

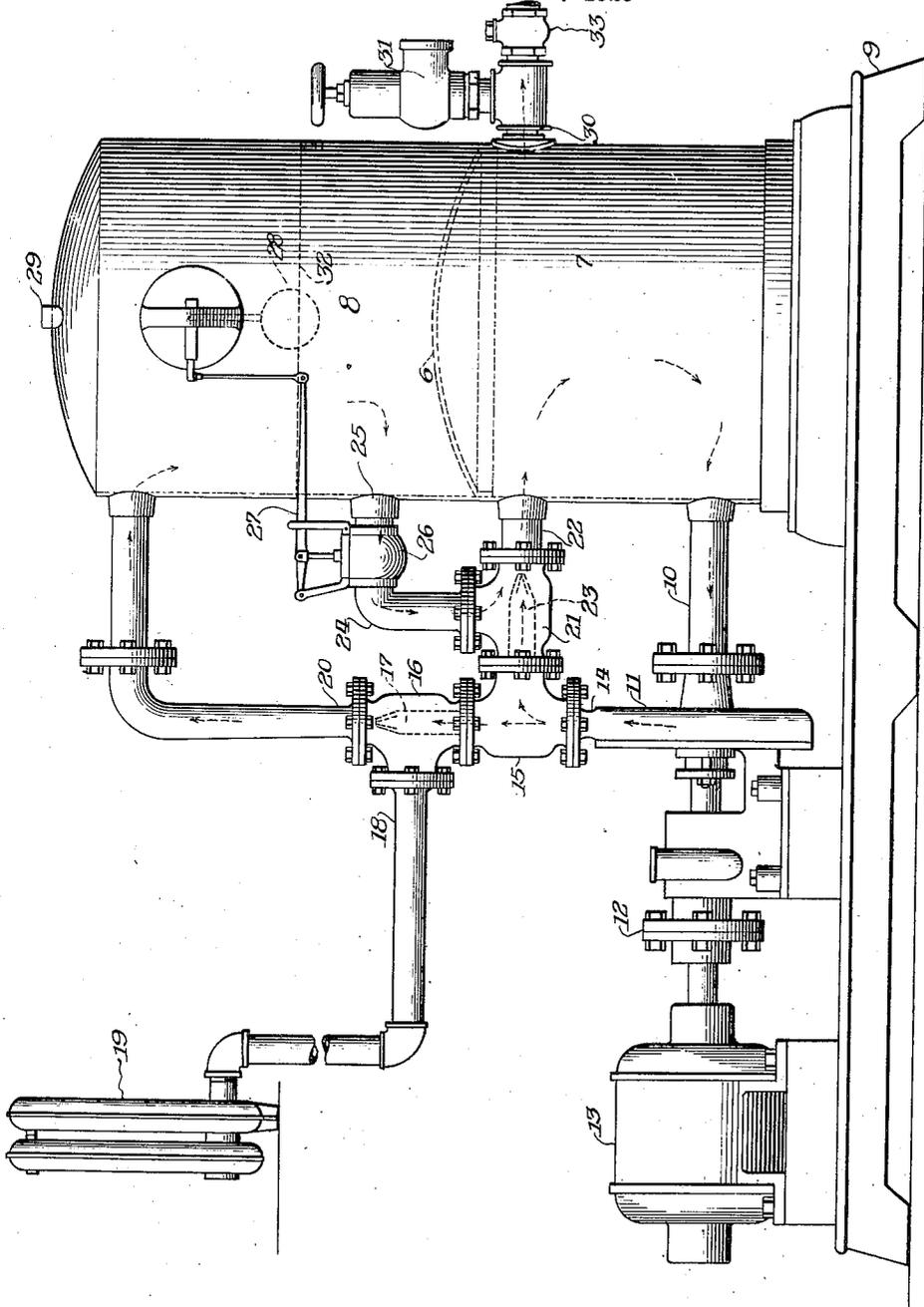
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HIGH PRESSURE STEAM SYSTEM

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Witness:

[Handwritten signature]

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UNITED STATES PATENT OFFICE.

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HIGH-PRESSURE STEAM SYSTEM.

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This invention relates in general to means for draining high pressure steam systems of the products of condensation, gases and vapors, etc., which accumulate therein, and relates particularly to a system for producing a vacuum in the pipe leading from said heating system whereby the liquid therefrom is returned to the steam producing unit.

