No. 710,039. Patented Sept. 30, 1902.

W. D. BUTT.

HYDROSTATIC PRESS.

(Application filed Aug. 30, 1901.)

(No Model.) 2 Sheets—Sheet 1.

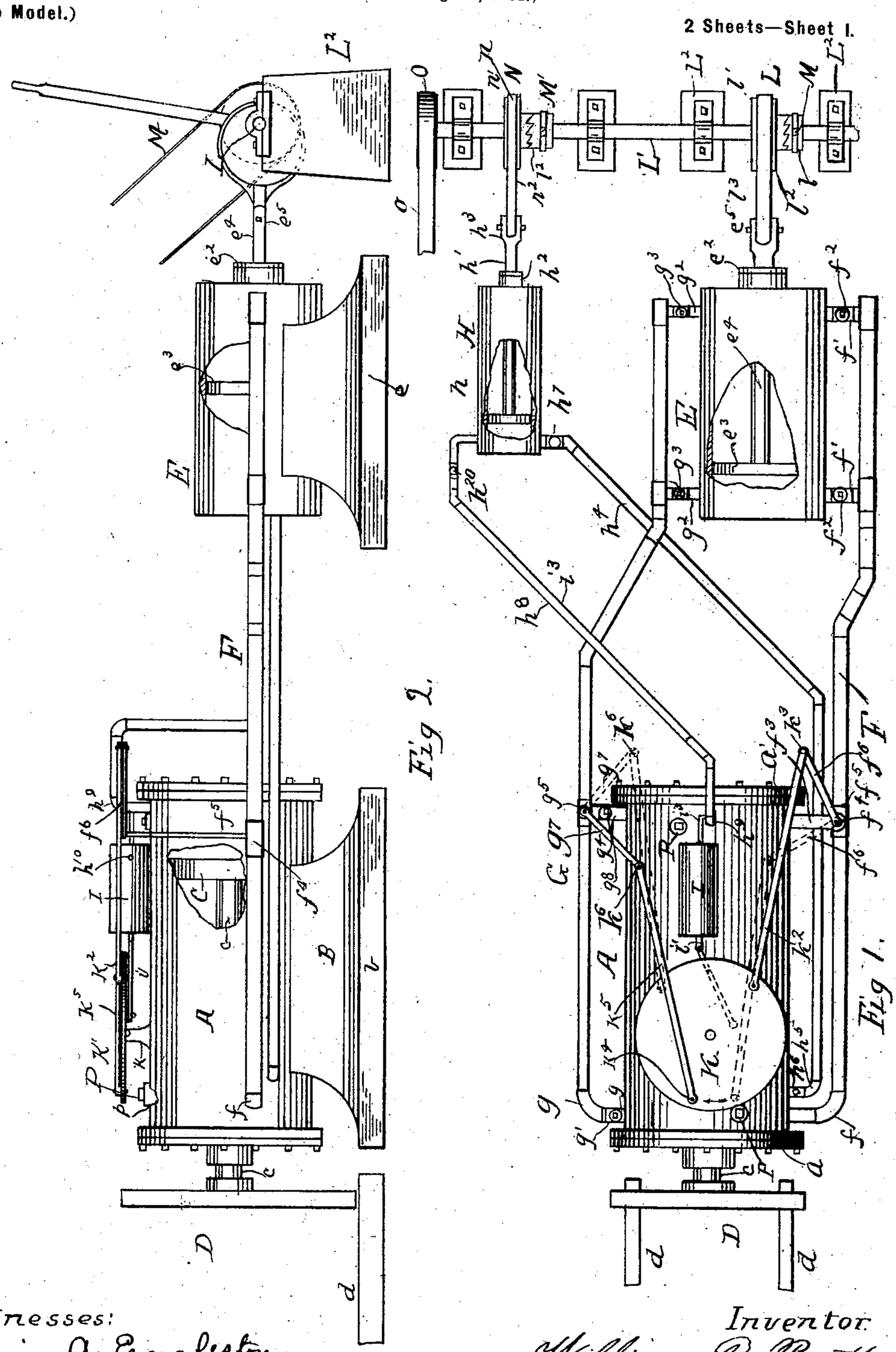

Fig 2.

