No. 841,791. PATENTED JAN. 22, 1907.

H. LEMP.

ACCUMULATOR FOR FLASH BOILERS.

APPLICATION FILED JULY 27, 1901.

2 SHEETS—SHEET 1.

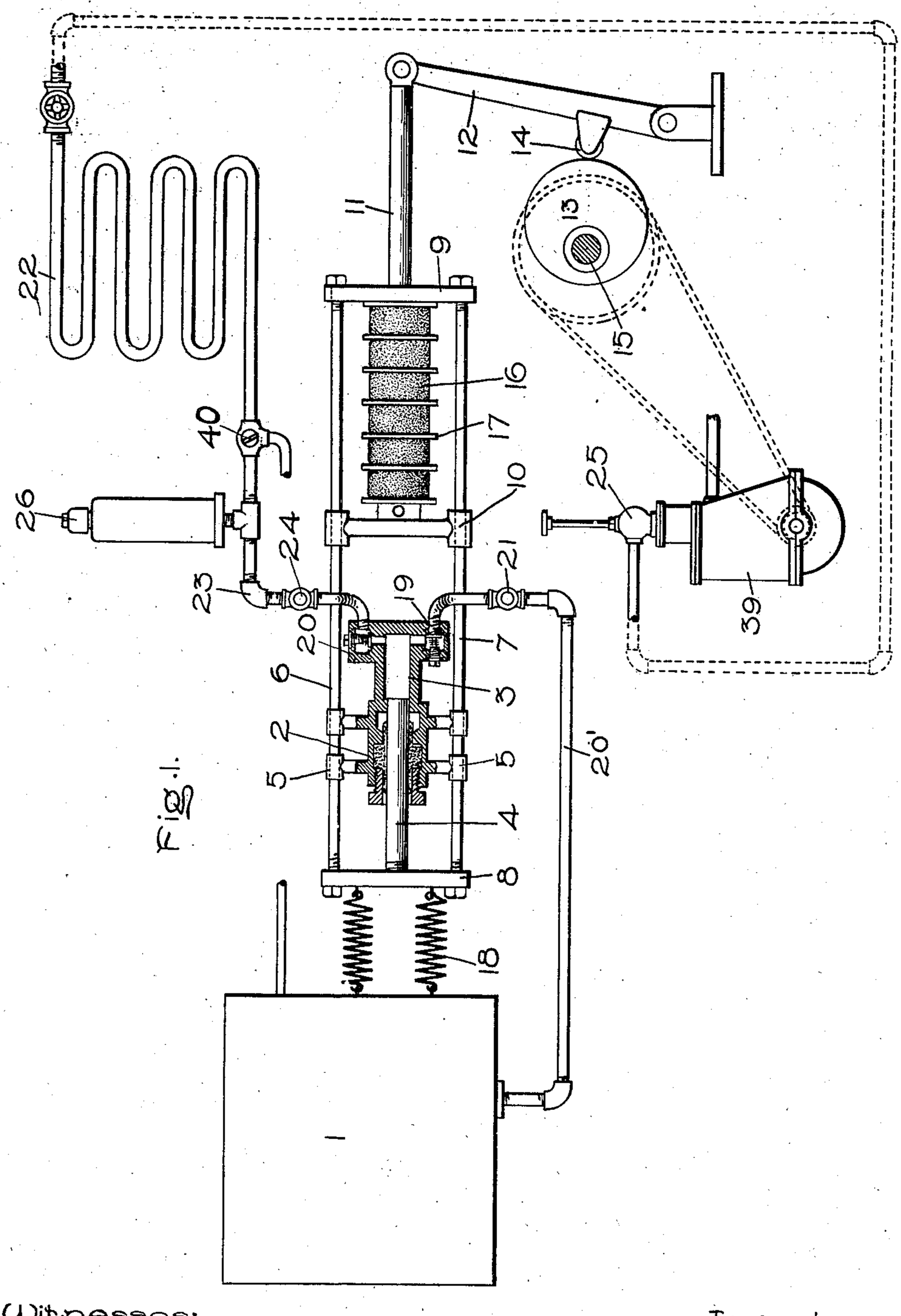

Fig. 1.

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2 SHEETS—SHEET 2.

Fig. 3.

