

H. M. & T. M. CHANCE.
 APPARATUS FOR PUMPING LIQUIDS.
 APPLICATION FILED JAN. 10, 1912.

1,021,237.

Patented Mar. 26, 1912.

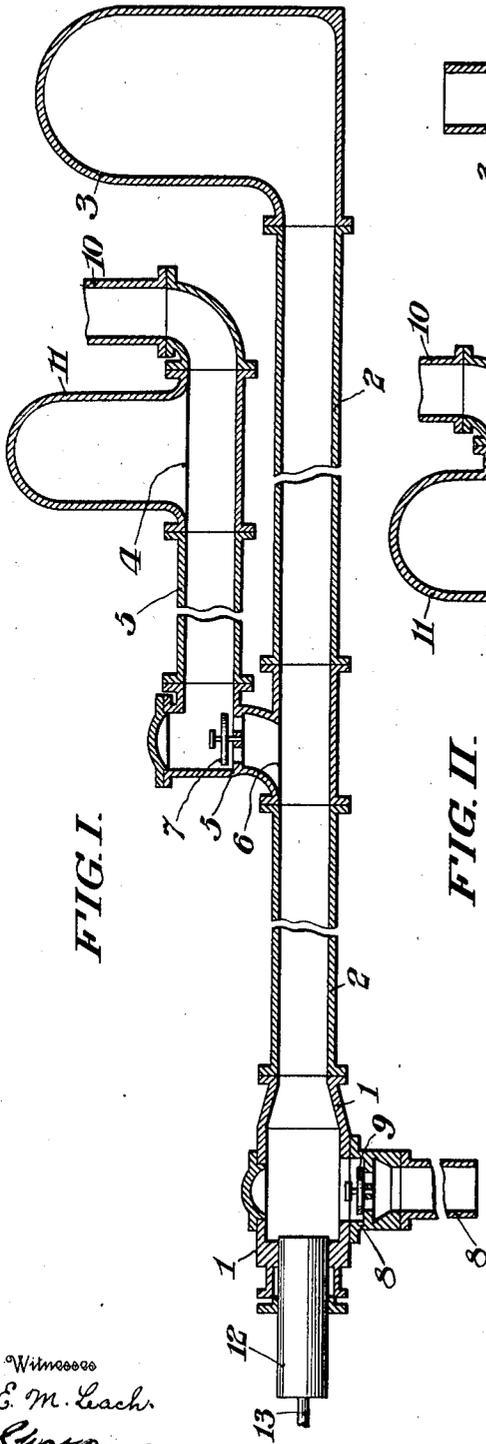


FIG. I.

