

Aug. 26, 1947.

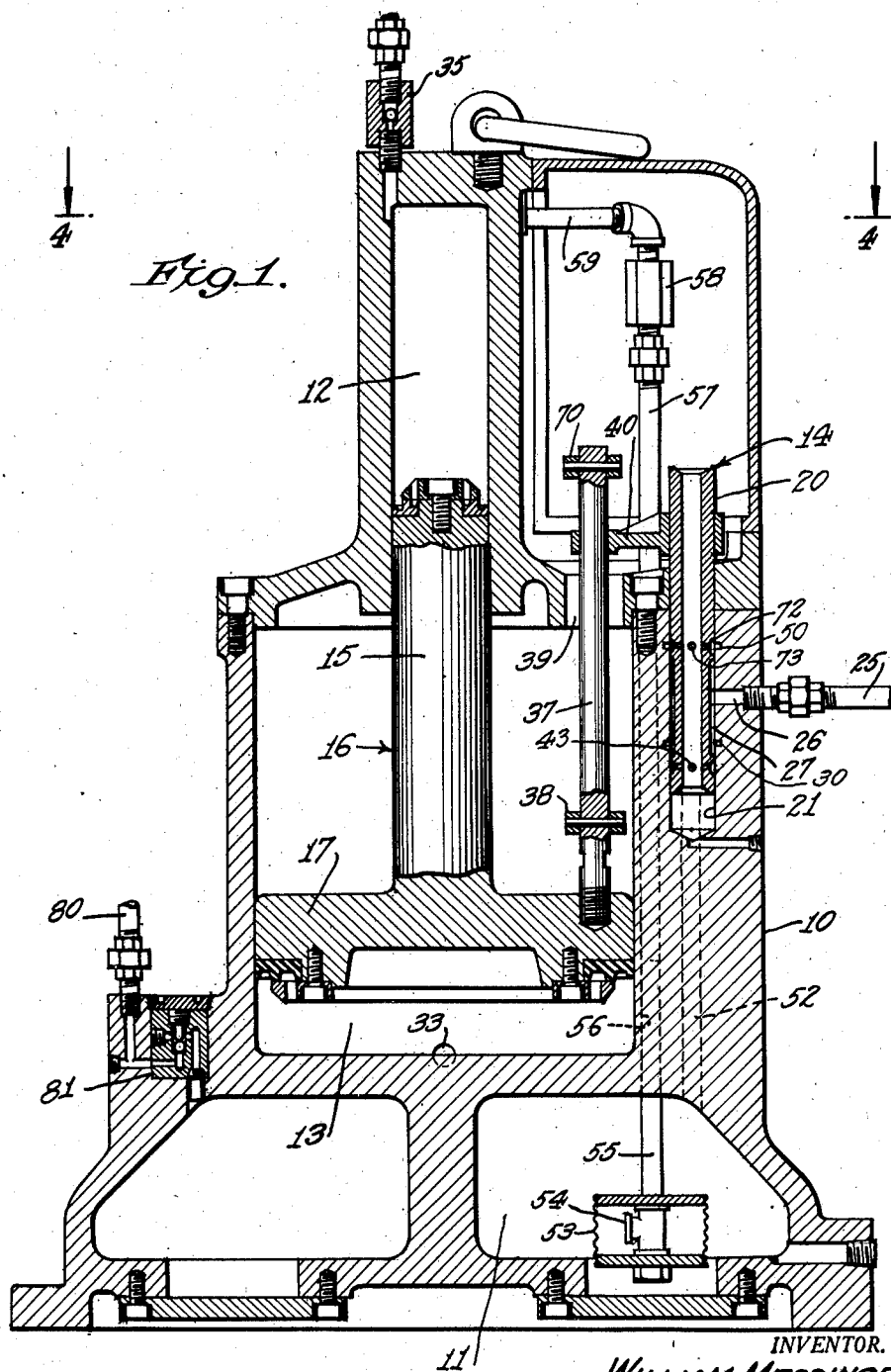
W. MESSINGER

2,426,320

HYDRO-PNEUMATIC ACCUMULATOR

Filed Aug. 10, 1945

5 Sheets-Sheet 1



INVENTOR.

