No. 775,585. PATENTED NOV. 22, 1904.

A. SUNDH.

WATER ELEVATING APPARATUS.

APPLICATION FILED OCT. 30, 1903.

NO MODEL. 2 SHEETS—SHEET 1.

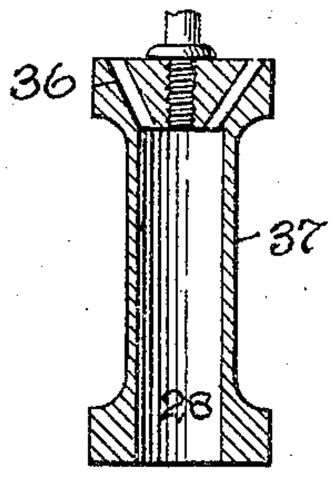

Fig. 2.

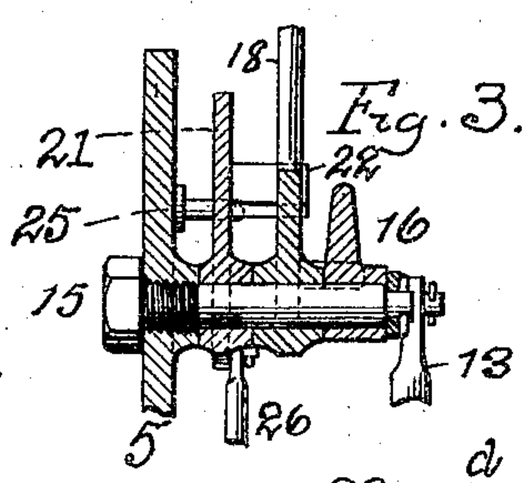

Fig. 3.

Fig. 1.

WITNESSES:

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A. Henderson.

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August Sundh

BY Carl Benjamin

His ATTORNEY

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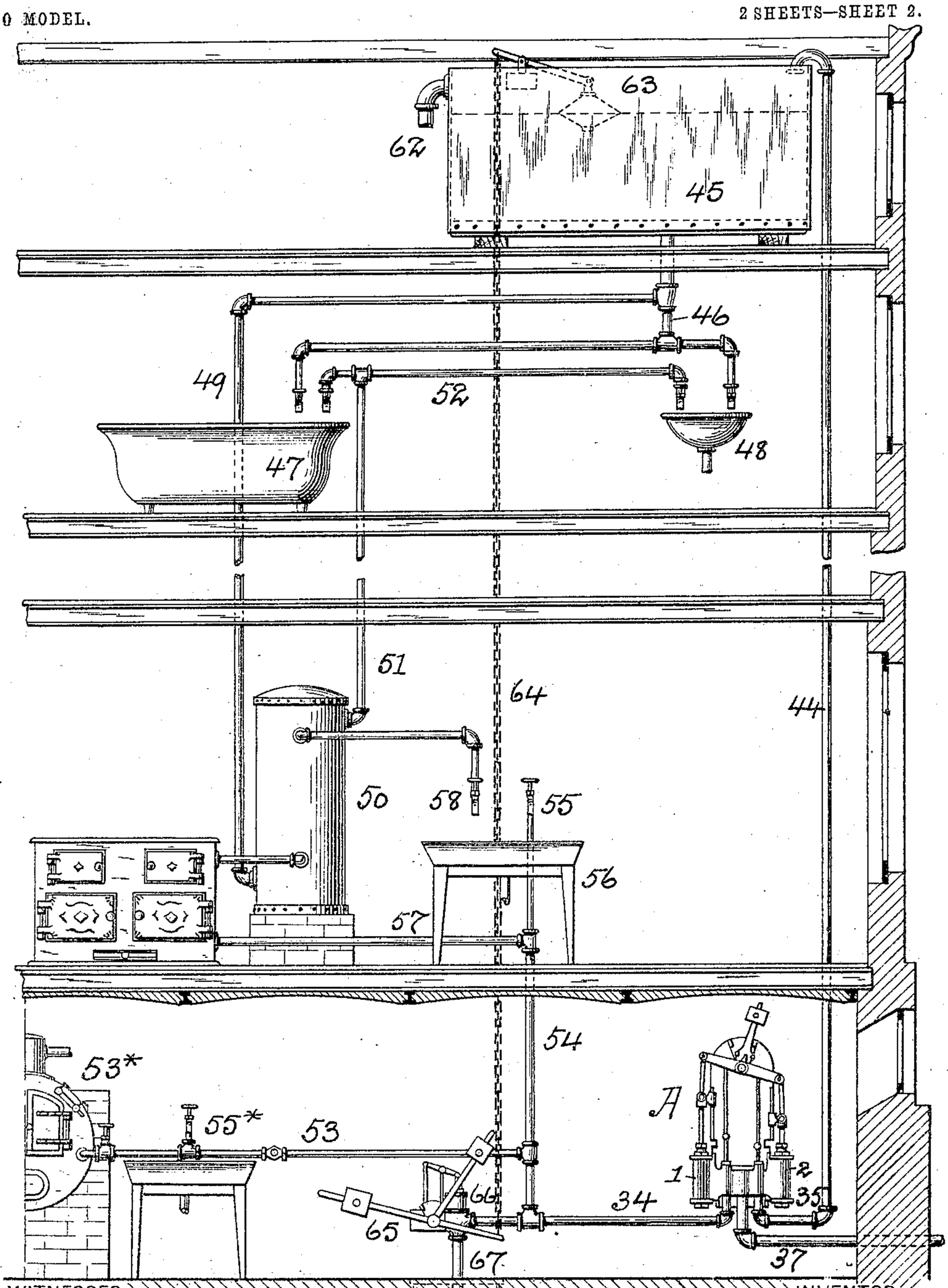
NO MODEL. 2 SHEETS—SHEET 2.



