

Sept. 16, 1941.

L. C. ROOF

2,256,268

LIQUID FEEDING APPARATUS

Filed Aug. 8, 1940

3 Sheets-Sheet 1

Fig. 5.

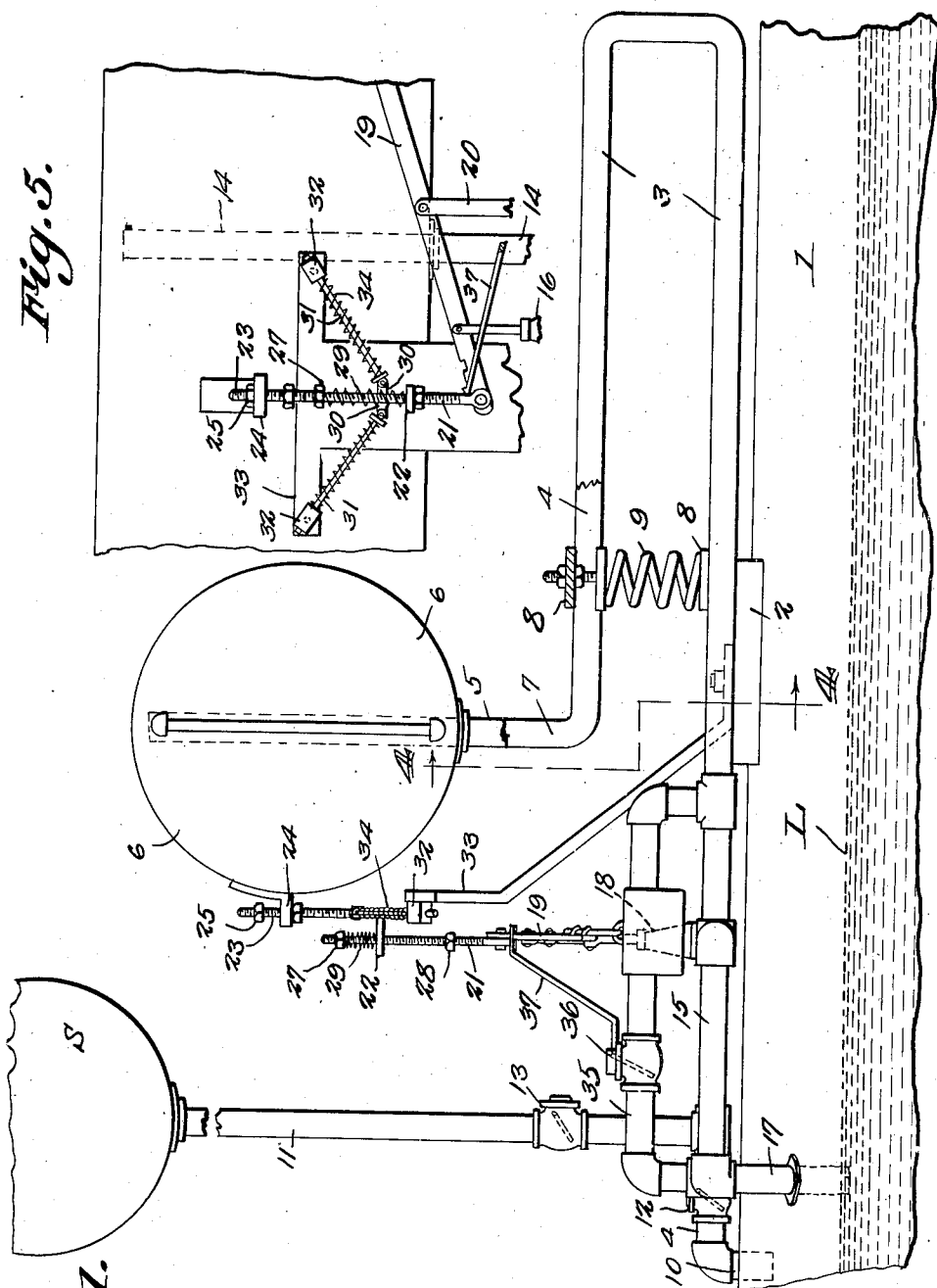


Fig. 1.