WILLIAM MESSINGER

BY

Joseph H. Lipschutz

ATTORNEY

Aug. 26, 1947.

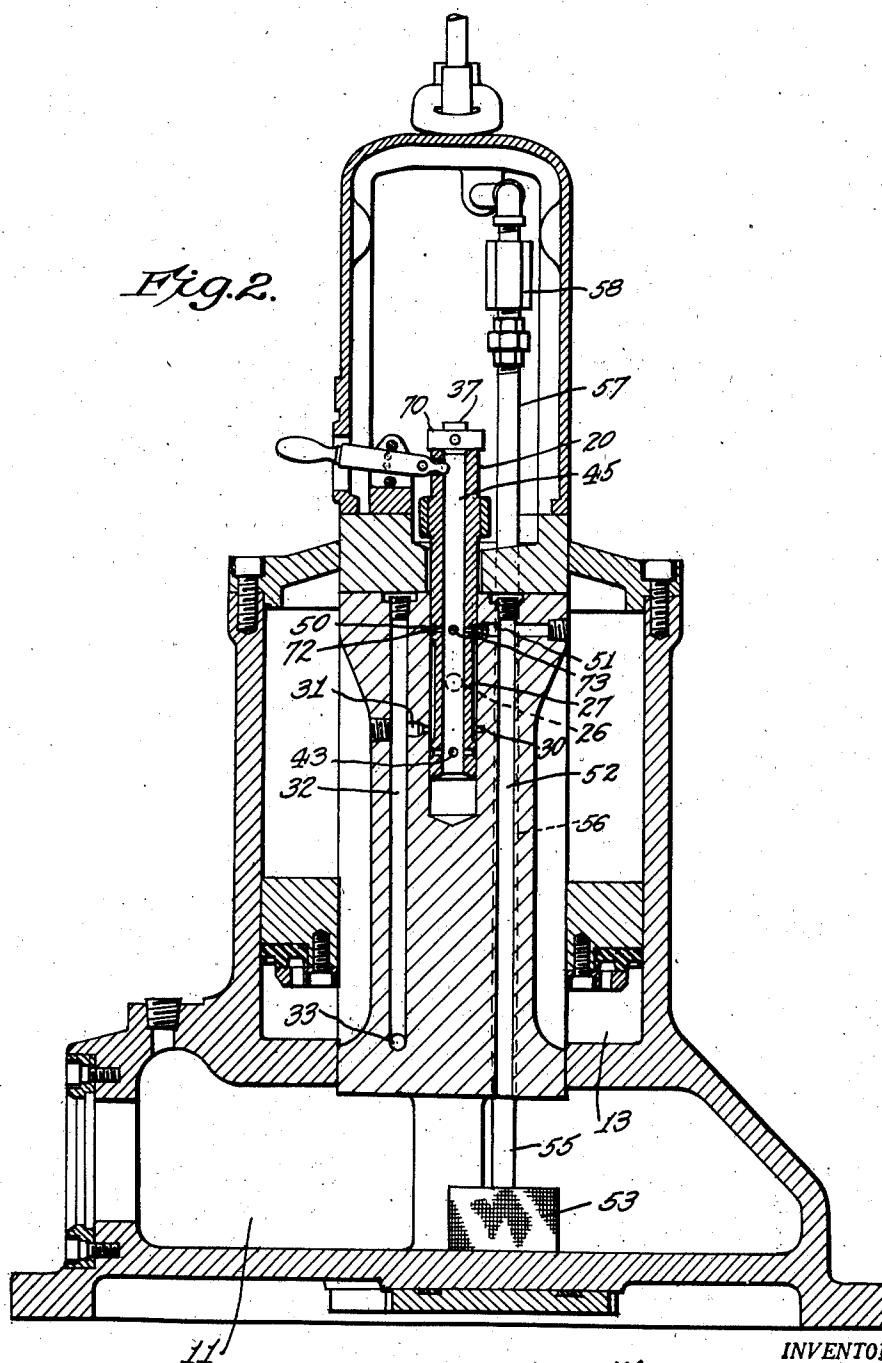
W. MESSINGER

2,426,320

HYDRO-PNEUMATIC ACCUMULATOR

Filed Aug. 10, 1945

5 Sheets-Sheet 2



INVENTOR