In heating systems of this character, it is understood that air and other non-condensable gases must be withdrawn from the radiator together with a variable amount of water vapor and condensed steam which accumulates in the radiators and in the pipe leading thereto and therefrom.

Various methods of obtaining this result have been installed and many of them involve complicated machinery attendant with a great deal of noise and confusion which have made them more or less impractical. In my United States Letters Patent, #1,287,169, issued December 10, 1918, I have shown a device or system for producing a vacuum in heating systems having a low pressure in which, through injector means, a suction is created whereby the products of condensation, water vapor, gases, etc., are withdrawn from the radiators, and my present invention is designed for the purpose of producing like results in a system where a high steam pressure is used.

Many of the parts and devices used in my aforementioned patent are applicable to my present system, but, by reference to the said patent, it will be noticed that the air returned from the radiators, etc., is used to create a pressure to force the accumulated discharged liquid back into the boiler. In my present invention, an extraneous means must be provided for this purpose and I have provided a high pressure container for obtaining the same result in a high pressure steam system. The main objection to the use of the device shown in my aforementioned United States Letters Patent in connection with high pressure systems is that the air capacity from the injector, being compelled to discharge against the pressure in the container, is greatly reduced, and in order to overcome this objection, I have devised the arrangement set forth in this application.

In order to better understand my invention I have illustrated the entire system, omitting only the steam heating unit, on the accompanying sheet of drawing, and this

drawing should be considered in connection with the description which follows:

The single figure shown on the drawing represents a side elevation of that portion of the heating system constituting my invention.

Referring in detail to the drawing, the reference character 5 represents a reservoir or container of suitable size and shape and for the purpose of better illustrating my invention I have divided the said container into two compartments by means of the partition 6 which, however, is merely so indicated on the drawing that a ready understanding may be had of the same, while in actual practice, the high pressure container 7 and low pressure container 8 formed by the partition 6 in the illustration will probably be separate containers, as conditions and experiments will determine.

In my illustration I have shown the said container 5 mounted upon a suitable base 9 in an upright position, and from the lower portion of the container 7, a pipe 10 leads directly to the intake side of a centrifugal pump 11 also mounted on the base 9 and in close proximity to the said container. This pump 11 may be of any well known or preferred design and is driven by means of a direct connection 12 with a suitable driving member, and, while in the present illustration I have shown an electric motor 13 used for such purpose, it is apparent that a steam turbine motor or other means may be used for the purpose of operating the pump. The motor 13 is driven from any suitable source of power and may be automatically connected with the steam heating system or may be manually operated when the steam heating system is in use.

Connecting with the discharge side 14 of the centrifugal pump 11 is a three-way pipe coupling 15, one side thereof leading directly to the injector member which I have designated generally by the reference character 16. This injector is provided with a suction chamber 17 and for the purpose of my invention I have assumed that an injector of the same type shown and described in my application for United States Letters Patent Serial No. 749,071, filed November 10, 1924, may be used. A pipe 18 connects with one side of the suction chamber 17 and leads directly to the radiator 19 as shown. At that side of the injector 16 opposite to where it connects the member 15 is a pipe 20 which

leads upward to and is adapted to drain into the low pressure container 8.

The member 15 is provided at one side thereof with another injector 21, the discharge side of which leads through the pipe 22 into the upper portion of the high pressure container 7 and said injector is of the same type as that shown by reference numeral 16 and is provided with a suction chamber 23, the purpose of which is later explained. Connected with the suction chamber 23 of the injector 21 is a pipe 24, which, in the present illustration is shown as extending upwardly and into the lower portion of the low pressure container 8 as indicated by the numeral 25. Such pipe is provided with a valve which is generally indicated by the numeral 26 and such valve is connected through the intermediate connection 27 with a copper ball float 28 in the container 8. The container 8, adapted to receive the products of condensation, etc., as later explained, is provided at the upper end thereof with a vent or outlet 29 which is open to atmosphere as hereinafter explained. At the upper portion of one side of the high pressure container 7 is an outlet pipe 30 which is provided with a suitable safety valve 31 and leads to the boiler or steam heat producing unit (not shown) while the flow of the liquid from the said high pressure container 7 is controlled through the medium of a check valve 33 located in said pipe. The use and operation of my improved steam heating system will be readily understood from the following description.