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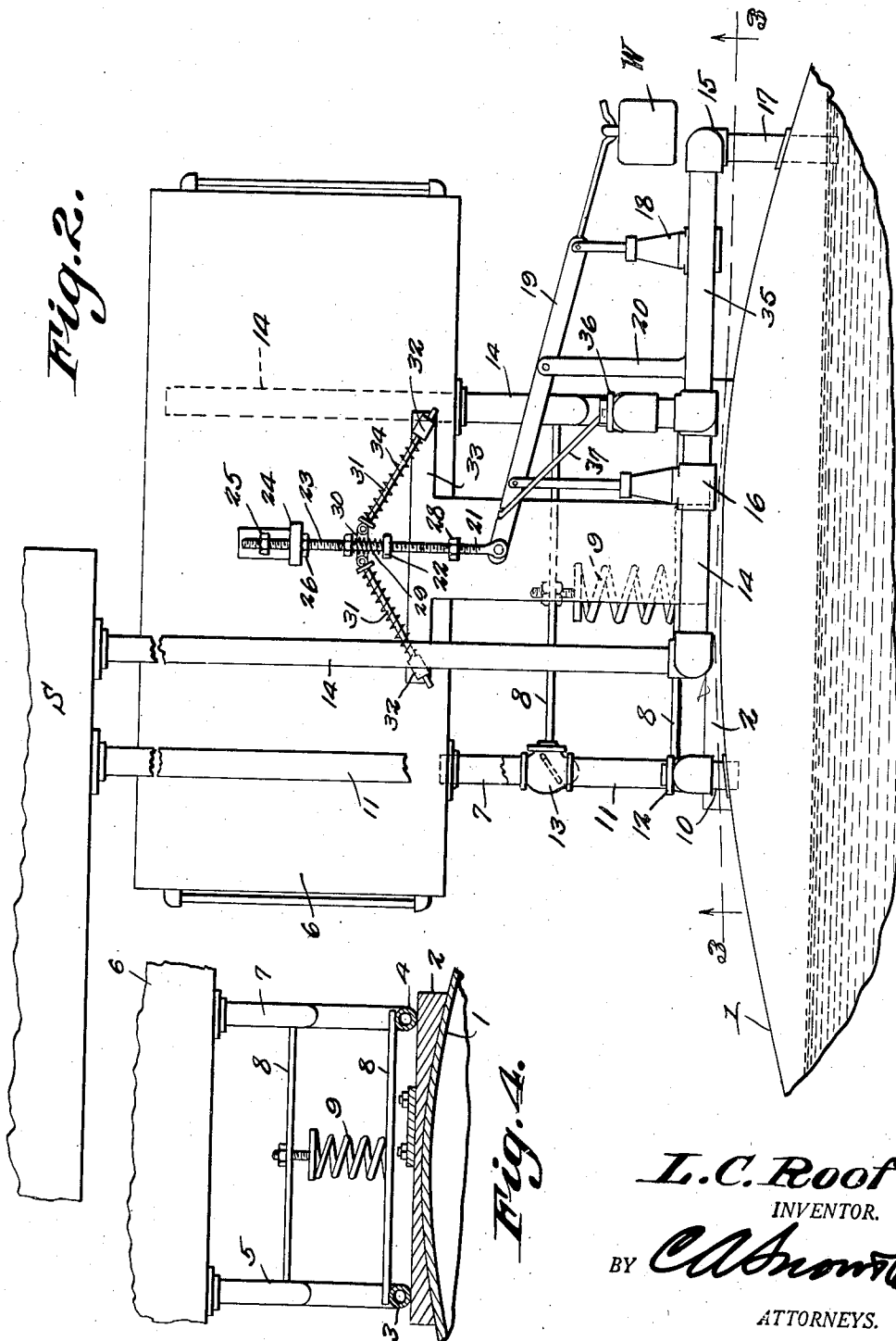
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## LIQUID FEEDING APPARATUS