WILLIAM MESSINGER

BY

Joseph H. Lipschutz

ATTORNEY

Aug. 26, 1947.

W. MESSINGER

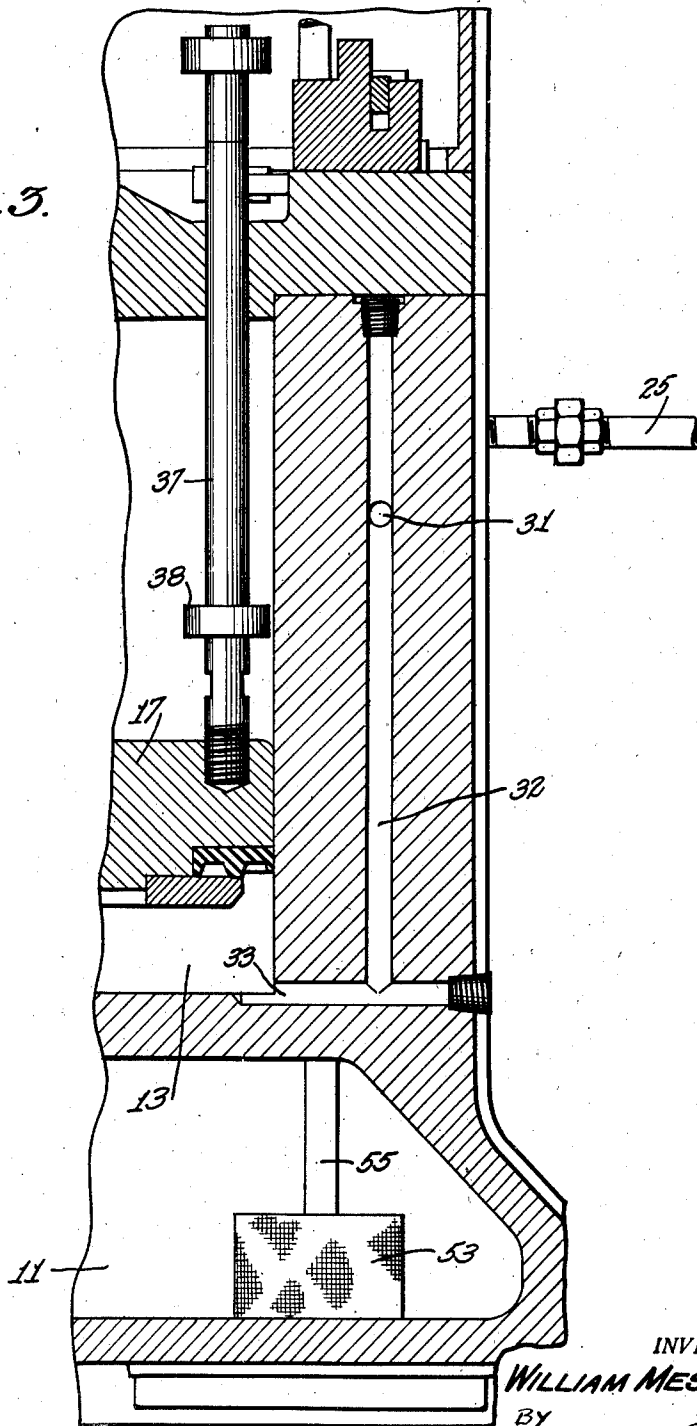
2,426,320

HYDRO-PNEUMATIC ACCUMULATOR

Filed Aug. 10, 1945

5 Sheets-Sheet 3

Fig. 3.



