

No. 623,470.

Patented Apr. 18, 1899.

E. G. HARRIS.
WATER SERVICE SYSTEM.

(Application filed Feb. 19, 1898.)

(No Model.)

3 Sheets—Sheet 1.

FIG. 1.

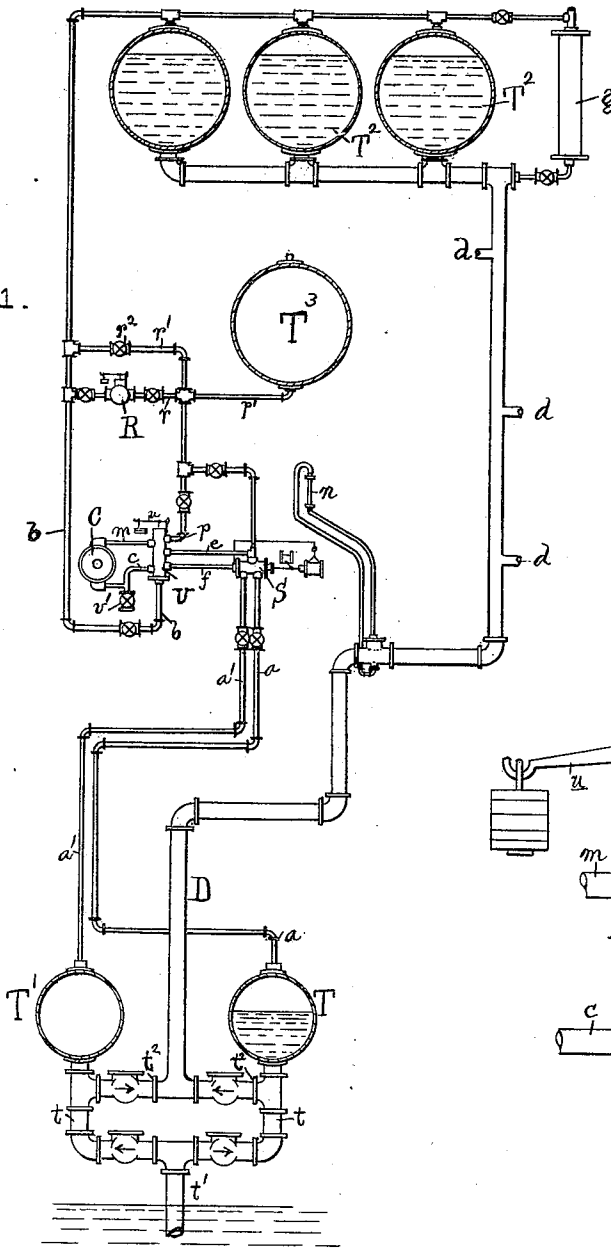
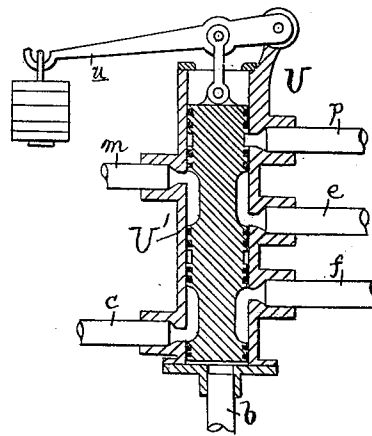


FIG. 2.



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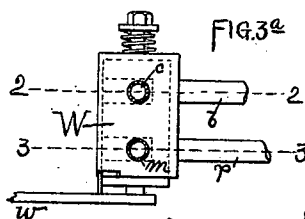
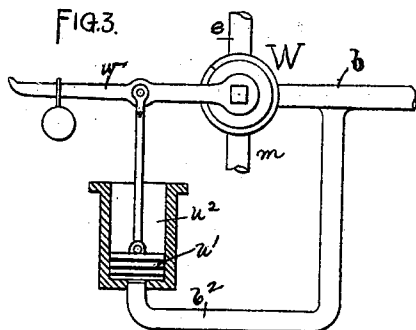


FIG. 3ᵇ
[SECTION ON 2-2]

