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E. V. PRENTICE

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HYDRAULIC APPARATUS

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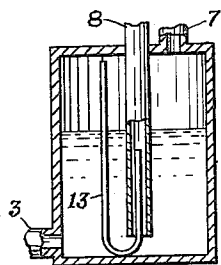


Fig. 2.

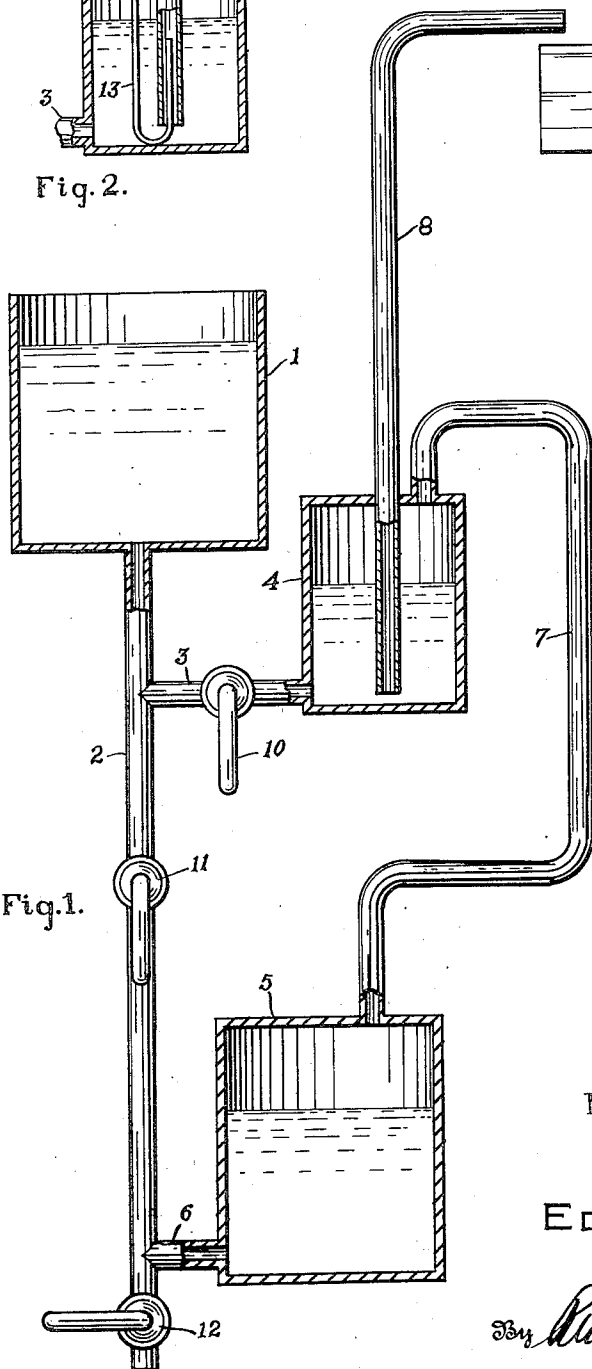


Fig. 1.

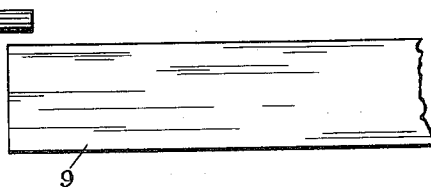


Fig. 3.

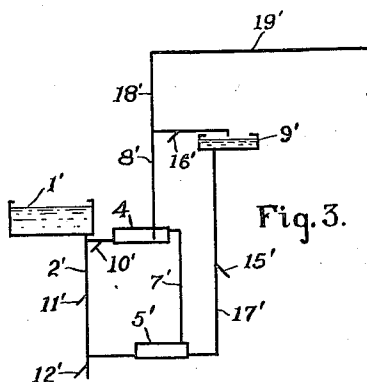
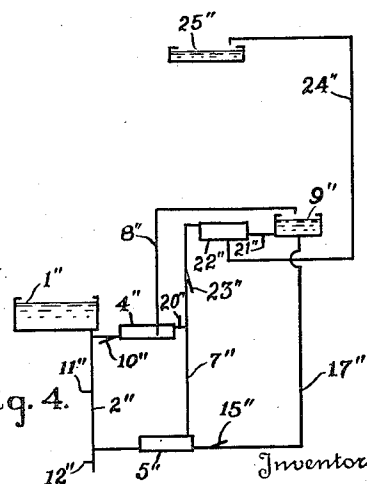


Fig. 4.



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HYDRAULIC APPARATUS

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3 Claims. (Cl. 103—237)

My invention relates to hydraulic apparatus for delivering water or other fluid to a place of higher elevation than a source of supply.

