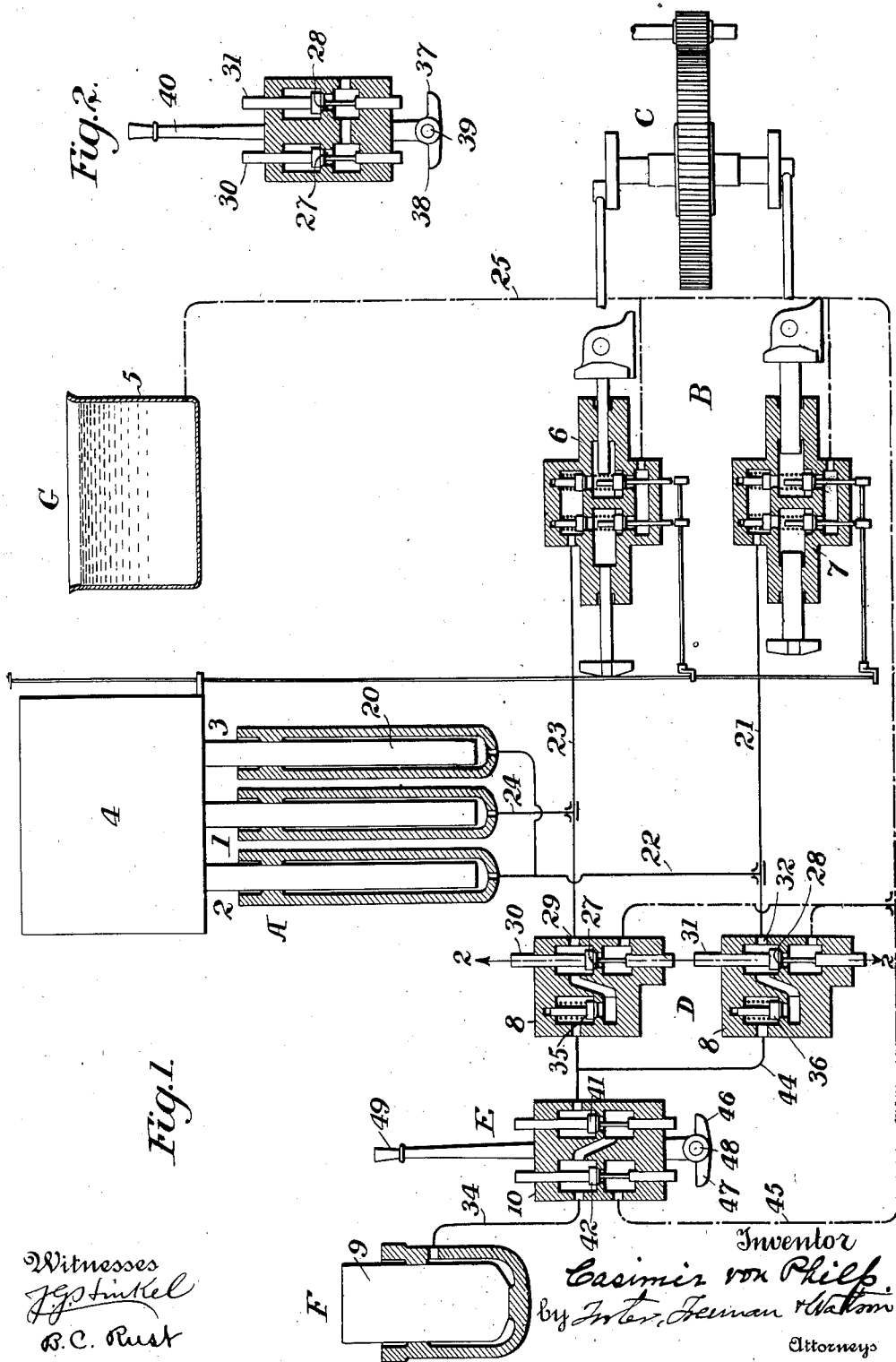


C. VON PHILP.
MULTIPLE PRESSURE SYSTEM.

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Witnesses
J. F. Ferman
B.C. Rust

Inventor
Casimir von Philp.
by *J. F. Ferman & Watson*
Attorneys

UNITED STATES PATENT OFFICE.

CASIMIR VON PHILP, OF BETHLEHEM, PENNSYLVANIA, ASSIGNOR TO BETHLEHEM STEEL COMPANY, OF SOUTH BETHLEHEM, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

MULTIPLE-PRESSURE SYSTEM.

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To all whom it may concern:

Be it known that I, CASIMIR VON PHILP, a citizen of the United States, residing at Bethlehem, in the county of Northampton and State of Pennsylvania, have invented certain new and useful Improvements in Multiple-Pressure Systems, of which the following is a specification.

