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J. E. STARR.

MEANS FOR PUMPING LIQUIDS.

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Fig. 1

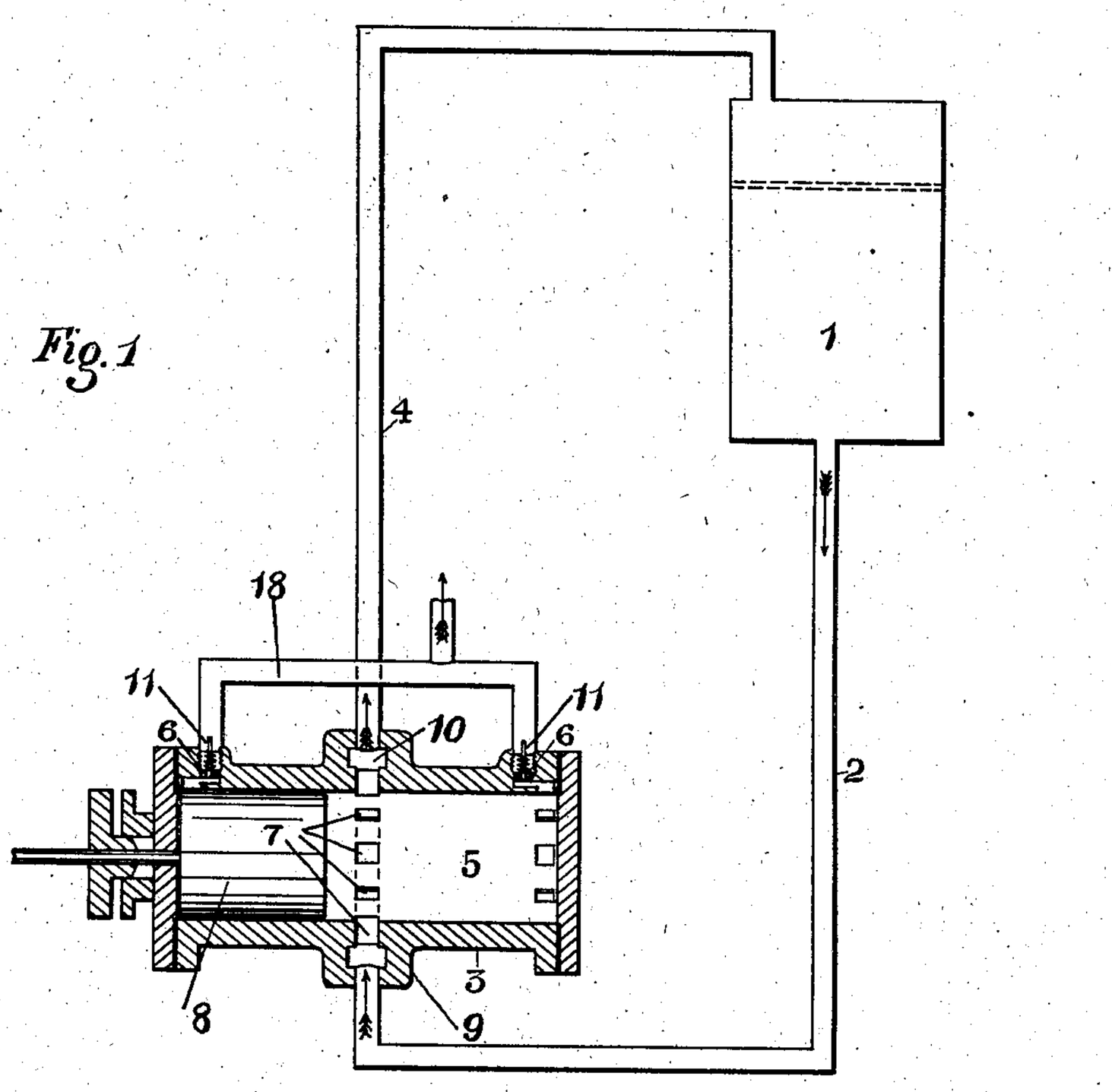
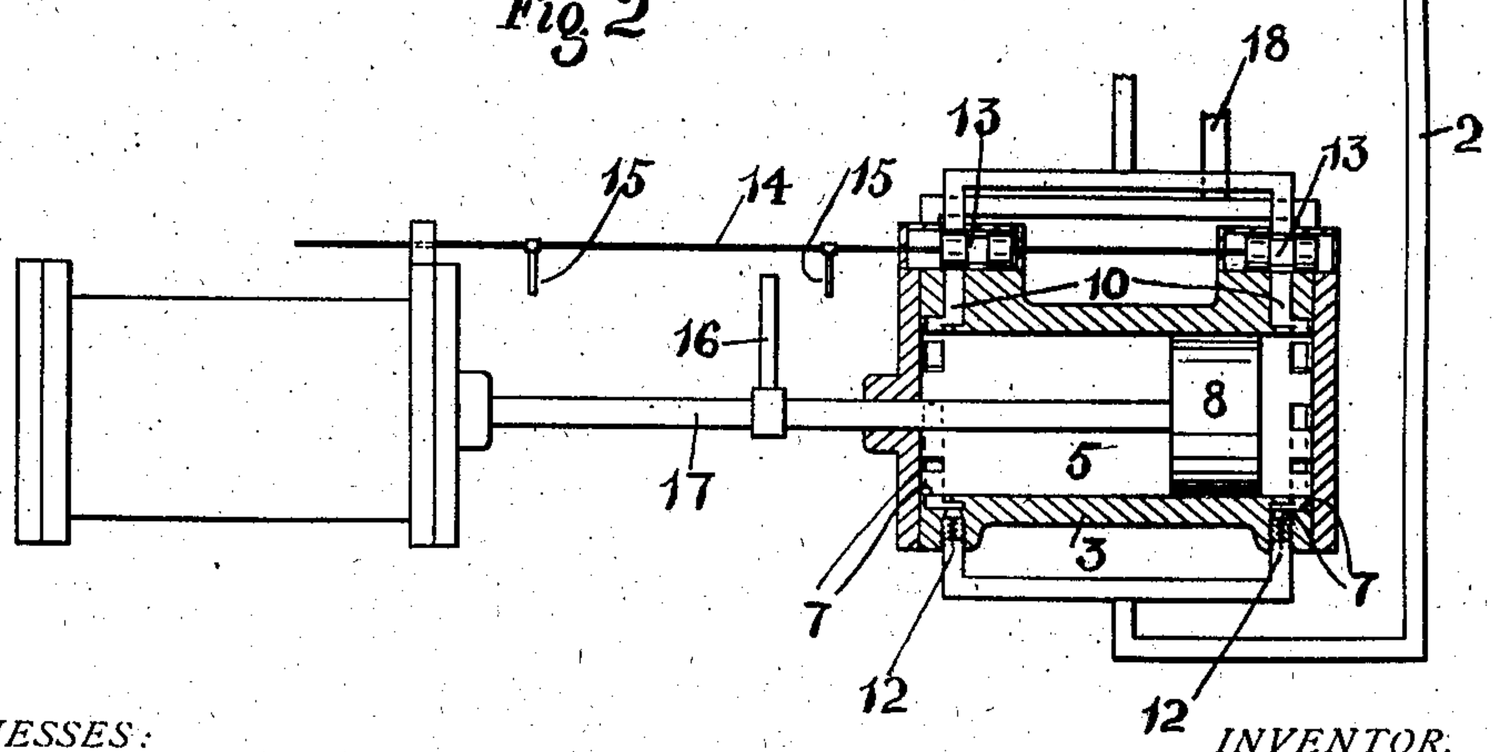


