March 19, 1935. B. S. T. BISHOP ET AL 1,994,747

ACCUMULATOR

Original Filed April 23, 1929 3 Sheets-Sheet 1

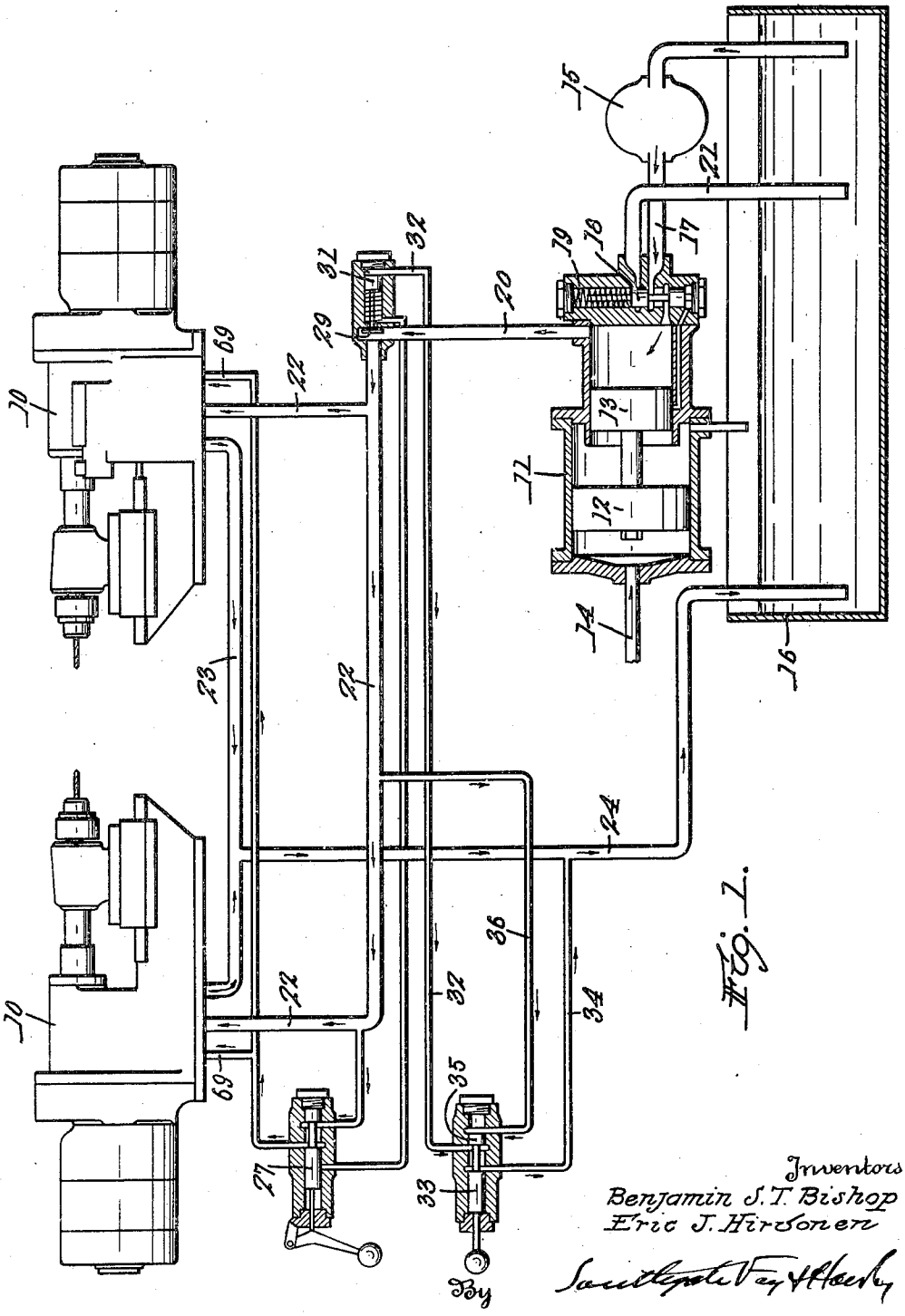


Fig. 1.