My invention relates to an accumulator system, and consists in an accumulator having a plurality of cylinders and connected plungers, with means for supplying pressure to one or others of the cylinders and means whereby the pressure may be removed from one or others of said cylinders so as to secure a variable pressure in the press or other device operated from the accumulator, and control means to direct the flow of the fluid to and from the accumulator-cylinders and to the press, as fully set forth hereinafter, and as illustrated in the accompanying drawings, in which—

Figure 1 is a sectional diagrammatic view illustrating the main parts of my improved system and showing two different sections through the change-valve device. Fig. 2 is a section on the line 2 2, Fig. 1.

The main features of this system comprise an accumulator A, means for supplying the latter with fluid, as illustrated, by a pressure device B, shown as having two independent pumps, and operated from any suitable motor C, a change-valve device D, and an apparatus to receive the fluid under different pressures, which apparatus F may be of any suitable character, but which I have designated as a press, a cylinder 9 of which receives the motor fluid under different pressures. With these there is connected any suitable source of fluid-supply G, which, as shown, is an elevated tank 5, but which is not necessarily elevated except where it is desired to restore the discharge-water from the cylinders.

The accumulator is provided with a series of independent cylinders 1, 2, and 3, adapted to receive separate plungers 20, and, as shown, these are all connected to a common cross-head 4, which may be so constructed as to receive or constitute the weight of the accumulator. The different cylinders of the accumulator communicate either separately with the pressure device or there may be sep-

arate communications between one or more of the cylinders and the pressure device, and the discharge from the different accumulator-cylinders is so controlled as to be opened to a suitable exhaust or discharge port, as required, so that such discharge will be opened from each cylinder that does not at that time receive its supply from the pressure device. There are independent conduits or communications between the different cylinders and the press-cylinder, and by properly operating the control device of the conduits—as, for instance, the change-valve device—one or more of the accumulator-cylinders may be opened to the discharge, while the other or others communicate with the press-cylinder under the full energy of the weight 4, or the communication may be changed so that others of the accumulator-cylinders are open to the discharge and the remaining cylinders put in communication with the press-cylinder, and if these latter constitute a plurality of accumulator-cylinders there is a reduced pressure from that secured when the entire weight 4 is upon the contents of a single accumulator-cylinder. There is thus secured a multiple of pressures in the press-cylinder which may be controlled by a single device, pressure may be changed from one degree to another, the communication between the accumulator and the press-cylinder is direct and permits of rapid action, and a comparatively small volume of water may be employed.

The various parts of the apparatus may be of different constructions. The pressure device B is illustrated diagrammatically and has two pumps 6 7, each having two cylinders to which plungers extend from opposite directions, the cross-heads of said plungers connected together and with the engine, and with an inlet and outlet valve for each section of each pump. Each pump therefore is a duplex pump of such known construction that it need not further be described in detail. The two pumps differ, however, in size, the cylinders and plungers of the pump 7 being of double the area of those of the pump 6, inasmuch as the pump 7 is connected by its discharge-pipe 21 and a pipe 22 with different branches to two of the cylinders of the accumulator, while the pump 6 communicates through its discharge-pipe 23 and a branch

24 with but one of the accumulator-cylinders. Each pump communicates with the supply-pipe 25, leading from the tank 5.

The change-valve device, as shown, is a casing 8 containing two valves 30 31, which control ports 27 28. These ports 27 28 communicate with a chamber below the same, the latter through a port at one side (see Fig. 1) communicating with the pipe 25, leading to the tank 5, and a port 29 communicating with the chamber of the valve 30 communicates with the discharge-pipe 23 of the pump 6, while a port 32 communicates with the chamber of the valve 31 and with the discharge-pipe 21 of the pump 7. The chambers of both valves 30 31 are in communication through suitable conduits with the press-cylinder. As shown, there is a line of pipe 34 44, which extends from the press-cylinder to the change-valve, the control-valve E being included in this line of pipe, and in this conduit, and preferably within the casing of the change-valve, are check-valves 35 36, preventing any back pressure from the press-cylinder to the valves 30 31. Preferably the two valves of the change-valve device are combined with means whereby either may be opened without disturbing the position of the other. As shown, the stem of each valve extends through the casing 8 to a position above the arms 37 38 of a rock-shaft 39, provided with a hand-lever 40, the movement of which in one direction will lift one valve and in the other direction will lift the other.

