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SELF REGULATING PUMPING PLANT.

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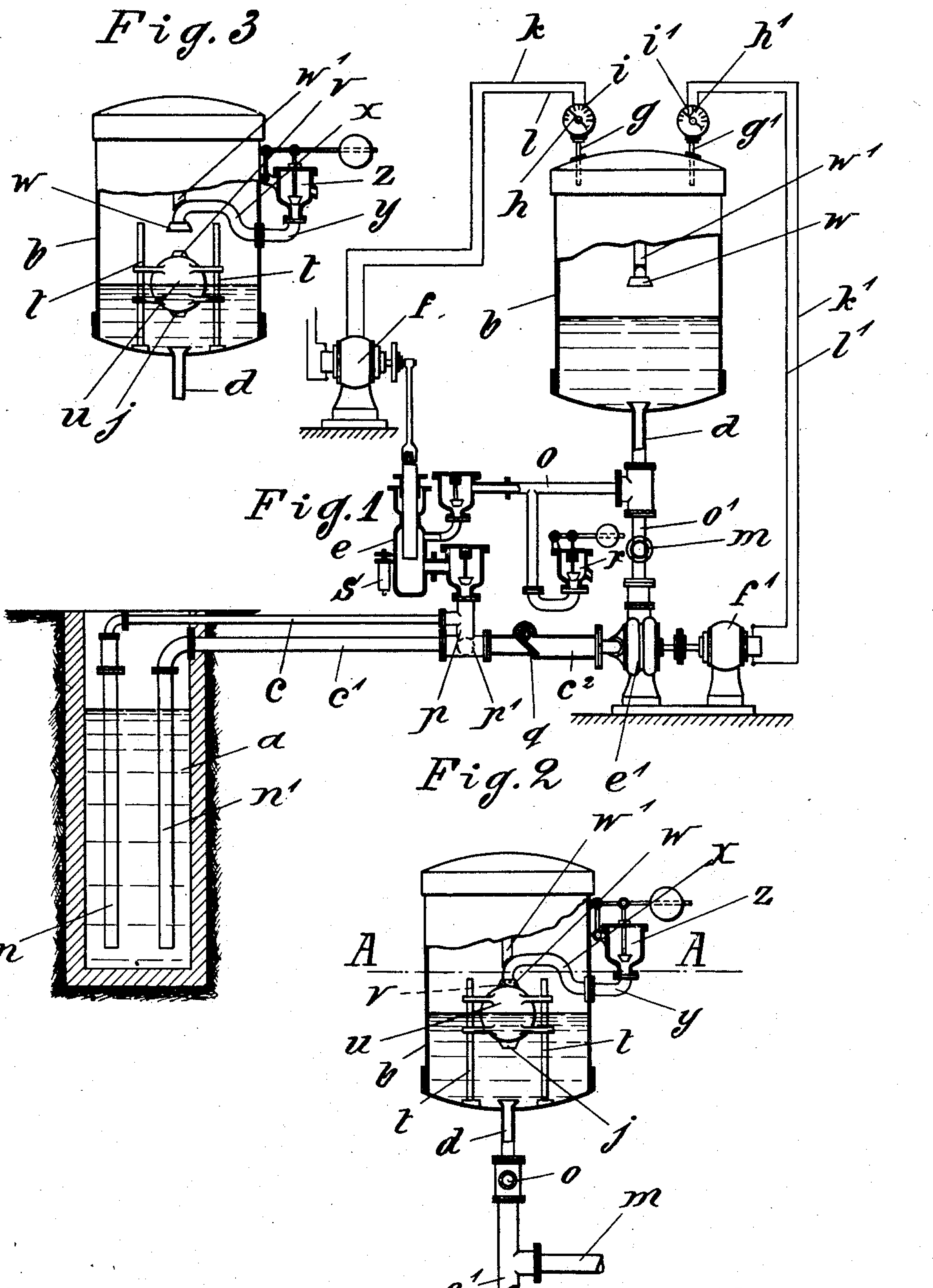

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SELF-REGULATING PUMPING PLANT.

946,787. Specification of Letters Patent. Patented Jan. 18 1910.

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To all whom it may concern:

Be it known that I, HEINRICH SCHEVEN, a citizen of the Empire of Germany, residing at Dusseldorf, in the Empire of Germany, have invented a new and useful Self-Regulating Pumping Plant, of which the following is a specification.