WITNESSES:
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Fig. 4.

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UNITED STATES PATENT OFFICE.

AUGUST SUNDH, OF YONKERS, NEW YORK, ASSIGNOR TO WILLIAM E. QUIMBY, INCORPORATED, A CORPORATION OF NEW YORK.

WATER-ELEVATING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 775,585, dated November 22, 1904.

Application filed October 30, 1903. Serial No. 179,160. (No model.)

To all whom it may concern:

Be it known that I, AUGUST SUNDH, of Yonkers, Westchester county, New York, have invented a new and useful Improvement in Water-Elevating Apparatus, of which the following is a specification.

My invention consists in utilizing the velocity of efflux of a liquid under constant pressure to increase the elevation to which a portion of said liquid may be raised over that due to said pressure alone.

This improvement in the art of raising liquids I believe to be wholly new. It may be applied to practical use in many ways and embodied in many forms of apparatus. One useful and practical embodiment, the best I now know, is hereinafter described and illustrated; but it is to be distinctly understood that I do not limit the application of my invention to this particular embodiment, but include therein the broadest range of equivalents.

My invention may be applied with advantage to cases where water is drawn off under pressure simply for the water itself, the energy of the outflowing stream then going to waste. Such a condition very commonly occurs in the lower stories of buildings in cities, and especially when the normal pressure in the mains is high. In such cases the water drawn off for ordinary household purposes is projected from the faucets with considerable force, which is far greater than is necessary and which therefore involves direct waste of energy. It also happens that although the pressure in the mains may be sufficient to deliver the water on the lower floors of buildings with much energy it may not be sufficient to force an adequate water-supply to the upper floors, or, in other words, the normal head is not sufficient to give the desired elevation. In such cases it is ordinarily the custom to provide house-pumps or some means to force the water into a tank at the top of the house, from which it is distributed to the service-pipes below. This of course involves an additional source of power and consequent expense. By my present invention this outlay is avoided, and the energy of the necessary escaping water drawn off for ordinary consumption at the lower floor of a building is here utilized to increase the head sufficiently of a portion of the incoming supply to cause that portion to reach the upper floors, or, if need be, a reservoir in the garret or on the roof. I desire to call special attention to the fact that I am here not using the pressure in the mains as a source of supply, such as is the case when water-motors or other hydraulic apparatus are employed, a proceeding which is usually placed under considerable restriction, if not prohibited, by the authority which furnishes the water-supply in towns and cities. I am simply utilizing the energy which now goes to waste on the low level because of the drawing off of water at such point for ordinary consumption and converting that energy into useful work in supplying the elevated tank. No additional water is drawn off for power purposes beyond that taken for usual consumption, so that the installation of my apparatus is not subject either to the restriction or prohibition often applied, as above stated, to water-motors and the like. This follows not only from the principle of my apparatus, but is affirmatively proved by the form of apparatus which is here illustrated, which, in addition to its function already described, serves as an efficient and practical water-meter capable of accurately registering the amount of water drawn off for consumption purposes.