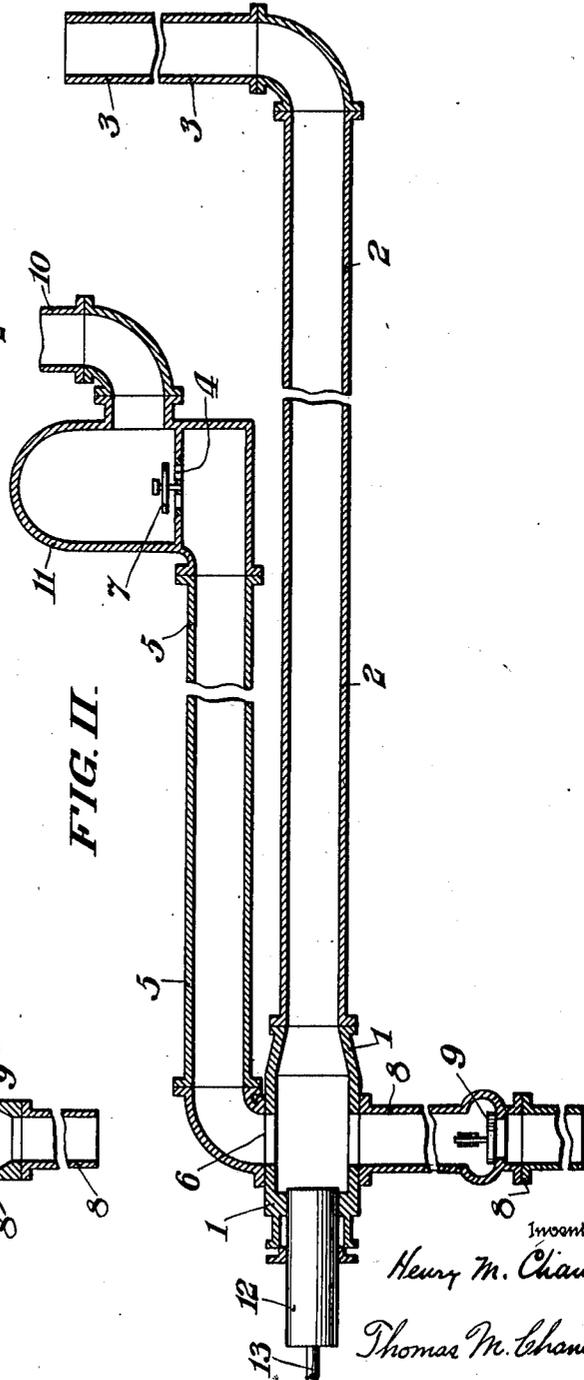


FIG. II.

Witnesses
 E. M. Leach
 Chairman

Inventors
 Henry M. Chance
 Thomas M. Chance

UNITED STATES PATENT OFFICE.

HENRY M. CHANCE AND THOMAS M. CHANCE, OF PHILADELPHIA, PENNSYLVANIA.

APPARATUS FOR PUMPING LIQUIDS.

1,021,237.

Specification of Letters Patent. Patented Mar. 26, 1912.

Application filed January 10, 1912. Serial No. 670,356.

To all whom it may concern:

Be it known that we, HENRY M. CHANCE and THOMAS M. CHANCE, citizens of the United States, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented a certain new and useful Apparatus for Pumping Liquids.

Our invention relates to apparatus adapted for use in operating a method of pumping liquids for which an application for patent was filed by us in the United States Patent Office November 6th, 1910, Serial Number 590,790, and in which application said apparatus was shown but not claimed. The method of pumping liquids which said application describes is one whereby a portion of the high pressure energy of a medium having high initial pressure and expansive force and a portion of the expansion energy of said medium is used to pump against relative high pressures and the balance of the energy of said prime medium is used to pump against relatively low pressure or to store energy in an accumulator. In the apparatus which we have invented for carrying out this method of pumping liquids, a large portion of the energy of the prime medium is used directly as potential energy in displacing liquid and discharging it against relatively high pressure, a portion of the said energy is also used in direct displacement work done upon an accumulator, a portion is used in developing velocity in the liquid which is being forced toward the high pressure discharge and a portion is used in developing velocity in the liquid which is being forced toward the accumulator, and the kinetic energy represented by these velocities is used respectively to discharge against the relatively high pressure and to perform work upon said low pressure accumulator.

Figure I is a central vertical cross-section of such an apparatus and Fig. II is a central vertical cross-section of the same apparatus showing a different arrangement of the parts.

In Fig. I, 1 is a pump chamber, 2 is an extension of the pump chamber 1 forming a conduit connecting said pump chamber 1 with an accumulator 3 which is shown as an air chamber and intended to represent diagrammatically any type of accumulator or device capable of absorbing and giving