All those liquid supplying systems, in which the pressure required for forcing the liquid into the distributing pipe system is not presented by nature, but is artificially produced by forcing the liquid from cisterns, wells, springs, or other sources upward into elevated reservoirs, present various drawbacks. Not only is the erection of elevated reservoirs with the appertaining electric or pneumatic devices for reporting the levels over distance very expensive, but also frequently difficulties arise from the fact, that subsequently liquid is wanted in new districts more elevated than the old ones and the pressure in the pipe system is then too low for forcing the liquid up to the new districts, so that very expensive alterations, rebuildings or new buildings are necessary. Also in case a temporary increase of the pressure is rendered compulsory, for example when extensive fires in elevated town districts are to be extinguished, the invariable head of the elevated reservoirs would fail to supply the demand. The elevated reservoirs also present the defect, that their contents are subjected to the influences of the temperature, so that in winter the water is apt to freeze in and to break the reservoir, pipes or the like, while in summer the water becomes flat.

My invention relates to a self-regulating pumping plant, in which the said drawbacks are avoided. No elevated reservoirs are any more necessary, but the reservoirs may be disposed on the ground-floor or even in cellars.

The plant in general comprises a closed reservoir adapted to contain liquid under pressure and compressed air or gas, a main leading to the distributing pipe system, pumps adapted to suck liquid from a source and to deliver it to the main, a connection between the bottom of the closed reservoir and the delivery pipe of the first pump, electromotors severally driving the pumps, electrical devices controlled by the pressure within the closed reservoir for starting and stopping the necessary number of the pumps by their electromotors and thus maintaining a regular supply of liquid in accordance with the variations of the consumption, and a regulating device within the closed reservoir for permitting the level of the liquid to vary between two limits.

I will now proceed to describe my invention with reference to the accompanying drawing, in which—

Figure 1 is an elevation of a self-regulating pumping plant comprising two electrically driven pumps and a well, the well and parts of the plant being shown in section and the regulating device being omitted from the closed reservoir, Fig. 2 is a vertical section through the closed reservoir in a plane at right angles to that of the paper in Fig. 1, the upper part of the reservoir being shown in elevation and the float of the regulating device occupying its upper extreme position, and Fig. 3 is similar to Fig. 2 and shows the float in an intermediate position.

Similar letters of reference refer to similar parts throughout the several views.

Fig. 1 illustrates for example a plant with only two pumps e and e^1, of which one e is driven by an electromotor f and the other one e^1 is driven by a separate electromotor f^1. It is immaterial, of what kind the pumps e and e^1 are. Of course the number of the pumps may be increased, as will be hereinafter explained. A common source of liquid is assumed, which is shown to be a well a, from which the pump e can suck liquid through a suction piping n c and the pump e^1 can suck liquid through another piping n^1 c^1 c^2. A connection p is provided for connecting the two suction pipes c and c^1 beneath the first pump e and a retaining valve q is preferably inserted in the suction pipe c^2 between the two pumps e and e^1, so that the first pump e can suck liquid from both suction pipings n c and n^1 c^1 through the connection p, if the second pump e^1 is at rest. A closed reservoir b is provided, which at the same time serves as an air-vessel. The first pump e is shown as provided with a valve s of any known construction, through which air can be sucked in during the work of the pump e for replacing air that may have escaped from the reservoir b. Or the valve s may be connected by a pipe (not shown) with a source of compressed air or gas. Also air or gas contained in the liquid passing upward from the source a through the sucking pipings n c and n^1 c^1 and the pumps e e^1 may collect in the space of the reservoir b above the liquid level. The reservoir b is at its bottom provided with a connection d, which communicates with the delivery pipe o of the first pump e and with that o^1 of the second pump e^1 and thereby with a main m (Fig. 2) leading to the distributing pipe system. A safety-valve r of any known construction is connected with the delivery pipe o of the first pump e and thereby with the reservoir b for discharging liquid on the pressure exceeding a predetermined limit.

The closed reservoir b is provided with a regulating device of the following construction. Within the reservoir b two vertical rods t t are shown to be fastened on the bottom for guiding a float u of any known construction. This float u is provided with a valve j below and a valve v above. The upper end of the connection d forms a seat for the lower valve j, which therefore can open and close the communication between the reservoir b and the two delivery pipes o and o^1 and the distributing pipe system. A bent pipe x is shown to be provided within the reservoir b and connected with a safety-valve z without by a bent pipe y. The safety-valve z may be of any known construction. The inner end of the bent pipe x forms a seat for the valve v which is therefore adapted to close the pipe x for the upper extreme position of the float u and thus to render the safety-valve z inactive, so that all the compressed air or gas contained in the reservoir b above the liquid level is prevented from escaping. The seat w may be connected with some strut w^1 suspended from the top of the reservoir b so as to prevent the tube x from bending under the action of the upwardly pressing float u, whereby otherwise the closure of the pipe x might be rendered impossible.