Fig 1.

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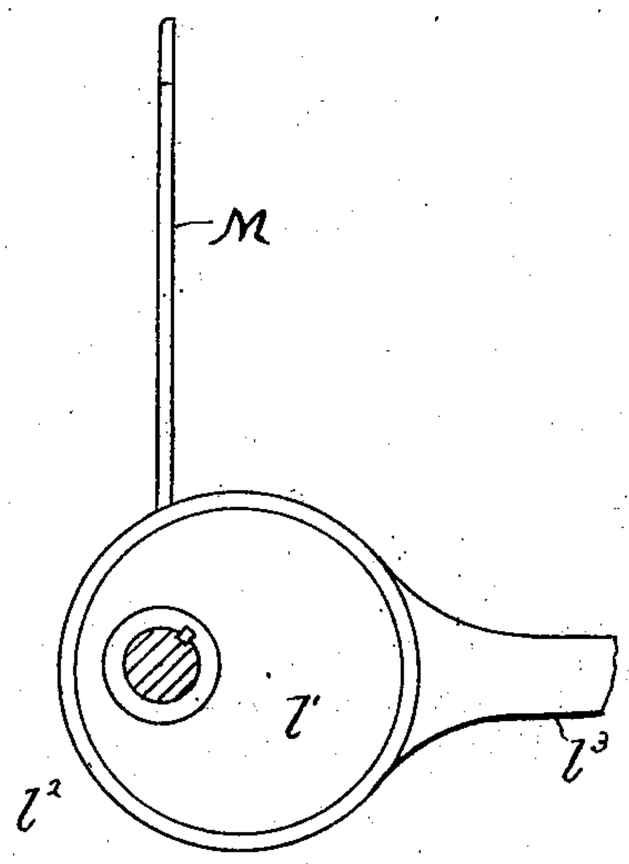


Fig 6.

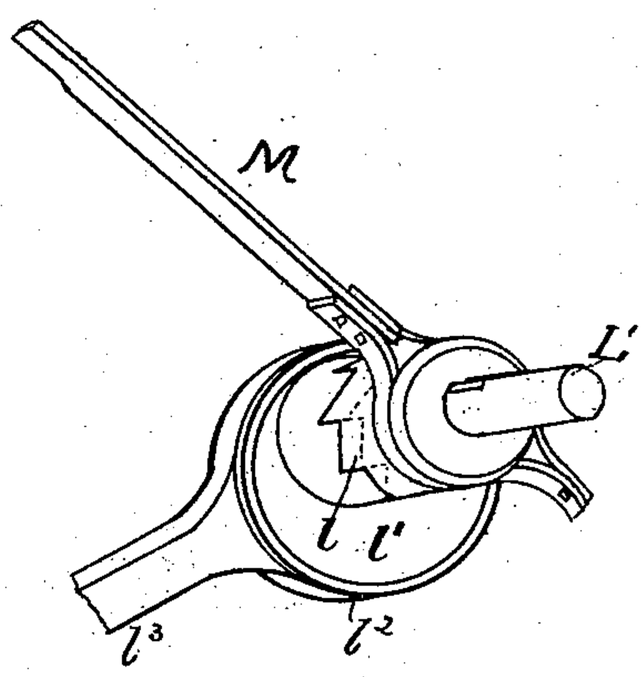


Fig 5.

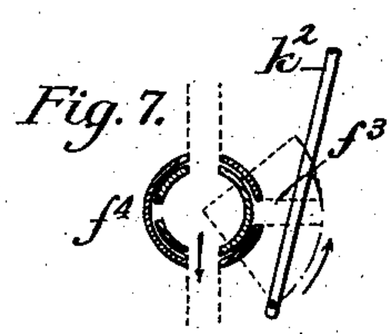


Fig. 7.

