

Aug. 27, 1935.

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2,012,315

STEAM ACCUMULATOR

Filed Jan. 30, 1933

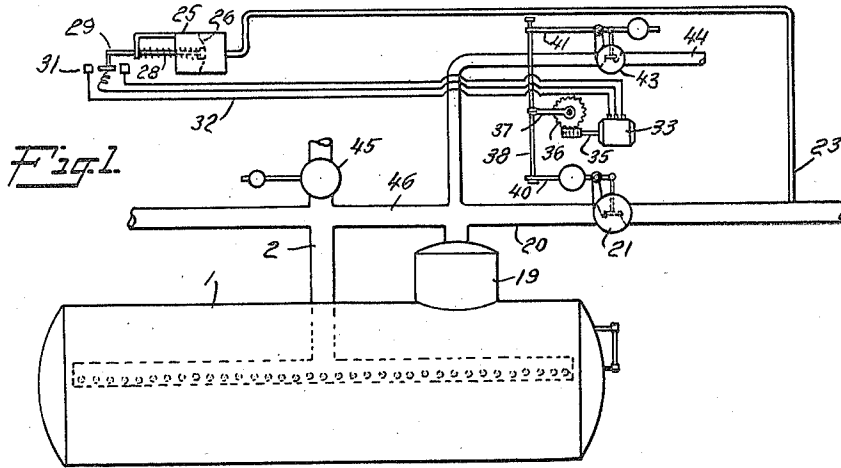


Fig. 2.

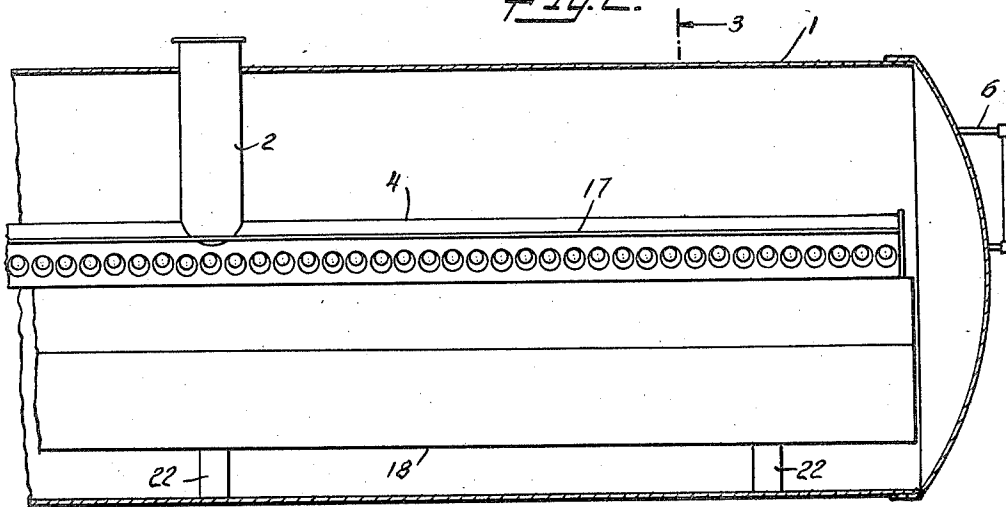


Fig 3.

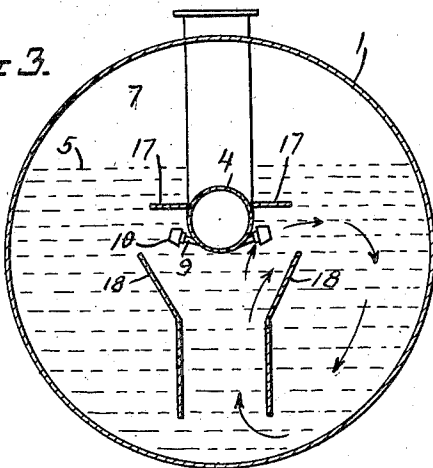
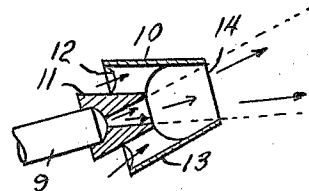


Fig. 4



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2,012,315

STEAM ACCUMULATOR

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Application January 30, 1933, Serial No. 654,138

5 Claims. (Cl. 122—35)

This invention relates to steam accumulators and more particularly to steam accumulators for storing low pressure steam for use in generating water gas.

One object of the invention is to provide a steam accumulator which brings about intensive circulation of water and insures a rapid and efficient transfer of heat from incoming steam to the water in the accumulator.

Another object of the invention is to provide a steam accumulator in which the circulation of the water is aided by the positive discharge force of steam being stored.

A further object of the invention is to provide a steam accumulator which will store low pressure exhaust steam from steam driven engines and turbines so that this steam can later be utilized in some other operation, as for example in the generation of water gas by passage into the generator and superheater of the usual water gas set.