The principal object of my invention is the delivery of water at an elevation above a source of supply by the direct application of power evolved from the descent of a quantity of water through a given distance from the said source of supply without the use of intermediate mechanical means.

A second object of my invention is the elevation of water for irrigating and other purposes at a minimum of expense of both equipment and the operation thereof.

Other objects and advantages of my invention will be apparent in the following discourse wherein the significance of the reference characters in the accompanying drawing, details of construction of typical apparatus embodying my invention, and the particular advantages thereof are explained.

Figure 1 represents a view of a complete apparatus of my invention partially in section and partially in elevation.

Figure 2 represents a view of an element of the apparatus in vertical section.

Figure 3 is a diagram illustrative of a varied mode of employment of the device.

Figure 4 is a diagram illustrative of another varied mode of employment of the device.

My invention consists essentially of means for intermittently applying the pressure at the lower extremity of a water column connected to a source of supply to a volume of water contained in a suitable receptacle disposed immediately of the said source of supply and lower extremity of said water column, through a medium of lesser gravity than said water column, to force the water contained in said immediately disposed receptacle to a higher level than said source of supply.

In any use of the apparatus, the medium of lesser gravity than the said water column as above referred to may be any of the fluids, both liquids and gases, and, of course, mechanical means of similar function, which conform to the requirement of lesser gravity than said water column.

The device illustrated in the drawing consists of a source of supply of water 1, a vertically disposed pipe 2 communicating at the upper end thereof with said source of supply of water, a pipe 3 communicating with said vertical pipe 2 and a receptacle 4, a compression chamber 5 the lower end of which communicates with

the vertical pipe 2 through the pipe 6 and the upper portion of which communicates through the pressure transmission pipe 7 with the upper portion of said receptacle 4, a discharge pipe 8 extending from the lower portion of the said receptacle 4 upwardly to conduct fluids flowing therethrough to the flume 9, and valves 10, 11, and 12 controlling the flow through the respective pipes in which the same are located.

As illustrated in Figure 1 the device illustrates one in which the transmission medium is air; the operation being as follows:

Considering both the compression chamber 5 and the receptacle 4 to be empty, the valve 11 is first closed and the valve 10 opened when water will flow by gravity from the source of supply 1 through the pipes 2 and 3 into the receptacle 4 to fill the same. When the receptacle 4 is thus filled with water, the valve 10 is closed and the valve 11 opened when water will flow through the pipe 2 and the pipe 6 to fill the compression chamber 5; the valve 12 being closed.

As the compression chamber fills with water, the contained air will be compressed in the upper portion thereof and flow through the pipe 7 into the upper portion of the receptacle 4 when the water contained in the receptacle 4 will be forced upwardly through the pipe 8 and discharged into the flume 9 situated above the source of supply 1. The valve 12 is next opened to drain the compression chamber 5 of water and refill the same with air when the valve 12 is again closed. This cycle of operations is repeated to elevate further volumes of water.

As will be apparent, a residuum of compressed air will be evacuated through the discharge pipe 8 at the end of each cycle of operation unless some means be employed to prevent. A manner of utilizing the expansive force of such compressed air may be employed by substituting the receptacle shown in Figure 2 for the one shown in Figure 1 at 4.

The receptacle shown in Figure 2 is characterized by a pipe 13 communicating at opposite ends with the upper portion of the receptacle and the lower portion of the discharge pipe 8 respectively to conduct compressed air into the lower portion of the discharge pipe 8 from the upper portion of the receptacle 4 in a manner well understood to reduce the aggregate weight of the water column in the discharge pipe 8 and hence provide for correspondingly greater elevations of water.

The diagram in Figure 3 illustrates a variation of the device shown in Figure 1. In this manner

of use the water previously raised as through the discharge pipe 8 in Figure 1 is utilized as a second source of supply for a secondary water column of greater height than the first.

Referring to Figure 3 the original source of supply of water is indicated at 1', the primary water column at 2', the compression chamber at 5', the intermediate receptacle at 4', the primary discharge pipe at 3', the secondary source of supply at 9', the secondary water column at 17', a discharge pipe extension 18' conducting water to the flume 19', and control valves 11', 12', 13', 16', and 15'.

In the operation of this device water is first raised to the secondary source of supply as in the manner of operation of the apparatus shown in Figure 1 just described. Assuming that the secondary source of supply has thus been supplied, the valves 13', 11', 12', and 16' are closed after a fresh charge of water has been admitted into the intermediate receptacle 4' from the original source 1' as in the first instance.