In the accompanying drawings, Figure 1 is an elevation of the preferred form of my apparatus, showing the main cylinders, the pump-cylinders, and the water-passages in vertical section. The connecting-rods and supporting-plate are here shown broken twice in order to bring the drawing within the limits of the sheet and still keep the parts on a suitable large scale. Fig. 2 is a longitudinal section of one of the valves. Fig. 3 is a cross-section on the line *a a* of Fig. 1. Fig. 4 is a vertical section of the water-supply system of

a house, showing the arrangement of the service-pipes on the different floors and the mode of installation of my invention.

Similar characters of reference indicate like parts.

1 and 2 are the main cylinders, threaded at their extremities and so secured in the heads 3, which heads are bolted to the casting 4, which contains the water-passages hereinafter described and which in turn is bolted to the main supporting-plate 5. Within the main cylinders 1 and 2 are the pistons 6 and 7. The piston-rods 8 extend upwardly through stuffing-boxes 9 in the heads 3 and terminate in the gibs 10, which traverse slides 11 on the supporting-plate 5. Jointed to the gibs 10 are connecting-rods 12 13, which are forked at their upper ends to receive the lever 14, which is supported at its middle point on a pivot 15. The flared ends of the connecting-rods are secured to the lever 14 by pins passing through holes in said lever. There are several such holes at each end of the lever 14, so that either connecting-rod may be attached to said lever at points nearer to or farther from the pivot. Fast on the lever 14 is an upwardly-extending tappet 16, which may make contact with either of two fixed pins 17 on an arm 18, carried by the pivot 15, which arm is provided with an adjustable weight 19. In rear of the arm 18 and also supported on the pivot 15 is a lever 20, having an upward sector-shaped projection 21, on which are projecting stops 22 23. Finally on an upward extension of the main supporting-plate 5 are stops 24 25, which limit the movement of the upward extension 21 on its pivot 15. To the ends of the lever 20 are secured connecting-rods 26, which are jointed to the valve-rods 27. The rods 27 are connected to the valves 28 29, and these valves move in cylinders 30 31 and pass through stuffing-boxes 32 in heads 33 of said cylinders. The valve-cylinders 30 31 are open at their lower end and directly communicate with the delivery-pipes 34 35. As shown in Fig. 2, the valves 28 29 are hollow cylinders open at their lower end and provided with open passages 36 at their upper end. They are also contracted in diameter at their middle portions 37, so that at said middle portions there is considerable clearance between their outer peripheries and the inner peripheries of the cylinders 30 and 31, these clearances then forming water-passages and operating as hereinafter described.

37 is an inlet-pipe which is to be connected with the service-main or other source of constant supply of liquid under pressure. This pipe communicates with a chamber 38 in the casting 4, and the chamber 38 in turn communicates by ports 39 in the cylinders 30 31 with the clearance-spaces around the valves 28 29. Near the upper end of each cylinder 30 31 are ports communicating with the water-passages 40 41, which connect with the passages in the upper heads 3 or with the upper ends of the cylinders 1 and 2. Near the lower part of each cylinder 30 31 are similar ports which communicate with the water-passages 42 43, which lead to the passages in the lower heads 3, which in turn open into the lower ends of main cylinders 1 and 2.