A further object of the invention is to provide such accumulator with a control for introducing make-up high pressure steam into the outlet from the accumulator whenever the supply of low pressure steam in the accumulator is unable to meet the demand for steam.

It is now common practice to construct steam accumulators in such a manner that distributor pipes are provided for introducing steam downwardly into the upper portion of the water contained in the accumulator. The water in the upper portion of the accumulator is thus quickly heated, whereas the water in the lower portion of the accumulator, with which the steam does not come in contact, remains comparatively cool. Moreover, since hot water is lighter in weight than cold water, there is little or no tendency for the cold water to rise and become heated. Consequently poor heat transfer between incoming steam and water in the accumulator and low steam generating efficiency of the accumulator result.

The accumulator of this invention is so designed that a positive and rapid circulation of the water in the accumulator will be obtained, thus insuring efficient heat interchange between the incoming steam and the water in the accumulator. This is accomplished by providing a series of upwardly and outwardly directed distributor pipes provided with injector nozzles submerged beneath the surface of the water. The force of the steam discharging from these nozzles causes circulation in the accumulator resulting in maximum heat transfer and very high overall efficiency.

The apparatus is intended particularly for application where the periods of supply and demand of exhaust steam do not coincide, as in the manufacture of water gas where exhaust steam is supplied to the accumulator by the turbine driven air blower during the air blasting cycle, followed by a period of gas making requiring a quantity of low pressure steam which is derived from the accumulator.

For a better understanding of the invention, reference should be made to the accompanying drawing, wherein is shown by way of illustration, a preferred embodiment of the invention.

In the drawing:

Fig. 1 is a side elevation of the accumulator of this invention equipped with a control for regulating the supply of outlet steam;

Fig. 2 is a fragmentary sectional side elevation showing the arrangement of piping and baffles in the interior of the accumulator;

Fig. 3 is a transverse section taken along the line 3—3 of Fig. 2; and

Fig. 4 is an enlarged detail showing the construction of the injectors at the discharge end of the distributor pipes.

As shown in Figures 1 and 2 the steam accumulator comprises a cylindrical tank 1 having a steam inlet pipe 2, from a source of low pressure steam, connected with steam header 4 adapted to lie beneath the surface 5 of water contained in said tank. The tank is provided with a suitable indicator such as gage 6 so that the water level can readily be observed. Ordinarily the tank is kept about two-thirds full of water, as shown in Fig. 3, so that a suitable steam space 7 will be provided between the surface of the water and the top of the tank. To each side of the lower portion of the header 4 are connected a series of upwardly and outwardly extending distributor pipes 9 provided at their discharge ends with suitable steam injectors 10. As shown in Fig. 4, each steam injector comprises a central discharge nozzle 11 in the form of a truncated cone surrounded by, and supporting by means of suitable webs 12, a larger hollow truncated cone 13. The force of the steam leaving discharge nozzle 11 causes water to be drawn through the annular space separating the discharge nozzle 11 and the surrounding cone 13 and be forced with the steam through the discharge end 14 of the steam injector.

Deflector plates 17 are connected to both sides of the upper portion of the steam header 4 and extend horizontally outward over the discharge ends of the distributor pipes 9 (Figs. 2 and 3).

These deflector plates preferably extend the entire length of the steam header. A set of angular baffle plates 18 extending the entire length of the tank are supported by arms or brackets 22 welded or otherwise joined to the tank walls and the baffle plates 18. The baffle plates, are preferably disposed on opposite sides of the center line of the tank, as shown in Fig. 3, and rise vertically upwardly from a level near the bottom of the tank to a level about one-third the way up. They then diverge outwardly and upwardly, ending at a level about half way up the tank and below the discharge outlet of the injector nozzles. They thus provide with the walls of the tank 1 and with the horizontal deflector plates 17 suitable channels in which the water will circulate, as shown by the arrows in Fig. 3.

As shown in Fig. 1, steam leaving the accumulator passes from the dome 19 through discharge line 20 to the point of consumption. Inserted in the line is a low pressure regulating valve 21 for controlling the discharge pressure. A small off-take line 23 leads from discharge line 20 at a point after the regulating valve 21 to a diaphragm device 25 provided with diaphragm 26. A spring 28 holds rod 29 firmly against the diaphragm so that any movement of the diaphragm will be transmitted to the rod. Movement of the rod 29 actuates electric switch 31 which in turn, through suitable wiring 32, controls the operation of electric motor 33. Shaft 35 of the electric motor is connected through suitable gearing 36 to crank or lever arm 37 and linkage 38 whereby rotation of the motor shaft results in a proportional longitudinal movement of the linkage. The linkage is connected through extension arm 40 with low pressure regulating valve 21 and through extension arm 41 with a control valve 43 in high pressure steam make-up line 44 leading into the low pressure steam discharge line 20. Both the low pressure regulating valve 21 and the high pressure control valve 43 are suitably counterweighted so that the valve 21 has a tendency to open and the control valve 43 has a tendency to close.

