam in the pipe 51, the steam in the said cylinders gradually becomes cool, but the piston 12 and parts 11, 18, 16, 17 and 20 cannot descend because the valve 29^a prevents the passage of water from the cylinder 15 to the pressure cylinder 13.

What I claim as my invention and desire to secure by United States Letters Patent is:

1. In a hydraulic press the combination of a pressure cylinder, a filling cylinder, pistons in said cylinders, means of communication between said cylinders, return cylinders, pistons therein co-acting with the piston in the pressure cylinder, a valve adapted to control communication between the pressure and filling cylinders, a pressure intensifier, a pressure pump coupled thereto, means of communication between said pressure pump and the filling and pressure cylinders, a fluid controlling device, means of communication between the latter and the pressure intensifier and return cylinders respectively and means operated from the controlling device for actuating the aforesaid valve.

2. In a hydraulic press the combination of a pressure cylinder, a filling cylinder, pistons in said cylinders, means of communication between said cylinders, return cylinders, pistons therein co-acting with the piston in the pressure cylinder, a valve adapted to control communication between the pressure and filling cylinders, a pressure intensifier, a double acting pressure pump coupled thereto, means of communication between said pressure pump and the filling and pressure cylinders, a fluid controlling device, means of communication between the latter and the pressure intensifier and return cylinders, and a flexible joint and transmission mechanism interposed between the aforesaid valve and the controlling device and operated from the latter.

3. In a hydraulic press the combination of a pressure cylinder, a filling cylinder in communication therewith, pistons in said cylinders, return cylinders, pistons therein co-acting with the piston in the pressure cylinder, a spring controlled valve adapted to intercept communication between said pressure and filling cylinders, a pressure intensifier, a double acting pressure pump coupled thereto, means of communication between said pressure pump and the filling and pressure cylinders, a fluid controlling device, means of communication between the latter and the pressure intensifier and return cylinders, a flexible joint and transmission mechanism interposed between the aforesaid valve and the controlling device and operated from the latter and an expansible connection between the flexible joint and said valve.

4. In a hydraulic press the combination of a pressure cylinder, a filling cylinder in communication therewith, pistons in said cylinders, return cylinders, pistons therein co-acting with the piston in the pressure cylinder, a spring controlled valve adapted to intercept communication between said pressure and filling cylinders, a pressure intensifier, a double acting pressure pump coupled thereto, means of communication between said pressure pump and the filling and pressure cylinders, a fluid controlling device, means of communication between the latter and the pressure intensi-

fier and return cylinders, a flexible joint and transmission mechanism interposed between the aforesaid valve and the controlling device and operated from the latter and an expansible connection between the flexible joint and said valve, and means operated by the aforesaid transmission mechanism for locking said valve in its closed position.

5. In a hydraulic press the combination of a pressure cylinder, a filling cylinder, pistons in said cylinders, means of communication between said cylinders, return cylinders, pistons therein co-acting with the piston in the pressure cylinder, a twin valve acting in opposite directions to control communication between the pressure and filling cylinders, a pressure intensifier, a pressure pump coupled thereto, means of communication between said pressure pump and the filling and pressure cylinders, a fluid controlling device, means of communication between the latter and the pressure intensifier and return cylinders, respectively, and means operated from the controlling device for simultaneously actuating the valves of the twin valve aforesaid.

6. In a hydraulic press the combination of a pressure cylinder, a filling cylinder in communication therewith, pistons in said cylinders, return cylinders, pistons therein co-acting with the piston in the pressure cylinders, a twin valve adapted to act in opposite directions to control communication between the pressure and filling cylinders, a pressure intensifier, a double acting pressure pump coupled thereto, means of communication between said pressure pump and the filling and pressure cylinders, a fluid controlling device, means of communication between the latter and the pressure intensifier and return cylinders and a flexible joint and transmission mechanism interposed between the aforesaid valve and the controlling device and operated by the latter.

7. In a hydraulic press the combination of a pressure cylinder, a filling cylinder in communication therewith, pistons in said cylinders, means of communication between said cylinders, return cylinders, pistons therein co-acting with the piston in the pressure cylinder, two interconnected valves adapted to act in opposite directions to control communication between the pressure and filling cylinders, a pressure intensifier, a double acting pressure pump coupled thereto, means of communication between said pressure pump and the filling and pressure cylinders, a steam controlling device, means of communication between the latter and the pressure intensifier and return cylinders, a flexible joint and transmission mechanism interposed between the aforesaid valves and the controlling device and operated by the latter and an expansible connection between said flexible joint and each of said valves.

8. In a hydraulic press the combination of a pressure cylinder, a filling cylinder in communication therewith, pistons in said cylinders, means of communication between said cylinders, return cylinders, pistons therein co-acting with the piston in the pressure cylinder, two interconnected valves adapted to act in opposite directions to control communication between the pressure and filling cylinders, a pressure intensifier, a double acting pressure pump coupled thereto, means of communication between said pressure pump and the filling and pressure cylinders, a steam controlling device, means of communication between the latter and the pressure intensifier and return cylinders, a flexible joint and transmission mechanism interposed between the aforesaid valves and the controlling device and operated by the latter, and an expansible connection between said flexible joint and each of said valves and means operated by the aforesaid transmission mechanism for locking both of said valves in closed position.

The foregoing specification signed at Berlin, Germany, this 16th day of September, 1907.

WILAND ASTFALCK.

In presence of two witnesses:

HENRY HASPER,

WOLDEMAR HAUPT