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APPARATUS FOR PUMPING LIQUID AND GAS.

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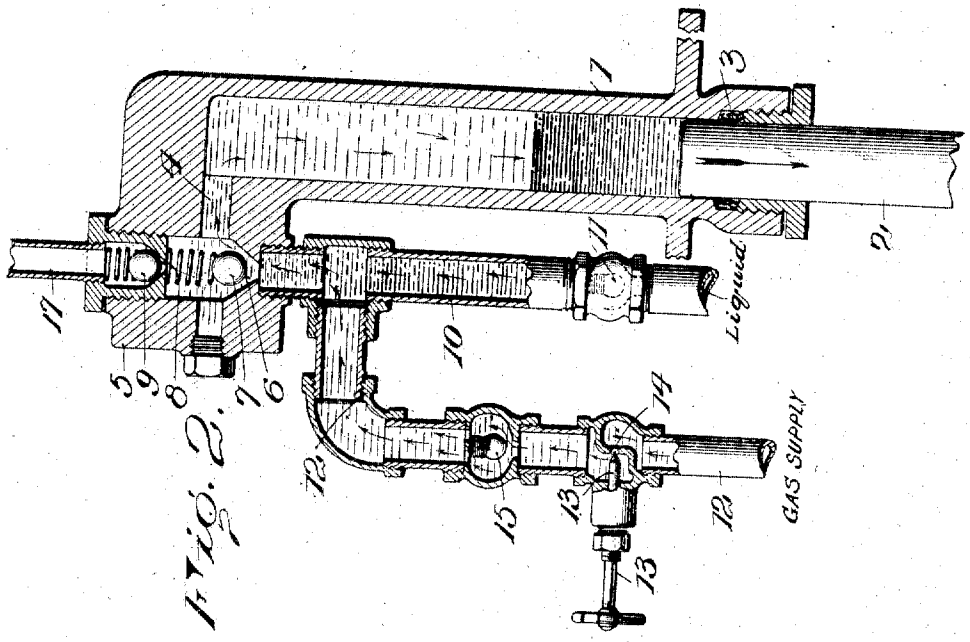


Fig. 2.

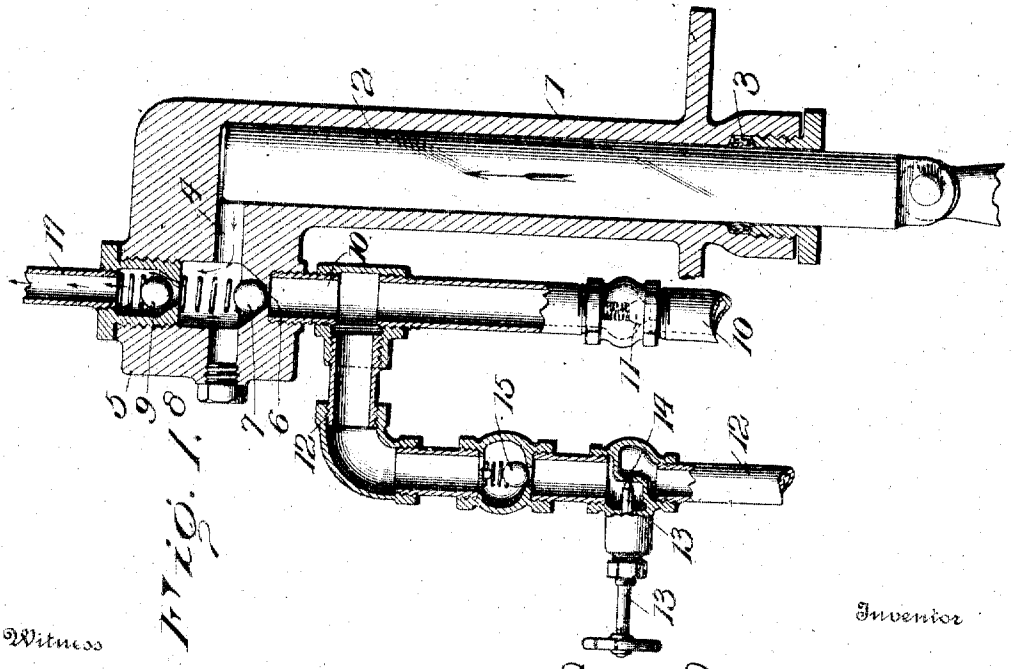


Fig. 1.

Witness

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To all whom it may concern:

Be it known that I, LOUIS BOND CHERRY, a citizen of the United States, and resident of Kansas City, Jackson county, and State of Missouri, have invented certain new and useful Improvements in Apparatus for Pumping Liquid and Gas, of which the following is a specification.

This invention relates to certain improvements in apparatus for forcing or pumping liquid and gas; and the objects and nature of the invention will be readily understood by those skilled in the art in the light of the following explanation of the accompanying drawing illustrating what I now believe to be the preferred mechanical expression or embodiment of my invention from among other forms, arrangements and constructions within the spirit and scope thereof.