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Original Filed April 23, 1929 3 Sheets-Sheet 2

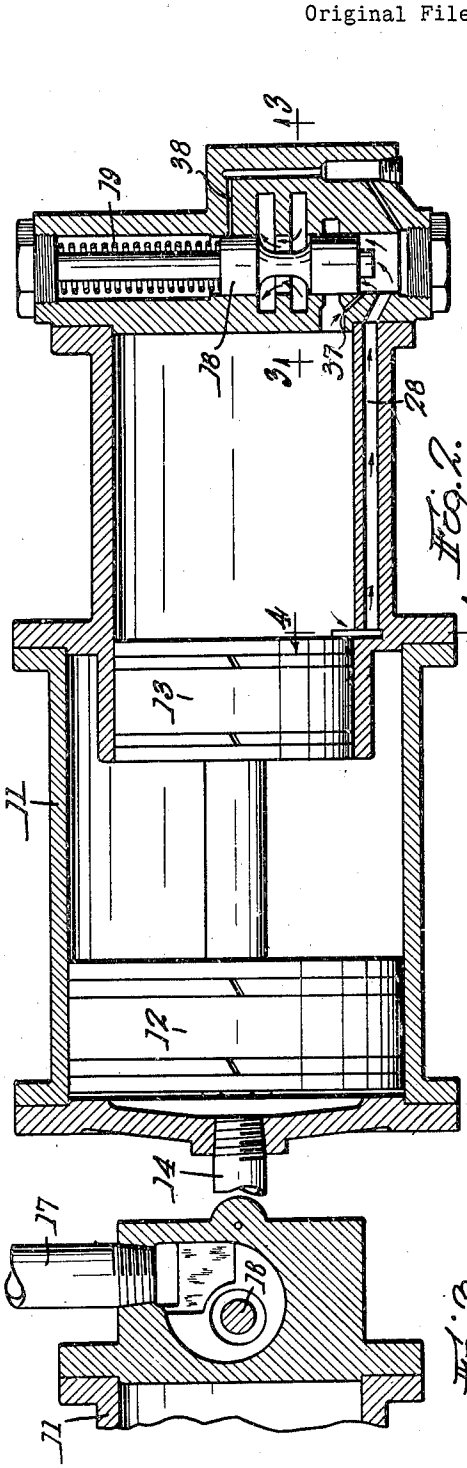


Fig. 2.

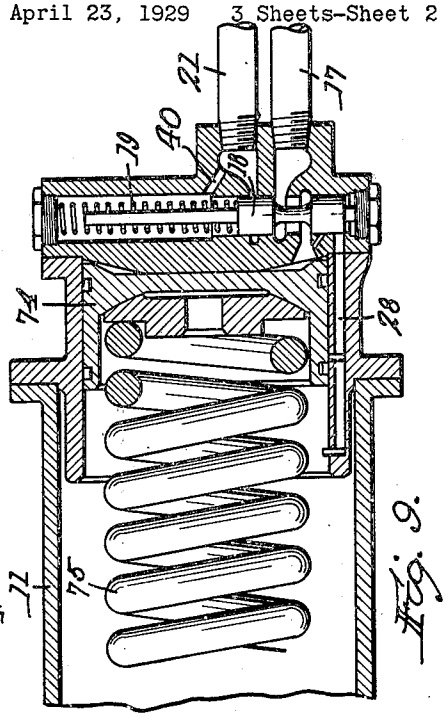


Fig. 9.

Fig. 3.

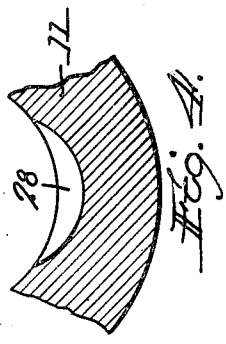


Fig. 4.