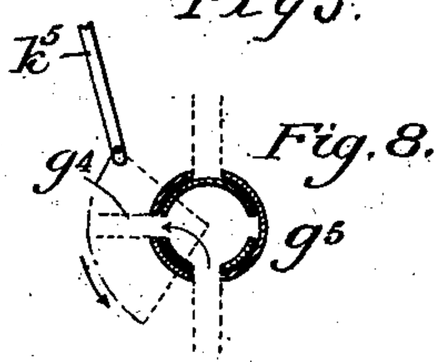
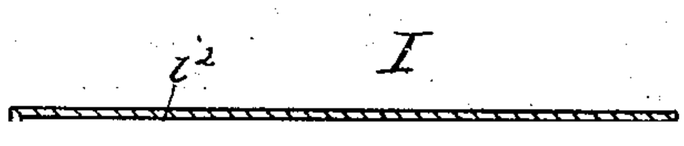
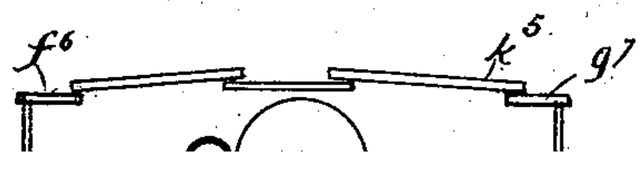


Fig. 8.





UNITED STATES PATENT OFFICE.

WILLIAM D. BUTT, OF KANSAS CITY, MISSOURI.

HYDROSTATIC PRESS.

SPECIFICATION forming part of Letters Patent No. 710,039, dated September 30, 1902.

Application filed August 30, 1901. Serial No. 73,820. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM D. BUTT, a citizen of the United States of America, residing at Kansas City, in the county of Jackson and State of Missouri, have invented certain new and useful Improvements in Hydrostatic Presses; and I do hereby declare that the following is a full, clear, and exact description of the invention, such as will enable others to make and use the same, reference being had to the accompanying drawings, forming a part of this specification.

The object of my invention primarily is in the coaction of high-pressure fluids within a hydrostatic press to obtain quicker compression and the reuse of the fluids without waste; second, the release of the pressure automatically, and, third, the reciprocal action of the low pressure of the fluids upon the piston.

The invention consists in the novel construction and combination of parts, such as will be first fully described, and specifically pointed out in the claims.

In the drawings, Figure 1 is a plan view of the novel invention, a portion of the pump-cylinder being broken away to show the piston and its rod. Fig. 2 is a side view of the invention as seen in Fig. 1. Fig. 3 is an end view of the press-cylinder, taken from the rear end and showing the valve-releasing cylinder and the fluid-conducting pipes in section. Fig. 4 is a sectional view of the valve-releasing cylinder. Fig. 5 is a detail view in perspective of a portion of the power-shaft, showing one of the combined clutch-wheels and eccentrics, and the movable parts of the clutch keyed on the shaft and the operating-lever. Fig. 6 is a view of the opposite side of the clutch-wheel to that seen in Fig. 5. Figs. 7 and 8 are detail horizontal sectional views of the three-way valves, showing the position of the ports.

Similar letters of reference indicate corresponding parts in all the figures of the drawings.

Referring to the drawings, A represents the double-acting hydrostatic press-cylinder supported by a base B, of which cylinder a and a' are the heads at the respective forward and rear ends thereof.

C is the piston, and c the piston-rod, which extends through the head a of the cylinder, and upon its outer end a short distance from the outer surface of head a is a head or compression block D of an ordinary material compressing or baling press, which block moves forward and backward upon the guides d d, arranged in position in a parallel line with the lower portion b of the base B.

E represents a double-acting low-pressure-fluid pump, which is supported by a base e and arranged in position a short distance in rear of the rear end of cylinder A. Upon the rear end of cylinder E is an ordinary stuffing-box e^2. Within the cylinder E is a piston e^3, with which is connected one end of a piston-rod e^4, which rod extends through the stuffing-box e^2 and a short distance beyond the outer end of the stuffing-box and is forked at e^5.

