No. 857,477. PATENTED JUNE 18, 1907.

G. J. MURDOCK.

PUMPING APPARATUS.

APPLICATION FILED APR. 17, 1906.

Fig. 1.

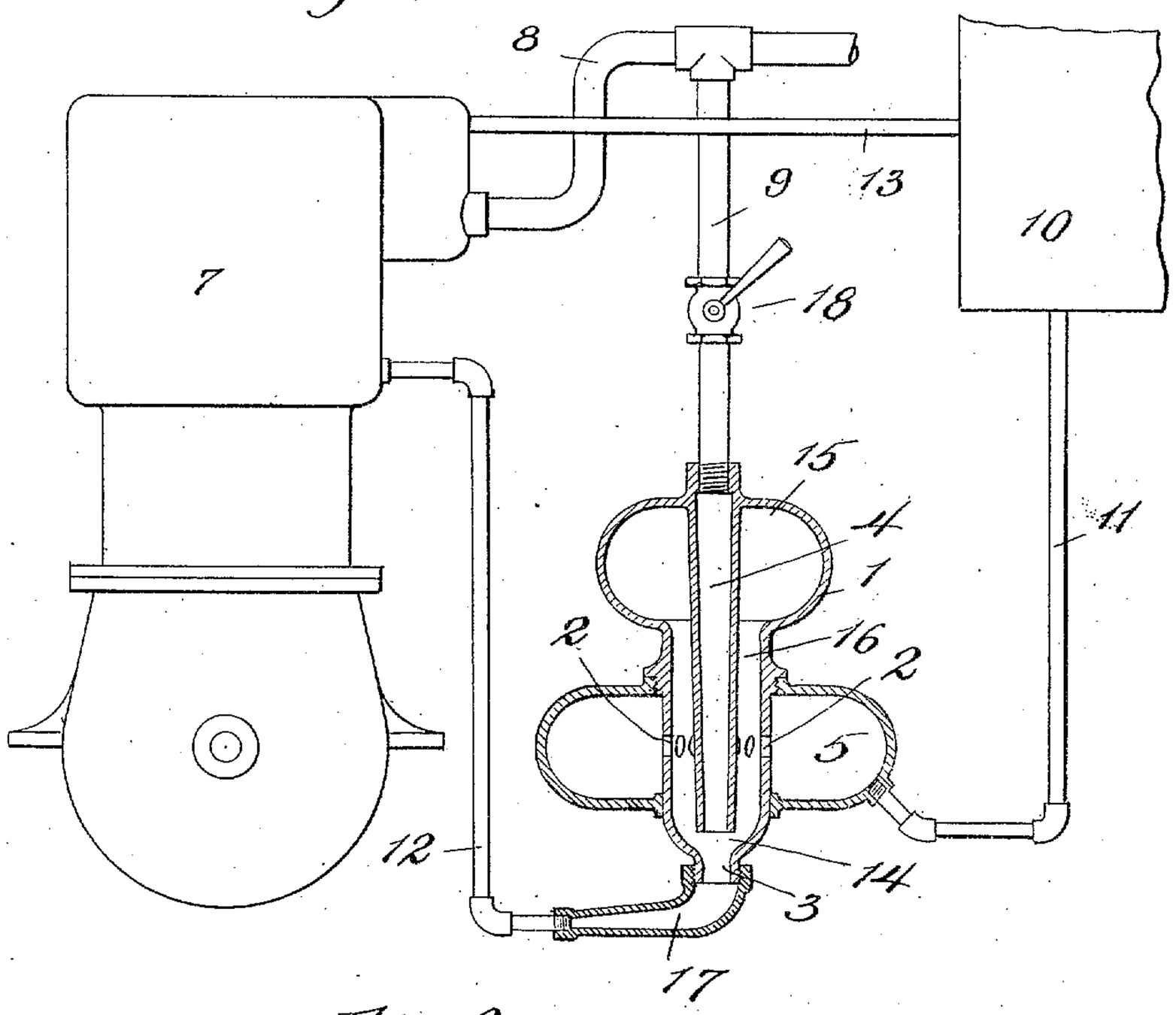
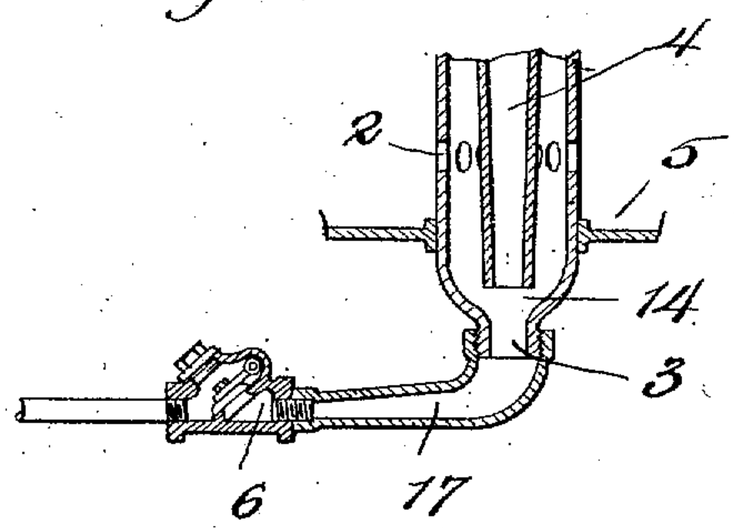


Fig. 2.