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Original Filed April 23, 1929 3 Sheets-Sheet 3

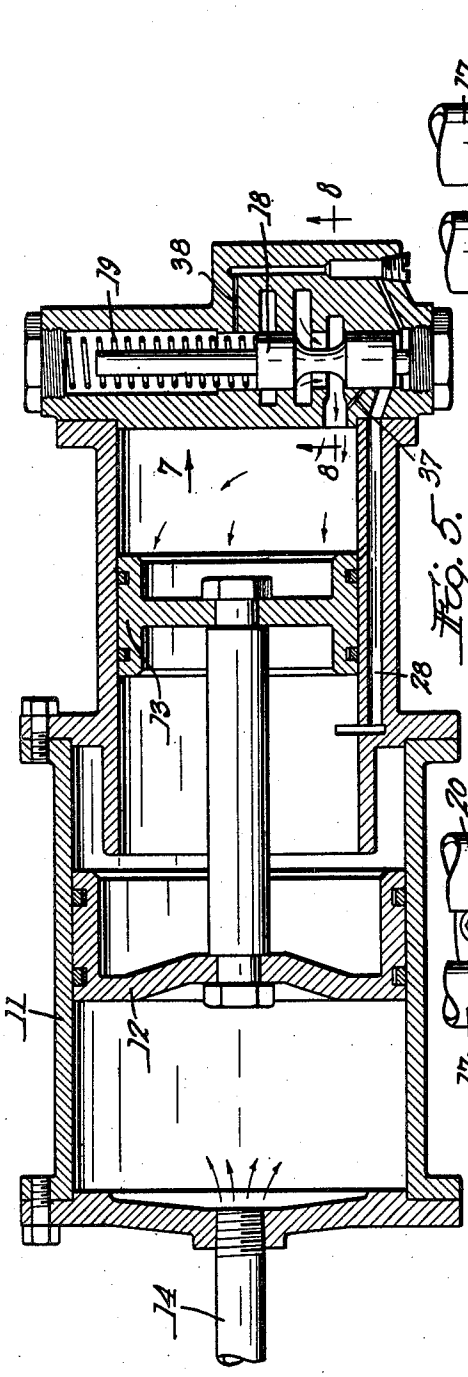


Fig. 5.

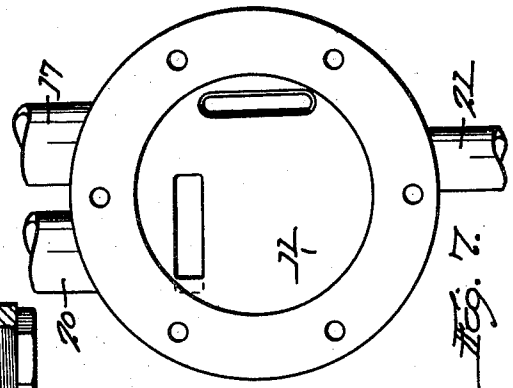


Fig. 7.

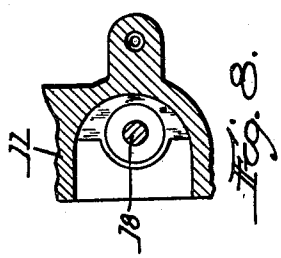


Fig. 8.

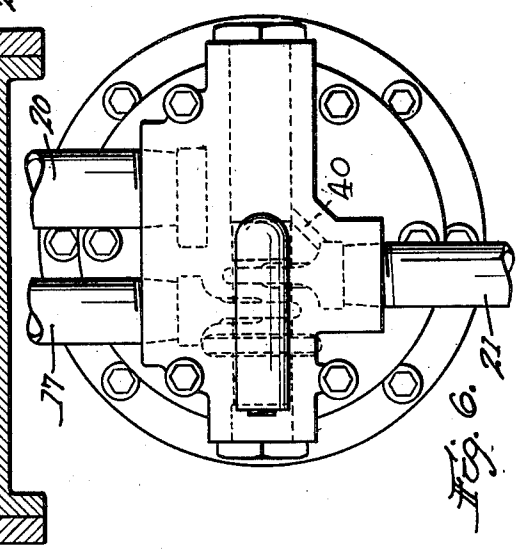


Fig. 6.