With the eduction-opening located in the side of the cylinder A and near its forward end is connected the forward end of a suction-pipe F, upon which is an elbow f, the rear end of which pipe extends parallel with the side of cylinder A and past the rear end of said cylinder and along the side of the cylinder E corresponding to that of cylinder A, with which it is connected, and to a position near the line of the rear end of cylinder E and is closed at said rear end. Extending from the inner side and rear end of the suction-pipe F are branch pipes f' f', which are connected with the induction-openings in said cylinder E near its forward and rear ends. In said branch pipes f' f' are check-valves f^2. With the inner side of the suction-pipe F, opposite the cylinder A, is connected one end of branch pipe f^3, the other end of which pipe is connected with the eduction-opening in said cylinder A near the rear end of said cylinder and a short distance forward of the head a'. In the suction-pipe F at the point of connection of the branch pipe f^3 with said pipe is a three-way valve f^4, of ordinary construction, with which valve is connected one end of a valve-operating stem or rod f^5, the other end of which rod extends in an upward direction a short distance above the plane of the top of cylinder A and upon which end is a crank f^6, which is automatically actuated, as hereinafter described.

Upon the other side of cylinder A to that

having the suction-pipe F is an induction or fluid-supply pipe G. Upon the forward end of pipe G is an elbow g, which is connected with the side of cylinder A near the forward end of said cylinder at a point directly opposite the forward connecting end of pipe F. In the elbow g is a check-valve g'. The rear end of pipe G extends parallel with the cylinder A and along the side of the pump-cylinder E opposite to that having pipe F and to a position near the line of the rear end of said pump-cylinder and is closed at said rear end. With the inner side of the rear end of pipe G is connected one end of the branch pipes g^2 g^2, the other ends of which pipes are connected with the eduction-openings in the sides of cylinder E near the respective forward and rear ends of the said cylinder. In each branch pipe g^2 g^2 is a check-valve g^3. With the inner side of the pipe G opposite the cylinder A is connected one end of a branch pipe g^4, the other end of which pipe is connected with the induction-opening located near the rear end of said cylinder and a short distance forward of the rear head a'. In the pipe G at the point of connection of the said branch pipe g^4 is a three-way valve g^5, the valve stem or rod g of which extends upwardly to a height corresponding to the valve stem or rod f^5, and upon said end is a crank g^7. In the branch pipe g^4 is a check-valve g^8.

H represents the high-pressure single-acting pump adjacent to the side of the pump E, having the pipe G, the cylinder of which is small in size and comparatively less than one-third the size of the cylinder of the pump E. In the pump H is a piston h and a piston-rod h', which extends through the rear end of the cylinder and a short distance from the outer end of the stuffing-box h^2 on said end and is forked at h^3. With the induction-opening in the side and forward end of the pump H is connected one end of a suction-pipe h^4, the other end of which pipe extends beneath the pipe G, thence in the direction of pipe F, and along the side of cylinder A beneath the said pipe F, and upon said end is an elbow h^5, which is connected with the side of the cylinder A at a point a short distance in rear of a vertical line extending through the elbow f of pipe F. In the elbow h^5 is a check-valve h^6. In the end of pipe h^4, near the pump H, is a check-valve h^7. With the eduction-opening to pump H upon the other side of pump H, which is directly opposite the induction-opening, is connected one end of a pipe h^8, which is smaller in size than the pipe h^4, the other end of which pipe h^8 extends above the pipe G in the direction of the rear end of the cylinder A and is extended upwardly to a position a short distance above the line of the top of said cylinder, and upon said end is an elbow h^9, which connects with the said cylinder a short distance forward of its rear end. In the pipe h^8, adjacent to the cylinder H, is a check-valve h^{20}.