The operation of the apparatus so far described is as follows, the pistons 6 and 7 being at the middle of their stroke and the other parts as represented in Fig. 1, it being further assumed that the lower end of the delivery-pipe 34 is open while pipe 35 leads to the upper level to which the water is to be carried: The water entering under pressure through the pipe 37 passes to the chamber 38, to the middle ports of valve-cylinder 30, around the valve 28, and so by passage 40 to the space above the piston 6 in main cylinder 1. It thus may operate by its pressure to force down the piston 6, the movement of which is unimpeded, since there is free waterway through the passage 42, the lower ports of valve-cylinder 30, and pipe 34. On the other side of the apparatus the water under pressure passes through the middle port of cylinder 31, around the valve 29, through the passage 43, and so to the space below the piston 7. In the main cylinder 2 the space above the piston 7 communicates by the passage 41 the upper ports of valve-cylinder 31 and the interior of the hollow valve 29 with the delivery-pipe 35, which pipe, as already stated, may lead to the upper level to which the water is to be supplied. It will be obvious that under these conditions the full pressure of the mains coming through pipe 37 is exerted above the piston 6 and below the piston 7. If we assume that the space above the piston 7 is filled with water and that the area of piston 6 is equal to that of piston 7, then (excluding friction) the pressure exerted to force the water from cylinder 2 to the pipe 35 acts upon an area double that of the piston 7. As the piston 6 descends piston 7 rises, the lever 14 tilts to the left of the drawing, and the tappet 15, which is in contact with the pin 16 on the arm 20, moves that arm to the left until it passes a vertical line drawn through the center of pivot-pin 15, when said arm, assisted by the weight 19, falls by its own gravity to the left and meets the stop 23 on the upward projection 21 of the lever 20. Because the arm strikes the stop 23 quickly by reason of its fall, it suddenly tilts the lever 20 until the projection 21 strikes the stop 24, and thereafter by reason of this quick tilting of the lever 20 changes the position of the valves 28

29 to the reverse of that shown in the drawing Fig. 1, and as a consequence of this change the water entering pipe 37 now passes above the piston 7 and below piston 6. The water which is above piston 6 escapes through the passage 40, and so through the hollow valve 28 to the delivery-pipe 34. The water which is below the piston 7 escapes through the passage 43, through the lower ports of valve-cylinder 31, which now come below the valve 29, and so to pipe 35. This operation then goes on continuously as long as a free outlet is permitted at the pipe 34, but of course stops when that outlet is closed. It follows, therefore, that by reason of this construction I have added to the head due to the normal water-pressure exerted on the piston 7 the energy due to the velocity of the efflux at the pipe 34, which is exerted upon the piston 6, and hence the work done by the two pistons 6 and 7 is sufficient to raise at each stroke an amount of water equal to the cubic contents of cylinder 2.

Referring now to Fig. 4, which, as already stated, represents the pipe service and appurtenances of an ordinary dwelling-house, the apparatus of Fig. 1 appears at A. The pipe 37 passing through the wall of the building connects with the service-main, and the delivery-pipe 35 connects with the riser-pipe 44, which delivers into the tank 45 under the roof. Connected with the lower part of the tank 45 is a pipe 46, which delivers cold water from the tank into the bath-tub 47 and sink 48. A branch 49 from pipe 46 goes to the ordinary kitchen-boiler 50 and through said boiler in the usual way to the riser-pipe 51, which communicates with branches 52, which deliver hot water to the tub 47 and sink 48. The delivery-pipe 34 from the apparatus A connects by a branch 53 with the hot-water heating apparatus 53*, which is of any suitable construction, and with the sink-faucet 55* in the cellar and also by the riser-pipe 54 with the faucet 55 at sink 56. A branch 57 leads the supply through the water-back of the range and boiler to the hot-water faucet 58 at sink 56.