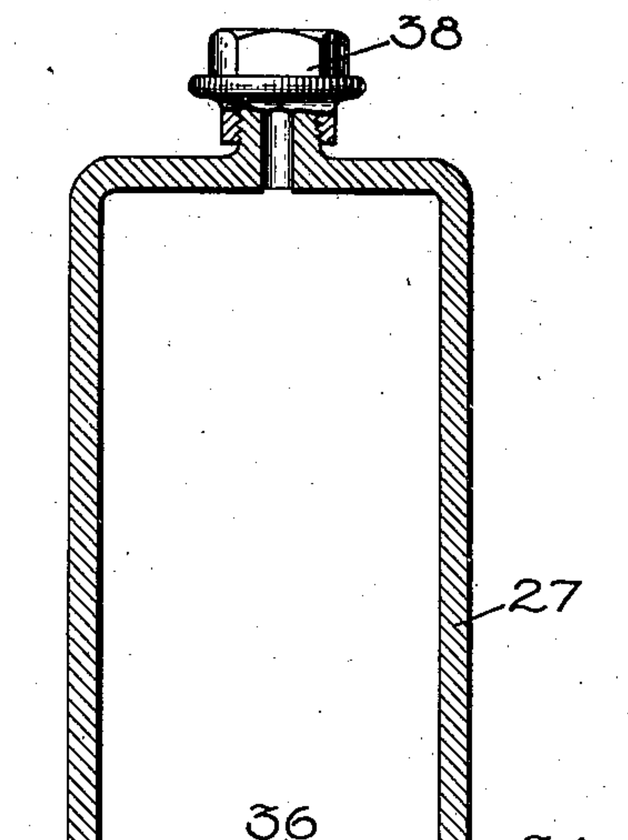
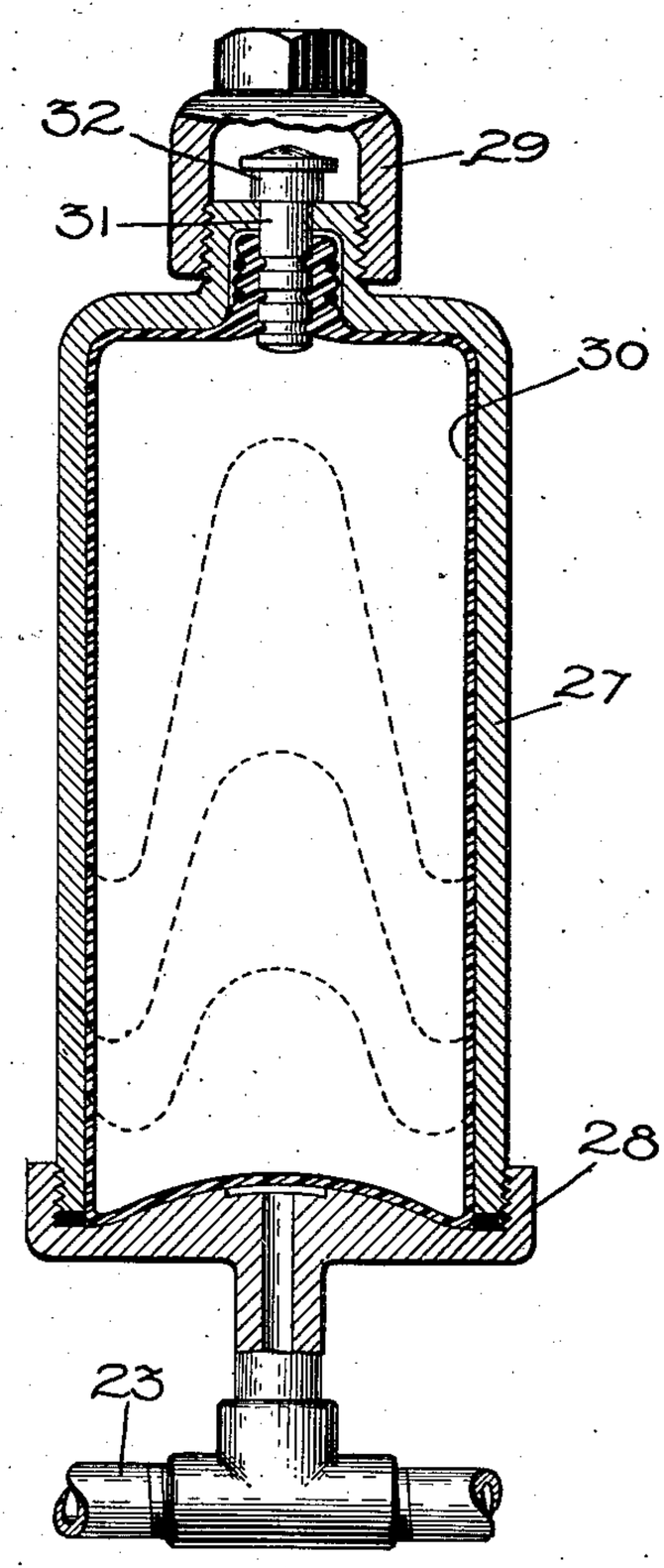


Fig. 2.



