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AUTOMATIC LIQUID REGULATING SYSTEM

Filed Dec. 20, 1935

Fig. 1

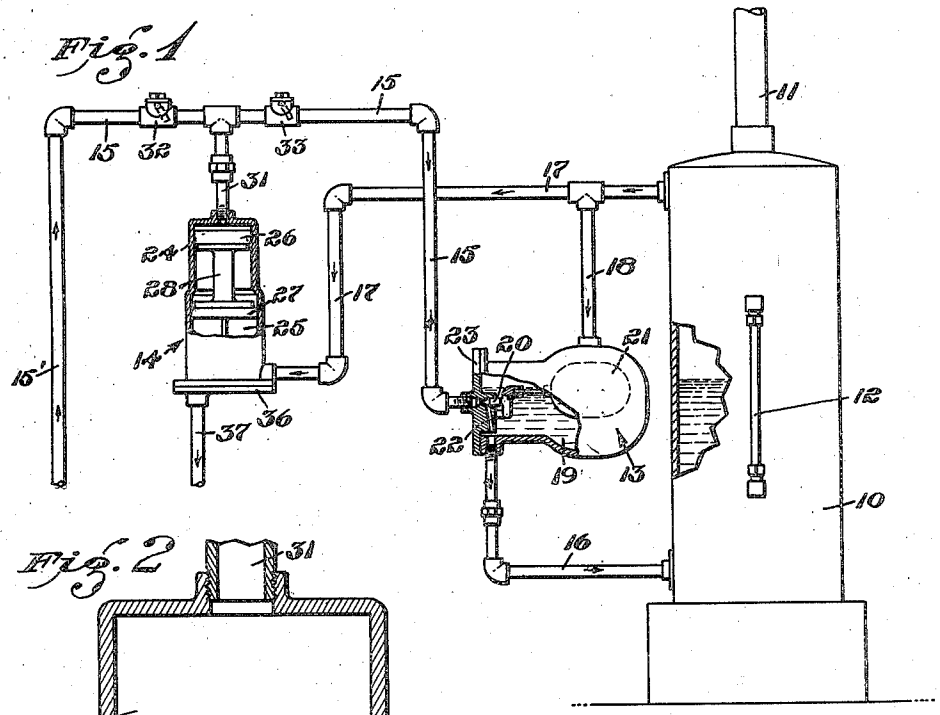


Fig. 2

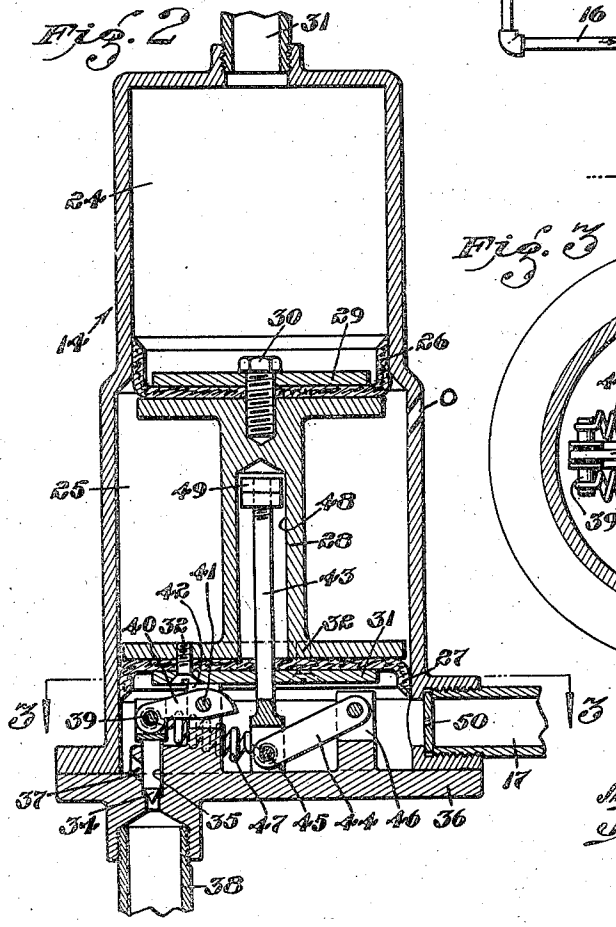
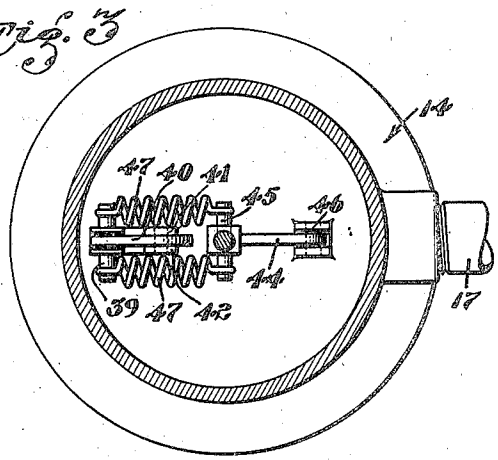


Fig. 3



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AUTOMATIC LIQUID REGULATING SYSTEM

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8 Claims. (Cl. 122—451)

This invention relates to a system for controlling the liquid level in a steam boiler or the like, and particularly to a pumping device for supplying water to the boiler.