A suitable pressure relief valve 45 is provided in steam inlet pipe 2 which valve will open when the pressure in the accumulator or in the steam inlet line rises above a predetermined point and will release excess steam to the atmosphere. A bypass line 46 is also inserted between the inlet and discharge lines so that low pressure steam may be sent directly to the point of consumption without first passing through the water in the accumulator.

The operation of the apparatus is as follows:

Low pressure steam entering the accumulator through inlet pipe 2 passes into the steam header 4 inside the accumulator tank and is forced through the numerous distributing pipes upwardly into the water contained in the tank. As it leaves the distributing pipes, the steam passes through steam injectors and forces the surrounding water upwardly and outwardly in the direction of the steam discharge. This brings about an intimate mixing of the steam with the water whereby the steam is cooled and condensed and the water heated. The force of the steam causes the water to flow past the baffle and deflector plates on both sides of the injectors and be forced against the sides of the tank. This displacement causes a simultaneous rise of cold water in the central channel between the angular baffle plates in the lower portion of the tank. This in turn causes the water in the outer chan-

nels between the baffle plates and the sides of the tank to flow in a downward direction into the central channel between the baffle plates. An improved positive circulation is thus set up due to the force of the steam discharging into the water in an upward direction and due to the injector action of the nozzles causing upward flow of the colder water near the base of the tank.

The steam which is accumulated in the tank is conducted to the point of consumption through discharge line 20 and low pressure control valve 21. This consumption of steam will cause the pressure in the accumulator to decrease except when the input of steam equals the momentary demand. Such diminution in pressure will be transmitted through line 23 causing a movement of diaphragm 26 and rod 29. This movement will close electric switch 31, and cause motor 33 to rotate in such a direction that interconnected linkage 38 will move in a downward direction. Weighted extension arm 40 will thus be moved in a downward direction causing the low pressure regulating valve 21 to open and admit more low pressure steam into the discharge line. In case the full supply of steam contained in the accumulator is not able to meet the consumption demand, the motor will continue running and linkage will continue moving in a downward direction opening the high pressure control valve 43 and causing high pressure make-up steam to be introduced into the low pressure steam line through line 44. When the supply of steam in the accumulator is again able to meet the demand or when the pressure of the steam in discharge line 20 is built up to the desired point, diaphragm 26 will be forced in the opposite direction causing switch 31 to be thrown in an opposite direction. This in turn causes the direction of rotation of the electric motor to be reversed, and automatically, through movement of linkage 38, the high pressure control valve will close. By means of this system of regulation a constant supply of steam at a uniform pressure from the accumulator to the point of consumption is always insured.

If for any reason the pressure in the accumulator or in the steam inlet line should rise above a certain predetermined maximum, the pressure relief valve 45 will open and release the excess steam to the atmosphere.

It will be noted that the apparatus of this invention is simple in construction and causes the steam which is introduced into the accumulator to set up a positive circulation of the water. Hence a very efficient heat transfer and high operating efficiency are obtained. Furthermore, an accurate means of control is provided so that a continuous supply of steam at a uniform pressure can always be obtained from the accumulator.

In connection with the above description and illustration of the construction and operation of this invention, it should be understood that these are merely for the purpose of clarifying an understanding thereof. Various modifications of the forms and arrangements of the parts may be made without departing from this invention.

I claim:

1. A steam accumulator comprising a tank adapted to contain water, a steam header in the tank, and upwardly directed distributor pipes extending from the lower portion of the steam header, and extending in different directions with respect to each other, said pipes being adapted to discharge steam into the water.

2. A steam accumulator comprising a tank con-

5 taining water, a steam header extending horizontally below the surface of the water, a series of distributor pipes directed upwardly from both sides of said steam header adapted to discharge
10 steam into the water, and injector nozzles connected to the discharge ends of said distributor pipes, each injector nozzle comprising a central discharge nozzle and a surrounding cone, said cone being spaced from said discharge nozzle and
15 providing therewith an annular space through which water is drawn by the force of discharging steam, said cone decreasing in diameter in the direction of flow therethrough.

3. A steam accumulator comprising a tank
15 adapted to contain a liquid, a steam header in said tank, distributor pipes directed upwardly from said steam header, and baffle plates each having one portion extending at an angle to another portion the top of one baffle plate being located between the steam header and one side of
20 the tank and the top of another baffle plate being located between the header and the other side of the tank.

4. A steam accumulator comprising a tank adapted to contain water, a steam header in said tank, distributor pipes extending from said header, baffle plates in the lower part of the tank on opposite sides of the said header, and injector
5 nozzles on the distributor pipes directed over the tops of the baffle plates to set up a circulation of water around the baffle plates by the injector action of the discharging steam.

5. A steam accumulator comprising a tank
10 adapted to contain water, a steam header in said tank, distributor pipes directed divergently upward from both sides of the lower portion of said steam header adapted to discharge steam into
15 the water, horizontal deflector plates extending from both sides of the upper portion of the steam header and baffle plates immersed in the water and supported in the lower portion of the tank on each side of the steam header, each baffle plate having one portion extending at an angle to another portion.

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