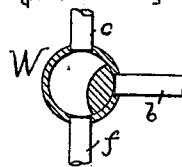
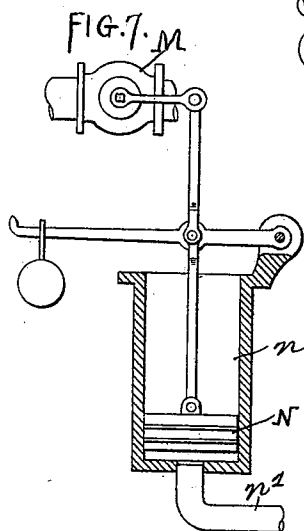
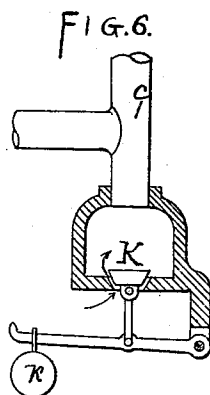
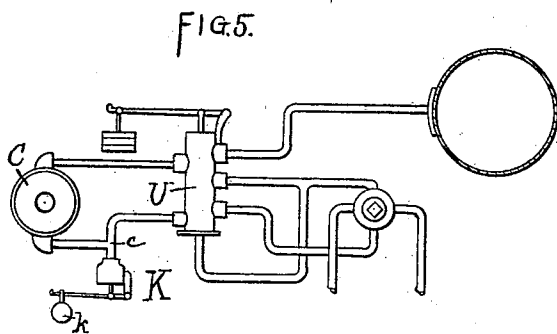
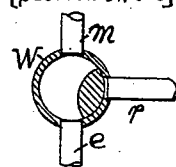


FIG. 3ᶜ
[SECTION ON 3-3]



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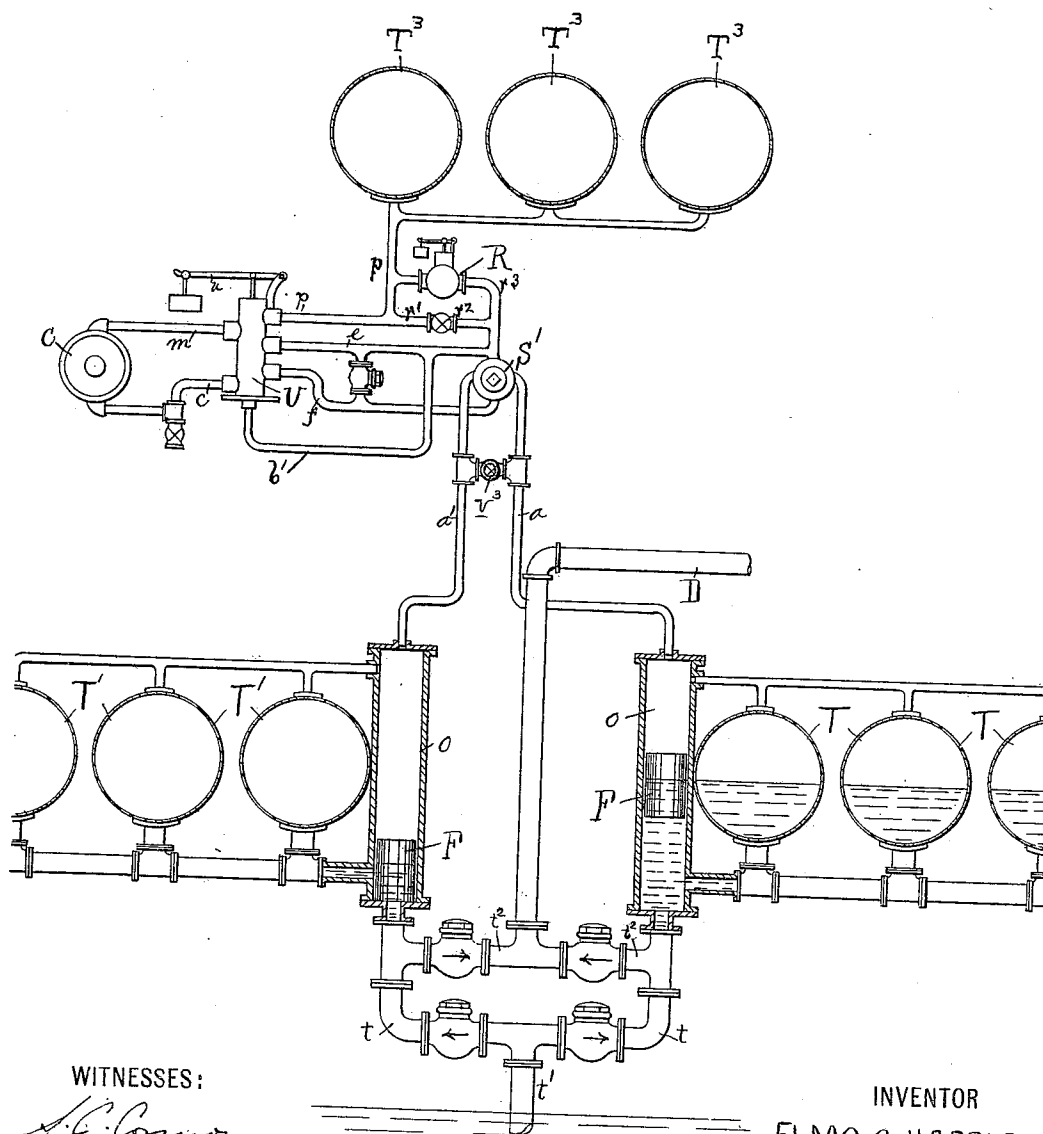
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3 Sheets—Sheet 3.