It will be seen from the foregoing that delivery-pipe 34 supplies escape-vents in the lower part of the house—that is, in the cellar and kitchen floors—while the pipe 35 supplies the tank 45 under the roof, from which tank by the pipe 46 the upper floor is supplied. Normally the apparatus A is at rest; but as soon as any tap is opened, so as to afford free escape of the water from main cylinder 1 through pipe 34, then the apparatus will begin to operate and will continue operating as long as the tap is kept open. Of course the more taps that are open on the lower floor the less will be the resistance to the movement of the piston 6, and hence the more rapid will be the operation of the apparatus; but as long as the apparatus is working at all it is causing the water to be forced through the riser-pipe 44 to the tank 45, which tank, it is of course understood, is at a level higher than that to which the water would normally be forced by the pressure in the mains. It will also be seen from the foregoing that the apparatus after once it is installed requires no attendant and in this respect is like a water-meter, operating when the water is drawn off and coming to rest when the outflow is stopped. As a matter of fact it is a water-meter requiring only the addition of any suitable counter capable of being operated by any selected moving part. Thus, for example, in Fig. 1 I have shown at 59 an ordinary counter, which may be placed in any convenient position and provided with the usual operating-lever 60, which lever is vibrated by means of a cord 61 and counter-spring 61*, secured to the lever-arm 18. Of course I do not limit myself to this particular counting device, since after this explanation it will be obvious to any one skilled in the art how a suitable registering device may be applied.

The effects of possible overflow of the tank 45 may be guarded against by any suitable means. Thus, for example, there may be an overflow-pipe fixed at a given level, as indicated at 62, which may connect with the sewer or any other convenient point. In order that the tank 45 may be kept filled when but little or no water is being drawn off on the lower floors, I arrange an ordinary float 63 in the tank, which by means of the chain 64 operates the weighted lever 65, which controls the valve 66 to open and close communication with the escape-pipe 67. It will be seen that when the water in the tank falls sufficiently the float 63 will drop and cause chain 64 to pull upwardly on the weighted lever 65 and cause it to open the waste-valve 66 and allow the water to run until the tank is again filled. When the tank is filled, the float rises and the weighted lever 65 again closes the valve. This attachment is automatic and is intended to be used particularly in the summer, when the house may be closed.

In the apparatus, as shown in Fig. 1, I have attached the connecting-rods 12 13 to points on lever 14 equidistant from the pivot 15. In case it is desired to increase the lifting power of the apparatus, of course at the expense of the quantity per given time lifted, the connection of the rod 13 may be set inward on the lever 14 toward the pivot-point, so that the stroke of the piston 7 will be made less than that of piston 6, and generally by suitably setting the connecting-points of the rods 12 13 with respect to the pivot-point 15 any desired relation of stroke between the two pistons 6 and 7 may be established to suit varying pressures of the supply. Of course the power of the lifting device is always depend-

ent upon the pressure, the piston area, the length of the stroke, the number of strokes per given time, and it is to be understood that it is within my invention to vary that power by changes in any of these several functions. Thus, to illustrate, in the apparatus of Fig. 1, with the connecting-rods fastened at the extreme end of the lever 14, as shown, the pressure may be regarded as constant, the number of strokes per given time constant, but the piston area is doubled. As I have already stated, by changing the point of connection of connecting-rod 13 to lever 14 I can increase the power at the expense of quantity of water lifted through decreasing the stroke, the piston area, pressure, number of strokes per given time remaining the same. So, also, the same result can be reached, other things being equal, by changing the relation of the number of strokes made by one piston in a given time as compared with the number made by the other in the same time. These are equivalents embodying my aforesaid principle.

