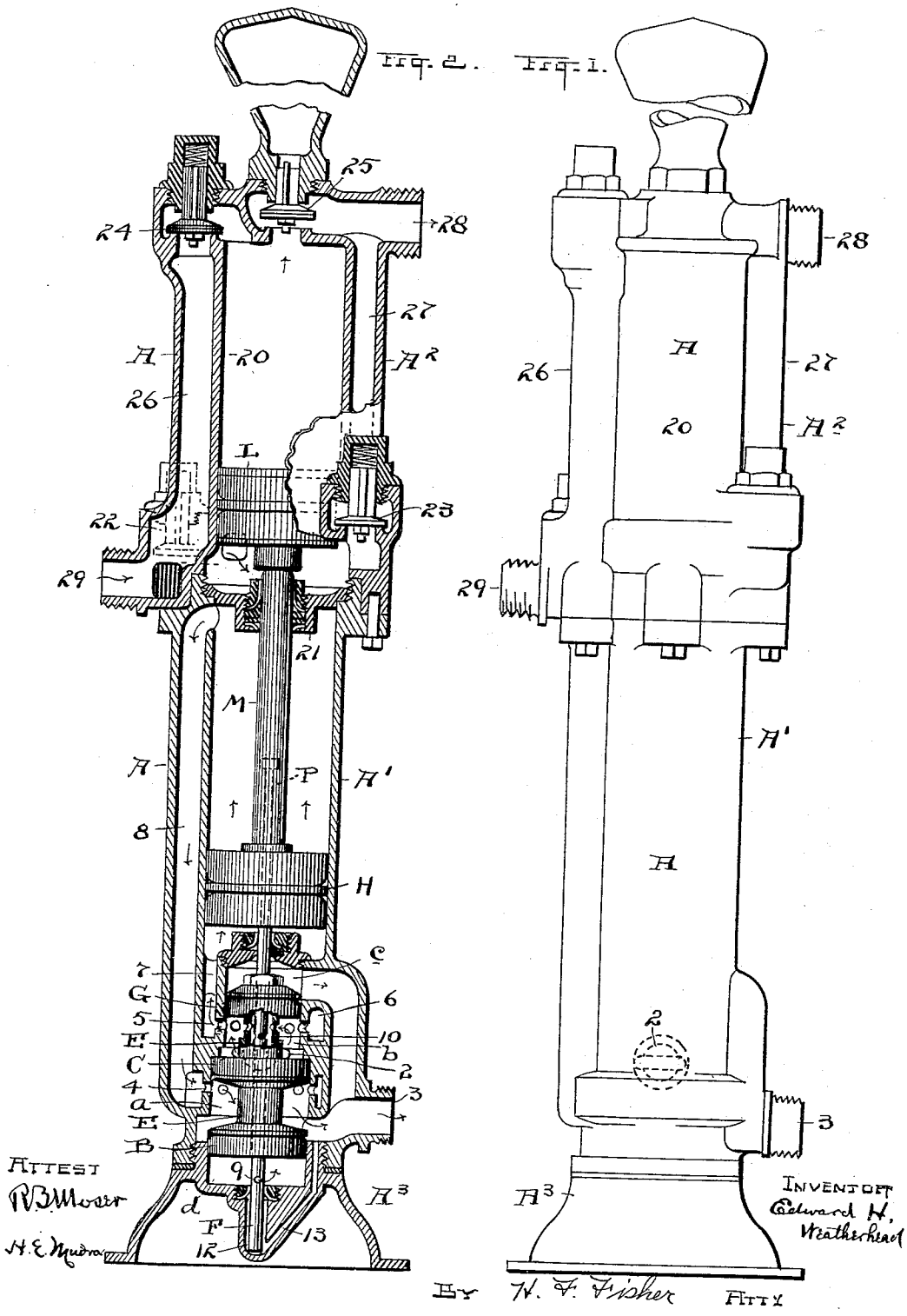
No. 623,297. Patented Apr. 18, 1899.