FIG. 4.



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ELMO G. HARRIS, OF ROLLA, MISSOURI.

WATER-SERVICE SYSTEM.

SPECIFICATION forming part of Letters Patent No. 623,470, dated April 18, 1899.

Application filed February 19, 1898. Serial No. 670,886. (No model.)

To all whom it may concern:

Be it known that I, ELMO G. HARRIS, a citizen of the United States, residing at Rolla, Phelps county, State of Missouri, have invented Improvements in Water-Service Systems, of which the following is a specification.

The object of my invention is to provide a water-service system with means economical in construction, in operation, and in consumption of energy for maintaining a uniform water-delivery pressure, while also permitting the instantaneous application of high pressure when needed for special work, such as fire protection, &c. This object I attain by the construction hereinafter set forth and claimed.

In the accompanying drawings, Figure 1 is diagram illustrating one construction or form of water-service system embodying my invention. Fig. 2 is a sectional view, drawn to a larger scale, of one form of the automatic unloading-valve forming a feature of my invention. Figs. 3, 3^a, 3^b, and 3^c are views of a modified form of unloading-valve. Fig. 4 is a diagram of a modified system embodying my invention. Fig. 5 is a diagram illustrating a further feature of invention. Fig. 6 is a sectional view, drawn to a larger scale, of a form of automatic recharging-valve which may be employed; and Fig. 7 is a view illustrating an automatic stopping device for the compressor.

In carrying out my invention I so construct the water-service system as to employ an air-compressor to perform the functions of pumping or raising the water and automatically storing up air under pressure to provide a uniform water-delivery pressure, while permitting of instantaneous application of high pressure whenever desired or required.

In Fig. 1 I have shown my invention as applied to a pneumatic water-pumping system of the type illustrated in my Patent No. 580,687, dated April 13, 1897, and I will first describe my improvements in connection with Figs. 1 and 2, which latter shows in section, on a larger scale, the form of unloading-valve illustrated in outside elevation in Fig. 1.

T and T' are two water vessels connected at their lower ends through piping *t t* and check-valves (opening as indicated by the arrows) with a pipe or pipes *t'*, leading into the well or other source from which water is to be

elevated. The lower ends of these tanks are also connected through branches *t*², having check-valves, with the water-delivery pipe D, leading to points of discharge or delivery *d* and also (in this case) to the water-storage vessel T², which in this instance is shown as consisting of three connected tanks.

The upper ends of the water vessels T T' have air-pipes *a a'* opening into them and connected to the air-compressor C through any suitable form of a switch or reversing-valve S. In Fig. 1 I have shown in outside view the reversing-valve and its operating mechanism fully set forth in my above-mentioned patent, No. 580,687. The connection to the suction or inlet side of the compressor is through the pipes *f* and *c*, while the connection to the discharge or outlet side of the compressor is through the pipes *e* and *m*, the unloading-valve U being interposed between these two sets of pipes. In Figs. 1 and 2 I have shown this unloading-valve as in the form of a piston-valve working in a suitable casing U' and adapted to be normally maintained in the position shown in Fig. 2 by suitable means, such as a weighted lever *u*. When the valve is in this position, there is a clear passage to the inlet side of the compressor through the pipes *f* and *c* and likewise a clear passage from the outlet side of the compressor through the pipes *m* and *e*. Opening into the bottom of the valve-casing U' is a pipe *b*, leading from the upper part of the water-storage vessel T², so that when the air-pressure in this vessel T² and the pipe *b* exceeds a prescribed limit such pressure will move the piston-valve U against the weighted lever *u* to shut off connection between the pipes *f* and *c* and between the pipes *m* and *e*. This movement of the valve will open communication between the pipe *b* and the pipe *c*, leading to the inlet side of the compressor, and at the same time communication will be opened between the pipe *m* from the outlet side of the compressor to a pipe *p*, which connects through a pipe *p'* with the air-reservoir T³. This air vessel T³ itself is connected with the upper parts of the water-storage vessel T² either directly or through the pipe *p'*, branch *r*, and pipe *b*, as shown, and in this connection is any suitable pressure-reducing valve R. A branch *r'*, having a globe or other

