(No Model.)

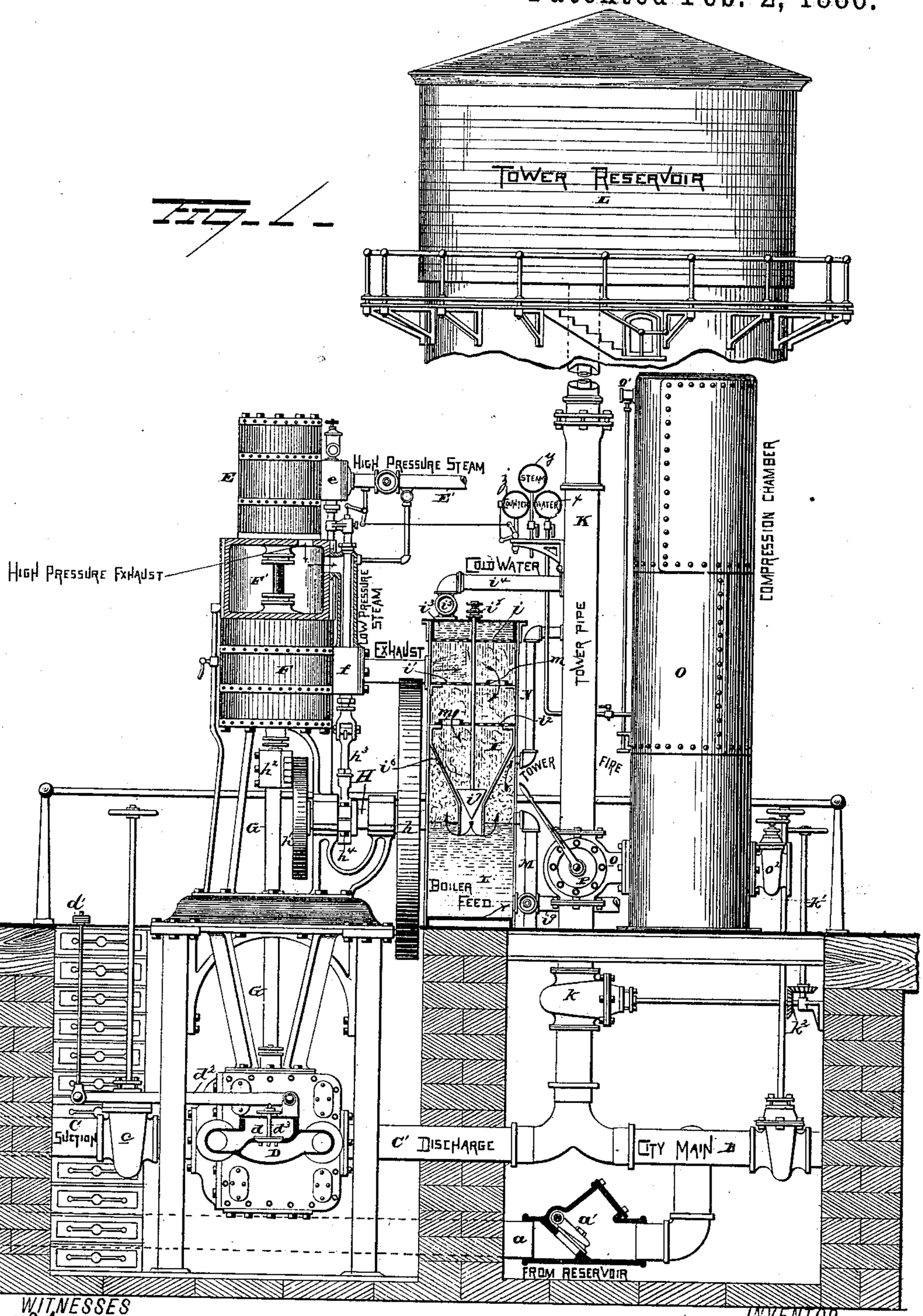
2 Sheets—Sheet 1.

P. B. PERKINS.

SYSTEM OF WATER WORKS.

No. 335,303. Patented Feb. 2, 1886.

FIG. 1.



WITNESSES

E. Nottingham.

W. A. Ruff

INVENTOR

Paul B. Perkins.

By Leggett & Leggett.

Attorney

(No Model.)