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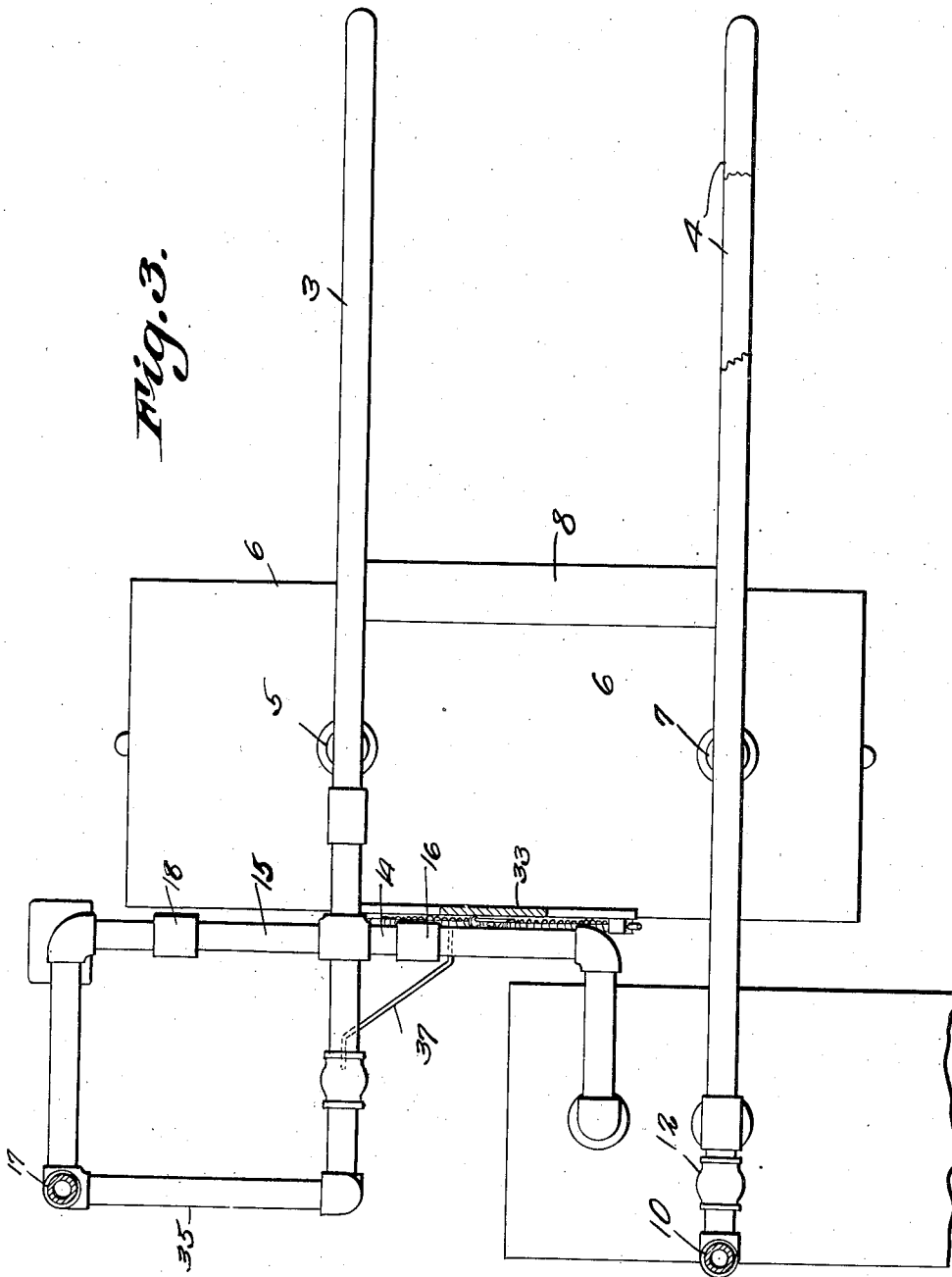
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LIQUID FEEDING APPARATUS

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3 Sheets-Sheet 3



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## UNITED STATES PATENT OFFICE

2,256,268

## LIQUID FEEDING APPARATUS

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Application August 8, 1940, Serial No. 351,810

4 Claims. (Cl. 122—456)

This invention relates to apparatus for automatically supplying liquid, as needed, to boilers, tanks or the like containing steam, gas, etc., under pressure.

An object of the invention is to provide an apparatus which can be made of any desired proportions and can be located either close to or remote from the tank or boiler to be supplied, there being a new and novel arrangement of valves under the control of the liquid being supplied, whereby the liquid will be directed into the boiler as needed and a new supply or portion of the liquid taken into the apparatus for delivery during the next succeeding cycle of operations.

With the foregoing and other objects in view which will appear as the description proceeds, the invention consists of certain novel details of construction and combinations of parts hereinafter more fully described and pointed out in the claims, it being understood that changes may be made in the construction and arrangement of parts without departing from the spirit of the invention as claimed.