hand-controlled valve r^2 , is provided to allow of a direct connection being made between the high-pressure air-reservoir T^3 and the tanks T^2 on opening the valve r^2 .

- 5 Any suitable device g may be employed to indicate the water-level in the storage-tanks T^2 . A glass joint n in a loop of a small pipe may be provided on the delivery-pipe D to serve as a gage of the air charge in the tanks T^2 .

- 10 To charge the apparatus, assuming that the reservoirs and pipes are empty, an air-inlet cock v' on the pipe c is opened and the compressor set in operation. The unloading-valve U is moved from its normal position by hand or otherwise, so as to open communication between the pipe b and the pipe c to the inlet side of the compressor and to open communication between the pipe m on the outlet side of the compressor and the pipe p , leading to the air-reservoir T^3 . Air is pumped into this reservoir up to the desired pressure—say one hundred pounds to one hundred and fifty pounds. The air-inlet valve v' is now closed and the valve U returned to its normal position, (shown in Fig. 2,) shutting off communication between the pipes b and c and between the pipes m and p and opening communication between the pipes f and c and the pipes m and e . The pipe f is in communication through the reversing-valve S with one of the water vessels—say T —while the pipe e is in communication through the same valve S with the other water vessel T' . The operation of the compressor now exhausts the air from the tank T and causes the water to rise therein, while air is forced into the other vessel T' , and as that is as yet without water such air will pass up into the pipe D . When the tank T is filled with water, the valve S is reversed and the compressor begins to exhaust air from and to draw water into the vessel T' , and at the same time it forces the water which has previously been drawn into the vessel T out and into the discharge-pipe D . More air will probably now need to be drawn in from the outside to thoroughly charge the system and to discharge the water in the vessel T' , and for this purpose the air-cock v' may be opened again until the necessary air has been introduced. The system is now charged and the operation continues automatically. The water thus pumped up through the piping D will rise in the storage-tanks T^2 until the pressure in the upper part of these tanks exceeds a given limit. Then such pressure acting through the pipe b will move the unloading-valve from its normal position, (shown at Fig. 2,) so as to shut off communication between the compressor and the piping $a a'$ and water-tanks T and T' and to open communication between the pipe b and the inlet side of the compressor and between the outlet side of the compressor and the pipe p , leading to the high-pressure air-reservoir T^3 . When the pressure is thus relieved in the upper part of the water-tanks T^2 , the valve U will drop back again

to its normal position. On the other hand, when the pressure of air in the vessels T^2 descends below the desired limit, owing to drawing off of water at the delivery branches d , air will be supplied to make up the deficiency from high-pressure reservoir T^3 through the reducing-valve R . In this way I maintain automatically a practically uniform delivery-pressure, the one air-compressor C doing all the work. By opening the valve r^2 in the pipe r' , however, high pressure can be supplied instantaneously for fire purposes or other special occasions.

All parts of the system requiring care and attention can be conveniently brought within the compressor-room, and though the reversing-valve and the unloading-valve are designed to be automatic they are within the direct control of the attendant. The use of the one compressor to do all the work is advantageous not only in the matter of simplicity and economy in construction, but also in economy of energy, since it utilizes practically all the energy in the compressed air.

In the construction illustrated in Fig. 4 the water-pumping vessels T and T' and the water-storage vessel T^2 of Fig. 1 are combined. In this view, Fig. 4, the air-reservoir T^3 is shown as composed of a group of tanks, while the water vessels T and T' are shown in two groups of three tanks each. Corresponding letters of reference are used in Fig. 4 for corresponding parts of Fig. 1; but in this diagram I have for simplicity indicated the reversing-valve S as of the rotary type. In this case the connection between the high-pressure air vessel T^3 and the water-tanks T and T' through the reducing-valve R is made through a piping r^3 , connecting the pipe p with the pipe e . The pipe b of Fig. 1 is replaced by pipe b' , connecting the same pipe e with the under side of the unloading-valve U , for this pipe e is always in communication with one or other of the water vessels T and T' and may be thrown into communication with both on opening a cross-connection valve v^3 .