As many pressure gages g g^1 . . . are disposed on the closed reservoir b, as there are electromotors f f^1 . . . These gages g g^1 . . . are provided with stationary contacts i i^1 . . . and movable contacts h h^1 . . . of any known construction, which are respectively connected with the electromotors f f^1 . . . by lines k l, k^1 l^1 . . . I have not shown the special construction of the contacts i i^1 . . . h h^1 . . ., as it is immaterial to my invention. The stationary contact i in any gage g is so constructed, that the pointer of the gage (forming a switch) remains in contact with it, as long as the pressure of the air or gas does not exceed a certain limit, while the pointer comes out of contact with the contact piece i on the pressure exceeding the limit. The other contact piece h in each gage g permanently remains in electrical connection with the pointer.

It will now be understood, that current is supplied to the respective electromotor f or f^1 . . . as long as the pressure of the air or gas in the reservoir b does not exceed the respective limit. If there is a series of electromotors f f^1 . . . the gages g g^1 . . . are so adjusted, that the said limit is the maximum pressure allowed in the reservoir b for the first electromotor f and is the minimum pressure allowed in the reservoir b for the last electromotor, while for the electromotors in the range between the first and the last one the limits for their gages successively decrease from the first to the last electromotor. It will be now evident, that as long as the pressure in the reservoir b does not exceed the said minimum, all the electromotors f f^1 . . . will operate for driving their pumps e e^1 . . . which thus supply the maximum quantity of liquid through their delivery pipes o o^1 . . . and the main m to the distributing pipe system. If the said pressure gradually increases, first the last electromotor, then the last but one electromotor and so on will stop, so that the quantity of liquid supplied to the distributing pipe system will be diminished. At last the first electromotor f alone may be left to operate for driving its pump e, which therefore supplies the minimum quantity of liquid to the pipe system. If the pressure in the reservoir b exceeds the maximum, of course also the first electromotor e will stop, when no liquid at all will be sent into the pipe system. On the contrary, if the pressure in the reservoir b again and gradually decreases, the number of electromotors and consequently that of the pumps set to work will increase in accordance with the varying consumption for maintaining the pressure in the pipe system within the predetermined limits.

For the normal working of the plant the safety-valve z is so adjusted, that the float u occupies its upper extreme position and must close the pipe x, so that the safety-valve z is shut off from the reservoir b. Then the safety-valve r is called upon to perform its duty for discharging any excess of liquid, if the pressure in the pipe system exceeds the predetermined limit. In this manner the liquid in the reservoir b is prevented from rising higher than the predetermined line indicated say by the dotted broken line A—A in Fig. 2.

If too much air or gas is pressed into the reservoir b, its pressure will force the level of the liquid downward, so that the float u sinks and its upper valve v opens the tube x and permits the compressed air or gas to pass through this tube and to act upon the safety-valve z. The latter is so adjusted as to discharge the compressed air or gas under a pressure slightly less than the lowest pressure permitted for the compressed air or gas in the reservoir b (see Fig. 3). Thereby the pressure of the compressed air or gas in the reservoir b is reduced. In this case, when the distributing pipe system is extensive, some liquid will therefrom return to the reservoir b or the pumps e e^1 . . . will force liquid into it, so that the float u will again rise and close by its valve v the pipe x. In this manner the quantity of the compressed air or gas in the reservoir b and its pressure are automatically regulated.

In case pipes in the system should break and more liquid escapes from the system, than the pumps can supply, of course the level of the liquid in the reservoir b will sink, but the float u therewith sinking will by its lower valve j soon close the connection d and thus prevent the compressed air or gas from entering the main m and thereby the distributing pipe system, which otherwise would be objectionable.

If there are more than two pumps e and e^1, the suction pipes c^2 of the second and following pumps e^1 . . . are preferably connected with a main indicated by a dotted circle p^1 in Fig. 1 and they are each provided with a retaining valve q. The main p^1 is connected with all the suction pipings n^1 c^1 . . . (which may be alike and cover one another in Fig. 1) and by the connection p with the first pump e. The delivery pipes o^1 . . . of the second and following pumps e^1 . . . are connected with the main m leading to the pipe system. The first pump e is preferably adapted to work day and night without any interruption, so that it will suck in any air or gas that may get into the main p^1 by leakage in the several suction pipings n c, n^1 c^1, . . . or in the several retaining valves q . . . and discharge it into the reservoir b. In this manner the air or gas will be retained in the reservoir b and prevented from entering the distributing pipe system. The liquid discharged by the first pump e through the main m into the pipe system will then replenish the latter should it leak somewhere.

