G. RENNERFELT.

STEAM DRIVEN PUMP.

APPLICATION FILED JUNE 29, 1907.

904,449. Patented Nov. 17, 1908.

Fig. 1

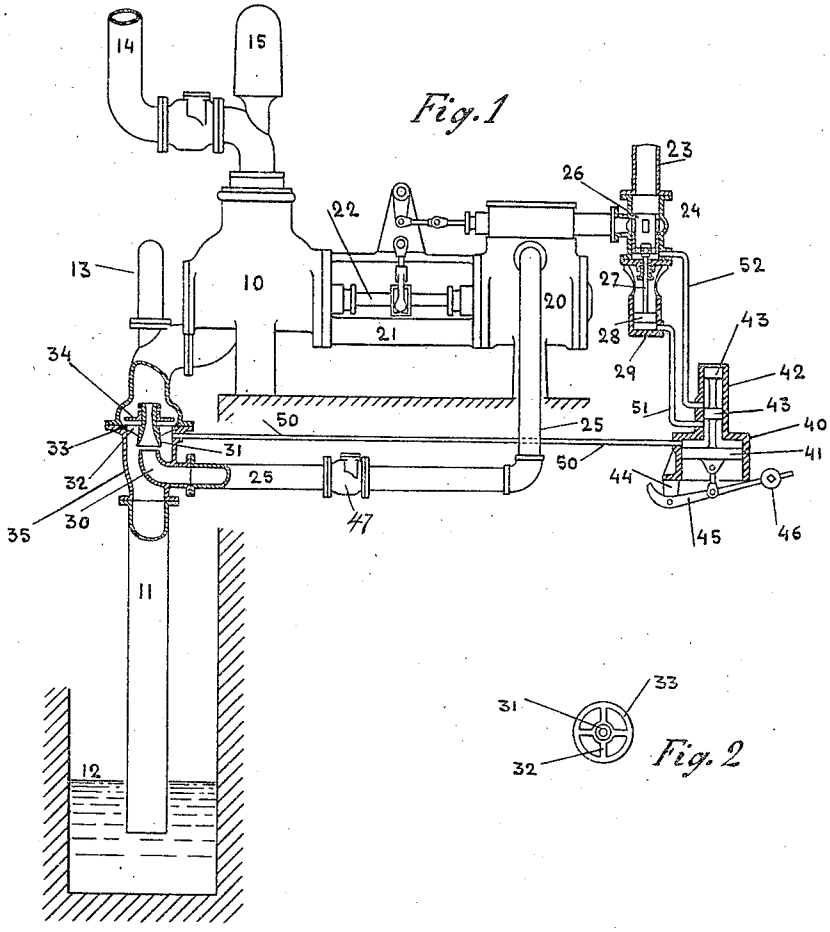


Fig. 2

WITNESSES

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STEAM-DRIVEN PUMP.

No. 904,449. Specification of Letters Patent. Patented Nov. 17, 1908.

Application filed June 29, 1907. Serial No. 381,440.

To all whom it may concern:

Be it known that I, GUSTAF RENNERFELT, a subject of the King of Sweden, and a resident of Scranton, in the county of Lackawanna and State of Pennsylvania, United States of America, have invented certain new and useful Improvements in Steam-Driven Pumps, of which the following is a specification.

My invention relates to improvements in steam driven pumps, and its object is to increase the efficiency of such apparatus.

My invention is of particular advantage in combination with such pumps—whether rotary or reciprocating—as derive a supply of cold water from a source located at a lower level than the pump.

I will describe my invention in the following specification and point out the novel features thereof in claims.

Referring to the drawings, Figure 1 is a side view, partly in section, of a direct-steam-driven pump embodying the features of my invention. Fig. 2 is a top view of a detail, referred to in the specification as the "tube".

Like characters of reference designate corresponding parts in both of the figures.

10 designates a pump; 11 the suction pipe of the pump, and 12 a pump at a lower level, in which the end of the suction pipe is submerged.

13 designates the suction air chamber, 14 the delivery pipe, and 15 the delivery air chamber.

20 designates a steam engine connected with the pump through the frame 21 and piston rod 22.

23 designates the steam inlet pipe; 24 an automatically operated throttle valve in said pipe, and 25 the exhaust pipe of the engine.