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UNITED STATES PATENT OFFICE

1,994,747

ACCUMULATOR

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Original application April 23, 1929, Serial No. 357,532. Divided and this application September 28, 1931, Serial No. 565,472

3 Claims. (Cl. 137—153)

This is a division of our application for patent on a Hydraulic feed for machinery, Serial No. 357,532, filed April 23, 1929.

This invention relates to an accumulator for supplying oil or the like to a hydraulic feed for a battery of machines.

The principal objects of the invention are to provide an accumulator for storing up oil or other liquid under pressure for running machines with means for constantly applying pressure to that fluid and means whereby, when a quantity of liquid is collected, the liquid will be circulated back without pressure into the supply with no necessity for stopping the pump which supplies it so that a single pump can be used for a number of machines and will take care of all their needs under all circumstances, and will not require constant attention, and to provide improvements in the valve mechanism and operating connections therefor for each of the machines by which the valve will be forced to the end of its stroke if anything happens to stop it.

Other objects and advantages of the invention will appear hereinafter.

Reference is to be had to the accompanying drawings, in which

Fig. 1 is a diagrammatic view of the piping and the accumulator connected up with a plurality of machines in accordance with this invention;

Fig. 2 is a sectional view of the accumulator, shown in Fig. 1, on enlarged scale;

Fig. 3 is a transverse sectional view on the line 3—3 of Fig. 2;

Fig. 4 is a sectional view on the line 4—4 of Fig. 2;

Fig. 5 is a view similar to Fig. 2 showing the pistons in section also;

Fig. 6 is an outside end view of the same;

Fig. 7 is an inside end view of the same, as indicated by the arrow 7 of Fig. 5;

Fig. 8 is a sectional view on the line 8—8 of Fig. 5, and

Fig. 9 is a view similar to Fig. 5 showing a modification.

This invention is designed to operate a plurality of machines as for example, drills 10. These drills are constructed in such a way that the tools are rotated by means, not constituting a part of this invention, and this invention is designed to move the drill heads inwardly to perform drilling operations.

This invention has for its object the provision of an accumulator for the oil or other liquid for operating the several machines which will be capable of supplying all the fluid under pressure necessary and will accommodate itself to differences in the amount of fluid used by the different units and will be universal in operation, that is, capable of operating the machines in any desired way and of supplying sufficient fluid for them if they all do their cutting at the same time and yet will be sufficiently flexible so that it will operate a single unit by itself if desired and everything will be taken care of. It is intended that the pump for supplying the accumulator with the pressure fluids shall operate all the time and by this condition this pump can be made much smaller than would be necessary to operate the same number of machines if the accumulator feature were not used. If any machine is stopped, or any number of machines, anywhere in the stroke, it or they can be started again from that point and the stroke completed, without any attention being paid to the single pump or to any regulating means for the pressure. The pressure on the motive fluid in the accumulator is constant as the pressure in the pipe 14 is constant.

The units which are shown in the form of horizontal drills are illustrated as comprising certain elements involving the use of fluid pressure for actuating a piston and moving the drill heads forward or back. They are all connected with a single accumulator 11 which includes a main cylinder having two diameters and two pistons 12 and 13 therein rigidly connected together. Constant pressure of compressed air, steam, or other elastic fluid is introduced through a pipe 14 so that the pistons will move in the cylinders in accordance with the volume of oil in the small cylinder, the pressure on the piston 12 being constant. The pressure in the small cylinder is provided by a rotary pump 15 taking oil, water, or other liquid out of the tank 16 and constantly operating.