Considering the motor 13 operating to drive the pump 11 and the liquid in the chamber 7 being under pressure, the said liquid is drawn through the pipe 10 into the pump 11 where the pressure of the same is raised at the discharge point 14 by means of said pump. When the said liquid from the discharge point 14 of the pipe reaches the three-way coupling 15, part of the same is forced upwardly into the injector 16 and forms a vacuum in the pipe 18 so that the products of condensation, water, vapor, gases, etc., are drawn into the pipe 20 and pass with said liquid into the upper portion of the low pressure chamber 8. This chamber 8, being open to the atmosphere, will allow the escape of the gases, etc., through the vent 29, while the liquid will tend to raise the level which I have indicated by the reference numeral 32.

A portion of the liquid discharged from the pump 11 at the point 14 will pass into the injector 21 connecting the pipe 22 with the upper portion of the container 7, and will tend to create a vacuum in the pipe 24 leading to the low pressure container at the point 25.

When the liquid level 32 in the low pressure container 8 has reached a predeter-

mined point, the valve 26 in the pipe 24 will be operated through the medium of the float 28 and intermediate connections 27 in order to permit the contents of said container to be drawn downwardly to the suction chamber 23 of the injector 21 and thus forced through the pipe 22 into the high pressure container 7. It will be readily seen that the pressure in the high pressure container 7 will be raised over its initial pressure by means of the centrifugal pump 11 and the increase in said pressure will be the pressure at the discharge end 14 of said pump less the pressure consumed in the operation of the injectors 16 and 21.

The high pressure container 7 is normally filled with liquid and as the liquid from the drain pipe 18 from the radiators is drawn into the container 8 and subsequently into the container 7, the pressure thereof will be increased so that when said pressure becomes great enough to overcome the pressure in the boiler or heat producing unit (not shown) the check valve 33, located in the pipe 30 will be opened and will allow the liquid from the said high pressure container to flow into the boiler or heat producing unit.

In the drawings, I have shown by the dotted arrows the two passages of flow of liquid and it will be noted that one path is directly from the bottom of the high pressure container 7 through the pump 11, the injector 21 and back to the upper portion of the said high pressure container. The three-way coupling 15 forms the dividing point of the liquid from the discharge side 14 of the pump 11 and the path of the liquid used in the injector 16 for forming the suction chamber 17 will be through the pipe 20 and into the low pressure container 8 where, when a predetermined level 32 is attained, the valve 26 is operated through the intermediate connections 27 in the pipe 24 and the liquid permitted to flow from the said container where it is drawn down to the suction side 23 of the injector and forced into the upper portion of the high pressure container 7. The low pressure container 8 is open to atmosphere through the vent 29, and none of the gases or the air from said container will be permitted to pass through the valve 26 and suction chamber 23 into the high pressure container 7.

It will be manifest from the foregoing description, that I have provided a system which will maintain a constant vacuum in the return pipe 18 from the heaters or radiators and this vacuum will withdraw all products of condensation, water gases, vapors, etc., therefrom, irrespective of the amounts or proportions of each, and that when the gases, etc., are admitted into the low pressure container 8, they are free to escape to the atmosphere through the vent 29,

while the condensed liquid will be delivered into the said container and thus raise the level 32 thereof until the predetermined point therein has been reached for operating the valve 26 through means of the float 28 and intermediate connections 27.

It is believed that my invention, its construction, mode of operation and many of its inherent advantages will be understood and appreciated without further description, and while I have shown and described a preferred embodiment, it is obvious that the details may be varied within wide limits without departing from the spirit of the invention or from the scope of the appended claims.

I claim:

1. In a high pressure steam system, a high pressure container, a circuit leading from the lower to the upper portions of said container, a centrifugal pump, interposed in said circuit, a pipe leading from a steam heating system, an extension from said circuit, an injector in said extension, the pipe from said steam system being connected with the suction side thereof, a container connecting with said extension for receiving the liquid therefrom, means for automatically delivering the liquid from the last named container to the high pressure container, and means automatically permitting the liquid to flow from said high pressure container when the pressure therein becomes greater than that in the steam heat producing unit.