INVENTOR.

WILLIAM MESSINGER

BY

Joseph H. Lipschutz
ATTORNEY

Aug. 26, 1947.

W. MESSINGER

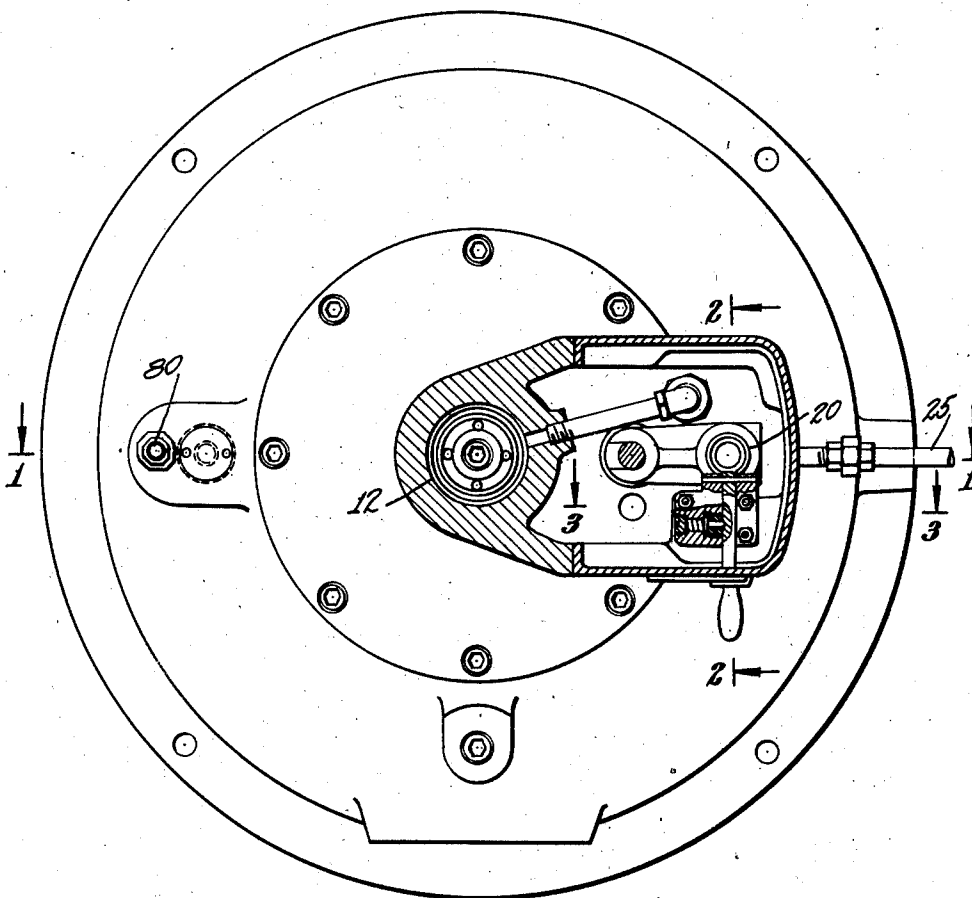
2,426,320

HYDRO-PNEUMATIC ACCUMULATOR

Filed Aug. 10, 1945

5 Sheets-Sheet 4

Fig. 4.



INVENTOR.

WILLIAM MESSINGER

BY

Joseph H. Lipschutz

ATTORNEY

Aug. 26, 1947.

W. MESSINGER

2,426,320

HYDRO-PNEUMATIC ACCUMULATOR

Filed Aug. 10, 1945

5 Sheets-Sheet 5

Fig. 5.