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UNITED STATES PATENT OFFICE.

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ACCUMULATOR FOR FLASH-BOILERS.

No. 841,791. Specification of Letters Patent. Patented Jan. 22, 1907.

Application filed July 27, 1901. Serial No. 69,902.

To all whom it may concern:

Be it known that I, HERMANN LEMP, a citizen of the United States, residing at Lynn, county of Essex, State of Massachusetts, have invented certain new and useful Improvements in Accumulators for Flash-Boilers, of which the following is a specification.

Automobiles employing flash-boilers have up to the present time been found to be deficient in hill-climbing as compared to those employing water-tube or shell boilers, which have a considerable storage-space for steam. Flash-boilers while not having such a space do have its equivalent—namely, a highly-heated mass of metal. In other words, the large mass of metal, being heated to a high temperature, is ready, up to a definite point, of course, to flash water into steam, providing the necessary amount of water is forced into it. As ordinarily constructed and arranged these boilers will furnish sufficient steam to take the vehicle up ten and even twelve per cent. grades; but when the gradient is increased to from fourteen to twenty per cent. it becomes necessary to help out the automatic water-supply system by means of a manually-actuated pump. It is impracticable to provide an automatic water-pump of sufficient capacity to supply the necessary amount of water at such a time, for it requires high pressure, whereas the engine and driving-wheels will be moving slowly, and the demand for steam, and hence for water, will be at a maximum. Such a pump, if used for ordinary service, would supply water in great excess, and the energy required to drive it would be excessive from an economical standpoint. The loss in energy would be dependent upon the character of the regulator employed; but in any event there would be a sacrifice in economy.

The present invention has for its object to provide an automatic system of water-supply which is so arranged that a certain storage capacity for water under pressure is provided that will when necessary augment the supply from the automatic pump, the latter being of sufficient capacity to supply water for ordinary running conditions. The scope of the invention will be more fully set forth in the description and in the claims appended thereto.

In the accompanying drawings, which illustrate an embodiment of my invention, Figure 1 is a diagrammatic view of the main and auxiliary devices for feeding water to a boiler. Fig. 2 is a vertical section of an improved storage space or chamber, and Fig. 3 is a slight modification of said chamber.

1 represents the water-tank, and 2 a pump of an elastic type, wherein 3 represents the cylinder, and 4 the piston. Formed on or otherwise secured to the cylinder are guides 5, and working therein are rods 6 and 7. At the left-hand end these rods are connected by the yoke 8, which in turn is rigidly connected to the piston 4. The right-hand ends of the rods are connected by a yoke 9, and between the yokes and guided by the rods is a sliding cross-head 10. To the cross-head is pivotally secured a connecting-rod 11, which in turn is pivotally secured to the lever 12. Mounted on the lever and arranged to engage with the eccentric 13 is a roller 14. The eccentric is mounted on a driving-shaft 15 or other moving part. In the present instance it is mounted on the driving-axle of a vehicle.

Between the cross-head and the yoke is a plurality of elastic buffers 16, the latter being separated one from the other by metal disks 17. In the present instance the buffers are perforated centrally, and extending through the perforations is the connecting-rod 11. As the back pressure on the boiler increases more and more of the piston-stroke is taken up by the buffers until finally when the maximum pressure is reached the entire movement of the connecting-rod 11 will be taken up by them, and the piston will be stationary. Between the left-hand yoke 8 and a stationary abutment are extension-springs 18, that tend at all times to withdraw the piston from the cylinder and at the same time hold the roller in contact with the eccentric.

The pump is of the single-acting type and is provided with a suction-valve 19 and a delivery-valve 20. The suction-valve is connected with the water-tank by means of a pipe 20′, containing a throttle-valve 21, while the delivery-valve is connected with the flash-boiler 22 by means of the pipe 23, the latter containing a throttling-valve 24. Under ordinary conditions the valves 21 and

24 are not used and only come into service when it is desired to cut the pump out of service.

The boiler consists of a number of turns or convolutions of pipe bent into any convenient shape. The particular construction of the flash-boiler is immaterial, the one shown being intended merely to typify a boiler of that class. The passage of steam from the boiler to the engine 39 is controlled by the throttle-valve 25.