An object of the present invention is the provision of means for maintaining a substantially constant fluid level in a steam boiler.

Another object of the invention is to make possible the utilization of the steam pressure within the boiler for forcing fluid thereinto.

Another object of the invention is the provision of an automatic differential pumping device which employs the steam-pressure within the boiler for forcing liquid thereinto.

A further object of the invention is to provide a liquid regulating system which embodies a differential fluid pump for forcing liquid into the boiler, and a float-controlled valve for controlling its operation; and to further provide such a valve which is responsive to a variation in liquid level within the boiler for effecting the operation of the pump.

Another object contemplated by the invention, is the provision of a novel differential fluid pump having a valve-controlled outlet in its low pressure side and a restricted inlet for rendering the low pressure side continuously communicative with a source of fluid pressure.

A further object of the invention is the provision of a system for regulating the liquid level in a vapor generator, which embodies a differential fluid pump adapted to employ the gas pressure from said generator for forcing liquid thereinto, and means for regulating the admission of liquid from said fluid pump into said generator.

Another object of the invention is the provision of a differential fluid pumping device having a restricted inlet into its low pressure side, and a valve controlled outlet from said low pressure side whose cross sectional area is substantially greater than that of the restricted inlet, whereby to permit a rapid evacuation of fluid from the low pressure side with a minimum effect upon the fluid pressure source, and to obviate the necessity of a valve for said inlet.

This invention possesses many other advantages and has other objects which will be made more easily apparent from a consideration of one or more embodiments thereof. For this purpose one form is shown in the accompanying drawing which illustrates the general principles of our invention and is hereinafter described in detail; but it is to be understood that this description is not to be taken in a limiting sense, since the scope of our invention is best defined in the appended claims.

In the drawing:—

Figure 1 is an automatic fluid regulating system embodying the invention.

Figure 2 is an enlarged longitudinal sectional view through the novel differential fluid pump contemplated by the invention, and

Figure 3 is a transverse sectional view taken as indicated by line 3—3 of Figure 2.

We find our regulating system particularly useful in connection with steam boilers such as those used in pressing establishments, where steam is constantly being used in the pressing of garments. At present, the operator must rely upon his memory to observe the water gauge on the boiler from time to time, in order to maintain the proper water level within the boiler, which is accomplished through the manual manipulation of a valve. Such an arrangement is uncertain and results in much loss of time, since the water in the boiler is often inadvertently permitted to reach a low level, whereupon an appreciable admittance of cold water reduces the temperature of the water within the boiler, thus making it necessary to discontinue operations until the steam pressure is again built up. The present invention obviates such difficulties by the provision of a system for automatically admitting water to the boiler gradually as the water therein is converted into steam.

Figure 1 of the drawing shows a steam boiler 10 of the type commonly used in pressing establishments. Said boiler is provided with a steam take-off pipe 11 and a water level indicating tube 12. It should be understood that the temperature and pressure within the boiler may be controlled by a thermostatically controlled heat source (not shown).

The system employed for maintaining a substantially constant water level in the boiler, embodies a float actuated regulating device 13 and a novel differential pump or injector 14, which is adapted to employ steam pressure from the boiler 10, for forcing water from a low pressure source of supply, through the regulator, into the boiler, and against the steam pressure therein. The actuation of the pump 14 is controlled by the regulating device 13, which is responsive to variations in the water level within the boiler for admitting and cutting off the flow of water into the boiler. The regulator 13 and the high pressure side of the pump 14 are connected to a source of water supply through a pipe 15, which may be connected with the ordinary water main 15', and

the regulator is in turn connected to the water chamber of the boiler through a pipe 16. The low pressure side of the pump is connected with the steam chamber of the boiler through a steam supply pipe 17, and a balanced steam pressure is established in the boiler and regulator through the pipe 18, which connects said regulator with the steam supply pipe 17.

The regulating device 13 comprises a housing 19 which contains a valve 20, and a float 21 for actuating the same. The valve 20 controls the passage of water into the regulator from the pipe 15, through a passage 22 formed in the cover 23. It is preferred to position the regulator as near to the boiler as is practical, in order to maintain the temperature of the water in both containers substantially the same. By directing the cold water from the pipe 15 to the bottom of the regulator 13, the possibility of affecting appreciably the temperature of the water's surface within the regulator is reduced, thus insuring against any undesirable steam condensation in the regulator and lowering of the steam pressure within the boiler 10. The regulator 13 is so positioned with respect to the desired water level within the boiler 10, that the buoyant force on the float 21 is just sufficient to normally maintain the valve 20 in its closed position. However, it will be obvious how a slight drop in the water level within the boiler, will result in a corresponding drop in the water level within the regulator, and a lowering of the float 21 to open the valve 20.