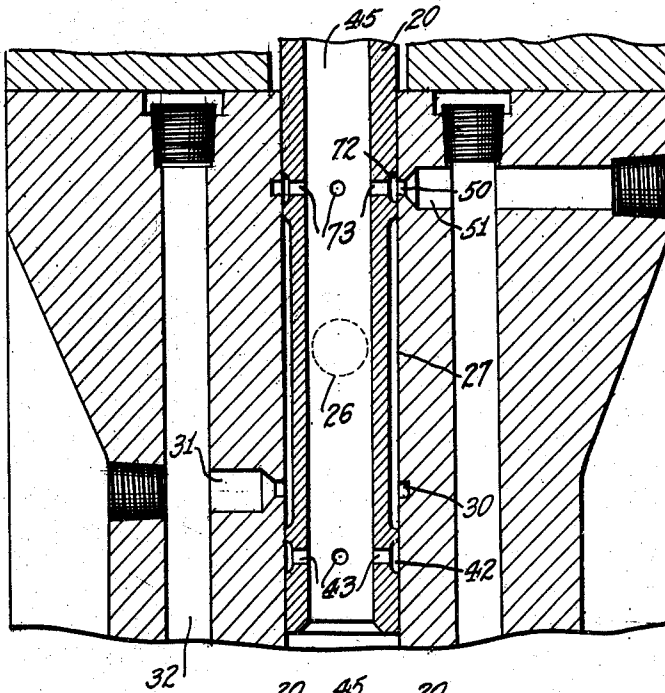
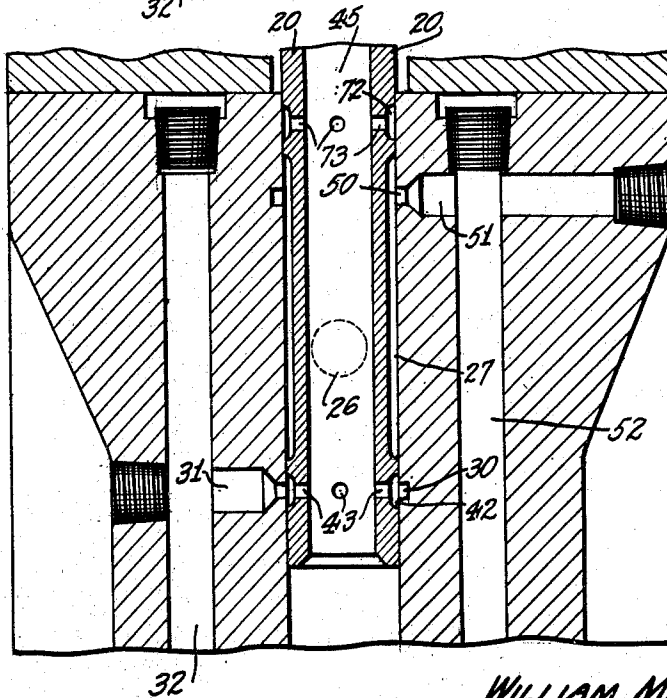


Fig. 6.



INVENTOR.
WILLIAM MESSINGER
BY
Joseph H. Lapschütz
ATTORNEY

UNITED STATES PATENT OFFICE

2,426,320

HYDROPNEUMATIC ACCUMULATOR

William Messinger, Philadelphia, Pa.

Application August 10, 1945, Serial No. 610,095

7 Claims. (Cl. 103-5)

1

This invention relates to a pressure intensifier or accumulator for maintaining a supply of liquid, most commonly water or oil, continuously under pressure. Heretofore this was accomplished by the use of a pump driven by an electric motor, which forced liquid into a charging cylinder against weight or other resisting force.

It is one object of this invention to accomplish the function described above without employing a motor and pump. For this purpose I propose to utilize the mill supply of compressed air, which is usually maintained at 80 to 100 lbs./sq. in. In this manner the initial expense and overall space occupied by the equipment, as well as maintenance costs, are substantially reduced.

A further object of this invention consists in utilizing the mill supply compressed air to force liquid from a reservoir into a charging cylinder from which the liquid is withdrawn for use, and after the cylinder has been charged to a predetermined degree, cutting off the compressed air from the reservoir and introducing it into a low pressure or compressed air cylinder for applying pressure to the liquid in the charging cylinder.

