May 28, 1929. E. S. SANDBERG 1,714,925

STEAM TRAP

Filed Sept. 6. 1927 2 Sheets-Sheet 1

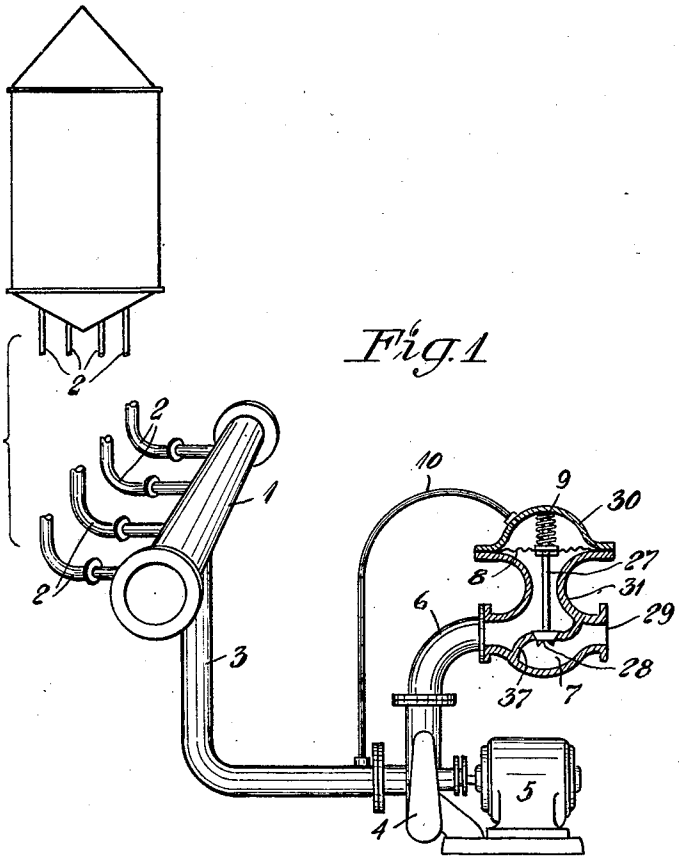



Fig. 1

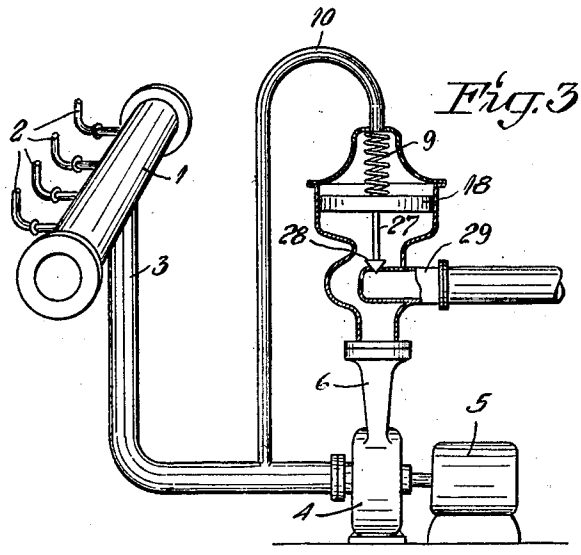



Fig. 3

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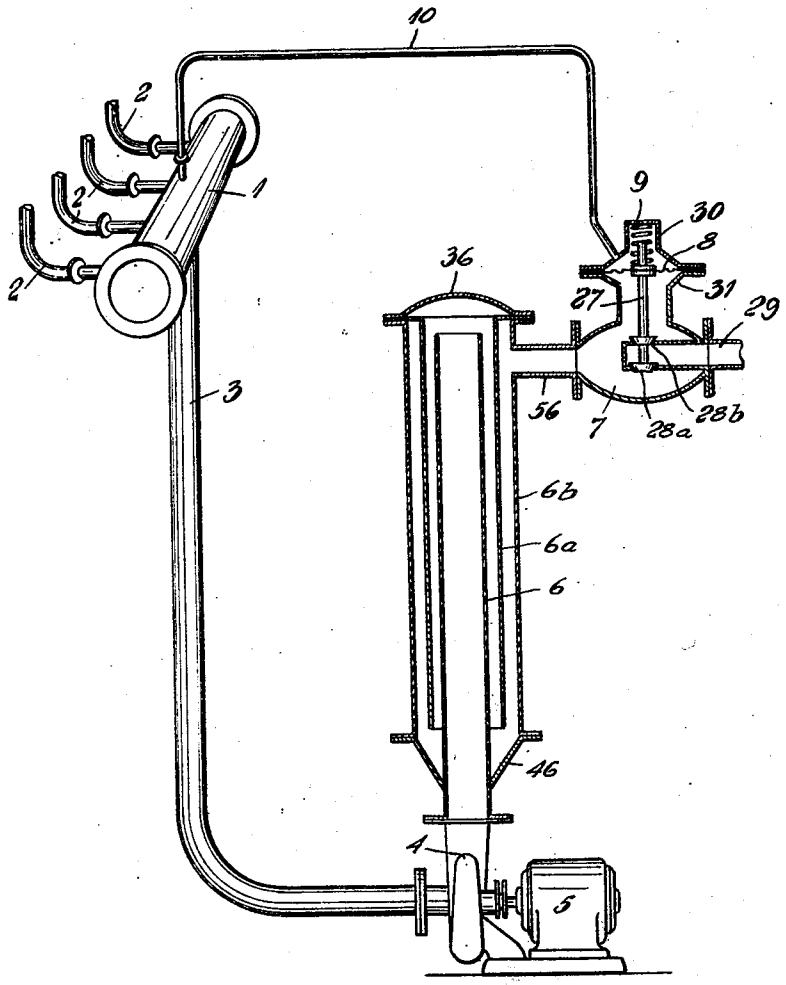
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Fig. 2