47 designates a check valve located in the exhaust pipe 25.

30 designates a steam nozzle located in the suction pipe of the pump, and connected with the exhaust 25 of the engine.

31 designates a tube located within the suction pipe in front of and in close proximity to the nozzle. This tube is supported by arms 32 from a rim 33 adapted to be clamped between two sections of the suction pipe in such manner that the tube can be readily replaced when worn out.

34 designates a disk or valve arranged to slide loosely upon the end of the tube 31, the aforesaid arms 32 and rim 33 serving as a seat for the valve.

35 designates a casing which, if desired, may be cast integrally with the nozzle and which forms a part of the suction pipe 11.

It will be seen from Fig. 1 that the nozzle 30 and the injector tube 31 form an arrangement constituting or resembling an injector.

The aforesaid throttle valve 24 is shown as consisting of an outside casing and a hollow and perforated cylinder 26 arranged to slide loosely therein. A valve stem 27 is attached to the cylinder 26, and it will be seen from the drawing that by reason of the steam pressure on the stem 27 the throttle valve will be normally open as indicated in Fig. 1. A piston 28 of larger diameter than the valve stem 27 is attached to the valve stem, and arranged to move in the steam cylinder 29 fastened to the casing of the throttle valve.

40 designates a vacuum cylinder containing a diaphragm or piston 41.

42 designates a cylinder of smaller diameter than the cylinder 40, which, with pistons 43, 43, constitutes a steam pilot valve, the piston rod of which is fastened to the piston 41.

The cylinder 40 is provided with lugs 44 serving as fulcrum for a lever 45, joined with a link to the piston 41, and supporting an adjustable counter-weight 46.

50 designates a pipe connecting the vacuum cylinder 40 with the suction pipe of the pump; 51 a pipe connecting the cylinders 29 and 42; and 52, a pipe connecting the cylinder 42 with the steam inlet pipe of the engine.

The operation of the above-described apparatus is as follows: As long as the pump is working properly, water will flow from the sump upwards and keep the valve 34 open, as shown in Fig. 1. The exhaust steam passing through the nozzle 30 will be condensed by the water, and the steam engine receives the benefit of such degree of vacuum as corresponds to the height of the column of water contained in the suction pipe between the nozzle and the level of the water in the sump. The amount of air contained in the steam and in the water will escape through the delivery pipe, a part of it

being retained in the air chambers 13 and 15. If the amount of air should be so great as to cause a tendency on the part of the pump to lose its suction, the backward flow of water in the suction pipe will cause the valve 34 to close, so that at such moment the suction pipe is divided into an upper and a lower compartment communicating only through the tube 31. The water forced by injector action through the tube 31 will then increase the pressure in the upper compartment until the suction valves of the pump are lifted, and the suction is reëstablished, when the valve 34 will again open. It is thus apparent that as long as the amount of air contained in the steam or in the water is not excessive, any tendency of such air to cause the loss of suction of the pump will be automatically counteracted by the injector acting so as to prime the pump. In order to prevent any water backing up into the engine exhaust on account of the engine stopping or from other cause, a check-valve 47 is placed in the exhaust pipe 25 which effectively prevents any flow of water from the suction pipe into the engine. If through a break of the suction pipe, or from some other cause, such an excessive amount of air should enter the suction pipe as to prevent the proper condensation of the steam and cause the loss of suction of the pump, the throttle valve 24, actuated by the vacuum cylinder 40, will close and shut off the steam supply to the engine, so as to stop or slow down the pump. Under nor nal running conditions the throttle valve is fully open as shown in Fig. 1, by reason of gravity and of steam pressure on the valve stem 27. The space in the cylinder 29 below the piston 28 communicates through the cylinder 40 and pipe 50 with the suction pipe 11. By reason of the vacuum caused by the suction the atmospheric pressure on the piston 41 lifts it together with the counter-weight 46 and the pilot valve 43 so that steam supply to cylinder 29 is cut off. If the suction of the pump is lost the vacuum in cylinder 40 is destroyed and the counter-weight 46 will drop, pulling down the piston 41 and pilot valve 43 so that communication is established between pipes 52 and 51, admitting steam from the inlet pipe 23 into cylinder 29, and lifting the piston 28 so as to close the throttle valve, and thus prevent the engine from racing.