Connected in circuit with the pipe 23, leading from the pump to the boiler, is an accumulator 26, containing a body of gas or air under a permanent and relatively high pressure. In some instances a pressure of two hundred and fifty pounds will be sufficient. In other cases it may be desirable to increase it to four or five hundred, or even more.

If the accumulator was filled with gas at atmospheric pressure, it would have no practical effect on the water-supply system, because it would contain such a small body of air, and it is impractical to use a substantially larger tank on a vehicle, for obvious reasons. By utilizing a permanent body of highly-compressed air in a small accumulator I am enabled, however, to attain the same effect as with a large tank, and this by taking up only a very small amount of space.

Referring to Fig. 2, the construction of the accumulator will be described. 27 represents a casing of any convenient shape or size having a screw-threaded lower end, to which the base 28 is secured. The upper end of the casing is narrowed in to form a neck, and this neck is screw-threaded to receive the cap 29. Mounted within the casing is a flexible bag-like structure 30, containing air under pressure. The upper end of the bag is provided with a neck which fits into the neck of the casing and is provided with a stem 31, containing a self-closing valve of any suitable type, such as are used for pneumatic tires for vehicles. The stem is provided with a cap 32, for insuring the closure of the chamber. The base 28 is provided with a central opening and is connected to the water-pipe 23.

It is important to provide means for separating the gas or elastic fluid from the water; otherwise the two will mingle and the gas or elastic fluid will be carried out of the accumulator with the water. This could only be remedied by admitting more gas or elastic fluid to the accumulator and is objectionable because it demands additional attention on the part of the vehicle operator.

Assuming that it is desired to place the system in operative condition, the flexible bag 30 is subjected to any given pressure, which may be two hundred and fifty pounds, for example, and once the bag is put under pressure it is permanently retained. As the pressure in the water-pipe 23 increases above that of the accumulator, the bag assumes the shapes illustrated in dotted lines. The lowest line indicates the relatively low pressure, the intermediate line the higher pressure, and the upper line a high pressure. The use of this flexible bag within the casing is a very desirable construction, as it prevents all leaks, and the pressure can always be accurately determined. The interior surface of the chamber is provided with rounded corners, so that all danger of cutting the bag is eliminated.

Referring to Fig. 3, I have shown a slight modification of the accumulator wherein a long piston 33, having a suitable packing 34, is substituted for the flexible bag 30. The piston is grooved on its periphery to further prevent the passage of air or gas from the chamber in the upper end to the water and makes a working fit with the cylinder 27. The packing 34 is of any suitable construction and is held in place by a plate 35. The upper end of the casing is provided with a valve and cap 38, by means of which the chamber may be subjected to air-pressure. The interior of the piston is hollow and communicates with the interior of the cylinder through the pipe 36. As the pressure in the water-pipe 23 increases the piston is gradually raised, compressing the air or gas in the cylinder until a maximum is reached, when the upper end of the pipe 36 strikes the upper end of the cylinder 27. When this happens, the greater part of the air or gas is contained in the compression-chamber 37 in the piston, although a certain amount is contained in the space surrounding the pipe 36 and between it and the upper end of the cylinder. It will be seen that the air is confined in the chamber in the upper end of the cylinder and that it is out of contact with the body of water, thereby preventing the water and air from mingling.

With vehicles employing flash-boilers relief-valves are employed which are connected to the water end of the boiler, and it frequently happens that when the vehicle comes to a standstill the pressure in the boiler-tubes becomes so high that the water contained in the first end of the tubes is forced back into the water-tank through said relief-valve. This means that a considerable amount of heat units are lost, and, furthermore, it requires additional pumping to bring the boiler back to a normal condition. It is intended that the accumulator 26 shall take the place of this relief-valve; but in order to protect the accumulator I may employ a relief-valve 40 of the same general construction, but designed to act only when the maximum pressure of the accumulator has been attained, in which case it will permit water to flow from the boiler and accumulator back to the tank. Under ordinary

conditions the relief-valve will not open, and the hot water from the boiler will work back into the accumulator, so that when the demand for steam is increased the hot water which was discharged from the boiler is returned to it instead of the cold water from the tank. By reason of this arrangement a certain saving in heat units is accomplished. By supplementing the tank with an extra reservoir or accumulator in which water may flow from the boiler and be maintained under pressure the system will more nearly resemble those using larger boilers, so far as the storage capacity is concerned, without, however, its attending danger, for the storage is taking place in a place which is unaffected by the fire, and hence there is no danger of explosion.

Mounted on the driving-shaft of the engine 39 is a sprocket-wheel which is connected by a chain with a sprocket-wheel mounted on the shaft 15. The latter may or may not carry the driving-wheels, as desired.