E. H. WEATHERHEAD.

COMBINED HYDRAULIC ENGINE AND PUMP.

(Application filed May 13, 1898.)

(No Model.) 3 Sheets—Sheet 1.



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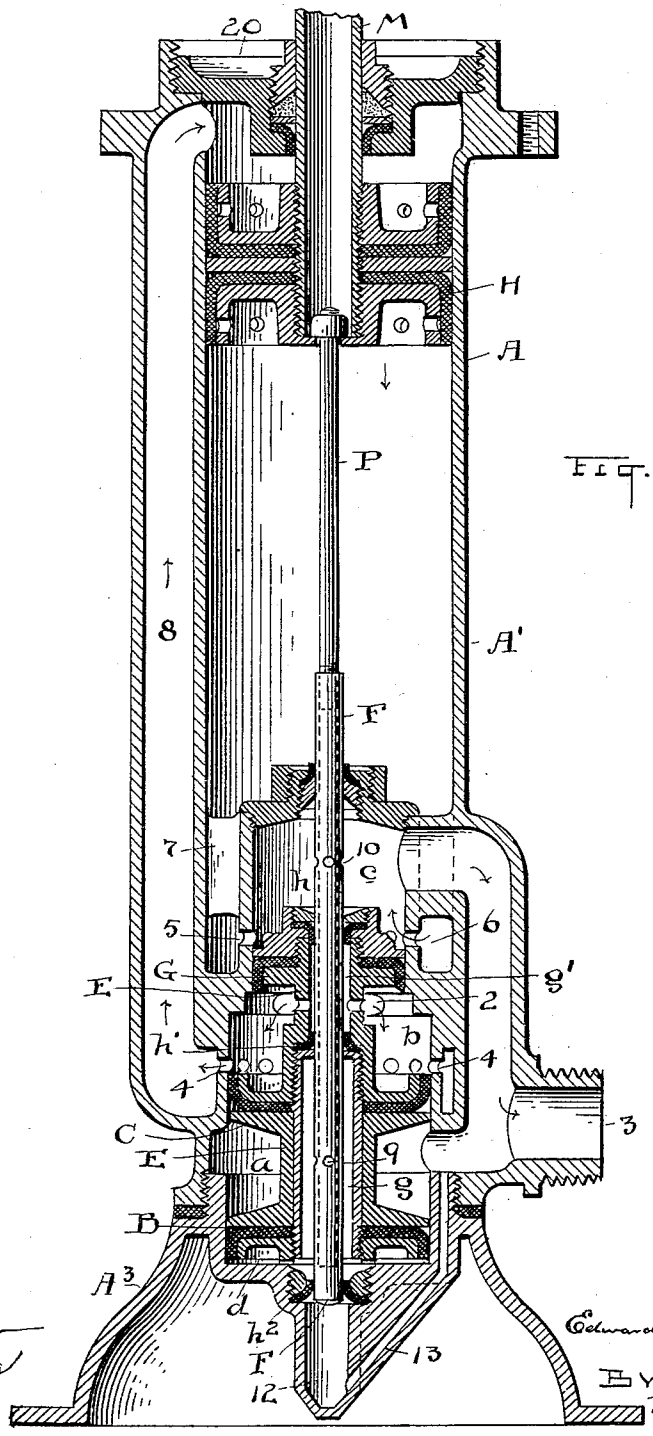

Fig. 3.

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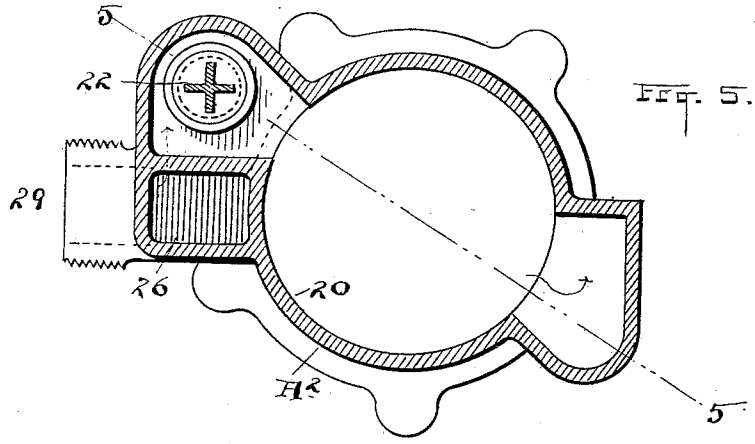

Fig. 5.