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# UNITED STATES PATENT OFFICE.

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## STEAM TRAP.

Application filed September 6, 1927, Serial No. 217,785, and in Sweden November 17, 1926.

My present invention refers to steam traps, i. e. apparatus for drawing off condensates from closed receptacles.

In hitherto known types of such steam traps the draw-back occurs, that relatively small forces are available for opening or shutting the valve used for regulating the drawing off of the condensate. The slightest amount of impurities in the steam or vapours therefore easily causes stopping of the machinery due to the fact that the available forces are not sufficient for overcoming the increase in friction caused by said impurities.

Several types of known apparatus of this kind work satisfactorily at a low steam pressure on working with pure condensates, but as a rule even these types become unsatisfactory at higher steam pressures. This is especially the case in connection with apparatus provided with a closed float due to the difficulties of constructing durable floats of that kind.

Most of the known types of steam traps have, moreover, the inconvenience that they, at a low pressure or under a vacuum, cannot transport the condensate to a point situated higher than that corresponding to the momentary steam pressure within the steam chamber.

In order to have greater forces available for said purpose it has also been proposed, for the drawing off of the condensate from a closed receptacle, to utilize a pump in combination with a valve, said valve being so adapted that it does not open itself solely under the action of the steam pressure in the receptacle but only after the fluid pressure from the pump has acted upon the same. These proposed constructions can, however, be used in practice only at relatively low steam pressures and always imply a relatively constant steam pressure within the steam chamber.

The present invention makes it possible to use steam traps in connection with high as well as varying steam pressures. The invention is principally characterized by this that the valve or other throttling means used in combination with the pump is connected with a movable organ for regulating its movements, such as a piston or a membrane, said organ being maintained counterbalanced by its both sides communicating with the steam chamber. According to a preferred form the one side of said organ communicates with the steam chamber through the pump.

Other features of the invention are set forth in the following description.

The annexed drawings illustrate some forms of execution of the invention. Fig. 1 shows a form of embodiment, partially in section. Fig. 2 shows another form partially in section. Fig. 3 shows a third form partially in section.

The collecting tube shaped receptacle 1 receives through the conduits 2 the condensate from the place where it is formed, for instance the heating coils of a sulphite cellulose boiler indicated in dotted lines. Through conduit 3 the condensate is led to the pump 4 to which motion is imparted by the motor 5. The pump 4, preferably a centrifugal pump, is through the tube 6 connected with the valve casing 7. The valve spindle 27 supports at its lower end a valve 28 (or other throttling means) having its seat in the partition wall 37. The other end of the valve spindle is attached to the central point of a membrane 8 fastened between the detachable portions 30 and 31 of the valve casing. The spindle 27 is preferably attached to the membrane 8 and to the valve 28 by universal joints so that the valve may not have any oblique position with relation to its seat even if the membrane be acted upon irregularly. On the upper side of the membrane there is a spring 9 which normally tends to force the valve 28 against its seat. The space above the membrane is through a conduit 10 connected with the tube 3 and consequently communicates with the steam chamber. The space on the lower side of the membrane communicates with said chamber through tube 6, pump 4 and tube 3. If, therefore, no condensate is supplied to the pump 4, the steam pressure in the tube 1 acts on both sides of the membrane 8 so that the latter is maintained counterbalanced. The spring 9 and the pressure within the valve casing force the valve 28 against its seat, so that no steam can escape from the apparatus. If, now, condensate is supplied to the pump the pressure within the tube 6 and within the valve casing 7 is increased. Thereby the membrane 8 is forced upwards against

the tension of the spring 9 and the valve 28 is raised from its seat. The free surface of the membrane 8 must be so adapted that it can overcome the pressure of the spring 9 and the pressure on the valve 28 caused by the pump. As long as condensate is supplied to the pump the valve is held open, so that the condensate escapes through the outlet 29, but as soon as steam comes into the pump, the pressure decreases in the tube 6 and in the valve casing 7 which causes the shutting of valve 28. Instead of using a special spring 9 for acting upon the one side of the membrane, the membrane may also be constructed in such a way that it is elastic in itself and thus may itself shut the valve 28 in the same way as if a spring be used.