In the accompanying drawings the preferred form of the invention has been shown.

In said drawings

Figure 1 is a side elevation of the apparatus, portions of the tank or boiler and of the supply or storage tank being shown assembled therewith.

Figure 2 is an end elevation of the apparatus shown in Figure 1, the parts in both figures being shown in their normal positions.

Figure 3 is a section on line 3—3, Figure 2.

Figure 4 is a section on line 4—4, Figure 1.

Figure 5 is an end elevation of a portion of the apparatus showing the positions of the parts when the valves are tripped for the delivery of liquid to the tank or boiler.

Referring to the figures by characters of reference, 1 designates a boiler or tank to be supplied with liquid as needed. Mounted on this boiler or tank is a base member 2 supporting a steam conducting pipe 3 and a liquid pipe 4 each of which is bent into substantially U-shape with upper and lower arms. The upper arm of the pipe 3 has an upwardly extending end portion 5 which projects through the bottom of an intermediate container 6 and opens into the container adjacent to the top thereof. The upper arm of the pipe 4 also has an upwardly extending portion 7 which opens into the bottom of the container 6. These pipes are formed of a resilient metal so that they are capable of flexing

under the weight of the intermediate container 6 and its contents. For the purpose of resisting this action, however, cross-strips 8 can be attached to the upper and lower arms of the pipes 3 and 4 and a compression spring 9 can be interposed between these strips to receive a portion of the load.

Pipe 4 has one end extended downwardly and opening into the upper portion of the tank or boiler 1 as shown at 10. A water supply pipe 11 opens downwardly into the pipe 4 and extends from the bottom of a storage tank S located at a suitable elevation and wherever found most convenient with relation to the tank 1. In the pipe 4 between its outlet end and the tank 1 is a check valve 12 adapted to allow liquid to flow into the tank or boiler 1 but preventing return flow. Another check valve 13 is located in the pipe 11 and while it allows liquid to flow through said pipe from the storage tank S to the pipe 4 it will not permit return flow of liquid through the pipe.

The pipe 3 opens into a steam pipe comprising oppositely extending branch pipes 14 and 15. The branch pipe 14 opens into the storage tank S and, in the structure illustrated, has an exhaust valve 16 which is normally open.

The branch pipe 15 of the steam pipe is extended to and opens downwardly into the tank or boiler 1 as shown at 17, the lower open end of this pipe terminating approximately at the liquid level L in the tank 1. This branch 15 likewise is provided with a pressure valve 18 which is normally closed.

A lever 19 is fulcrumed on a suitably located standard 20 and one arm of the lever is connected to the valve 18 while the other arm is connected to the valve 16. By means of a weight W the lever can be maintained normally in the position shown in Figure 2. This weight can be mounted in any suitable manner at one end of the lever. The other end of the lever has a threaded stem 21 pivotally connected thereto and extending upwardly therefrom. This stem is slidable within a foot 22 projecting from the lower end of a tripping stem 23 which is screw-threaded and in turn slidably mounted in a bracket 24 carried by the container 6. Adjustable stop nuts 25 and 26 are mounted on the stem 23 above and below bracket 24 and adjustable stop nuts 27 and 28 are mounted on the stem 21 above and below the foot 22. A coiled spring 29 is mounted on this stem 21 between nut 27 and foot 22 and constitutes a means for yieldingly supporting stem 21 from the foot 22.

Oppositely extending wings 30 are carried by stem 23 adjacent to the foot 22 and to these wings are pivotally connected diverging rods 31 which are slidable in guide sleeves 32. These guide sleeves are pivotally supported by a bracket 33 and, when lever 19 is in its normal position as shown in Figure 2, the rods converge upwardly. Springs 34 are mounted on the rods 31 and thrust against sleeves 32 and against the wings 30 so as to exert an upward pressure against stem 23 whereby its foot 22 is held in an elevated position as shown in Figures 1 and 2.

A by-pass is connected to the pipe 3 and is so located as to bridge the valve 18. This by-pass, which is shown at 35, is provided with a normally closed valve 36 adapted to open in the direction of the outlet end 17 of the pipe 15. The valve has an operating arm 37 which extends over that arm of lever 19 to which stem 21 is connected so that when lever 19 is in its normal position, arm 31 is held raised and valve 36 is closed.