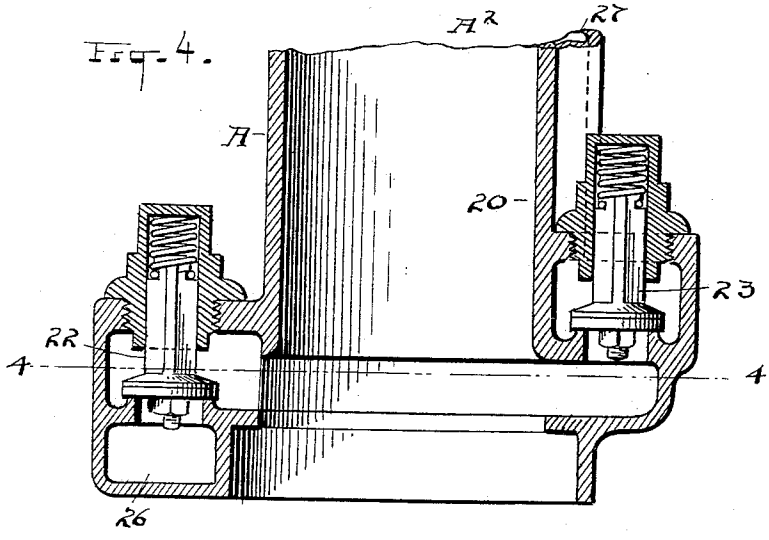

Fig. 4.

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UNITED STATES PATENT OFFICE.

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COMBINED HYDRAULIC ENGINE AND PUMP.

SPECIFICATION forming part of Letters Patent No. 623,297, dated April 18, 1899.

Application filed May 13, 1898. Serial No. 680,603. (No model.)

To all whom it may concern:

Be it known that I, EDWARD H. WEATHERHEAD, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in a Combined Hydraulic Engine and Pump; and I do declare that the following is a full, clear, and exact description of the invention, which will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to a combined hydraulic engine and pump; and the invention consists particularly in an engine and pump which, as here shown, are united in one structure and adapted to be connected up with a service-pipe or source of water-supply in cities and to run automatically and continuously as long as the pressure is on. However, the engine or motor portion of the structure is not necessarily limited to use with a pump, as hereinafter fully described.

In many towns and cities the water supplied through the mains is undesirable for any domestic or family use and in others it is undesirable for particular uses. For example, in some cities the city water is so heavily impregnated with lime that it is unsuited for any kind of washing. In others the city water is undesirable for drinking or cooking. In all such and kindred cases there is a growing demand for pumps which can be coupled up with the city water-supply and used as a medium for forcing cistern, spring, or well water into the service-pipes throughout the building or into a tank or reservoir from which the building can be supplied. I am of course aware that this is not a newly-discovered need and that a great many pumps have been invented and made which have for their object to supply this need; but I am also aware that comparatively few of all the pumps designed for this purpose have been able to withstand practical tests and enter the market on their merit, so that after all it remains true that it is still difficult for the public to find a thoroughly good hydraulic pump suited to this service and where my new and improved pump is doing its work.

Having reference now to the accompanying drawings, Figure 1 is a plain elevation of my pump. Fig. 2 is a vertical central sectional elevation thereof, showing the parts in one position; and Fig. 3 is a similar view showing the parts in the opposite position, as hereinafter described, but Fig. 3 is enlarged over Fig. 2 and the upper portion of the pump is removed. Fig. 4 is an enlarged sectional elevation on line 5 5, Fig. 5, of the lower portion of the upper part of the pump, not shown in Fig. 3, but shown in Fig. 2. Fig. 5 is a cross-section of Fig. 4 on line 4 4.