It is another object of this invention to provide a pressure accumulator which utilizes mill-supply compressed air instead of a motor and pump and which operates automatically to apply and to disconnect the air pressure when the charging cylinder has been filled and emptied to a predetermined degree.

It is another object of this invention to intensify the mill supply air pressure to make available to the mill hydraulic pressure of a much higher magnitude than the mill supply.

Further objects and advantages of this invention will become apparent in the following detailed description thereof.

In the accompanying drawings,

Fig. 1 is a vertical section of a hydro-pneumatic accumulator embodying my invention, the section being taken substantially on the line 1-1 of Fig. 4.

Fig. 2 is a vertical section taken substantially on the line 2-2 of Fig. 4.

Fig. 3 is a portion of a section taken on the line 3-3 of Fig. 4.

Fig. 4 is a plan view, partly sectioned horizontally on the line 4-4 of Fig. 1.

Fig. 5 is an enlargement of the valve section and bore of Fig. 2.

Fig. 6 is a view similar to Fig. 5 showing the valve in another operating position.

2

Referring to the drawings, the hydro-pneumatic accumulator embodying this invention may comprise a casing 10 within which is formed a liquid reservoir 11, a charging cylinder 12, a compressed air cylinder 13 and a valve mechanism 14. Liquid from the reservoir 11 is forced into the charging cylinder 12, in a manner to be described, and the liquid is then held under pressure by means of a piston 15 operating in the charging cylinder and forming part of a compound piston element 16 having another piston 17 operating in the compressed air cylinder 13.

Compressed air is supplied to the compressed air cylinder, in a manner to be described, beneath piston 17 so as to maintain pressure on the liquid in the charging cylinder, and a multiplication of the pressure may be obtained by forming the area of the piston 17 larger than the area of piston 15. By this means, for example, mill supply pressure of 100 lbs./sq. in. may be utilized to supply hydraulic pressure of 1600 lbs./sq. in. The control of the flow of liquid from the reservoir to the charging cylinder and the control of the compressed air is effected by the valve mechanism which may comprise a hollow tubular valve member 20 operating within a bore 21 within the accumulator casing 10.

In the position of the parts shown in Figs. 1 and 2, the charging cylinder 12 has been filled with liquid and compressed air has been fed into the bottom of compressed air cylinder 13 for maintaining the piston element, and hence the liquid in the charging cylinder, under pressure. In this position of the elements, compressed air from the mill-supply which is under 80 to 100 lbs. pressure is supplied through pipe connection 25 and hole 26 connecting with the bore 21. In the position of the valve shown in Figs. 1, 2 and 5, the hole 26 connects with an annular chamber 27 formed within the valve body 20, and the annular chamber 27 communicates with an annular groove 30 in the casing and with horizontal hole 31, vertical hole 32 and horizontal hole 33 leading directly into the bottom of compressed air cylinder 13. In this position of the parts, therefore, mill-supply compressed air from pipe connection 25 is being supplied to the compressed air cylinder below piston 17 to apply this pressure to the liquid in the charging cylinder 12.

As the liquid under pressure is withdrawn from the charging cylinder through the check valve 35 for use in the various mill operations, the piston element will travel upwardly until a predetermined amount of liquid has been withdrawn

3

from the charging cylinder, or, stated differently, until the charging cylinder has emptied to a predetermined degree at which point it is necessary to operate the valve mechanism so as to accomplish the function of replenishing the liquid in the charging cylinder.

To accomplish the above function, the piston element 16 has fixed thereto a tappet rod 37 which carries a rod collar 38 so positioned that when the charging cylinder has emptied to a predetermined degree and the piston element 16 has travelled upwardly to a predetermined degree the tappet rod 37 sliding upwardly through an opening 39 will cause the rod collar 38 to engage an arm 40 fixed to the valve member 20 and will therefore lift the valve member. Such lifting will, as shown in Fig. 6, accomplish the following three functions:

(1) Disconnection of the compressed air line from the compressed air cylinder.