What I claim is:—

1. The combination of a steam engine, a pump having a suction pipe, a nozzle within the suction pipe, a tube fastened in the suction pipe in front of the nozzle, a valve surrounding the tube, and a connection between the nozzle and the exhaust pipe of the steam engine.

2. The combination of a steam engine, a pump connected with the engine, a suction pipe for said pump, and an injector comprising a steam nozzle and a tube within the suction pipe, said injector being arranged to maintain a water supply to the pump.

3. The combination of a pump having a suction pipe and means within said pipe for removing air therefrom, said means arranged to automatically operate upon the backward motion of water in the suction pipe.

4. The combination of a pump having a suction pipe divided into an upper and a lower compartment, a steam nozzle in the lower compartment, and a tube in front of the nozzle extending from the lower into the upper compartment.

5. The combination of a pump having a suction pipe divided into an upper and lower compartment, and means for obtaining greater pressure in the upper compartment than in the pump, said means operating automatically upon a tendency of the pump to lose its suction.

6. The combination of a pump, a suction pipe therefor, and automatically operating means for compressing air within the suction pipe and removing it therefrom.

7. The combination of a pump having a suction pipe, means for driving the pump, an automatically actuated valve in the suction pipe, and an injector within the suction pipe arranged to force water past said valve to the pump.

8. The combination of a pump having a suction pipe, means for driving the pump, an injector-tube within the suction pipe arranged to form a portion of the suction pipe, and a valve surrounding the injector-tube arranged to close the remainder of the suction pipe.

9. The combination of a steam engine having an exhaust pipe, a pump connected with the engine, an injector-tube within the suction pipe arranged to form a portion of the suction pipe, a valve surrounding the injector-tube arranged to close the remainder of the suction pipe, and a connection between the engine exhaust pipe and the suction pipe below said injector-tube.

10. The combination of a steam engine having an exhaust pipe, a pump connected with the engine, a suction pipe for the pump, a nozzle within the suction pipe, a connection between the engine exhaust and said nozzle, an injector-tube above the nozzle and within the suction pipe arranged to form a portion of the suction pipe, and a valve surrounding the injector-tube arranged to close the remainder of the suction pipe.

11. The combination of a pump having a suction pipe, a rim clamped within the suction pipe, arms extending from the rim, a tube supported by the arms, a nozzle in front of the tube, a steam engine connected with the pump and having an exhaust, and connection between the exhaust and the nozzle.

12. The combination of a pump having a suction pipe, a rim fastened within the suction pipe, arms extending from the rim, a tube supported by the arms, a nozzle in front of the tube, a valve arranged to close upon the rim, a steam engine having an exhaust, and connection between the exhaust and the nozzle.

13. The combination of a pump having a suction pipe, a valve seat fastened in the suction pipe, there being a hole through the valve seat; a valve on the valve seat, a nozzle in close proximity to the seat, a steam engine having an exhaust, and connection between the exhaust and the nozzle.

14. The combination of a pump having a suction pipe divided into an upper and a lower compartment, a steam engine arranged to drive the pump, and means depending on the pressure in the lower compartment for stopping the engine in case the suction pipe should break.

15. The combination of a steam engine having an exhaust, a pump having a vertical suction pipe of considerable length, a valve in the suction pipe near its upper portion, an injector associated with said valve and arranged to force water past said valve to the pump, and a connection between the engine exhaust and the injector.

16. The combination of a steam engine having an exhaust pipe, a check valve therein, a pump having a suction pipe of considerable vertical length, an injector-tube within the suction pipe near its upper portion and forming a part of the suction pipe, a valve surrounding the injector-tube and arranged to close the remainder of the suction pipe, and a connection from the exhaust pipe to the suction pipe below the injector-tube.

17. The combination of a mechanically driven liquid pump having a suction pipe, and automatic means for reëstablishing its suction when its suction is lost by reason of the presence of air in the suction pipe.

In testimony whereof, I have signed my name to this specification, in the presence of two subscribing witnesses.

GUSTAF RENNERFELT.

Witnesses:

M. A. WOLFE,

CHARLES A. KIESEL.