An object of the invention is to overcome certain difficulties heretofore encountered in forcing or compressing liquid and gas into tanks or other receptacles for storing, subsequent treatment, or for the subsequent performance of work, and also where liquid such as hydrocarbon compounds, and gas such as natural gas, are forced under pressure and in approximately certain proportions, into stills for vaporization of the liquid and mixture with the gas or for other steps followed in methods of treating such compounds.

The invention consists in certain novel features of construction and in combinations and arrangements as more fully and particularly set forth and specified hereinafter.

Referring to the accompanying drawings:

Figure 1, is a vertical section somewhat diagrammatically illustrating apparatus embodying my invention; the pump piston being shown at the end of its upward or forcing stroke.

Fig. 2, is a vertical section diagrammatically illustrating the apparatus of Fig. 1, showing the piston near the completion of its downward or suction stroke.

In the particular embodiment illustrated, I show a reciprocating pump having a vertical cylinder 1, supported in any suitable manner and by any suitable means, and provided with a vertically reciprocating piston 2, actuated on its downward suction stroke and on its upward forcing stroke by any suitable mechanism well understood by those skilled in the art and not shown in the accompanying drawings. The lower end of the cylinder is preferably provided with suitable packing 3, to prevent liquid leakage around the piston.

The inlet and outlet of the pump are arranged at the upper end of the cylinder, and in this instance, both communicate with a common duct or passage 4, opening into the upper end of the cylinder and extending laterally therefrom in an enlargement or head 5, at the upper end of the cylinder. The suction inlet port 6, opens into the outer end portion of this passage and is controlled against out or back flow by any suitable inwardly or upwardly opening check valve 7. The outlet or discharge port 8, also opens into the outer end of this passage and is controlled against down or inflow by any suitable check valve 9. The suction or inlet port opens downwardly through the head 5, to receive the main suction pipe 10, which extends to the source of liquid supply (not shown) and is provided at any suitable point in its length with any suitable upwardly opening foot valve 11. The discharge port is here shown alined with the suction port and opening upwardly through the head 5, to receive the pump discharge pipe 17, which conveys the liquid and gas to a single tank, to separate tanks, or to a still according to the material being handled and the subsequent treatment to which the same is to be subjected or according to the work to be performed thereby.

In the example illustrated, a gas supply pipe 12, opens laterally into the main suction pipe above the foot valve therein and preferably adjacent to the suction port of the pump. This pipe 12, extends from any suitable source of gas supply usually any source of gas or air under light pressure. However, the gas or air need not be under pressure. The gas supply pipe is provided with a manually adjustable needle cut-off valve 13, controlling a very small gas inlet port 14, and this needle valve is arranged to accurately control the flow of gas to the pump cylinder and to thereby determine the volume of gas admitted and the proportion of gas in the liquid discharged by the pump,

Between the needle-valve-controlled gas inlet port and the main suction pipe of the pump, a suitable upwardly or inwardly opening check valve 15, is arranged in the gas supply pipe to prevent back flow of gas and liquid in said pipe.

When starting up the apparatus, the jet opening, perforation, or port 14, is tightly closed by the needle valve 13, to cut off the gas supply, until the pump is properly primed by the liquid and is in operation forcing liquid through discharge pipe 17.

When the pump is in full liquid forcing operation, the needle valve 13, is manipulated to open the gas inlet port a "crack" or slight extent to admit a jet of gas into pipe 12, behind the check valve 15, therein. After the gas jet inlet has thus been slightly opened, gas will be drawn into the main suction pipe 10, on each suction stroke of the pump piston and the mixture of liquid and gas will be drawn into the pump cylinder through suction inlet 6, and the passage 4.

In the pump cylinder, the liquid will settle onto the piston while the gas will occupy the cylinder space above the liquid, as indicated in an exaggerated manner by shade or horizontal hatch lines in Fig. 2. On the up or forcing stroke of the piston, the gas and liquid will be compressed together and driven out through passage 4, discharge port 8, and the pump discharge pipe 17.

The gas supply pipe and its needle valve controlled jet inlet and check valve, are so arranged as to prevent the gas breaking the pump suction and so as not to interfere with the proper maintenance of the liquid priming of the pump. At each suction stroke a small proportion of gas is drawn into the pump cylinder with the liquid and at each forcing stroke, the gas is driven from the pump with the liquid, and the proportion of gas admitted can be accurately controlled by the needle valve.

The body of liquid in the pump cylinder is interposed between the gas and the piston, and hence the piston is sealed or packed by the liquid against leakage of gas, and the various pump valves are also sealed by the liquid against gas leakage, thereby reducing waste to the minimum. The liquid absorbs the heat generated by compression of the gas, and hence it is not necessary to provide water jackets and other cooling means, and in other respects, economy is thereby attained in the operation of the apparatus.