out energy. This accumulator is designed to be maintained at a pressure relatively lower than the pressure against which liquid is to be pumped. A high pressure discharge 4 through the connection 5 is connected with the conduit 2 at 6, and the flow of liquid through this connection 5 is controlled by the high pressure discharge valve 7, which may be located in the connection 5 at any point between the high pressure discharge 4 and the point 6; and the point 6 which is the junction of the high pressure connection 5 with the conduit 2 may be located at the pump chamber 1 or at any point on the conduit 2 between the pump chamber 1 and the accumulator 3. An inlet 8 for liquid to be pumped connects with the pump chamber 1 or with its extension 2, to admit liquid to the apparatus and the flow of liquid through this inlet is controlled by the inlet valve 9. A delivery main 10 may be attached to the high pressure discharge through a high pressure air chamber 11. While such high pressure air chamber is not essential to the apparatus, in most cases its use will increase the efficiency of the apparatus, especially where the liquid to be pumped must be discharged through a relatively long delivery main. When the discharge from this pumping apparatus is herein referred to, it is intended to refer to the region of the outlet 4 where the liquid pumped leaves the described connection 5 and enters the high pressure air chamber, if no air chamber be used then the high pressure discharge 4 is at the outlet of the delivery main 10, (although in such case the outlet may not actually be at high pressure) and the delivery main 10 becomes a part of the connection 5. The drawing shows a piston 12 working in the chamber 1 and a piston rod 13 by which the piston 12 may be connected with the piston rod of a reciprocating prime mover such as a gas or steam engine or other reciprocating prime mover actuated by an expanding medium.

In Fig. II the parts will be understood by the above description of Fig. I, like numbers referring to the same parts. This Fig. II illustrates some of the variations in the arrangement of the parts mentioned in the foregoing description showing the valves 7 and 9 in different positions in the connection 5 and inlet 8, and showing a

different location of the junction 6 of the connection 5 with the pump chamber 1 and conduit 2. In this Fig. II the accumulator 3 is diagrammatically represented as a vertical column which when filled with liquid will perform the functions of an accumulator, but this may be made in the form of an air chamber or other device capable of absorbing and giving out energy. When such type of accumulator be used the column is to be designed of height to produce less pressure at its base than the pressure against which liquid is to be pumped. It is understood that the inlet valve 9 may be located at any point in the inlet 8.

In constructing this apparatus we do not confine ourselves to the particular arrangement of the parts shown by the drawings, for it is evident that the size, number, shape and arrangement of the parts may be varied to suit varying conditions of practice without departing from our invention as herein described, and that two or more high pressure connections may be used simultaneously to discharge liquid against different pressures and two or more inlets may be used to admit liquid to the apparatus. If the junction 6 of the high pressure connection 5 with the conduit 2 be relatively close to the low pressure accumulator 3, liquid can be pumped to pressures but slightly higher than that of the low pressure accumulator 3, but if this junction 6 be at, or relatively close to the pump chamber 1 liquid may be pumped against pressures nearly equal to the maximum pressure developed in the pump chamber and by locating this junction 6 at the proper point between the pump chamber 1 and low pressure accumulator 3 liquid may be pumped against any desired pressure within the range of the apparatus, which has for its high pressure limit a pressure slightly less than the maximum pressure developed in the pump chamber 1 and for its lower limit the pressure at which the low pressure accumulator 3 is designed to operate.

The quantity of liquid which can be discharged during each power stroke, the speed of operation, and the relation between the discharge pressure and the pressure of the low pressure accumulator will depend upon the shape, size and length of the conduit 2 and upon the shape, size and length of the high pressure connection 5 and upon the location of the junction 6 of said connection 5 with the conduit 2 or pump chamber 1.

In an application for patent filed by us in the United States Patent Office April 13th, 1911, Serial No. 620,804, for a method of pumping liquids in which differences in pressure produced by an oscillating body of liquid are utilized to perform useful work.

this apparatus is shown but not claimed and

we have therein described how the atmosphere may be used as a low pressure accumulator in connection with said apparatus. It will be understood that the air chamber 3 shown by the drawings is intended to represent an accumulator of any type capable of absorbing and giving out energy, and that when such accumulator takes the form of a column of liquid open to the atmosphere that the atmosphere may perform or assist in performing the functions of an accumulator, and that such an accumulator may be designed to operate at atmospheric pressure and may be maintained in free communication with the atmosphere.