The valve 15' is next opened and the water in the secondary source 9' allowed to flow by gravity into the compression chamber 5', where, as before, the air in the upper portion thereof will be compressed and caused to flow into the intermediate receptacle 4' through the pipe 7', forcing the water contained in the intermediate receptacle to flow through the discharge pipe 8' and extension thereto 18' when it will be discharged into the flume 19' at a still higher level.

In Figure 4 is illustrated another adaptation of my invention. In this use, water is first elevated to the secondary source of supply 9'' as in the manner first described for the apparatus shown in Figure 1. The valves 11'' and 15'' are opened and the water contained in the compression chamber 5'' is allowed to drain out through the valve 12'' after which the valves 11'', 12'', and 20'' are closed. The valve 13'' is opened to fill the intermediate receptacle 4'' and the valve 21'' is opened to fill the secondary receptacle 22'' from the secondary source 9''. When this is complete, the valve 21'' is closed and the valves 15'' and 23'' are opened. The remaining water in the secondary source 9'' flows through the secondary column 17'' into the compression chamber 5'' causing a flow of compressed air through the pipe 7'' into the upper portion of the secondary receptacle 22'' when the water contained therein will be forced out through the pipe 24'' into the flume 25''.

It will be apparent that there are many ways in which this apparatus may be used to compound the functions of the apparatus as a whole or parts thereof in various combinations to raise water to constantly increasing elevations. It is to be observed that the method shown in Figure 3 provides for elevations corresponding to the arithmetical progression, and the method shown in Figure 4 provides for elevations in the order of the geometrical progression.

While the operation of the several forms of the apparatus illustrated has been described as when used with air as a power transmission medium, it will be readily apparent that any fluid, either liquid or gaseous, may be used in lieu thereof if such fluid is lighter than the water to be elevated. In another use, for example, mercury may be used in the columns and water used as a power transmission medium to transmit the pressures developed at the lower extremity of the column; mercury, of course, being the element raised to the higher level.

It will also be readily understood that the use of liquids as a power transmission medium will provide for very efficient operation, though of course altitude differentials will be governed by the difference in gravity of the media employed.

A further deviation in form contemplating the use of elements corresponding to those described would employ mechanical means arranged in the form of any one of a number of well known expedients, as the power transmission medium operating between the compression chamber and the intermediate receptacle. One such device would consist of mechanically joined pistons in the compression chamber and the intermediate receptacle respectively by means of which the pressure in the lower chamber would be utilized to actuate the piston in the intermediate receptacle. Such a device would operate quite efficiently but of course be more costly to construct.

My invention provides an efficient method of raising water by the use of relatively inexpensive and durable means.

Having described my invention what I claim is:

1. Apparatus for increasing the head of a body of water comprising, a pipe extending downwardly from said body, a compression chamber normally filled with a lighter fluid disposed beneath and communicating with said pipe, an intermediate receptacle communicating with said body of fluid, a pipe extending from said compression chamber to said intermediate receptacle, a reservoir situated above said intermediate receptacle, a pipe extending from said intermediate receptacle to said reservoir, a pipe connecting said reservoir with said compression chamber, a pipe extending from said intermediate receptacle to a level higher than said reservoir, and valves in said pipes between said body of water and said compression chamber, between said body of water and said intermediate receptacle, between said reservoir and said compression chamber and between said compression chamber and said reservoir and an appropriate waste valve to drain said compression chamber.

2. Apparatus for increasing the head of a body of water comprising, a column of water extending downwardly, a compression chamber at the lower end of said column of water normally filled with a lighter fluid, an intermediate receptacle connected by pipe means to said body of water and to said compression chamber, a reservoir situated above said intermediate receptacle and connected thereto and to said compression chamber by pipe means, a secondary receptacle situated higher than the first receptacle connected to said reservoir and to said compression chamber, a discharge pipe extending upwardly from said secondary receptacle to a level higher than said reservoir, and valves in said pipes between said body of water and said receptacle, between said body of water and said compression chamber, between said compression chamber and said reservoir, between said reservoir and said secondary receptacle, between said compression chamber and said secondary receptacle, and between said compression chamber said receptacles and said reservoir respectively, and an appropriate waste valve to drain said compression chamber.

3. A device for increasing the head of a body of water comprising, a compression chamber situated below said body of water, a pipe containing a valve connected at opposite ends to said body of water and said compression chamber, a valve in said compression chamber venting the same to the atmosphere, an intermediate receptacle situated at a level between that of the body of water and

said compression chamber, two pipes each containing valves connecting said intermediate receptacle to said body of water and said compression chamber respectively, a reservoir situated at a level higher than said body of water, a pipe connecting said reservoir to said intermediate receptacle, and a pipe containing a valve connecting said reservoir to said compression chamber.

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