Fig. 2



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MEANS FOR PUMPING LIQUIDS.

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Application filed April 13, 1905. Serial No. 255,367.

To all whom it may concern:

Be it known that I, JOHN E. STARR, a citizen of the United States, residing in New York, in the county and State of New York, have invented certain new and useful Improvements in Means for Pumping Liquids which are Near their Boiling-Points and the Like; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to improvements in means for pumping liquids while the latter are near their boiling-points; and my invention consists in means for preventing interference with the operation of the pump through accumulation of gas therein.

The apparatus herein described is particularly intended for handling strong aqua-ammonia in refrigerating systems, and particularly in absorption refrigerating systems.

The object of my invention is to permit pumping of liquids near their boiling-points, and particularly strong warm solutions of ammonia, without the pump getting gas-bound.

I will now proceed to describe my invention in which apparatus constructed and arranged in accordance with my invention is illustrated diagrammatically and will then point out the novel features in said claims.

In said drawings, Figure 1 shows diagrammatically my invention applied to a pumping system comprising a pump the piston of which constitutes a valve thereof. Fig. 2 shows diagrammatically the use in such a pumping system of a pump having positively-actuated gas-escape valves and puppet inlet-valves.

In describing my invention I will describe it as employed for handling strong warm solutions of ammonia in refrigerating systems. From such description the application of the invention to other uses will be apparent.

In absorption refrigerating systems and the like the strong aqua-ammonia as withdrawn from the absorber is generally at a temperature very close to its boiling-point. In pumping such a fluid, if the pump employed has suction-valves, the pressure in the pump-cylinder during the inlet or suction stroke is necessarily slightly lower than the pressure between said valves and the source of supply, owing to the resistance caused by the valves themselves, friction in the passages, &c., and this difference in pressure, though slight, may be sufficient to cause boiling of the liquid in said cylinder. The gas so evaporated from the solution occupies space in the cylinder to the exclusion of the liquid. Such boiling is facilitated by the heat conducted from the steam-cylinder by which such pumps are customarily operated through the piston-rod to the pump-cylinder. Also during the compression or pumping stroke the gas is driven into the layer of ammonia nearest to the piston, making the liquid there stronger than the average of the incoming aqua-ammonia, and as such liquid near the piston is the last driven out the aqua-ammonia in the clearance-space in the pump is stronger than the inlet aqua-ammonia, and during the next succeeding suction-stroke and consequent reduction of pressure gas evaporates from such liquid left in the clearance-space, evaporation from this source cooperating with evaporation from the other sources mentioned to interfere with the operation of the pump. Such gas tends to accumulate to such an extent as to reduce the amount of liquid pumped, to cause the pump to jump in its strokes, and finally to prevent pumping of the liquid at all, the piston working back and forth ineffectively. Cooling the aqua-ammonia between the absorber and the pump is uneconomical and undesirable. This difficulty—*i. e.*, collection of gas in the pump—has interfered heretofore with the use in absorption refrigerating apparatus of aqua-ammonia of the strength that would give the best results. To overcome this difficulty, I provide an equalizing or gas-escape passage connecting the pump with the absorber or other chamber or receptacle containing the strong aqua-ammonia, said passage preferably connected to the space in said absorber or chamber above the level of the liquid. The pump is provided with means for opening this equalizing or gas-escape passage at or about the time when the inflow of liquid into the pumping-cylinder begins, and said passage therefore serves to prevent suction upon the entering liquid, said liquid flowing into the pump by gravity, and also serves to return to said absorber or chamber any gas which may collect in the pump. I preferably employ a pump having a mechanically-operated suction valve or valves, which may with advantage be the piston itself, but may also employ pumps having suction-operated inlet-valves.

Referring now to the accompanying drawings, and at first more particularly to Fig. 1, 1 designates an absorber or other chamber or receptacle from which the aqua-ammonia to be pumped is drawn. 2 designates the pipe conveying the aqua-ammonia from said vessel. 3 designates a pump located below the level of the liquid in the chamber or absorber 1, and 4 designates the equalizing or gas-escape passage.

The pump shown is of simple construction, comprising a cylinder 5, having discharge-ports 6 at its two ends and having also central inlet-ports 7. The piston 8 of the pump also forms the inlet-valve. The inlet-ports are in a passage 9, partly surrounding the cylinder. 10 designates another port in the center of the cylinder and at the top thereof, said port connecting the cylinder with the equalizing or gas-escape passage 4.

In the operation of this pump when piston 8 uncovers the ports 7 aqua-ammonia flows into the pump-cylinder by gravity, and at the same time any gas in said liquid or in the cylinder flows out through the balancing-passage 4 and is returned to the vessel 1. Since ports 7 and 10 are opened simultaneously, the operation of the pump does not cause suction such as will result in evaporation of the ammonia. During the following or pumping stroke the ports 7 and 10 are closed simultaneously by the piston and the liquid is forced out through the discharge-ports 6 and discharge-pipe 18. These operations take place successively and alternately in the two ends of the cylinder, the liquid being forced out at one end of the cylinder while piston is moving to permit inflow of liquid into the other end of the cylinder.