(2) Venting of the compressed air from the compressed air cylinder to the atmosphere.

(3) Application of compressed air to the reservoir to force liquid from the reservoir into the charging cylinder.

To accomplish the above functions reference may be made to Fig. 6 wherein it is disclosed that lifting of the valve member 20 causes an annular groove 42 in the valve member to register with the annular groove 30 which through holes 31, 32 and 33 communicates with the compressed air cylinder. The annular groove 42 is connected by a plurality of drilled holes 43 to the hollow interior 45 of the valve member 20 which is open at its upper end to the atmosphere. Therefore, as soon as annular grooves 30 and 42 register, the compressed air in the cylinder 13 will be vented through holes 33, 32, 31, annular grooves 30 and 42, drilled holes 43 and hollow interior 45 of the valve member 20 to the atmosphere. The liquid in the charging cylinder is therefore no longer under higher than atmospheric pressure.

At the same time that the compressed air cylinder 13 has been connected to the atmosphere, its connection to the source of compressed air through pipe connection 25 is cut off because the annular chamber 27 has moved out of registry with the annular groove 30.

The upward movement of the valve member 20 accomplishes the third function set forth above, namely, forcing liquid from the reservoir into the charging cylinder 12, by reason of the fact that the annular chamber 27 which is connected to the pipe connection 25 now registers with an annular groove 50 in the casing which connects by horizontal hole 51 and vertical hole 52 with the reservoir 11. The compressed air pressure now being applied to the reservoir 11 forces liquid from this reservoir through strainer 53 into inlet 54 and thence upwardly into pipe 55, vertical drilled hole 56, continuing pipe 57, check valve 58 and horizontal pipe 59 into the charging cylinder. The cylinder is thus charged with liquid from the reservoir under pressure from the compressed air entering through pipe connection 25.

The filling of the charging cylinder continues, and as it does so, the piston element is depressed since there is only atmospheric pressure in the compressed air cylinder 13 on the lower side of the piston element. When the charging cylinder has filled to a predetermined degree it is necessary to perform the following steps:

(1) Disconnect the compressed air line from the reservoir.

4

(2) Connect the compressed air line to the compressed air cylinder.

(3) Vent mill-supply pressure from reservoir.

These steps are accomplished by means of another rod collar 70 carried by the tappet rod 37 and adapted to engage arm 40 of valve member 20 at a predetermined point in the downward travel of the piston element and hence when the charging cylinder has been filled to a predetermined degree. This engagement of rod collar 70 with the arm 40 lowers the valve member to the position shown in Fig. 5. In this position the annular chamber 27 is moved out of registry with annular groove 50 and since annular chamber 27 is in communication with the source of compressed air, the compressed air pressure is cut off from the annular groove 50 and hence is cut off from the reservoir which connects to the annular groove 50 through holes 51 and 52. At the same time annular chamber 27 again is brought into registry with annular groove 30 which is in communication with the compressed air cylinder through holes 31, 32, and 33, whereby the compressed air is again supplied to the compressed air piston 17. The liquid in the charging cylinder is therefore again under intensified mill-supply pressure and is maintained so throughout the upward travel of the piston element. At the same time an annular chamber 72 is brought into registry with the annular groove 50, and since chamber 72 communicates with the hollow interior of the valve member 20 through drilled holes 73, mill-supply pressure on the reservoir will be vented to the atmosphere.

This accumulator is often used on a high pressure oil line which forms a closed system. Discharge out of the high pressure system can be returned through return line connection 80 and check valve 81. The return oil is at much higher pressure than any pressure which can occur in the reservoir 11, even in the interval when mill-supply air pressure is admitted. Consequently the check valve will always operate to permit the return of oil to the reservoir 11.

In accordance with the patent statutes, the preferred embodiment of the invention has been described, but it will be understood that changes may be made within the scope of the appended claims which define the invention.