A steam pressure of approximately seventy pounds is usually maintained within boilers used in pressing establishments, and the water pressure in the water main varies from thirty to fifty pounds. It is accordingly necessary that the steam pressure be sufficiently low to permit the admission of water into the boiler. In the system contemplated by the present invention, a substantially constant steam pressure and water level is maintained within the boiler, by forcing water into the boiler correspondingly as the water therein is being converted into steam. The float and valve mechanism can be so balanced with respect to the maximum water level within the boiler, as to permit a substantially constant seepage of water into the boiler to compensate for the water being converted into steam. Thus it will be obvious that the temperatures and pressures within the boiler will not be appreciably affected by the admission of such small quantities of water thereinto.

The novel differential pump or injector 14 used for forcing water through the regulator 13 into the boiler 10, is best illustrated in Figures 2 and 3 of the drawing. It comprises a pair of differential cylinders 24 and 25, respectively containing a pair of differential pistons 26 and 27, which are connected for simultaneous movement by a member 28. The pistons are shown in the form of cups, which may be made from any appropriate material such as leather or the like. The piston cup 26 is supported on the upper end of the member 28 and is secured thereto by a plate 29 and bolt 30. The piston cup 27 is secured to the lower end of the member 28 by a plate 31 and screws 32. The upper cylinder 24 communicates with the water supply pipe 15 through the pipe 31 and the lower cylinder communicates with the steam chamber of the boiler 10, through the steam supply pipe 17 as shown clearest in Figure 1. Thus, it will be obvious how the steam pressure is at all times acting on the lower piston 27 in an effort to raise the valve construction. However, when the regulator valve 20 is closed, the piston construction is maintained in its downward position (Figure 2), by the body of water previously confined between the check valve 32 and regulator valve 20, in the pipe 15 and upper cylinder 24 of the regulator. When the liquid level lowers within the boiler, the liquid level within the regulator correspondingly drops and the float 21 is lowered to open the valve 20. The steam pressure then forces the piston structure upwardly and due to the differential between the upper and lower cylinders and pistons, the pressure on the water is built up in excess of the steam pressure within the boiler 10, and the water is accordingly forced past the check valve 33 into the regulator, from whence it enters the boiler through the pipe 16. During this upward movement of the valve structure, the water being pumped is prevented from backing up into the water supply pipe 15'' by the check valve 32. An opening O in the upper end of the lower cylinder 25, provides a means of relief for steam or the like, which might become trapped between the pistons. During the downward movement of the valve structure, the high pressure water previously pumped, is restrained against backing up into the upper cylinder of the injector 14 by the check valve 33. Accordingly the water from the low pressure supply pipe 15' is permitted to enter the upper cylinder of the injector through the check valve 32.

Means is provided for quickly exhausting the steam from the lower cylinder 25 when the piston structure has reached the upper end of its stroke, whereby to permit its quick return to the position shown in Figure 2. This is accomplished through a quick acting valve structure which is actuated by the piston structure. It includes a valve 34, which operates in an opening 35 extending through the bottom 36 of the injector, to open and close the outlet passage 37, which is communicative between the interior of the cylinder 25 and the exhaust pipe 38 through the lower end of the valve opening 35. The upper end of the valve 34 is pivotally secured as by a pivot pin 39, to one end of an arm 40, which is in turn pivotally supported at 41, to an upwardly extending member 42 formed on the bottom 36 of the injector. The lower end of an operating rod 43 is supported for movement by a link 44, which has one end pivotally connected thereto as at 45, and the other end pivotally connected to a support 46 formed on the bottom 36. The lower end of the operating rod 43 is connected to the outer end of the valve operating arm 40 through a pair of springs 47, which are secured to the pivot pins 39 and 45. The operating rod 43 extends through the lower piston cup 27 into a longitudinal opening 48 formed in the piston connecting member 28, and is provided on its upper end with an enlarged head 49 over which the member 28 moves. Thus, when the piston structure approaches the upper end of its stroke, the lower piston cup 27 engages the enlarged head 49. The operating rod 43 is accordingly moved upwardly until its lower pivotal connection 45 moves above the pivotal connection 39, at which time the springs 47 act to quickly move the valve 34 above the steam outlet port 37, to permit an exhaust of the steam from the lower cylinder 25. The valve structure when in its downward position, is supported on the upper end of the member 42 formed on the bottom 36.