Fig. 2 shows another form of embodiment which is similar to that illustrated in Fig. 1, but differs from the latter in this that the tube 6 is constructed in such a way that there will always be a quantity of liquid in the same between the pump 4 and the valve casing 7. By this means the apparatus will work almost free from shocks. This is attained by the following construction: The tube 6 coming from the pump 4 is surrounded by another tube $6^a$ which is closed at its upper end by the cover 36. The tube $6^a$ is again surrounded by the tube $6^b$ which is closed at its lower end by the cover 46 and is at its upper end connected with the valve casing 7 through the tube 56.

Another difference from the form shown in Fig. 1 consists in this that the valve within the valve casing is fully or nearly fully counterbalanced with regard to the pressure within the valve casing. According to the figure the valve for this purpose consists of two valve bodies $28^a$ and $28^b$ both located on the valve spindle 27 and both having their seats in the outlet tube 29. Other parts are designated in the same way as in Fig. 1. Instead of such a counterbalanced valve an equivalent member, such as a slide construction may be used.

Fig. 3 shows another form of embodiment which differs from that shown in Fig. 1 principally in this that a piston 18 is used instead of the membrane 8. The piston can preferably be tightened by being formed as a so called labyrinth piston.

In a sulphite cellulose boiler the pressure in the steam coils and, consequently, in the collecting tube 1 gradually rises from atmospheric pressure to about 7 kilograms per square centimeter. Due to the great variations in the pressure it has hitherto been very difficult to draw off the water of condensation due to the above mentioned drawbacks in the hitherto used steam traps. The present steam trap, however, works very satisfactory at those varying pressures due to the fact that the collecting tube 1 communicates with both sides of the membrane, piston or other movable organ, so that said organ is always wholly or nearly balanced. It is, therefore, never exposed to a higher pressure on one of its sides than the liquid pressure caused by the pump. The present steam trap can therefore also be used for drawing off condensate from a closed receptacle in which there is a vacuum or any pressure higher than that of the atmosphere.

It is obvious that the invention is not limited to those forms of embodiment which are shown in the drawing since the details may be varied in many respects without departing from the scope of the invention.

I claim:

1. Steam trap, comprising in combination a continuously operating pump communicating with a steam chamber, a casing communicating with said pump, throttling means within said casing controlling the outlet from the same, a movable organ controlling said throttling means and located within a closed chamber, means for executing a pressure on one side of said organ so as to normally shut said throttling means, and means for establishing a communication between one side of said organ and the steam chamber, the other side of said organ being in communication with the steam chamber through said pump.

2. Steam trap, comprising in combination a continuously operating pump communicating with a steam chamber, means for imparting motion to said pump, a valve casing, a conduit between said pump and said valve casing, a valve within said casing controlling the outlet from the same, a movable organ connected with said valve and located within said closed chamber, a spring acting on one side of said organ so as to normally force said valve against its seat, a conduit for establishing a communication between the spring actuated side of said organ within said chamber and the steam chamber, the opposite side of said organ being in communication with the steam chamber through said pump.

3. Steam trap for drawing off water of condensation from the heating elements of cellulose boilers, comprising in combination a water collecting tube communicating with said heating elements, a pump, a conduit between said collecting tube and said pump, means for imparting continuous motion to said pump, a conduit between said pump and a valve casing, a valve within said casing controlling the outlet from the same, a piston movable in a closed chamber and connected with said valve, a spring actuating the opposite side of the piston to that which is connected with the valve so as to normally hold the valve forced against its seat, and a conduit establishing communication between the spring actuated side of the pis-

ton and the steam chamber, the opposite side of the piston communicating with said steam chamber through the pump.

4. Steam trap comprising a closed steam chamber, a pump in connection with said steam chamber and adapted to work continuously when the steam trap is working, a valve in the outlet of said pump, a movable member in a closed chamber connected with said valve, means for establishing a communication between both sides of said member and the steam chamber, one of said communicating means being through the pump so as to counterbalance the said member with regard to the pressure within the steam chamber.

5. Steam trap comprising in combination a centrifugal pump adapted to rotate continuously, means for establishing a communication between the inlet side of said pump and a steam chamber, a closed casing communicating with the outlet side of said pump, a valve within said casing for regulating the outlet from the same, a movable organ within said casing connected with the valve and controlling the movements of the same, a spring actuating one side of said organ so as to normally keep the valve closed, means for establishing a communication between the spring actuated side of the movable organ and the steam chamber, the opposite side of said organ communicating with the steam chamber through the continuously rotating pump, the pressure of said spring being so adapted that when no liquid is present and the pump works with only steam the valve does not open, but only opens when the pump supplies liquid.

In testimony whereof I have hereunto affixed my signature.

ERIK SIXTEN SANDBERG.