I have shown the cylinder as provided with puppet discharge-valves 11, but obviously any suitable type of discharge-valve may be employed.

In Fig. 2 I show a pumping system which is similar except that the pump is somewhat different. Said pump is provided with puppet admission-valves 12, operated automatically in the ordinary manner, and instead of causing the piston to open and close the gas-escape port two such ports, one at each end of the cylinder, are provided. Said ports are controlled by automatically-operated valves. Various types of valves and valve-gear therefor may be provided. The particular mechanism illustrated comprises slide-valves 13, controlling the gas-escape ports 10, said valves connected to a valve-rod 14, provided with tappets 15, arranged to be actuated by an arm 16 on the piston-rod 17 of the pump. When the piston nears the left-hand end of its stroke, said arm 16 encounters one of the tappets and moves the valve-rod 14, so as to open the left-hand port 10 and close the right-hand port 10, and, conversely, when the piston in its opposite movement nears the right-hand end of its stroke its arm 16 encounters the other tappet, shifting valves 13, so that the left-hand port 10 is closed and the right-hand port 10 opened.

My invention besides being applicable to the pumping of liquids which are near their boiling-points is also applicable to the pumping of volatile liquids or other liquids charged with gas or carrying such quantities of gas or air that a pump operating thereon, as such pumps have usually been arranged before, is apt to get gas-bound.

It is obvious that my invention is not limited to the particular types of pump illustrated, but is independent of the particular type of pump employed. I do not limit myself therefore to the particular details of construction and arrangement herein illustrated and described.

What I claim is—

1. The combination, with a source of supply of liquid to be pumped, of a pump having an inlet connected to such source of supply, and an equalizing-passage connecting said pump to said source of supply and serving to return thereto gas which accumulates in the pump.

2. The combination, with a source of supply of liquid to be pumped, of a pump having an inlet connected to such source of supply, and having also a gas-escape port at the top of its cylinder, connected to said source of supply, said pump comprising automatic means for closing said port during the pumping stroke.

3. The combination, with a source of supply of liquid to be pumped, of a pump having an inlet connected to such source of supply, and an equalizing-passage connecting said pump to said source of supply and serving to return thereto gas which accumulates in the pump, said pump comprising automatic means for closing said passage during the pumping stroke and for permitting escape of gas therethrough prior to such closing.

4. The combination with a source of supply of liquid to be pumped, of a pump having an inlet and gas-escape ports, the former connected to said source of supply, the latter likewise connected to said source of supply and adapted to return thereto gas which accumulates within the pump, said pump comprising automatic means for opening said inlet-port to permit entrance of liquid, and for opening said gas-escape port to permit escape of gas within the pump, and for closing said ports.

5. The combination with a pump comprising a pumping cylinder and piston, said cylinder having inlet and gas-escape ports arranged to be uncovered by said piston near one end of its stroke, said gas-escape port located at the top of the cylinder, of a source of supply of liquid to be pumped, such source of supply connected to said inlet-port and the

normal level of the liquid therein being above the level of such pump-cylinder, said escape-port also connected to said source of supply.

6. In refrigerating apparatus, the combination with an absorber or other receptacle containing aqua-ammonia at or near its boiling-point, of a pump having an inlet connected to such absorber or receptacle, and an equalizing-passage connecting said pump to such absorber or receptacle, said pump comprising automatic means for opening and closing said equalizing-passage.

7. In refrigerating apparatus, the combination with an absorber or other receptacle containing aqua-ammonia at or near its boiling-point, of a pump having a central inlet connected to such absorber or receptacle, and having also a central gas-escape port, the piston of said pump arranged to open and close said inlet and gas-escape port, and an equalizing-passage connecting said gas-escape port with said absorber or receptacle.

In testimony whereof I affix my signature in the presence of two witnesses.

JOHN E. STARR.

Witnesses:

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J. W. SINNOTT.