The liquid discharged by the pumps e^1 following the first pump e is prevented from entering the reservoir b, which is a special advantage, as the liquid is prevented from absorbing air or gas contained in the reservoir b, which otherwise would take place, if the liquid were to pass through the reservoir b. This is the more the case, if a liquid is to be raised and sent into the distributing pipe system, which liquid is most eager to absorb air or gas, so that the air or gas contained in the reservoir b is in this manner protected from getting lost, it being absorbed more slowly and constantly replenished by air or gas passing from the source a or through the valve s. The permanently working first pump e will constantly suck in any small quantity of air or gas, that may collect in the several suction pipes n^1 c^1, . . . during the stoppage of the other pumps e^1, . . . and thus prevent the columns of liquid in the suction pipes n c, n^1 c^1, . . . from dropping.

From the above explanations it will be clear, that the pumping plant described is capable of automatically regulating itself, whereby the management is greatly facilitated and the required supervision is reduced to a minimum. During the night the first pump e or the smallest number of pumps only will need to work for replenishing the pipe system. During the day as many pumps will be automatically set to work as is required by the consumption. When suddenly the quantity of liquid required to be supplied enormously increases, such as in cases of fires or the like, the plant will automatically set so many more pumps to work as to satisfy the demand.

The pumping plant can be varied without departing from the spirit of my invention. The several suction pipings n c, n^1 c^1, . . . may be replaced by a single common suction piping.

I claim:

1. In a self-regulating pumping plant, the combination with a source of liquid, of a closed reservoir adapted to contain liquid and air or gas under pressure, a safety-valve connected with said closed reservoir, a float in said closed reservoir and adapted to normally shut off in its uppermost position said safety-valve and to prevent in its lowermost position the liquid level from sinking beneath a lower limit, pumps, electromotors for severally driving said pumps, suction pipes between said source of liquid and said pumps, a main, delivery pipes between said pumps and said main, a connection between said closed reservoir and said main, a second safety-valve connected with said main and adapted on said float occupying its uppermost position to discharge liquid under the pressure in said closed reservoir for preventing the liquid level therein from exceeding an upper limit, and electrical devices controlled by the pressure in said closed reservoir for starting and stopping said electromotors in accordance with the consumption.

2. In a self-regulating pumping plant, the combination with a source of liquid, of a closed reservoir adapted to contain liquid and air or gas under pressure, a safety-valve connected with said closed reservoir, a float in said closed reservoir and adapted to normally shut off in its uppermost position said safety-valve and to prevent in its lowermost position the liquid level from sinking beneath a lower limit, pumps, electromotors for severally driving said pumps, suction pipes between said source of liquid and said pumps, a main, delivery pipes between said pumps and said main, a connection between said closed reservoir and said main, a second safety-valve connected with said main and adapted on said float occupying its upper-

most position to discharge liquid under the pressure in said closed reservoir for preventing the liquid level therein from exceeding an upper limit, pressure gages on said closed reservoir and each provided with a pointer serving as a switch and a contact piece adapted to remain in contact with the pointer as long as the pressure does not exceed a limit, and lines connecting said electromotors with the pointers and contact pieces of said pressure gages, the limits of the several pressure gages successively decreasing from a maximum for the first electromotor to a minimum for the last electromotor.

3. In a self-regulating pumping plant, the combination with a source of liquid, of a closed reservoir adapted to contain liquid under pressure and compressed air or gas, pumps, electromotors for severally driving said pumps, suction pipes between said source of liquid and said pumps, a main, delivery pipes between said pumps and said main, a connection between the bottom of said closed reservoir and the delivery pipe of the first of said pumps, a safety-valve connected with said main, a pipe extending into said closed reservoir to a point above the upper end of said connection, a second safety-valve without said closed reservoir and connected with said pipe, a float vertically guided in said closed reservoir and adapted to close either said connection or said pipe, pressure gages on said closed reservoir and each provided with a pointer serving as a switch and a contact piece adapted to remain in contact with the pointer as long as the pressure does not exceed a limit, and lines connecting said electromotors with the pointers and contact pieces of said pressure gages, the limits of the several pressure gages successively decreasing from a maximum for the electromotor driving the first pump to a minimum for the electromotor driving the last pump.

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Witnesses:
OTTO KÖNIG,
WILLY KLEIN.