The ports by which the oil is introduced into the small cylinder through a pipe 17 are controlled by a valve 18 constantly pressed forward by a spring 19. As the pump 15 operates constantly, it supplies the small cylinder with the liquid, which, as will appear, is fed to the various cylinders of the machine units and supplies all of them through a pipe 20. Whenever the amount of oil in the small cylinder increases too much on account of the constant operation of the pump, or the shutting down of some of the machines, the piston 13 will be forced back in the accumulator. Finally this will expose the end of a by-pass 28 and the oil will act against the end of the piston valve 18 and force it back

against the spring and allow the oil to flow back into the tank through a pipe 21 thus providing constant circulation without stopping or slowing down the pump, the pump idling or circulating oil under no pressure, so that there is no working load on the pump motor. Oil can be withdrawn at any time from the small cylinder under the constant pressure given by the large piston 12. When a sufficient amount of oil has been withdrawn so that the back side of the small piston 13 passes beyond and uncovers the by-pass 28, the pressure on the end of the piston valve is relieved and the spring 19 moves the valve down, thereby admitting oil from the pump to the small cylinder, to refill it.

The cylinder in which the spring 19 is located is always open to atmospheric pressure through a port 40 in both forms. Under ordinary working conditions, when drawing oil from the accumulator, the valve 18 might stick and throw out the entire system. For this reason a restricted port or by-pass 37 is provided constantly open to the pressure in the cylinder and open to the space at the end of the valve 18 when in the position shown in Fig. 2. Therefore, if the valve 18 tends to move down, this fluid pressure will hold it back against the action of the spring 19. The by-pass 37 is necessary only when the port 28 is closed. Then it counteracts the pressure of the spring 19. The by-pass 37 makes up for leakage past the piston 13. After the piston closes the port 28, the port 37, of course, will be uncovered by the valve and it keeps enough oil pressure below the valve 18 to move it enough to compress the spring 19. Of course, the port 28 is closed at this time by the piston valve 18. The oil entering under the valve through the port 37 completes the stroke of the valve and holds the valve at its extreme upward position, starting from the position shown in Fig. 2.

Likewise a restricted port 38 is provided for the other end of the valve and connected with the port 28. At any time, when the port 28 is closed by the piston 13, leakage might start valve 18 from the position shown in Fig. 5. This port 38 will permit the escape of pressure from below the valve.

After the valve 18 starts down in Fig. 2 the piston may close the port 28. Now, if the port 38 were not present, a body of oil below the valve would be incompressible and would prevent the valve completing its stroke, the port 37 being closed. But, as constructed, the port 38 furnishes an outlet for the oil below the valve and the spring is free to force the valve down to the end of its stroke. When by-pass 37 is open by-pass 38 is closed by the cylindrical surfaces of the valve 18 and vice versa.

This device is called an accumulator because, with a constantly operating pump, the pressure of the oil in it is kept at a substantially predetermined mark and it will supply oil for operating the various tools, no matter how many of them are at work or how many of them are stopped, and it contains means within it for keeping the pressure substantially constant under the influence of the constantly acting pump. This pump, on account of the above mentioned conditions can be made much smaller than has been possible with this system. The pump requires no special attention because it is run constantly as long as the machines are being used. The pump is never slowed down and never stopped and even if the machines should all be stopped it would not be necessary to go to the trouble of stopping the pump.

The oil is delivered from the small cylinder through the pipe 20 past a valve 29 and into a plurality of supply pipes 22 which feed the machines. The exhaust motive fluid oil from the pressure sides of the machines is delivered through pipes 23 into a main 24 which delivers the oil to the tank 16. The low pressure sides of the cylinders operating the several machines are connected with a pipe through which the oil passes first in one direction and then in the other and these outlets are connected with the pipes 23.