An important feature of the invention resides in the provision of the restricted steam inlet 50 leading into the lower cylinder 25, and through

which the cylinder is rendered continuously communicative with the steam chamber of the boiler **10**. It will be clear from the construction of Figure 2, that the cross sectional area of the steam exhaust port **37** is much greater than that of the restricted inlet opening **50** and that said exhaust port is controlled by a quick acting valve. Thus it will be obvious how the exhaust valve need only to be opened for an instant to permit a complete exhaustion of steam from the cylinder **25** and a quick return of the piston structure. The small amount of steam entering the cylinder **25** through the restricted inlet is not sufficient to affect the quick downward movement of the piston structure, and the back pressure through said restricted inlet into the steam chamber of the boiler is negligible. It will thus be clear from the construction, how the need for an inlet valve is obviated, thus reducing the cost of manufacture of the differential pumping device.

We claim:

1. In a system of the character described, a boiler for generating steam, a fluid boosting device having high and low pressure sides, means for connecting said high and low pressure sides with the water and steam chambers respectively of the steam boiler, the high pressure side of said boosting device being connected with the fluid to be pumped and the low pressure side being continuously under the influence of the steam pressure within the boiler, a float actuated valve interposed in the water line between the high pressure side of the boosting device and the boiler, said valve being responsive to variations in water level within the boiler for controlling the actuation of said boosting device, and means forming a valve-controlled outlet from the low pressure side of said device.

2. In a system of the character described, in combination, a reservoir for liquid, a boosting device having high and low pressure sides, means for connecting the high pressure side of said boosting device with said liquid reservoir, said high pressure side being also connected with a fluid supply source, means for rendering the low pressure side of the boosting device continuously communicative with pressure fluid by which said boosting device is actuated, means for controlling the admission of liquid from the high pressure side of said boosting device to the liquid reservoir, and means forming a valve-controlled outlet from the low pressure side of said device.

3. In a system of the character described, in combination, a generating device for converting liquid into gas, a fluid boosting device having high and low pressure sides, means for connecting the high pressure side of said boosting device with said generating device, said high pressure side being also connected with a source of liquid, means for rendering the low pressure side of the boosting device continuously communicative with a source of fluid pressure when the system is in operation, means for controlling the admission of liquid from the high pressure side of said boosting device to the generating device, and means forming a valve-controlled outlet from the low pressure side of said device.

4. In a system of the character described, a boiler for generating steam, means connecting said boiler with a source of water supply, a boosting device having its high pressure side connected with said water supply line, a pair of unidirectional valves in said water supply line on opposite sides of the connection from said boosting device, means for rendering the low pressure side of the boosting device continuously communicative with a source of fluid pressure when the system is in operation, said boosting device being operable by said fluid pressure for forcing water through said water supply line into said boiler, and means forming a valve-controlled outlet from the low pressure side of said device.

5. In a fluid boosting device, means forming an outlet from the high pressure side of said device, means forming a restricted inlet into the low pressure side of said device through which fluid is admitted from an external source for operating the device, said restricted inlet being permanently open and sufficiently small to permit continuous communication between the low pressure side of said booster and the fluid pressure source during the exhaustion of fluid from said low pressure side, and a valve controlled exhaust passage leading from the low pressure side whose cross sectional area is substantially greater than that of the restricted inlet.

6. A fluid boosting device embodying, a pair of differential cylinders, a pair of differential pistons connected for simultaneous movement within said respective cylinders, means forming a passage in the high pressure cylinder through which fluid to be pumped is passed into and out of the device, means forming a permanently opened restricted inlet into the low pressure cylinder through which fluid is admitted for operating the device, said inlet being sufficiently small to permit continuous communication between the low pressure cylinder and the operating fluid during the exhaustion of fluid from said low pressure cylinder without appreciably retarding the exhausting operation, and a valve controlled exhaust passage leading from the low pressure cylinder whose cross sectional area is substantially greater than that of the restricted inlet.

7. In a system of the character described, liquid receiving means, a liquid boosting device having high and low pressure sides, means for connecting the high pressure of said boosting device with said liquid receiving means for supplying liquid thereto, said high pressure side being also connected with a source of liquid supply, means forming a permanently opened restricted inlet through which operating fluid is supplied under pressure to said low pressure side for effecting a movement of liquid from the high pressure side, and means providing a valve-controlled outlet from the low pressure side for the exhaustion of operating fluid at the end of the liquid boosting operation.

8. A fluid boosting device including high and low pressure sides, said high pressure side being adapted to receive a fluid to be moved, means forming a permanently opened restricted inlet through which operating fluid is adapted to be supplied under pressure to the low pressure side of said device for effecting the operation of said device to force fluid from the high pressure side thereof, and means forming a valve-controlled outlet from the low pressure side for effecting an exhaustion of operation fluid therefrom at the end of the fluid boosting operation, said outlet being substantially larger than said restricted inlet.

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