A. W. FRENCH.

HYDRAULIC ACCUMULATOR.

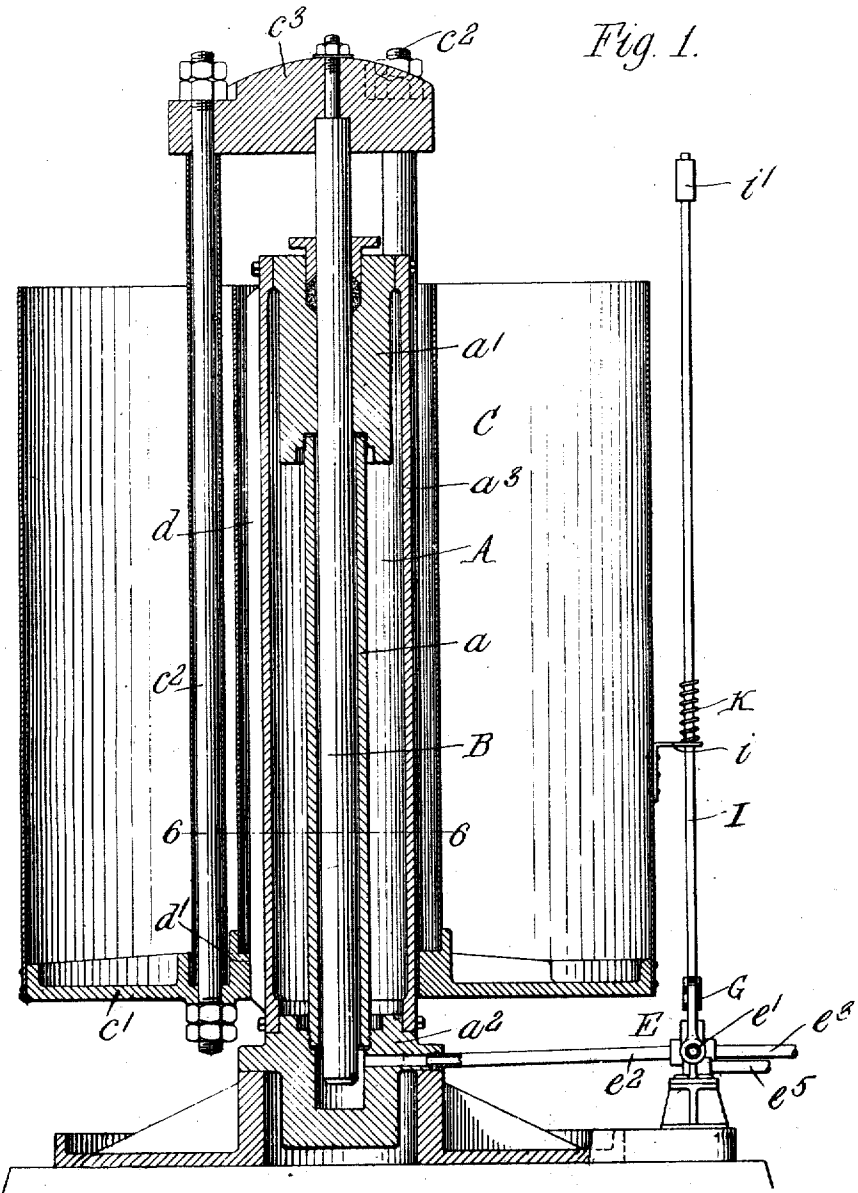
APPLICATION FILED APR. 23, 1908.

941,867.

Patented Nov. 30, 1909.

2 SHEETS—SHEET 1.

Fig. 1.



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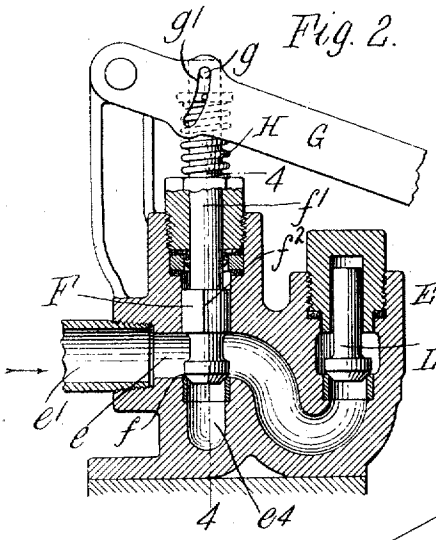
2 SHEETS—SHEET 2.

Fig. 2.