2. In a high pressure steam system, the combination of a centrifugal pump, a liquid container extending above said pump and comprising a high pressure compartment and a low pressure compartment, an intake pipe connecting the lower portions of said high pressure compartment with said pump, a discharge pipe leading from the pump and extending to the upper portion of said high pressure compartment and to the upper portion of said low pressure compartment, an injector interposed in each extension of said discharge pipe, that in the low pressure compartment having its suction side connected with the heating system, a by-pass connected between the lower part of the low pressure compartment and the suction side of the injector in that part of the discharge pipe leading to the upper part of the high pressure compartment, means for automatically permitting the liquid in the low pressure compartment to flow through said by-pass, and means for automatically permitting liquid to flow from said high pressure compartment when the pressure therein becomes greater than the pressure in the steam heat producing unit.

3. In a high pressure steam system, the combination of a high and a low pressure liquid compartment, a centrifugal pump connecting the lower portion of said high

pressure compartment, a discharge pipe from said pump having one branch thereof leading to the top of the high pressure compartment and one branch leading to the top of the low pressure compartment, an injector interposed in the low pressure branch of said discharge pipe, a return pipe from a heating system connected with the suction side of said injector, an injector located in the high pressure branch of said discharge pipe, a by-pass from the bottom of the low pressure compartment and connected with the suction side of said last named injector, and means automatically permitting liquid to flow from said high pressure chamber when the pressure therein becomes greater than the pressure in the steam heat producing unit.

4. In a high pressure steam system, the combination of a centrifugal pump, a high pressure liquid container, an intake pipe connecting the lower portion of said container and said pump, a discharge pipe leading from said pump and extending to the upper portion of said container whereby the pressure in said container is increased, an auxiliary container at atmospheric pressure, an extension from said discharge pipe and extending to the upper portion of said low pressure container, an injector in said extension having its suction side connecting a pipe from a steam heating system, a pipe normally closed leading from the lower portion of said low pressure container and being connected with the suction side of an injector located in said discharge pipe and beyond said extension, means automatically controlled for permitting liquid to flow from said low pressure container to the suction side of said last named injector whereby said liquid is drawn into said high pressure container, and means automatically permitting liquid to flow from said high pressure container when the pressure therein becomes greater than the pressure in the steam heat producing unit.

5. In a high pressure steam system, the combination of a high and a low pressure container, a pipe leading from the lower portion of said high pressure container, a centrifugal pump connecting said pipe, discharge pipes leading to the upper portion of said high pressure chamber and the upper portion of said low pressure chamber, whereby the liquid from the discharge side of said pump is divided between said pipes, a pipe leading from a steam heating system, an injector in that portion of said discharge pipe leading to the low pressure container and having its suction side connecting the pipe from the steam heating system, so that the contents thereof are drawn into said low pressure container, a pipe leading from the lower part of the low pressure container to that portion of the discharge pipe leading

to the high pressure chamber, an injector in the last named portion of said discharge pipe and having its suction side connecting the pipe from the lower portion of the low pressure container, a valve in said last named pipe operated by the volume of water in said low pressure chamber so that the liquid from said chamber is drawn into the high pressure chamber, and a valve controlled by the pressure in said high pressure chamber for automatically permitting the liquid to flow therefrom when the pressure therein becomes greater than the pressure in the steam heat producing unit.

6. In a high pressure steam system, a high pressure container, a circuit leading from the lower to the upper portions of said container, a centrifugal pump interposed in said circuit, a container at atmospheric pressure, an extension leading from the discharge side of the pump in said circuit and to the upper portion of said last named container, a pipe leading from a steam heat-

ing system, an injector in said extension having its suction side connected with said pipe whereby part of the discharge from said pump together with the products of condensation, gases and vapors from the heating system are delivered to said low pressure container, a pipe leading from the lower portion of the low pressure container and connecting with said circuit at a point between said extension and the high pressure container, an injector interposed in said circuit between said last named pipe and said high pressure chamber, the suction side thereof adapted to communicate with said pipe, a valve in said last named pipe adapted to open when the liquid in the low pressure tank rises to a fixed level, and means automatically permitting the liquid in the high pressure container to flow therefrom when the pressure therein becomes greater than the pressure in the steam heat producing unit.

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