When the valve 16 is open, as in Figure 2, liquid is free to flow from the storage tank S through pipe 11 to pipe 4 and thence into the intermediate tank 6. As the liquid is gradually stored in this intermediate tank, the increasing weight will cause the pipes 3 and 4 to sag under the load, this sagging action being resisted by the spring 9. As the filled tank 6 descends, the bracket 24 will come against the nut 26 and force stem 23 downwardly. This, in turn, will cause the foot 22 to move toward nut 28 and will also cause the rods 31 to slide in their guide sleeves 32 and to swing downwardly until they reach a dead center at which time the springs 34 are under compression. Continued downward movement of the parts will carry the rods 31 past their dead center with the result that the energy stored in the springs 34 will cause the foot 22 to abruptly move downwardly against nut 28 with the result that lever 19 will be abruptly shifted from the position shown in Figure 2 to the position shown in Figure 5. This results in prompt closing of valve 16 so that the steam and/or air exhausting from tank 6 to tank S by way of pipes 3 and 14 is cut off. At the same time the valve 18 is abruptly opened against the action of the weight W. Thus communication is established between the upper portion of the tank or boiler 1 by way of pipe 3 with outlet pipe 17 but as long as the lower end of said pipe 17 is submerged in the liquid content of the tank or boiler 1 and there is a pressure of air, gas or steam within the tank or boiler, there will be no release of liquid from intermediate tank 6.

As soon as the liquid level L drops below the end of pipe 17 the air, gas or steam held under pressure above the liquid level is released so that it can escape into pipe 3 and thence into the upper portion of the intermediate tank 6. As the pressure in the tanks 1 and 6 is thus equalized, the liquid content of tank 6 will be free to gravitate through pipe 4 and past valve 12 into tank 1. Escape of pressure to the storage tank S is prevented by the check valve 13 during this operation.

When the liquid level rises so as to submerge the outlet end of pipe 17, further flow of liquid to the tank or boiler 1 is stopped. Furthermore as the liquid is delivered from the tank 6, the weight is slowly reduced so that this tank is gradually moved upwardly by spring 9 and the resiliency of pipes 3 and 4 until it is restored to its normal or elevated position. During this operation the lever 19 is abruptly snapped back to

its initial position by the spring-controlled rods 31 after they move upwardly past their dead center and such action of course results in opening the valve 16 and closing the valve 18. Thus liquid is again free to flow into the tank 6 so as to prepare it for the next cycle of operations. When the valve 16 is open and valve 18 is closed as stated, and water begins to flow into the tank 6, any steam left in the said tank 6 will escape by way of pipe 3, valve 16 and pipe 14 into the storage tank where it may be utilized for pre-heating the water.

The steam by-pass has been provided as a supplemental feature for the purpose of increasing the efficiency of the apparatus but it is not essential. When pressure in boiler 1 is greater than that in tank 6, the check valve 36 is held closed by the boiler pressure even after lever 19 shifts to close valve 16 and open valve 18. When the pressures in the boiler 1 and tank 6 have almost equalized, arm 37 will act as a weight to open valve 36 and steam can then be by-passed quickly from pipe 15 to pipe 3 without first flowing through valve 18. When lever 19 is shifted to close valve 18 it picks up arm 37 and closes valve 36. The utilization of the by-pass results in prompt delivery of liquid from tank 6 when the pressures are equalized from any cause.

It will be obvious that a structure such as herein described permits the location of a storage tank and the intermediate container at any desired point above and away from the boiler or tank 1. The spring-tripped mechanism for controlling the valve operation is very important because it insures quick action of the valve so that the supply of liquid will take place only at the instant desired and at full flow. The cut-off will also operate instantaneously by using this tripping action.

Obviously many modifications of the structure can be made within the scope of the claims. For example any desired number of intermediate tanks can be used; the apparatus can be caused to operate with or without pressure from within the tank 1, and the connections can be modified without changing the operation as explained.

It will be apparent that the rods 31 and the parts associated therewith form an efficient toggle and that, as a result of the lost motion connection between it and the lever 19, the toggle can be moved in either direction toward its dead center, without operating the lever. This movement will store energy in the springs 34 of the toggle so that, when the toggle passes its dead center, the springs will actuate it abruptly to cause the quick shift of the lever.

The term "boiler" and/or "tank" herein used is to be understood as applying to any kind of a container to which liquid of any kind is to be supplied automatically as needed.