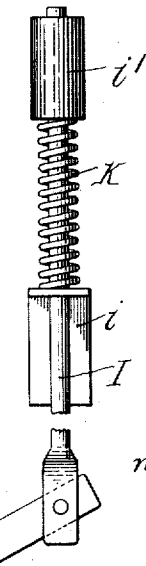


Fig. 4.

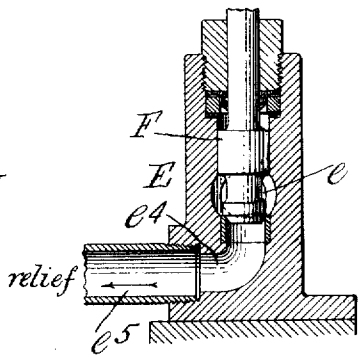


Fig. 3.

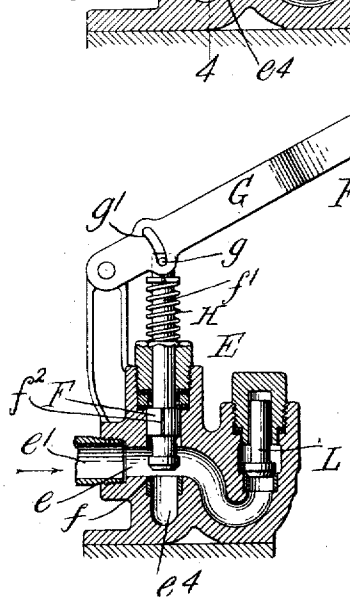


Fig. 5.

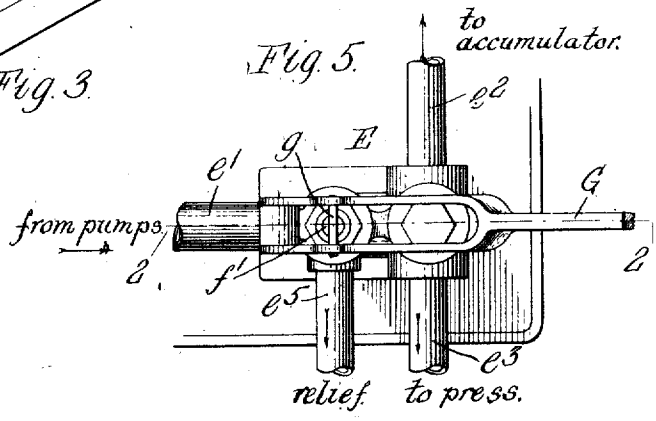
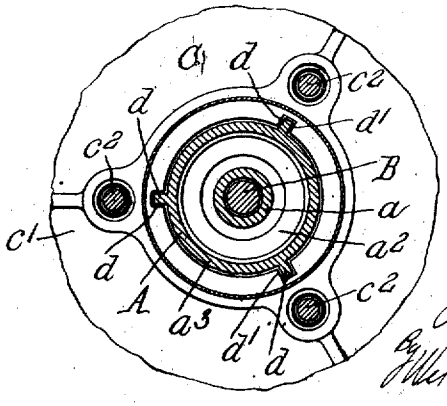


Fig. 6.



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UNITED STATES PATENT OFFICE.

ALFRED W. FRENCH, OF PIQUA, OHIO.

HYDRAULIC ACCUMULATOR.

941,867. Specification of Letters Patent. Patented Nov. 30, 1909.

Application filed April 23, 1908. Serial No. 428,858.

To all whom it may concern:

Be it known that I, ALFRED W. FRENCH, a citizen of the United States, residing at Piqua, in the county of Miami and State of Ohio, have invented a new and useful Improvement in Hydraulic Accumulators, of which the following is a specification.

This invention relates to automatic hydraulic accumulators of the sort that are employed in connection with presses and other hydraulic machines for storing the operating liquid (usually oil) under pressure to supplement the pumps or other source of supply in furinishing oil to the presses when required. These accumulators are provided with relief valves which allow the oil to pass from the pumps or other source of supply to the accumulator and presses until a predetermined desired quantity of oil is stored in the accumulator, when the relief valve is automatically operated to open a by-pass which allows the oil to pass back to the pumps or storage tank, or to circulate freely, so as to relieve the pumps from work.

The principal object of the invention is to produce a relief valve mechanism for this purpose of very simple and inexpensive construction, which requires little or no adjustment and will not readily get out of order, and which operates to quickly open and close the relief valve to the full extent and, when once opened to relieve the pumps, to hold it wide open during a considerable travel of the movable piston or part of the accumulator, so that the valve will not fluctuate and cause repeated sudden changes of load on the pumps, which results in pounding and wearing the valve and racking and straining the pumps.

Another object of the invention is to improve the construction of the accumulator cylinder as hereinafter described and set forth in the claims.