From the foregoing views it will be seen that the engine proper or motor is in the lower section or part of the apparatus, while the pump proper is in the upper part thereof, and for convenience this separation will be observed in the further description of the invention.

A represents the entire outer casing of the apparatus, but for convenience of manufacture and the introduction of the operating parts is made in two principal sections A′ and A^2, and a base A^3, on which the entire structure rests. Within the lower section are the piston B, the valve C, of the same size as said piston, and the smaller valve G, all rigidly connected together by neck E. This neck E is open at its lower end, so as to afford communication with the space immediately beneath piston C, and is closed near its middle and top portions by packing against tube F.

The pressure-fluid-inlet passage or port 2 is between the two valves C and G. The interior of the casing A is differential in its bearing-surfaces to conform to the size of said valves and piston, and these members being all rigidly connected together have all their strokes or movements in unison and more or less in mutual dependence one on the other.

Fluid-spaces are shown on opposite sides of both piston B and of the valves C and G, the space *a* between the piston B and valve C, the space *b* between the upper valve C and valve G, the space *c* above valve G, and the space *d* below piston B. The power-pressure-inlet port 2 communicates directly and always with space *b*, and the length of the neck coming between valve C and valve G is sufficient to enable this to occur.

The exhaust or outlet port 3 from the engine is in open communication with the fluid-

spaces *a* and *c* at all times and at given times with the openings 4. (Shown below valve C in Fig. 2 and which are above said valve in Fig. 3.) The valve C therefore crosses these openings 4 in its back-and-forth movements, leaving them first on one side for water-supply and then on the other for water-exhaust. This open communication through openings 4 with the exhaust-port occurs every time the piston and valves reach the limit of their upward stroke, as seen in Fig. 2. Another series of openings 5 and annular belt 6 is in the wall of the casing traversed by valve G, and these at certain times communicate with the fluid-space *c* above the said valve, as in Fig. 3, and at other times with the space *b* beneath said valve, according to the positions of the parts, as hereinafter described.

The piston B and valves C and G all have more or less part in changing in their own movements to control the direction of the flow of the motive fluid as one or another is under the direct pressure of said fluid, and their reversal is partly effected through the auxiliary-valve tube F, as also will hereinafter more fully appear. These parts also control piston H, which works in the cylindrical upper portion of the casing-section A′ and is double-acting, as the fluid comes first on one side and then on the other. When in position as seen in Fig. 2, the motive fluid enters beneath said piston from fluid-pressure space *b* through holes 5 and duct 7 and forces the piston upward. When the piston reaches the end of its upward stroke, the parts are in position as in Fig. 3 and the operation is reversed, and the motive fluid now finds inlet through holes 4 to outer duct 8 and thence to the space above piston H, causing it to travel downward. In either case the present fluid-pressure-supply channel has just been the exhaust-channel for the spent fluid, and in this respect said channels alternate. This is seen in Fig. 3, where the holes 5 are exhausting the fluid from beneath piston H, whereas a moment before they were passing said fluid in the opposite direction for power, and the same result is seen in Fig. 2 with respect to the channel 8 and holes 4, which are now exhausting the fluid from above piston H. This is accounted for by the fact that as said piston approaches the limits of its strokes up and down the valve and piston mechanism which controls the direction of flow of the motive fluid are also doing their appointed work and reversing the direction of flow and of exhaust. In this operation of piston B and valves C and G the auxiliary-valve tube F performs an important part. This tube has a limited rectilinear movement in its packing h h' h^2 at the terminations of the open spaces g and g' about the same within the neck E, and two sets of openings 9 and 10, through which and the interior of said tube communication is effected with the fluid-space *d* beneath piston B.