What is claimed is:

1. The combination with a boiler, a storage tank and a yieldingly supported container, of a steam pipe extending from the storage tank and downwardly into the boiler, separate exhaust and pressure valves in said pipe, a pipe connecting the upper portion of the container to the steam pipe between the valves, the exhaust valve being positioned between said connecting pipe and the tank, a liquid-conducting pipe connecting the bottom of the container to the top of the boiler, a check valve therein for preventing return flow from the boiler, a supply pipe connecting the storage tank to the liquid conducting pipe between said check valve and the container. a

check valve therein for preventing return flow to the storage tank, and means operated by the movement of the container in one direction for closing the exhaust valve and opening the pressure valve and by movement in the opposite direction to open the exhaust valve and close the pressure valve, said means including a spring-restrained toggle, a lost motion connection between the toggle and the valves, and means operated by the upward or downward movement of the container relative to the boiler for shifting the toggle against the action of its spring toward and past a dead center, said toggle and the stored energy of its spring after passing a dead center constituting means for abruptly actuating the lost motion connection to open one of the valves and close the other valve.

2. The combination with a boiler, a storage tank and a yieldingly supported container, of a steam pipe extending from the storage tank and downwardly into the boiler, separate exhaust and pressure valves in said pipe, a pipe connecting the upper portion of the container to the steam pipe between the valves, the exhaust valve being positioned between said connecting pipe and the tank, a liquid conducting pipe connecting the bottom of the container to the top of the boiler, a check valve therein for preventing return flow from the boiler, a supply pipe connecting the storage tank to the liquid conducting pipe between said check valve and the container, a check valve therein for preventing return flow to the storage tank, and means operated by the movement of the container in one direction for closing the exhaust valve and opening the pressure valve and by movement in the opposite direction to open the exhaust valve and close the pressure valve, said means including a lever fulcrumed between and connected to the exhaust and pressure valves, means connected to the lever for holding said valves normally in one position, a toggle structure including a spring, a lost motion connection between the toggle structure and the lever, and means operated by movement of the container for shifting the toggle toward and past a dead center to store energy in the spring, said toggle being operated by the spring when past a dead center to abruptly actuate the lever.

3. The combination with a boiler and a storage tank, of a container, a steam pipe extending from the storage tank and downwardly into the boiler, separate exhaust and pressure valves in said pipe, a connecting pipe leading from the upper portion of the container to the steam pipe between the valves, the exhaust valve being posi-

tioned between said connecting pipe and the tank, a liquid-conducting pipe connecting the bottom of the container to the top of the boiler, said connecting pipe and liquid conducting pipe constituting resilient supports for the container, a supplemental resilient support for the container, a check valve in the liquid-conducting pipe positioned to prevent return flow from the boiler, a supply pipe connecting the storage tank to the liquid conducting pipe between said check valve and the container, a check valve in the supply pipe for preventing return flow to the storage tank, and means operated by the movement of the container in one direction for closing the exhaust valve and opening the pressure valve and, by movement in the opposite direction, to open the exhaust valve and close the pressure valve.

4. The combination with a boiler, a storage tank and a yieldingly supported container, of a steam pipe extending from the storage tank and downwardly into the boiler, separate exhaust and pressure valves in said pipe, a pipe connecting the upper portion of the container to the steam pipe between the valves, the exhaust valve being positioned between said connecting pipe and the tank, a liquid conducting pipe connecting the bottom of the container to the top of the boiler, a check valve therein for preventing return flow from the boiler, a supply pipe connecting the storage tank to the liquid conducting pipe between said check valve and the container, a check valve therein for preventing return flow to the storage tank, and means operated by the movement of the container in one direction for closing the exhaust valve and opening the pressure valve and by movement in the opposite direction to open the exhaust valve and close the pressure valve, said means including a lever fulcrumed between and connected to the exhaust and pressure valves, means connected to the lever for holding said valves normally in one position, a toggle structure including a spring, a lost motion connection between the toggle structure and the lever, and means operated by movement of the container for shifting the toggle toward and past a dead center to store energy in the spring, said toggle being operated by the spring when past a dead center to abruptly actuate the lever, a by-pass bridging the pressure valve, a valve in the by-pass positioned to be treated by pressure from the boiler, and means released by the lever when moved in one direction, for opening said by-pass valve when pressure is equalized at both ends of the by-pass.

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