2 Sheets—Sheet 2.

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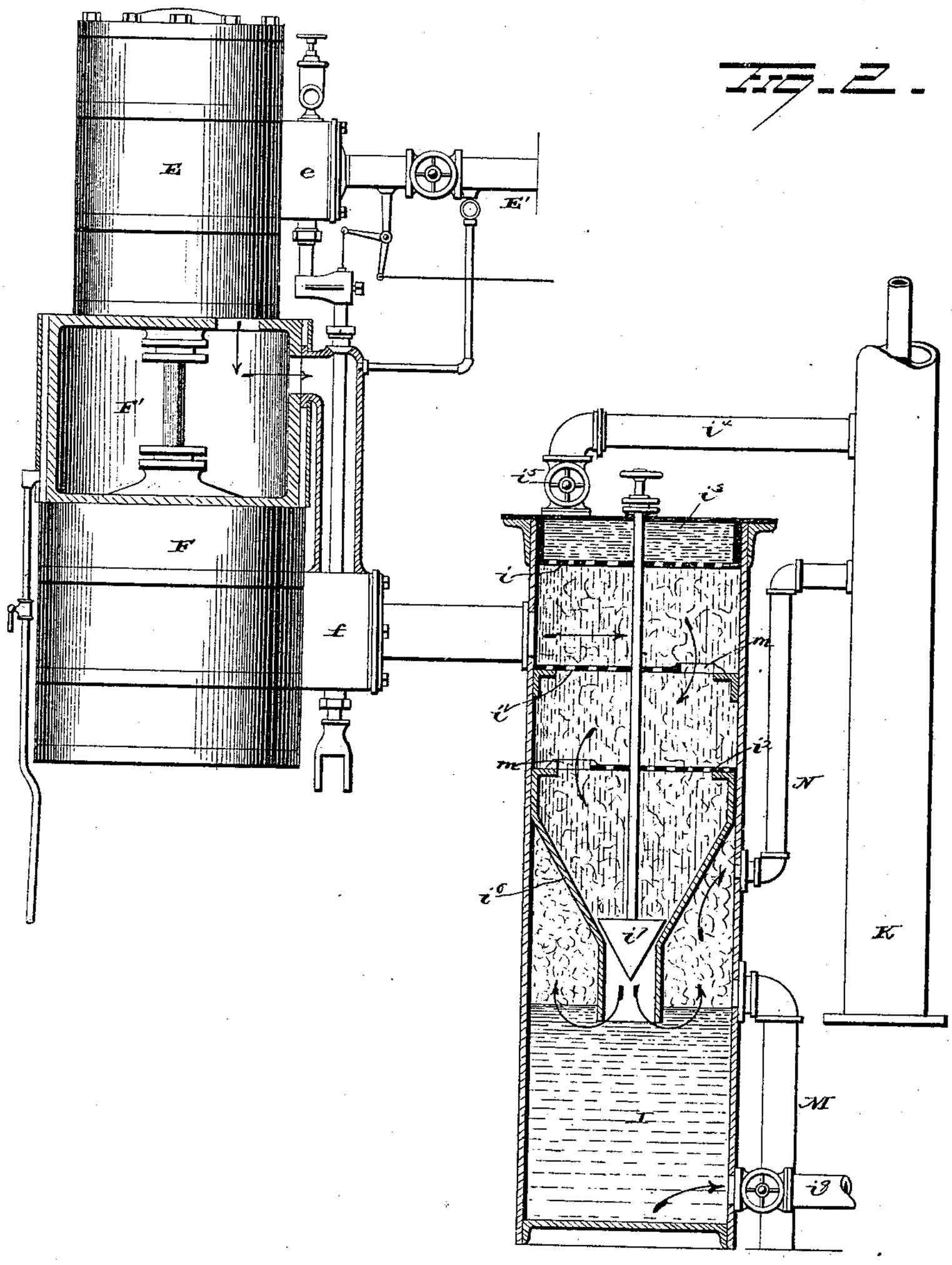

FIG. 2.

WITNESSES

C. C. Nottingham.

W. A. Ruff

INVENTOR

Paul B. Perkins.

By Sheffield & Seggett.

Attorneys.

UNITED STATES PATENT OFFICE.

PAUL B. PERKINS, OF NORTH SPRINGFIELD, MISSOURI.

SYSTEM OF WATER-WORKS.

SPECIFICATION forming part of Letters Patent No. 335,303, dated February 2, 1886.

Application filed May 21, 1885. Serial No. 166,297. (No model.)