In the accompanying drawings, consisting of two sheets: Figure 1 is a sectional elevation of an automatic hydraulic accumulator embodying the invention. Fig. 2 is a sectional elevation, on an enlarged scale, in line 2—2, Fig. 5, of the relief valve. Fig. 3 is a similar view, on a smaller scale, showing the valve open and also showing the operative connections between the valve and the accumulator. Fig. 4 is a transverse sectional elevation of the relief valve in line 4—4, Fig. 2. Fig. 5 is a plan view of the relief valve. Fig. 6 is a fragmentary sectional plan of the accumulator, in line 6—6, Fig. 1.

Like letters of reference refer to like parts in the several figures.

The accumulator, as usual, consists of an upright pressure cylinder A to the lower end of which the oil is admitted under pressure from the pumps or other source of supply; a piston or plunger B arranged to move vertically in the cylinder; and a weight tank or receptacle C which is hung from the upper end of the piston and contains weights for loading the plunger to produce the necessary pressure in the accumulator.

The pressure cylinder A can be of any suitable construction but is preferably constructed as shown in Fig. 1, consisting of an inner steel tube or cylinder a having screw-threaded connections at its ends with upper and lower heads a' a^2, and an outer cast iron tube a^3, the opposite ends of which surround and are securely bolted to the upper and lower heads a' a^2. The weight tank consists of inner and outer cylindrical sheet metal walls suitably secured to the inner and outer rims of an annular bottom c' which surrounds the pressure cylinder and is suspended by rods or bolts c^2 from a cross head c^3 at the upper end of the piston B. The outer tube a^3 of the pressure cylinder is cast with external longitudinal guide ribs d, Figs. 1 and 6, which enter guide notches d' in the bottom of the weight tank and act to guide the tank and prevent it from turning and tilting.

The described construction of the pressure cylinder is very desirable for high pressure accumulators. The cylinder is much lighter than a single-piece cast iron cylinder of the requisite strength, and the inner steel tube which carries the pressure reaching four thousand pounds or more per square inch, is much more reliable than the heavier cast iron cylinder which is apt to be spongy.

E represents the casing of the relief valve. Oil from the pumps, or other source of supply, enters a main passage e of the valve casing by a pipe e' and passes therefrom by a pipe e^2 to the accumulator and by a pipe e^3 to the presses or other machines where the oil is used.

e^4 is a by-pass passage connecting the main passage e with a pipe e^5 leading back to the storage tank or to the pumps.

F represents the relief valve, and f a seat therefor at the juncture of the main and by-

pass passages e e^4 of the casing. The valve has an enlarged guide portion in one side of which is located a groove f^2 for permitting the oil to pass above this enlarged portion in order that the pressure will tend to keep the valve on its seat. When this valve is seated it closes the by-pass and the oil will pass to the accumulator and presses, if the latter are taking oil, while by unseating the valve the by-pass e^4 is opened, which allows the oil to circulate back to the pumps or storage tank through the by-pass and relieve the load on the pumps. A reciprocating plunger valve is shown having a stem f' projecting from the valve casing and connected to an operating lever G by a pin g entering a slot g' in the lever. This pin and slot, or loose connection, between the valve and lever allows the lever, which is connected to the movable piston or part of the accumulator, to move in either direction with said piston or part, a distance depending upon the length of the slot, before actuating the valve and to then quickly and completely open or close the valve. A spring H surrounding the stem of the relief valve between a collar or part thereon and the valve casing assists in opening the valve and holding it open. The relief valve could be of other construction and have a different sort of loose connection with its operating lever, but the construction shown is preferred.

I represents a vertical operating rod connected to the free end of the relief valve lever and extending up through a perforated guide lug or bracket i on the movable weight tank of the accumulator and provided at its upper end with a head or enlargement i'. A coil spring K loosely surrounds this rod, resting upon the lug or bracket i and is adapted to ascend and descend with the weight tank.

L represents a check valve of any suitable kind arranged in the main passage e between the relief valve and the connections e^2 e^3 to the accumulator and presses to hold the pressure therein when the relief valve is open.