By reason of the combination and arrangement of parts I am enabled to provide a system of control for steam-actuated apparatus employing flash-boilers which will automatically compensate for overloads for limited periods of time.

While I have described the invention as applied to a water-supply system for the boilers, I desire to have it understood that it is also applicable to fuel-supply systems for burners.

In accordance with the provisions of the patent statutes I have described the principle of operation of my invention, together with the apparatus which I now consider to represent the best embodiment thereof; but I desire to have it understood that the apparatus shown is only illustrative and that the invention can be carried out by other means.

What I claim as new, and desire to secure by Letters Patent of the United States, is—

1. In combination, a flash-boiler, a pump for continually forcing water into the boiler when steam is being withdrawn therefrom, an accumulator for supplying the boiler which is located between the same and the pump to receive water from either under certain conditions as to pressure, said accumulator containing a permanent weight of gas compressed to a normal predetermined pressure before the accumulator is placed in service, and means for decreasing the effective delivery of the pump when the pressure on the boiler and accumulator increases and for increasing said delivery when the water-pressure decreases.

2. In combination, a flash-boiler, an accumulator containing a permanent weight of gas compressed to a predetermined normal pressure before the accumulator is placed in service, means for confining said gas under pressure, a pump which continually supplies water to the boiler when the system is in operation, means for varying the effective delivery of the pump in inverse ratio with the boiler-pressure, and a connection permitting an unobstructed flow of water from the boiler to the accumulator.

3. In combination, a flash-boiler, a water-pump which continually forces water directly to the boiler when steam is being withdrawn, an accumulator which is in free communication with the pump and boiler and is adapted to receive water from either, the said accumulator containing a confined body of gas compressed to a normal predetermined pressure, means for varying the effective delivery of the pump inversely with the boiler-pressure, and a movable element in said accumulator separating said body of gas from the water.

4. In combination, a flash-boiler, a pump which delivers water to the boiler at all times when steam is being withdrawn therefrom, means for decreasing the effective delivery of the pump when the pressure in the boiler increases, and vice versa, an accumulator provided with means whereby it can be supplied with a body of gas under permanent pressure, connections between the accumulator and the pump and the boiler whereby the accumulator will receive water from the boiler when the steam-pressure exceeds a predetermined amount and will deliver water when the pressure falls again, and means for confining said gas under pressure and also separating it from the water.

5. In combination, a receptacle, an accumulator in constant open communication therewith whereby fluid may flow from one to the other in accordance with relative changes in pressure, and means for supplying fluid directly to the receptacle.

6. In combination, a receptacle, an accumulator therefor, a constantly-open connection between them which permits fluid to flow from one to the other as the pressures vary, and means for discharging fluid to the connection between the receptacle and accumulator.

7. In combination, a receptacle, an accumulator therefor maintained under elastic-fluid pressure, a constantly-open connection between them which permits fluid to flow from the receptacle to the accumulator when the pressure in the former tends to exceed that of the latter, and to return when the pressure in the receptacle falls, and means for supplying fluid directly to the receptacle.

8. The combination of a flash-boiler, an accumulator therefor maintained under a permanent initial pressure, and a connection between them whereby the pressure in the accumulator varies substantially in correspondence with that of the boiler due to fluid being relieved to the former or returned therefrom to the latter.

9. The combination of a flash-boiler, an accumulator therefor maintained permanently under an initial pressure, a connection which permits fluid to pass freely between them due to relative difference of pressure, and a pump for supplying fluid directly to the boiler under normal conditions, and in conjunction with the accumulator when the pressure is below normal.

10. The combination of a flash-boiler, an accumulator therefor maintained under a permanent initial pressure, a source of water-supply, a connection leading from the source to the boiler and to the accumulator, which permits water to pass in either direction between the accumulator and boiler, and a variable-stroke pump delivering water to said connection at a point between the accumulator and boiler.

11. The combination of a source of water-supply, a flash-boiler, a supply-pipe between them, a variable-stroke pump connected with said pipe and adapted to deliver water directly to the boiler, an accumulator, and a branch supply-pipe extending from said pipe at a point between the boiler and the pump whereby water may enter the accumulator either from the pump or boiler when the pressure therein is below a certain point or flow therefrom to the boiler when the boiler-pressure is below that of the accumulator.

In witness whereof I have hereunto set my hand this 23d day of July, 1901.

HERMANN LEMP.

Witnesses:
DUGALD McK. McKILLOP,
JOHN J. WALKER.