To all whom it may concern:

Be it known that I, PAUL B. PERKINS, of North Springfield, in the county of Greene and State of Missouri, have invented certain new and useful Improvements in System, of Water-Works; and I do hereby declare the following to be a full, clear and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to an improvement in systems of water-works.

The systems hitherto in use may be classified under the three general heads—the natural system, the force-system, and the combined natural and force system.

In the natural system a reservoir is located at a sufficient height above the city to furnish the requisite head for supplying the buildings by hydrostatic pressure alone, and the water is allowed to flow from the reservoir to the points of discharge under the pressure from the reservoir only. This system is in general economical and satisfactory; but the location of a great majority of the cities is such that a head sufficient for ordinary and fire purposes cannot be provided except at an enormous expense.

The force system consists of pumps of great capacity, which force the water from a supply below the level of the service directly into the main, and sustain the necessary pressure by their constant action or by means of a weighted piston in a pressure-cylinder, but without the employment of a reservoir or stand-pipe. This system has its advantages, among which is the saving of the expense incurred in constructing and preserving a large reservoir; but it has the disadvantage of being constantly under a strain, and not available for any purpose except through the energy of the pumps, which must be kept in constant repair, and a reserve kept in readiness in case of breakage.

The combined natural and force system undertakes to add the advantages of the force system to those of the natural system, and thus overcome the defects of each. The systems of this latter class have employed a force-pump in connection with a reservoir, for forcing the water into a stand-pipe or high-service reservoir, for use in forcing the water into the buildings of greater elevation than the majority; or a force-pump has been used in connection with the supply for forcing the water into a high reservoir of limited capacity, which is used for furnishing the required supply and pressure to the mains, the pump being used to furnish additional pressure in case of fire. The former of these systems is defective in so far as it fails to provide against a fire of unusual magnitude or an unusual demand for water from any other cause, as the pump cannot be made to act directly upon the water in the main, while the latter of the above system is defective in so far as it affords no general supply for low service at a reduced pressure.

The object of my present invention is to provide a system of water-works which shall embody the desirable features of the several systems hitherto in use, exclude their defects, supply additional means for regulating the pressure and improved means for connecting the several parts of the system, whereby an economical, well-regulated, and certain supply of water for general and special purposes shall be maintained; and with these ends in view my invention consists in certain features of construction and combinations of parts, as will be hereinafter described, and pointed out in the claims.

In the accompanying drawings, Figure 1 is a view of the system in side elevation, partly in section. Fig. 2 is an enlarged detached view of the steam-cylinders and the condenser.

A represents a reservoir of sufficient capacity to supply the demands of the city. The reservoir A may be supplied naturally or by means of any approved force of pump. From the reservoir A a conduit-pipe, *a*, leads to the city main B, and is provided at a point between the reservoir and the city main with a check-valve, *a'*, adapted to automatically open to allow the water from the reservoir to flow into the main, and automatically close when the pressure in the main exceeds the pressure from the reservoir. A second pipe, C, leads from the reservoir to the pump-cylinder D, and constitutes the suction-pipe for the pump. The pump discharge-pipe C' leads from the cylinder D to the city main B. The

discharge and suction sections of the cylinder D are connected by a weighted valve, *d*, opening from the discharge into the suction, which acts as a relief-valve for the city main, the weight upon said valve *d* determining the amount of pressure which it is desired to maintain within the main B. The construction of the valve *d* is conveniently that shown, the weight *d'* being applied to an upright rod connected with the end of the long arm of a lever, d^2, of the second class resting on the valve-stem d^3. The suction-pipe C is provided with a cut-off valve, *c*, its stem extending within convenient reach of the operator.

The steam-cylinder for driving the pump is preferably located above and in a direct line with the pump-cylinder D, a suitable supporting-frame being arranged for the purpose of securing it in the desired position.

I find it advantageous to employ a high-pressure steam-cylinder and a low-pressure steam-cylinder acting in conjunction with one another on pistons secured to the pump piston-rod.

E represents the high-pressure steam-cylinder, provided with the steam-chest *e*, in which cut-off valves of any approved construction operate in the usual manner.

E' is the pipe leading from the boiler to the steam-chest, for supplying high-pressure steam thereto.

F represents the low-pressure steam-cylinder, separated from the cylinder E by a low-pressure exhaust-chamber, F', and provided with a steam-chest, *f*, which receives low-pressure steam from the exhaust-chamber F'. Cut-off valves of any approved construction are provided for regulating the admission of steam from the steam-chest *f* to the cylinder F, as usual.