The operation of the device is as follows: When the relief valve F is seated or closed as shown in Fig. 2, the oil from the pumps will flow to the accumulator cylinder A by the pipe e^2 and raise the piston B and weight tank C, and if the presses or other machines are in operation the oil will also pass to these by the pipe e^3. When the spring K, which rises with the tank, engages the head of the operating rod I it will lift the same and the relief valve lever G, the slotted connection between the lever and valve permitting the lever to move independently of the valve until the lower end of its slot engages the pin on the valve stem. The spring K is compressed by the weight of the valve lever and rod I and the resistance to the opening of the valve until it exerts sufficient power to overcome these opposing forces, when the spring will suddenly expand and open the relief valve F to its full extent. The spring H surrounding the stem of the relief valve assists in quickly opening the valve. The oil can then circulate freely back to the pumps or storage tank through the open by-pass passage e^4. The weight tank C will descend as oil is drawn from the accumulator, thus allowing the relief valve lever G and rod I to descend by reason of their weight. The relief valve will, however, be held up, or open, by the pressure of the oil thereon assisted by the spring H until the upper end of the slot in the lever engages the pin on the valve stem, when the weight of the lever and rod will quickly close or seat the valve. Thus the slotted or loose connection between the relief valve and its operating lever permit the valve to remain closed during the ascent of the accumulator piston and to be then suddenly opened when the pressure cylinder has been filled to the desired height, and to remain open until a considerable quantity of oil has been drawn from the pressure cylinder and the piston allowed to descend some distance, so that the valve does not respond to short movements of the accumulator piston caused by slight fluctuations in volume of the oil in the cylinder. The valve, therefore, will not be opened and closed at short intervals, which would cause it to pound and wear and produce rapid changes of load on the pumps, resulting in severe strains thereon. This distance which the relief valve lever is permitted to move with the accumulator piston independently of the valve is dependent upon the length of the slot in the lever and this can be made of the proper length to give the desired results. The parts of the relief valve mechanism are few in number and simple in construction, and there are no parts requiring adjustment and liable to get out of order.

I claim as my invention:

1. The combination of an accumulator having a part moved by the liquid pressure, a supply passage connecting the accumulator with a source of supply, a by-pass passage connecting with said supply passage between the source of supply and the accumulator, a relief valve for opening and closing said by-pass passage, and an operating device for said valve which has a lost motion connection with said relief valve which allows a limited movement of the operating device independently of the valve in both the valve opening and valve closing movements of the operating device, and connections between the movable part of the accumulator and said valve operating device which allows a predetermined movement of the movable part of the accumulator

before it actuates said valve operating device, substantially as set forth.

2. The combination of an accumulator having a part moved by liquid pressure, a supply passage connecting the accumulator with a source of supply, a by-pass passage connecting the said supply passage between the source of supply and the accumulator, a relief valve for opening and closing said by-pass passage, an operating device for said valve which has a lost motion connection with said relief valve which allows a limited movement of the operating device independently of the valve, and connections between the movable part of the accumulator and said valve operating device which allows a predetermined movement of the movable part of the accumulator before it actuates said valve operating device, and a check valve between the accumulator and said by-pass passage for preventing the escape of liquid from the accumulator through said by-pass passage, substantially as set forth.

3. The combination of an accumulator having a part moved by the liquid pressure, a supply passage for said accumulator, a by-pass passage connecting with said supply passage, a relief valve for opening and closing said by-pass passage, an operating lever for said valve which is actuated by the movable part of said accumulator and has a loose connection with said relief valve which allows a predetermined movement of the lever independently of the valve, and a spring which acts on said valve independently of said lever in a direction to open said by-pass passage, substantially as set forth.

4. The combination of an accumulator having a part moved by the liquid pressure, a supply passage for said accumulator, a by-pass passage connecting with said supply passage, a reciprocating relief valve for opening and closing said by-pass passage, an operating lever for said valve which is actuated by the movable part of said accumulator and has a slotted connection with said relief valve which allows a predetermined movement of the lever independently of the valve, and a spring which acts on said relief valve independently of said lever in a direction to open said by-pass, substantially as set forth.

5. The combination of an accumulator having a part moved by the liquid pressure, a relief valve casing having a supply passage for the accumulator and a by-pass passage connecting therewith, a reciprocating valve controlling said by-pass passage having a stem projecting out of said casing, a spring acting on said valve stem in a direction to move said valve to open said by-pass passage, and an operating lever for said valve which is actuated by the movable part of the accumulator and has a slotted connection with said valve stem which allows a predetermined movement of the lever independently of the valve, substantially as set forth.

6. In an accumulator, the combination of an inner steel cylinder tube, heads screwed on the opposite ends of said tube, an outer cast iron tube having its opposite ends fitting and secured to portions of said heads, said outer tube having integral external guide ribs extending longitudinally thereof, a piston working in said cylinder, and a weight tank surrounding said cylinder and having notches in which said guide ribs engage, substantially as set forth.

Witness my hand, this 13th day of April, 1908.

ALFRED W. FRENCH.

Witnesses:
CHAS. C. WATERMAN,
E. R. HARRIS.