Having described my invention, what I claim and desire to secure by Letters Patent is:

1. In combination, an accumulator for maintaining a quantity of liquid continuously under pressure, the accumulator having a charging cylinder for the liquid, said cylinder having an inlet and an outlet, a valve mechanism for controlling said inlet and outlet, a liquid reservoir connected to the charging cylinder, a source of compressed air, means whereby compressed air from the source is applied to the liquid in the reservoir to force the liquid into the charging cylinder, and means actuated in response to a predetermined amount of liquid supplied to the charging cylinder for disconnecting the compressed air from the reservoir and applying the pressure of the compressed air to the liquid in the charging cylinder, characterized by a compressed air cylinder, a piston element operating in the charging cylinder and the compressed air cylinder, the liquid acting on one end of the piston element and the compressed air acting on the other end.

2. In combination, an accumulator for maintaining a quantity of liquid continuously under pressure, the accumulator having a charging cylinder for the liquid, said cylinder having an inlet

5

and an outlet, a valve mechanism for controlling said inlet and outlet, a liquid reservoir connected to the charging cylinder, a source of compressed air, means whereby compressed air from the source is applied to the liquid in the reservoir to force the liquid into the charging cylinder, and means actuated in response to a predetermined amount of liquid supplied to the charging cylinder for disconnecting the compressed air from the reservoir and applying the pressure of the compressed air to the liquid in the charging cylinder, characterized by a compressed air cylinder, a compound piston element having one piston operating in the charging cylinder and another piston operating in the compressed air cylinder, the liquid acting on one piston and the compressed air acting on the other piston.

3. A device as specified in claim 2, characterized by the fact that the piston operating in the compressed air cylinder has a larger area than the piston operating in the charging cylinder.

4. A device as specified in claim 1, characterized by connections from said valve mechanism to the cylinders and reservoir and to the atmosphere, and means whereby the piston element actuates the valve mechanism in response to a predetermined reduction in the quantity of liquid in the charging cylinder to disconnect the compressed air from the respective end of the piston and evacuate the compressed air cylinder.

5. A device as specified in claim 1, characterized by connections from said valve mechanism to the cylinders and reservoir and to the atmosphere, and means whereby the piston element actuates the valve mechanism in response to a predetermined reduction in the quantity of liquid in the charging cylinder to disconnect the compressed air from the respective end of the piston and evacuate the compressed air cylinder, and means whereby the valve mechanism connects the compressed air from the source to the reservoir after disconnecting the compressed air from the compressed air cylinder.

6. A device as specified in claim 1, characterized by a connection from said valve mechanism to the

6

cylinders and reservoir and to the atmosphere, and means whereby the piston element actuates the valve mechanism in response to a predetermined reduction in the quantity of liquid in the charging cylinder to disconnect the compressed air from the respective end of the piston and evacuate the compressed air cylinder, means whereby the valve mechanism connects the compressed air from the source to the reservoir after disconnecting the compressed air from the compressed air cylinder, and means carried by the piston element for operating the valve mechanism.

7. A device as specified in claim 1, characterized by connections from said valve mechanism to the cylinders and reservoir and to the atmosphere, and means whereby the piston element actuates the valve mechanism in response to a predetermined reduction in the quantity of liquid in the charging cylinder to disconnect the compressed air from the respective end of the piston and evacuate the compressed air cylinder, means whereby the valve mechanism connects the compressed air from the source to the reservoir after disconnecting the compressed air from the compressed air cylinder, means carried by the piston element for operating the valve mechanism, the charging cylinder being provided with an outlet for the liquid, the piston element being adapted to move from one limiting position to another as a predetermined amount of liquid is supplied to and withdrawn from the charging cylinder, and means whereby the piston element actuates the valve mechanism when the piston element reaches the limiting positions.

WILLIAM MESSINGER.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
202,660	Maguire	Apr. 23, 1878
1,380,603	Smythe	June 7, 1921