Upon the top of cylinder A in the direction of its rear end is rigidly connected a short valve-releasing cylinder I, which extends in the longitudinal direction of said cylinder A. Within said cylinder I is a piston i. Through the forward end of the cylinder I extends a piston-rod i', which is connected rigidly with the piston i. Within the forward end of the cylinder I is a spiral spring i^2, the tension of which in compression will require an equal fluid-pressure to operate the piston to that exerted within the cylinder A. With the rear end of the cylinder I is connected one end of a pipe i^3, the other end of which pipe i^3 is connected with the elbow h^9 of the pipe h^8, extending within the top of the cylinder A. In the side and rear end of the cylinder I is a leak-opening h^{10}. Upon the top of the cylinder A in the direction of the forward end of said cylinder is a fixed support k, which extends a short distance in height, and upon its upper end is pivotally connected a circular plate or horizontal disk K. With the upper surface and one side of disk K, near its circumference, is pivotally connected one end of a rod k^2, the other end of which rod is pivotally connected at k^3 with the outer end of the crank-arm f^6 of the valve-stem f^5, which arm is extended in a direction in rear of a vertical line extending through the branch pipe f^3 and which at the same time opens the pipe F for the passage of the fluid. With the other side and upper surface of disk K is pivoted at k^4 one end of a rod k^5, which is slightly longer than rod k^2, the other end of which rod k^5 is pivotally connected at k^6 to the outer end of the crank-arm g^7 on the valve stem or rod g^6, which crank-arm is extended forward of a vertical line extending through the branch pipe g^4 when the three-way valve with which it is connected is in a normally opened position to the branch pipe g^4 and which valve at the same time closes the passage of fluids to the forward end of pipe G. With the under surface of the disk K and the portion of said disk in rear of its pivotal point of connection with the support K and eccentrically to the pivotal points of the forward ends of the rods k^2 k^5 is connected pivotally the outer end of the piston-rod i' of the valve-operating cylinder I.

In rear of the pumps E and H is a line-shaft L', which is supported in a transverse direction to the said pumps and journaled upon the upper ends of the series of standards L^2 L^2, arranged in position near the ends of shaft L' and also intermediate said ends.

Upon shaft L', opposite the rear end of pump E, is a combined eccentric plate and clutch L of the ordinary well-known description, the movable part l of which is keyed on shaft L' and is operated by the lever M. Over the eccentric-plate l' extends the ring l^2, with which ring is connected the eccentric-rod l^3, which is pivotally connected with the forked end e^5 of the piston-rod e^4 of pump E.

Upon shaft L' in rear of the high-pressure

pump H is a combined eccentric plate and clutch N, which is the same as the eccentric plate and clutch L, the movable part of the clutch being operated by a lever similar to to the lever M. With the eccentric-ring n on the eccentric-plate n' is an eccentric-rod n^2, which is pivotally connected with the forked end h^3 of the piston-rod h' of the pump H.

Upon the end of shaft L' is a pulley O, over which extends one end of belt o, the other end of which belt extends over the belt-pulley upon the engine (not shown) and the two ends of the belt connected together in the usual manner.

In the top of the cylinder A, near each end of said cylinder, are separate openings p p for the fluid, which are closed by the screw-plugs P P.