I claim—

1. The combination with two motors constructed to be operated by liquid flow, of valve mechanism for governing the supply and discharge from each, connections between said motors for causing them to operate in unison, delivery-passages leading from said motors respectively to waste and to a point at which the liquid is delivered against resistance, and means for regulating the power of each of said motors.

2. The combination with two motors constructed to be operated by liquid flow, of valve mechanism for governing the supply and discharge from each, connections between said motors for causing them to operate in unison, delivery-passages leading from said motors respectively to waste and to a point at which the liquid is delivered against resistance, and means for regulating the power of said motors relatively to one another.

3. Two motors and valves actuated thereby to control the admission of liquid under pressure to opposite ends of each; the said motors being connected and operating conjointly to force liquid from the exhaust side of one motor to a level above that due to the head corresponding to said pressures, a high supply-pipe leading from the valve of the latter motor and an ordinary service-pipe leading from the valve of the other motor.

4. Two motors and valves actuated thereby to control the admission of liquid under pressure to opposite ends of each; the said motors being connected and operating conjointly to force liquid from the exhaust side of one motor to a level above that due to the head corresponding to said pressures, a high supply-pipe leading from the valve of the latter motor and a valved service or through pipe leading from the other valve for controlling the escape of liquid from the exhaust side of the other motor.

5. Two cylinders, ports leading to both ends of the cylinders and an inlet communicating with both sets of ports or passages, a reciprocating piston in each cylinder, means for connecting said pistons for conjoint operation, and valves actuated by said pistons to control the admission of liquid under pressure to said cylinders; the aforesaid parts being constructed and arranged to force liquid on the exhaust side of one of said pistons to a level above that due to the head corresponding to said pressure, a high supply-pipe leading from the valve of the last-named piston and a service or through pipe for the valve of the other piston.

6. Two cylinders, ports leading to both ends of the cylinders and an inlet communicating with both sets of ports, a reciprocating piston in each cylinder, means for connecting said pistons for conjoint operation, and valves actuated by said pistons to control the admission of liquid under pressure to said cylinders; the aforesaid parts being constructed and arranged to force liquid on the exhaust side of one of said pistons to a level above that due to the head corresponding to said pressure, a high supply-pipe leading from the valve of the last-named piston and a service or through pipe for the valve of the other piston, and means for suddenly reversing the position of said valves when said pistons reach the ends of their strokes.

7. Two cylinders, ports leading to both ends of the cylinders and an inlet communicating with both sets of ports or passages, a reciprocating piston in each cylinder, a pivoted vibrating lever connecting said pistons and valves actuated by said lever to control the admission of liquid under pressure to said cylinders; the aforesaid parts being constructed and arranged to force liquid on the exhaust side of said pistons to a level above that due to the head corresponding to said pressure, a high supply-pipe leading from the valve of the last-named piston and a service or through pipe for the valve of the other piston.

8. Two cylinders, ports leading to both ends of said cylinders and an inlet between said ports, a reciprocating piston in each cylinder, a pivoted vibrating lever connecting said pistons, a tappet on said lever, valves operating to control the admission of liquid under pressure to said cylinders, a pivoted vibrating lever connecting said valves, stops on said lever and a freely-swinging arm disposed between said valve-lever stops; the said arm being operated by said piston-lever to move into contact with one or the other of said valve-lever stops and thereby to actuate said valve-lever, a high supply-pipe leading from the valve of

one piston and a service or through pipe leading from the valve of the other piston.

9. In combination with a building, a reservoir, two pipe systems therein, one of said systems having an outlet at a certain level and the other having an outlet in said reservoir at a certain higher level, and a source of water-supply under pressure connected with said systems, means actuated by the energy of discharge of said supply at said lower outlet for forcing a portion of said supply to said reservoir and means controlled by the falling of the water-level in the reservoir to open an outlet in the first or low-level system to set in action the said forcing mechanism to refill the reservoir.

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

AUGUST SUNDH.

Witnesses:
WM. H. SIEGMAN,
I. A. VAN WART.