Where handling certain liquids for certain purposes, it is desirable for the pump to deliver the liquid at as high a temperature as possible, and hence advantages are attained by thus compressing the gas and liquid in the one cylinder to enable the liquid to absorb a large percentage of the heat of compression as well as some of the gas.

Apparatus embodying my invention will compress liquid and gas in tanks or other receptacles to a high degree without the employment of multistage pumps and compressors, and at comparatively slow piston speeds.

I have used apparatus in accordance with this invention, to great advantage in forcing liquid hydrocarbon compounds and natural gas into stills wherein the liquid is vaporized and the gas united therewith, and wherein it was necessary to compress the liquid and gas to overcome the pressure in the still, and wherein it was desirable to maintain a surplus proportion of gas in the liquid and gas mixture.

The invention however, can be utilized for other purposes where it is desirable to draw gas and liquid from different sources and compress them in the same or separate receptacles.

The invention can be utilized to great advantage in supplying the necessary air pressure for elevating water in so-called suburban or house water supply systems, inasmuch as the one pump will not only force the water into the pressure tank but will also simultaneously force the necessary air into the tank for maintaining the necessary pressure for forcing the water throughout the system.

The pump can be employed for elevating liquid only by closing the gas jet inlet by the needle valve. This gas jet inlet controlled by the needle valve constitutes an important feature of my apparatus, whereby the operator can manipulate the valve to secure the largest possible flow of gas into the pump consistent with proper operation of the pump where a large percentage of gas is desired in the mixture forced through the pump discharge pipe, or whereby the percentage of gas in the mixture discharged by the pump can be cut down to the minimum where it is necessary to pump only a small volume of gas.

I herein employ the term "gas" in a broad sense to include air and vapor.

It is evident that various changes, modifications and variations might be resorted to without departing from the spirit and scope of my invention, and hence I do not wish to limit my invention to the exact disclosure hereof.

What I claim is:—

1. A liquid and gas forcing pump having an upright cylinder, a vertically-movable piston for compressing liquid and gas in said cylinder, valved gas and liquid suction connections leading to the upper end of said cylinder, manually-controlled means controlling the quantity of gas admitted, and

a gas and liquid discharge connection from the upper end of said cylinder so arranged as to maintain the liquid priming of the pump with respect to said gas and liquid suction connections.

2. Apparatus for simultaneously forcing both liquid and gas comprising a single pump having a combined liquid and gas discharge pipe, and separate liquid and gas suction connections leading into said pump, said last mentioned connection being provided with check valves and said gas connection having a gas supply jet opening and a manually controlled needle valve controlling said opening.

3. Apparatus for simultaneously forcing both liquid and gas comprising a liquid forcing pump having a combined liquid and gas discharge and a liquid suction connection having a foot valve and provided with a lateral gas supply connection opening thereinto, and having a needle valve controlled gas inlet port.

4. A liquid forcing pump having a discharge outlet and provided with a cylinder so arranged that liquid and gas will separate therein, and gas and liquid suction connections to said pump, the gas suction connection being provided with a needle valve controlled gas inlet port.

5. Apparatus for forcing a mixture of liquid and gas comprising a pump having a cylinder, and a piston movable downwardly on the suction stroke and upwardly on its forcing stroke so that liquid and gas will separate in the cylinder with the liquid on the piston, said pump having a liquid suction inlet maintained primed by the liquid during the operation of the pump, and also having a jet inlet for gas and a valve controlling the same, substantially as described.

6. Apparatus for simultaneously forcing both liquid and gas comprising a single upright pump having a combined liquid and gas discharge and a combined liquid and gas suction connection with a gas supply connection opening into said suction connection, said suction connection being so arranged as to maintain therein the liquid priming of the pump, substantially as described.

7. Apparatus for simultaneously forcing both liquid and gas comprising a single upright liquid forcing pump having a combined liquid and gas discharge, and separate liquid and gas supply connections for the pump leading to the upper end thereof, and so arranged as to maintain therein the liquid priming of the pump, substantially as described.

8. Apparatus for forcing a mixture of liquid and gas, comprising a cylinder and reciprocating piston, said cylinder having a valved offtake for the mixture, and also having a suction inlet and a gas supply jet inlet exposed to the suction of the cylinder and piston and a check valve protecting said jet inlet from the compression of the cylinder and piston.

9. A pump for forcing a mixture of liquid and gas, said pump having a valved offtake for the mixture, and also having a check valved suction inlet for the mixture, said inlet having suction communication with a liquid supply and with a check valved gas supply, said inlet, liquid supply and gas supply being so arranged with respect to the pump as to be primed by the liquid priming of the pump.

10. A pump for forcing a mixture of liquid and gas, said pump having a gas supply subject to the pump suction, an adjustable needle valve controlling said supply, a check valve protecting said supply from the pump compression, said pump also having a suction inlet, and a liquid and gas discharge.

Signed LOUIS BOND CHERRY.