For the purpose of stopping the machine in case of emergency, an emergency stop valve 33 is provided. Normally a pipe 32 is connected with a pipe 34 through this valve which drains the space back of a piston 31 and leaves a spring operated valve 29 open so that the machine can operate. When the valve 33 is pushed in and this connection is closed, a second piston 35 on the valve 33 will open communication between a pipe 36 and the pipe 32. The pipe 36 is connected with the high pressure when the machine is operating and consequently this full pressure will be introduced through the pipe 32 behind the piston 31 and close the valve 29. This can be done because the pressure on the other side of the valve 31 is merely that of the spring, this side being open to the drain pipe 24.

It will be seen therefore that at any time, no matter what the position of the parts, the emergency stop valve can be operated to stop the entire machine. But even then the pump 15 can be left running and by-pass the accumulator and the accumulator will be ready to start into operation as soon as the valve 29 is opened.

The pipes 22 and 23 enter valve casings for controlling the drills 10 as set forth in our above identified application.

It is to be noted that a battery of machines is intended to be employed, all these machines being connected with the accumulator 11 in a manner that has been described. The valve 29 is closed if the emergency stop valve 33 is pushed in, because the pressure from the pipes 22, through the pipes 36 and 32, will operate on the piston 31 to keep it closed. If the stop valve 33 is pulled out as shown, the pipe 32 will be drained into the pipe 24 and the valve 29 will open.

Now the starting valve 27 is pushed in, as shown, and the oil under pressure in the pipes 22 is allowed to flow through the pipe 69 to push out the rods of the entire battery of machines. Now the pressure enters various casings through the several pipes 22 and each machine thereafter is self-controlled, that is, independently of the other machines.

The object of this invention can be carried out in other ways, one of which is shown in Fig. 9. Here the same principle is maintained, the elastic pressure being provided for the piston 74 by a spring 75 which will tend to produce the same effects as in the other case illustrated. No further description of this figure is thought to be necessary because the parts common to both forms are designated by the same reference numbers as in the other figures. Of course, in this case there would be no pipe 14.

Although we have illustrated and described only two forms of the invention we are aware of the fact that modifications can be made therein by any person skilled in the art without departing from the scope of the invention as ex-

pressed in the claims. Therefore, we do not wish to be limited in this respect but what we do claim is:—

1. The combination of a cylinder having an inlet through which liquid is forced under pressure, a piston valve having means which in one position effects communication into said cylinder from the inlet and which in another position isolates said cylinder from the pressure, a piston in the cylinder for controlling the operation of said valve in one direction, other means for operating said valve in the opposite direction, and a port independent of said conducting means for conducting liquid from said cylinder for applying liquid pressure to said piston valve to operate said valve in the first named direction and also to relieve said piston valve from such liquid pressure afterwards, whereby to permit said other means to operate said valve in the opposite direction.

2. The combination of a cylinder for receiving a liquid, a piston valve having means which in one position effects communication into said cylinder and which in another position isolates said cylinder from the source of the liquid, a piston in the cylinder responsive to a predetermined change of volume of liquid in said cylinder for admitting pressure liquid from said cylinder to said valve for operating it, and a restricted port from the cylinder to the valve for forcing the valve to the end of its stroke if its motion is interrupted.

3. The combination of a cylinder for receiving a liquid, a piston valve having means which in one position effects communication into said cylinder and which in another position isolates said cylinder from the pressure, a piston in the cylinder responsive to a predetermined change of volume of liquid in said cylinder for admitting pressure liquid from said cylinder to said valve for operating it, and a port and a restricted by-pass from the cylinder to opposite ends of said valve in position to be closed by the valve except when it is started away from its seat, whereby pressure can be built up at the end of the valve to close it in either direction if it starts and then stops, said by-pass being constantly open to the cylinder and the port being open to the cylinder only when the piston therein is at the extreme end of its stroke.

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