The control-valve device E is provided with a casing 10, having ports to which are adapted two valves 41 42, the chamber of the valve 41 communicating with the conduit 44, leading from the change-valve device D, and the chamber of the valve 42 communicating with the conduit 34, leading to the press-cylinder. The port closed by the valve 41 communicates with the chamber of the valve 42, while the port below the latter communicates with a conduit 45, leading to the pipe 25, that extends to the water-tank 5. Either valve 41 or 42 may be raised and lowered independently of the other by the arms 46 47 of a rock-shaft 48, provided with an operating-handle 49. When the valve 41 is raised, the change-valve device is put in communication with the press, the valve 42 closing under the pressure. When the valve 42 is raised, the press can discharge to the conduit 25 through the conduit 34, the casing 10, and the conduit 45.

With the apparatus constructed as above described the cylinders 2 3 may be connected to discharge to the water-supply, when the plunger of the cylinder 1 will carry the entire load securing the maximum specific pressure. When the exhaust from the cylinder 1 is opened, the weight will be upon the plungers of the cylinders 2 and 3, and the press will thus receive the intermediate pressure.

If the exhaust of each of the cylinders 1 2 3 is closed, the weight 4 is upon the plungers of all these cylinders, and the minimum pressure, therefore, can be supplied to the press. It will be seen that the change from one pressure to the other may be effected by the simple adjustment of the change-valve device D.

While it is practicable to supply the accumulator with water from any source, a tank is used when the discharge-water must be restored, and in such case the tank is placed at such a height that the cylinders connected with it are always filled with water. In the operation of the pumps, if none of the accumulator-cylinders are connected with the discharge or exhaust, both of the pumps will pump water at minimum pressure into the corresponding cylinders. If part of the accumulator-cylinders are connected with the exhaust, the water supplied to the corresponding pump-cylinder will be pumped back and forth without the consumption of energy except from loss by friction, while the other pump will pump water to the required pressure. The proportions of the parts are so designed as to areas and pressures that the pump will always require the same amount of energy for operating it.

In operating the press when low pressure is required the operator closes both valves 30 31 of the change-valve device, when the weight 4 will be equally distributed over all the three cylinders 1, 2, and 3, and both pumps will work effectively. When there is an intermediate pressure, the valve 30 being lifted, thus connecting the cylinder 1 with the tank 5 and the cylinders 2 and 3 carrying the pressure of the weight 4, the pump will draw water from the pipe 25 and pump it through the port of the valve 30 back through the pipe 25 to its own inlet-port, the water being thus circulated through the pump, and the pump 7 draws the water from the pipe 25 and pumps it to the cylinders 2 and 3 and through the chamber of the valve 31, lifting the check-valve 36 and through the control device E to the press-cylinder, the check-valve 35 preventing any back flow toward the valve 30. With the maximum pressure, the valve 31 of the change-valve device being raised and connecting the cylinders 2 and 3 with the tank 5 and the entire pressure of the weight 4 being then exerted, the pump 6 will draw water from the pipe 25 and pump it to the cylinder 1 and through the passage above the valve 30, lifting the check-valve 35 and through the control-valve device to the press-cylinder, while the pump 7 pumps the water to the space above the valve 31 through the port 28 and to the pipe 25, from which it passes again to the pump 7 and is circulated.

It will be evident that while I have illustrated three accumulator-cylinders and plun-

gers, the number may be increased, and while I have referred to a single press-cylinder, it will be evident that the devices described may be used in connection with the series of apparatus F to be operated, there being a control-valve E between the change-valve D and each press-cylinder.

Without limiting myself to the construction and arrangement shown, I claim—

1. The combination of an accumulator having a plurality of cylinders and plungers, a source of water-supply communicating with each cylinder, a press-cylinder, means for forcing the motor fluid into the accumulator-cylinders, and means for putting the different accumulator-cylinders into communication with the forcing means and with the press-cylinder to secure different pressures in the latter, substantially as set forth.

2. The combination of an accumulator having a plurality of cylinders and plungers, a source of water-supply communicating with each cylinder, a press-cylinder, a plurality of means for forcing the motor fluid into the accumulator-cylinders, and means for putting the different accumulator-cylinders into communication with the forcing means and with the press-cylinder to secure different pressures in the latter, substantially as set forth.

3. The combination of an accumulator having a plurality of cylinders and plungers, a source of water-supply communicating with each cylinder, a press-cylinder, a plurality of independent pumps, constituting means for forcing the motor fluid into the accumulator-cylinders, and means for putting the different accumulator-cylinders into communication with the forcing means and with the press-cylinder to secure different pressures in the latter, substantially as set forth.

4. The combination of an accumulator having a plurality of cylinders and plungers, a source of water-supply, independent pumps for forcing water into the different cylinders and a press-cylinder, separate communications between the latter and different cylinders of the accumulator, and means for controlling said communications and for controlling the discharge from the different accumulator-cylinders, substantially as set forth.