In the operation of the invention the plugs P P in cylinder A are removed and the fluid supplied to the cylinder in any convenient manner on opposite sides of the piston C. Power being applied to shaft L' from the engine the lever M on shaft L' is then operated to throw the part l into engagement with the eccentric plate l' and the piston e^3 caused to move slowly and draw the fluid through the suction-pipe F into pump E during the time the supply of fluid is being maintained to the cylinder A. When the cylinders A and E are each filled with the fluid to nearly two-thirds their capacity, the plugs P P are replaced in the openings p p in the cylinder A. The lever M is then operated to disengage the clutch l from the eccentric plate l', and the action of pump E is arrested. The lever M' being operated to throw the clutch into engagement with the eccentric plate n' motion is imparted through the piston-rod n^2 to the piston h in the high-pressure pump H, which action draws a sufficient quantity of the fluid through the suction-pipe h^4 from the forward end of cylinder A, to be utilized at the proper time. The lever M' is then operated to disengage the clutch, and the operation of the high-pressure pump ceases and remains normally inactive until the proper time for imparting the power of its fluid agent to the cylinder A. The material to be compressed or the resistance to be overcome being placed against the compression-plate D, the lever M is operated to set in motion the piston e^3 of the pump E, and the fluid is drawn from the forward end of cylinder A, through the suction-pipe F, into the pump-cylinder E, through the branch pipes f' f' on opposite sides of the piston at each stroke, the three-way valve f^4, as before stated, cutting off the passage of the fluid from the rear end of cylinder A through the branch pipe f^3 and the check-valves f^2 f^2 from its back pressure or return to the pipe F from cylinder E. The fluid in cylinder E is displaced by the piston e^3 and forced through the branch eduction-pipes g^2 g^2 to the supply-pipe G, thence to the rear end of the cylinder A through the branch pipe g^4 at each stroke of the piston, the three-way valve g^5, as before stated, cutting off the passage in its normal position to the forward end of the pipe G, the check-valve g^8 preventing too great a back pressure in the branch pipe g^4, and piston C in cylinder A is forced to about two-thirds the distance toward the forward end of the cylinder, and the compression-plate D moved forward to compress initially the material. At this juncture the lever M is operated to disconnect the clutch and stop the action of the pump E and the lever M' operated to set in motion the piston h of pump H, the fluid in which is forced through the small pipe h^8, imparting high pressure to the fluid in the cylinder A and increasing the hydrostatic pressure upon piston C to complete the full action of the compression-plate D. At the end of the forward stroke of the piston h in pump H, at the highest degree of fluid-pressure, sufficient to overcome the resistance of the spring i^2 in the cylinder I, the pressure of the fluid in said cylinder causes the piston i to move forward and the piston-rod i' to partially rotate the disk K, which action pushes upon rod k^5 and crank g^7 on the valve-stem g^6 and closing the branch pipe g^4 and opening the pipe G for the passage of the fluids to the forward end of cylinder A, and at the same time the rod k^2 draws upon the crank f^6 of the valve-stem f^5 and closing the suction-pipe F forward of the valve and opening the passage for the fluid through the branch pipe f^3 to the pump E, the return of piston i in cylinder I being retarded sufficiently to allow pump E to exhaust cylinder A in rear of piston C and simultaneously fill the front end of said cylinder. Before the lever M' is operated to stop the action of pump H the lever M is operated to set in motion the pump E, and during the action of the spring i^2 in the cylinder I to force the piston i toward the rear end of the piston, which occurs as fast as the leakage is permitted through the small opening h^{10}, the pump H draws its quantity of fluid from the forward end of the cylinder as the supply is forced through the pipe G from the pump E to force the piston C to the rear end of cylinder A, thereby utilizing its supply from the fluid-supply from the pump E without waste and during the reuse by suction and supply of the fluid by the pump E in cylinder A without waste.

The apparatus in its capability of developing great power of compression is an efficient factor in compressing hay or cotton or in lifting loads, in which case the compression-cylinder may be arranged in a vertical position. Other well-known forms of power than an engine may be employed to operate the main-line shaft, and well-known means employed to intermittently check the action of the pumps.

Such other modifications may be employed as are within the scope of the invention.

Having fully described my invention, what I now claim as new, and desire to secure by Letters Patent, is—

1. In a hydrostatic press, press-cylinder and its piston, said cylinder having separate induction and eduction openings upon opposite sides and at each end and normally closed openings for the supply of fluid to the cylinder, a double-acting suction and forcing pump having eduction and induction openings upon the respective opposite sides and at the forward and rear ends, separate suction and supply conductors for the fluid on opposite sides of said press-cylinder and the said double-acting suction and forcing pump and closed at one end, branch pipes connected with said fluid suction and supply conductors and also with the respective eduction and induction openings to said pump, and branch pipes connected with the suction and supply conductors, and also with the respective induction and eduction openings to said press-cylinder, means for operating said pump, and three-way valves in the supply and suction pipes at the junction of the branch pipes communicating with the rear end of the press-cylinder, and means for operating said valves automatically.