G is the combined pump and steam-piston rod, to which the steam-pistons in the cylinders E and F are attached, and also the pump-piston in the cylinder D.

The engine-shaft H is journaled in suitable bearings in the cylinder-supporting frame, and provided with a fly-wheel, *h*, and with a disk-crank, *h'*, the latter being connected with a cross-head yoke, h^2, secured to the piston rod G, by means of which the shaft is driven. The cut-off valves for the two cylinders E and F are attached to and operated by the same rod, h^3, connected with the eccentric h^4, secured on the shaft H. The cylinder F exhausts into a condenser, I, the construction of which will be hereinafter explained.

K represents a stand-pipe connected with the city main at its junction with the pump-discharge pipe, said junction being located between the pump and the juncture of the reservoir-conduit *a* with the main B. The stand-pipe K communicates with the tower-reservoir L, located at such a height as to afford the desired pressure.

The capacity of the tower-reservoir is such in comparison with the diameter of the stand-pipe that only a very slight fall in the head of water therein takes place when the tower-pressure is applied for extinguishing fires, high service, &c., thereby maintaining the full amount of pressure.

The stand-pipe K is provided with a cut-off valve, *k*, near its juncture with the city main, said valve being operated by an upright rod, *k'*, connected with its stem by bevel-gear k^2.

The condenser I consists of an upright cylinder provided with transverse perforated partitions *i i' i²*, through which the water falls in spray from the cold-water chamber i^3, connected with the stand-pipe K by a pipe, i^4, provided with a valve, i^5, for regulating the supply. The exhaust-steam from the cylinder F enters the condenser between the perforated plates *i* and *i'*, immediately beneath the cold-water chamber i^3, and here comes in contact with the cold-water spray, and is held in contact therewith until it reaches a point beneath the plate i^2, where a funnel-shaped partition, i^6, is located, in the mouth of which a cone-valve, i^7, is seated and operated by a screw-stem, i^8, extending upwardly through the top of the cylinder. Beneath the funnel-partition i^6 is the hot-water chamber, from which the boiler is fed through a valved pipe, i^9.

M is an overflow-pipe leading from the upper portion of the hot-water chamber, to prevent the water from rising too high therein. Enlarged steam-passages *m* are formed in the perforated plates *i'* and i^2. The condensed steam, mingled with the cold-water spray, is admitted into the hot-water chamber through the mouth of the funnel-partition i^6 by raising the cone-valve i^7.

The vapor which rises from the hot water in the chamber beneath the funnel-partition is condensed in the following manner: A pipe, N, leads from the upper portion of the said chamber into the stand-pipe, and thence upwardly into the tower-reservoir, the upper end of the pipe being closed. The vapor in the chamber naturally rises in the pipe N, which by its contact with the cold water in the stand-pipe and reservoir condenses the vapor. This in the liquid state descends and tends to produce a vacuum in the pipe, which vacuum in turn causes the vapor from the chamber to more rapidly ascend. Thus a constant circulation is maintained within the pipe N, and the condensation of the vapor in the hot-water chamber effectually accomplished.

In connection with the stand-pipe, and hence with the city main, is a compression-chamber, O, consisting, preferably, of an upright cylinder capable of withstanding a high pressure, and communicating with the stand-pipe K at or near its lower end through a branch pipe, *o*. The upper end of the cylinder O is provided with an air-inlet valve, *o'*, the stem of which descends to a point within convenient reach of the operator, and the lower end of the cylinder is provided with a water-gate, o^2. A two-way valve, P, is located at the juncture of the branch pipe *o* with the stand-pipe K, and is provided with an operating-lever,

p, by means of which the valve may be easily and quickly turned to throw the pressure from the tower-reservoir onto the city supply in case of fire or for high service, or to throw the compression-chamber into communication with the main and shut it off therefrom. By opening the air-inlet valve *o'* and the water-gate o^2, and permitting the water to escape and air to enter, the compression-chamber may be recharged with air, when desired, and a uniform pressure thereby maintained, which will prevent the water from hammering in the pipes, and relieve the back-pressure caused by a sudden stoppage of the flow. *x*, *y*, and *z* represent water, steam, and stroke gages, connected, respectively, with the compression-chamber, the boiler, and the steam-cylinder cut-off-valve rod.