The operation of the device shown in Fig. 4 is similar to that shown in Fig. 1 both in the matter of charging and the general operation of the system.

To make clear how the tanks T and T' also serve as water-storage vessels, it will be understood that when water is not being drawn off from the piping D the pressure in these tanks will run higher than desired. This excess of pressure passing from the pipe e through the branch b' will act on the unloading-valve U , raising it from its normal position, Fig. 2, to close off communication between the pipe m and pipe e and open communication between the pipe m and the pipe p , thus carrying the excess into the high-pressure reservoir T^3 until the pressure in the water-tanks T or T' , as the case may be, is reduced sufficiently to allow the valve U to return to its normal position. The operation will be renewed and continued until both sets

of tanks T and T' are more or less filled with water (assuming that little or none has been drawn off through D) and the air will be stored in the high-pressure tanks T³. The compressor may then be stopped either by hand or automatically, and then the valve *v*³ is opened to open communication between the pipe *a* and the pipe *a'*, when the water in both sets of tanks T and T' will be under uniform pressure from the air in the reservoir T³ through the reducing-valve R.

In conjunction with the water vessels T and T', I prefer to use automatic float-valves F F in vertical cylinders O O, Fig. 4. These floats are designed to rise and fall with the water in the tanks, so as to close the outlets against the passage of the water at the top or air at the bottom of the cylinders O O when brought into contact therewith by the rising or falling of water-line. Hence water can never ascend into pipes *a* and *a'* or air descend into the water-pipes and escape.

I wish it to be understood that I do not intend to restrict myself to any special construction of unloading-valve U. For instance, instead of that already described the construction shown in Figs. 3, 3^a, 3^b, and 3^c may be employed. The valve there illustrated is a double rotary valve W, controlling two sets of ports and adapted either to connect pipe *f* with pipe *c*, Fig. 3^b, and pipe *m* with *e*, Fig. 3^c, or by a partial turn to close those connections and at the same time open pipe *b* to pipe *c* and the pipe *m* to pipe *p*. To turn the valve, I may have a weighted arm *w*, acted on by a piston *u'* in a cylinder *u*², a branch *b*² of the pipe *b*, Fig. 3, opening into the bottom of the cylinder *u*² to raise the piston and turn the rotary valve when there is an excess of pressure in pipe *b*, as before described.

In Figs. 5 and 6 I have shown a construction whereby the compressor may automatically recharge itself with air to make up for the air lost during the operation. For this purpose I apply to the pipe *c* or at any suitable point on the inlet side of the compressor in place of the air-cock *v'*, before described, an automatic valve K with a counterweight *k*, which can be adjusted to keep the valve

normally closed, but to open when the pressure on the inlet side of the compressor descends below a prescribed limit.

In connection with my pneumatic water-pumping system described I provide means for automatically stopping the compressor when the pressure in the system exceeds a prescribed limit. This stopping device may take many different forms; but in Fig. 7 I have indicated one which may be employed. M is a cut-off valve in the steam-pipe leading to the compressor-engine, and this valve is under the control of a weighted piston or diaphragm N in a cylinder *n*, and the piston in the cylinder is open to the pressure from the air-reservoir T³ through a pipe *n'*. As will be readily understood, an excess of pressure in this pipe *n'* will move the piston N against its counterweight and close the valve M, causing the compressor to stop until the pressure in the air-reservoir is reduced again by the drawing off of the water from the system.

I claim as my invention—

1. The combination of the water vessels of a pumping system with an air-compressor connected with said vessels to elevate the water in the system, a high-pressure air-reservoir, an unloading-valve and connecting-piping, whereby on an excess of pressure in the water vessels, the unloading-valve opens the compressor-discharge to the said air-reservoir, substantially as described.

2. The combination of the water vessels of a pumping system with an air-compressor connected with said vessels to elevate the water in the system, a high-pressure air-reservoir an unloading-valve, connecting-piping between the unloading-valve and the water vessels and air-reservoir and a reducing-valve in connection between the said air-reservoir and the water vessels, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

ELMO G. HARRIS.

Witnesses:

ARTHUR H. TIMMERMAN,
R. P. GARRETT.