The apparatus herein described enables us to pump liquids by methods which differ materially from those heretofore used. It will be observed that by the use of conduits containing bodies of liquid acting both as liquid pistons and as flywheels, it becomes possible to utilize a portion of the energy of the prime medium for direct displacement by pressure, so that only that portion of this energy which is converted into kinetic energy must be transformed into potential energy to be converted into useful work. The operation of our apparatus therefore differs materially from that used in apparatus of the hydraulic ram type in which all the energy utilized to do useful work is at one stage of the cycle represented by the velocity of the moving mass, and from other apparatus of types in which the moving mass acts upon an accumulator to raise the pressure or resistance of the accumulator up to a pressure equal to or greater than the pressure against which liquid is to be discharged, and these differences in functions require corresponding differences in the construction of such apparatus.

The use of this apparatus increases the efficiency of those methods of pumping in which a body of liquid is used as a piston and as a flywheel to store up and give out energy because as only a portion of the useful energy is transformed into kinetic energy represented by the velocity of the moving body of liquid, the velocity of said body of liquid may be reduced without decreasing the quantity of work done, and this decrease in velocity reduces the loss in energy from friction and eddy currents which attend the employment of relatively higher velocities.

In operating this apparatus the continued travel of the body of liquid after the end of the power impulse of the prime medium creates a reduction in pressure at the inlet and permits a new increment of the liquid to be pumped to enter the apparatus, and the power stored in the accumulator during the outward travel of the body of liquid, is utilized to effect or to assist in effecting the return stroke of the prime mover, to

react upon the prime medium in preparation for the next power stroke, to discharge liquid or to perform any or all of these functions.

5 The inlet valve to control the admission of liquid is shown in the drawings as an automatic non-return flat-seated lift valve of a type in common use, but we do not confine ourselves to the use of valves of this particular type for it is evident that valves
10 of the puppet, globe, piston, disk or other types, single or multiple seated, or automatically or mechanically operated may be used to admit liquid to the apparatus.

15 The methods herein described, or partly described, as applicable for use in the operation of this apparatus are not herein claimed, being the same methods claimed in the hereinbefore named applications for patent Serial Nos. 590,790 and 620,804.

20 Having described our invention, we claim,

1. An apparatus for pumping liquids comprising in combination a pump chamber, an accumulator adapted to be operated at relatively low pressure, an extension of said
25 pump chamber forming a conduit connecting said pump chamber with said accumulator and establishing free communication between said pump chamber and said accumulator, a connection from said conduit
30 and pump chamber to a discharge outlet adapted to discharge liquid against a relatively high pressure, a discharge valve, an inlet for the admission of liquid to said

apparatus and an inlet valve, said inlet being connected with said conduit and pump
35 chamber at a point in said apparatus relatively remote from said high pressure discharge outlet.

2. An apparatus for pumping liquids comprising in combination a pump chamber, an
40 accumulator adapted to be operated at relatively low pressure, an extension of said pump chamber forming a conduit connecting said pump chamber with said accumulator
45 and establishing free communication between said pump chamber and said accumulator, a connection from said conduit and pump chamber to a discharge outlet adapted to discharge liquid against a relatively high
50 pressure, a relatively high pressure accumulator connected to and in communication with said discharge outlet, a discharge valve, an inlet for the admission of liquid to said
55 apparatus and an inlet valve, said inlet being connected with said conduit and pump chamber at a point in said apparatus relatively remote from said high pressure discharge outlet.

In testimony whereof we have hereunto signed our names at Philadelphia, Penn-
60 sylvania, this eighth day of January, 1912.

HENRY M. CHANCE.

THOMAS M. CHANCE.

Witnesses:

CHAS BUSH,
E. M. LEACH.