5. The combination of an accumulator having a plurality of cylinders and plungers, a source of water-supply, independent pumps for forcing water into the different cylinders and independent means for permitting its discharge from different cylinders, a press-cylinder, and a valve device with valves and ports arranged to connect the press-cylinder with one or more of the accumulator-cylinders and to connect the others of said accumulator-cylinders with the discharge-port, substantially as set forth.

6. The combination with an accumulator

having a plurality of cylinders, of independent pumps connected one to one of the cylinders and the other to others of the cylinders, a press-cylinder communicating independently with different accumulator-cylinders, means for opening and closing the communications, and means for opening and closing the discharge from each accumulator-cylinder, substantially as set forth.

7. The combination with an accumulator having a plurality of cylinders, of independent pumps, a press-cylinder, a valve device, a conduit connected in circuit with one of the accumulator-cylinders, the valve device and one of the pumps, a second conduit connected in circuit with a plurality of accumulator-cylinders, with the valve device and with the other pump, and a conduit between the valve device and the press-cylinder all arranged to permit one or more of the accumulator-cylinders to be put into communication with the press-cylinder or with the pipe supplying one of the pumps, substantially as set forth.

8. The combination with a press-cylinder, of a supply-pipe, an accumulator having a plurality of cylinders, and means whereby water may be forced into one or more of said cylinders and whereby one or more may be put into communication with the press-cylinder and others connected with an exhaust-port, substantially as set forth.

9. The combination with a press-cylinder, of a supply-pipe, an accumulator having a plurality of cylinders, and independent pumps whereby water may be forced into one or more of said cylinders and whereby one or more may be put into communication with the press-cylinder and others connected with the pipe supplying one or other of the pumps, substantially as set forth.

10. The combination with a press-cylinder, of an accumulator having a plurality of independent cylinders and plungers therefor, and means whereby to put the press-cylinder in communication with a single accumulator-cylinder or with a plurality of such cylinders and for discharging the water from the accumulator-cylinders with which the press-cylinder is not in communication, substantially as set forth.

11. The combination with a press-cylinder, of an accumulator having a plurality of independent cylinders and plungers therefor, and means whereby to simultaneously put the press-cylinder in communication with a single accumulator-cylinder or with a plurality of such cylinders and for discharging the water from the accumulator-cylinders with which the press-cylinder is not in communication, substantially as set forth.

12. The combination with a press-cylinder, of an accumulator having a plurality of independent cylinders and plungers therefor, and a valve device having a plurality of

valves and ports whereby to put the press-cylinder in communication with a single accumulator-cylinder or with a plurality of such cylinders and for discharging the water from the accumulator-cylinders with which the press-cylinder is not in communication, substantially as set forth.

13. The combination with a press-cylinder, of an accumulator having a plurality of independent cylinders and plungers therefor, and a valve device having a plurality of valves and ports whereby to put the press-cylinder into communication with one or more of the accumulator-cylinders, and simultaneously open the exhaust from the accumulator cylinder or cylinders not in communication with the press-cylinder.

14. The combination with a press-cylinder, of an accumulator having a plurality of independent cylinders and plungers therefor connected to a common cross-head, and means whereby to put the press-cylinder in communication with a single accumulator-cylinder or with a plurality of such cylinders and for discharging the water from the accumulator-cylinders with which the press-cylinder is not in communication, substantially as set forth.

15. The combination in a multiple-pressure system, of an accumulator having a plurality of cylinders and plungers, a tank, independent pumps for supplying different cylinders, a press-cylinder, conduits between the said parts, and a valve device

communicating with the conduits and having ports and valves arranged to connect a single accumulator-cylinder or a plurality of such cylinders with the press-cylinder and to open the line of communication between the accumulator-cylinders not so connected, with the source of water-supply to the pumps.

16. The combination in a multiple-pressure system, of an accumulator having a plurality of independent cylinders and plungers, a press-cylinder, a change-valve device and conduits whereby to connect the press-cylinder with a single accumulator-cylinder or with a plurality of such cylinders, and a control-valve device between the change-valve device and the press-cylinder, substantially as set forth.

17. The combination in a multiple-pressure system, of an accumulator having a plurality of independent cylinders and plungers, connected to a common cross-head, a press-cylinder, a change-valve device and conduits whereby to connect the press-cylinder with a single accumulator-cylinder or with a plurality of such cylinders, and a control-valve device between the change-valve device and the press-cylinder, substantially as set forth.

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

CASIMIR VON PHILP.

Witnesses:

W. A. CUTLER,
HARRY WILBUR.