As seen in Fig. 2, the upper series of holes 10 are in position to receive the fluid-pressure directly from inlet-port 2 and to convey the same down beneath piston B through the center of the tube and outlet-holes 9. This balances piston B and valve C and gives the pressure against valve G opportunity to act and raise the said valves and the piston, as has been done and is shown in Fig. 2. On the other hand, when the operation is reversed the fluid is exhausted from space *d* upward through tube F and out through holes 10 into the space *c* and thence out.

A peculiarity of the construction of the base A^3 is shown, which is of material consequence in this case. It will be noticed that the lower end of tube F at no time leaves the well 12, which is packed at h^2 against said tube, and that said well has an outlet-duct 13 to the exhaust 3. Therefore at no time is there any fluid-pressure endwise against the lower end of said tube F. This is important, because such pressure would reverse the tube at the wrong times and defeat the action of the engine. Such untimely reversal is impossible with my present construction.

It has been noted that the power-piston H is cut off from the motive fluid except through holes or passages 4 and 5 and ducts 7 and 8, which are supply and exhaust ducts and passages alternately, as before described, and the direction of flow in these is governed by piston B and valves C and G.

Now referring to Fig. 2, we see one application and use of the engine or motor shown in the lower section of the apparatus. Here we have the pump portion proper of the structure, comprising the cylinder 20, the piston L, working therein, and the tubular shaft M, connecting said piston with power-piston H, through the closely-packed diaphragm 21 at the top of lower casing-section A′.

The pump, like the engine, is double-acting, and to this end has four valves 22, 23, 24, and 25 and ducts or passages 26 and 27 and a common outlet 28 for the water and inlet 29. The operation is as follows: Having the piston L in position as seen in Fig. 2 and the piston H to drive it upward, the water above piston L is forced forward through valve 25 and out at 28 and at the same time the suction causes the cylinder 20 to fill behind said piston through passage controlled by valve 22. Then said piston having reached the end of its stroke and begun the descent by the reverse action and power of piston H the water beneath the same will be forced up through channel 27, past valve 23, and out at 28, while a fresh supply is being received above piston L through channel 26 by valve 24. This operation is then again alternated as the piston L reverses, and so on.

It will be observed in Figs. 2 and 3 that the shaft M, connecting pistons H and L, is not only tubular, but that the rod P, which is connected to the tube F, extends into the same and operates therein, so that when the said pistons descend the said rod P and the tube F

stand still until pressed downward by the shaft M, and then remain down until they are again drawn upward. The changing of position of tube F precedes the movements of the piston B and valves C and G, and the tube F depends for its movements on the positions of piston H and the shaft M. All the movements coöperate, however, and the action of the apparatus is automatic and exceedingly satisfactory by reason of its high efficiency and its quiet operation.

What I claim is—

1. In an apparatus substantially as described, the main casing comprising the base having a well in its bottom and an open passage therefrom to the exhaust-port, in combination with the piston and valves in said casing and the auxiliary valve extending through said piston and valves and having its lower end projected into said well, and packing about said tube to prevent the motive fluid from reaching and pressing against the extremity of said auxiliary valve, substantially as described.

2. The main casing having inlet and exhaust ports and a well in its bottom, and an open passage from said well to the exhaust-port, in combination with the valve and piston mechanism in the casing and an auxiliary-valve tube extending into said well and packing at the entrance to the well to prevent the fluid escaping about the tube, substantially as described.

3. The combination of the main casing having a well in its bottom and an outlet therefrom to the exhaust, in combination with the valves and pistons in the casing, a connecting-tube rigidly uniting two of said pistons, H and L, the auxiliary-valve tube and a rod thereon working in said connecting-tube, the said auxiliary-valve tube having its lower end packed to operate in the said well in the bottom of the casing, whereby the said auxiliary valve is protected from water-pressure against its end and the said parts are caused to reverse at the appointed times and places, substantially as described.

Witness my hand to the foregoing specification this 15th day of April, 1898.

EDWARD H. WEATHERHEAD.

Witnesses:
H. T. FISHER,
R. B. MOSER.