The system is operated as follows: If the head of water in the reservoir is sufficient for ordinary purposes, the reservoir-conduit alone is open to the city main, the pump and tower-reservoir being cut off therefrom, and the air-compression chamber left in communication therewith or not, as may be desired. Should the head in the reservoir, however, only serve to supply the great majority of buildings, and a high service be required for a small section of the city, the pump may be employed to furnish the additional pressure required; or, if the high service be required for a portion of the day only the tower-reservoir may be put in communication with the main and furnish the additional pressure required. Should a fire break out at any moment, and an unusual demand be created, either the tower-pressure alone or the tower and pump pressure combined may be used to supply the demand. The sudden stoppage of such increased demand is provided for by the introduction of the weighted valve between the discharge and suction chambers of the pumps, which yields under an abnormal pressure and allows the water to run back, thereby limiting the quantity of water pumped to the exact amount drawn from the city mains. The tower-reservoir is charged at any time by increasing the pump-pressure a sufficient amount over the city demands, or more rapidly by shutting off the city main from communication therewith and pumping directly into it.

The advantages of this system consist in its comparative simplicity and the opportunity it affords for economy in supplying all the demands of the city. Its parts are few and constructed with a view to durability and the highest degree of efficiency.

The form of engine explained in connection with this system is one well adapted to the purpose, but does not form an essential feature of the same, as the pump might be operated in quite a satisfactory manner by numerous other forms of engines or by other mechanical powers.

I make no claim in the present application to the improved form of condenser referred to above, as it forms the subject of a separate application, and is introduced here for the purpose of showing one very effective form of condenser which may be advantageously employed in connection with a steam pumping-engine, when such power is used to make the system complete.

It is evident that the form and arrangement of parts herein shown and described might be modified in many respects without departing from the spirit and scope of my invention; hence I do not wish to limit myself strictly to the construction herein set forth; but,

Having fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The combination, with a city main, of supply-pipes leading therefrom to a low service-reservoir, a tower-reservoir, and a force-pump, and valves connected therewith adapted to open and close communication between the city main and any one or more of the supplies, at the will of the operator, substantially as set forth.

2. The combination, with a distributing-main, of a low-service reservoir, a tower-reservoir, a force-pump, and a compression-chamber, and valved pipes connecting the same with the city main, whereby the pressure from one or more of the above-named sources may be applied to the water in the city main at the will of the operator, substantially as set forth.

3. In a system of water-works, the combination, with a city main, a low-service reservoir, and a supply-conduit connecting the two, and provided with a check-valve, of a force-pump connected with the said reservoir and city main for increasing the pressure therein, and a weighted valve located between the suction and discharge of the pump for determining the limit of pressure without waste of water, substantially as set forth.

4. In a system of water-works, the combination, with a city main, a low-service reservoir, and a supply-conduit connecting the two and provided with a check-valve, of a force-pump connected with the said reservoir and city main, a tower-reservoir connected with the pump-discharge and city main, and a weighted valve located between the suction and discharge of the pump, for determining the limit of pressure without waste of water, substantially as set forth.

5. In a system of water-works, the combination, with the force-pump connecting the low-service reservoir with the city main, of a tower-reservoir connected with the city main and pump-discharge, and a relief-valve located between the suction and discharge of the pump, for the purpose substantially as set forth.

6. In a system of water-works, the combination, with the main water-supply, the city main, a tower-reservoir, and means for forcing the water from the main supply into the tower-reservoir, of a stand-pipe leading from the tower-reservoir to the city main, a compression-chamber connected with the stand-pipe, and a two-way valve located at the juncture of the com-

pression-chamber and stand-pipe, for the purpose substantially as set forth.

7. In a system of water-works, the combination, with the city main and a force-pump connecting the main with the low-service reservoir, of the compression-chamber in communication with the main, said compression-chamber being provided with an air-inlet valve and water-gate, whereby the air-cushion may be maintained at a uniform tension, substantially as set forth.

8. In a system of water-works, the combination, with a low-service supply, and a force-pump connected therewith for increasing the pressure in the city mains, of a tower-reservoir of great capacity connected with the pump-discharge and city main by a stand-pipe of small diameter, substantially as set forth.

9. In a system of water-works, the combination, with the city main, and the low-service reservoir connected therewith by the conduit with its self opening and closing valve, of the force-pump connected with the said reservoir and city main, the stand-pipe, tower-reservoir, compression-chamber, and the valves, the whole constructed and arranged substantially as set forth.

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

PAUL B. PERKINS.

Witnesses:
H. WALKER,
CHAS. BROOKS.