2. In a hydrostatic press, press-cylinder and its piston, said cylinder having separate eduction and induction openings upon opposite sides and at its forward and rear ends and normally closed openings for the supply of the fluid to the cylinder, a double-acting suction and forcing pump having separate eduction and induction openings upon opposite sides and at its forward and rear ends, means for operating said pump, separate suction and supply conductors on opposite sides of the press-cylinder, and said pump closed at one end, branch pipes connected with the respective eduction and induction openings to said press-cylinder and the forward ends of the respective suction and supply conductors, and branch pipes connected with said rear ends of said suction and supply conductors and the respective eduction and induction openings to said pump, three-way valves in the suction and supply conductors, at the junction of the branch pipes leading to the rear end of the press-cylinder, and valve-stems to said valves, means for operating said valve-stems and said three-way valves simultaneously, and a high-pressure pump and its conductor connected with the press-cylinder.

3. In a hydrostatic press, the combination with a press-cylinder having duplex eduction and induction openings upon opposite sides, and with the piston of a piston rod or plunger, a compressing-plate, a double-acting low-pressure suction and forcing pump having duplex eduction and induction openings upon opposite sides, and separate suction and supply pipes on each side of the said press-cylinder extending upon both sides of said pump and connected with the respective duplex induction and eduction openings to said press-cylinder and said pump, means for supplying said press-cylinder and said pump with fluid, and a high-pressure pump having induction and eduction openings, and pipes connected therewith, one of which is connected with the eduction-opening to said pump and provided with a check-valve adjacent thereto, and also connected with the rear end of the press-cylinder, and the other pipe being connected with the induction-opening to said force-pump and also connected with the front end of said press-cylinder, a check-valve in said pipe, means for operating said low-pressure and high-pressure pumps alternately, and three-way valves in the suction and supply pipes to the press-cylinder.

4. In a hydrostatic press the combination with a press-cylinder having duplex induction and eduction openings at the forward and rear ends, a piston and a piston-rod, branch pipes connected with said duplex induction and eduction openings, and suction and supply pipes on opposite sides of the cylinder connected with the branch pipes, three-way valves in the suction and supply pipes at the junction of the branch pipes leading to the rear end of the press-cylinder, crank-rods connected with said three-way valves, means for forcing the fluid in the supply and drawing of the fluid from the press-cylinder, a pivoted disk on the press-cylinder, rods pivotally connected therewith, and also with the crank-rods operating said three-way valves, a fluid-operated cylinder on the press-cylinder, a piston and a piston-rod eccentrically connected with said disk, a spring acting to force the piston in one direction and a fluid-pipe connected with the other end, and means for forcing the fluid through said pipe.

5. The combination in a hydrostatic press with the press-cylinder having duplex induction and eduction openings at the forward and rear ends of a piston a piston-rod and a compressing-plate, a double-acting suction and forcing pump having duplex induction and eduction openings, separate suction and supply pipes upon each side of said press-cylinder and extending upon each side of said pump, branch pipes connected with the said suction and supply pipes and with the duplex eduction and induction openings to said press-cylinder and said pump, check-valves in the branch pipes leading to said pump and three-way valves in the suction and supply pipes at the junction of the branch pipes leading to the rear end of the press-cylinder, and crank-rods operating said valves, a valve-releasing cylinder on the press-cylinder having a leak-opening, a piston and a piston-rod, a spring within said cylinder actuating said piston in one direction, and a high-pressure-fluid-forcing pump and a conductor of the fluid connected with said pump and also with said valve-releasing cylinder upon the opposite side of the piston having said spring, and a

check-valve in said conductor, a separate pipe leading from the induction-opening to said pump to the forward end of the press-cylinder, a disk on the press-cylinder and rods pivotally connected therewith and also pivotally connected with the crank-rods operating the three-way valves, and means substantially as described for operating said double-acting and said high-pressure pumps alternately.

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