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PUMPING APPARATUS.

No. 857,477. Specification of Letters Patent. Patented June 18, 1907.

Application filed April 17, 1906. Serial No. 312,072.

To all whom it may concern:

Be it known that I, GEORGE J. MURDOCK, a citizen of the United States, residing at Newark, in the county of Essex and State of New Jersey, have invented certain new and useful Improvements in Pumping Apparatus; and I do hereby declare the following to be a full, clear, and exact description of the same, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates generally to pumping apparatus operated by intermittent flow of fluid through a pipe or passage, and particularly to pumping apparatus adapted to be operated by the exhaust from fluid pressure motors such as steam engines or gas or oil explosion engines.

The pumping apparatus herein described is particularly intended for maintaining circulation of cooling fluid through the jackets of internal combustion engines, such as gas engines, but is not limited to such use. It embodies improvements upon the pumping apparatus illustrated and described in my Patent No. 765,438, dated July 19th, 1904.

The objects of my invention are to increase the efficiency of pumping apparatus operated by intermittent pulsatory fluid pressure; to adapt such apparatus for operation by pulsations recurring with extreme frequency; to reduce to a minimum the number of valves required, and even to dispense with valves altogether; to adapt the apparatus for pumping against relatively high heads and for taking water below the level of the pump; to make the apparatus efficient in operation, positive in action; simple, free from liability to derangement, and inexpensive; and to make the apparatus simple and attractive in design and external appearance.

I will now proceed to describe my invention with reference to the accompanying drawing in which one embodiment of my invention is illustrated, and will then point out the novel features in claims.

In the said drawings: Figure 1 shows a gas engine, with piping constituting a circulating system for supplying cooling water to the engine jacket, and a pump embodying my invention, said pump being shown in section. Fig. 2 is a detail view showing in section the lower portion of the pump and the check valve forming a foot-valve therefor.

Referring now to the drawings and at first to Fig. 1, the pump there shown comprises an air chamber 1, provided at the sides with inlet openings 2 and at the bottom with a discharge opening 3. At substantially the center of the air chamber is a downwardly projecting slightly tapered pipe 4 adapted to be connected at the top to the exhaust pipe of the engine or to any other source of supply of motive fluid. 5 designates an annular chamber surrounding the portion of chamber 1 in which are the openings 2. 7 designates the cylinder of the engine, 8 the exhaust pipe thereof, 9 a standpipe having a T-connection with said exhaust pipe and connected to the inner pipe 4 of the pump, 10 a reservoir for cooling water, 11 a water supply pipe connecting said reservoir to chamber 5, 12 a pipe leading from outlet 3 to the jacket of the engine cylinder and 13 a pipe conveying the water from said jacket back to tank 10.

The air chamber 1 comprises a contracted portion 14 near mouth of the inner pipe 4, and an enlarged portion 15 some distance above the mouth of said pipe 4, and an intermediate neck 16, constituting a somewhat contracted passage between chamber 15 and the contracted portion 14; and the openings 2 are in this neck 16.

The operation of the pump is as follows: When the engine exhausts, a quick sharp pressure is exerted in the exhaust pipe and is communicated through the standpipe 9 and inner tube 4 to water within the neck 16 and contracted portion 14 of the pump. The water within this neck 16 and contracted portion 14 is thereby forced through the outlet 3 into the pipe 12 and thence through the engine jacket and pipe 13 back to the tank 10.

While it might seem that the water instead of passing through the outlet 3 and pipe 12, would be forced back through openings 2, chamber 5 and pipe 11, I find that in practice this is not the case, at least not to any considerable extent. Without committing myself to any particular theory of operation, I will state that I believe the relative freedom from back flow of the water through chamber 5 and pipe 11 is due to the following circumstances: First, the action of the exhaust pressure is very sudden and is exerted in the direction of the outlet 3, which offers to such a sudden flow, less resistance than the relatively contracted openings 2, even though the total area of said openings 2 is the same as the area of outlet 3; second, the action of the exhaust is exerted upon a column

of water of considerable height in the standpipe formed by the internal tube 4 and pipe 9, the effect of the action of the exhaust on the water in the standpipe being first to force a jet of water from said standpipe through the outlet 3 and then, as partial vacuum in air chamber 15 and pipe 9 succeeds pressure due to the passage of the exhaust past the upper end of said standpipe, water is drawn back into the standpipe and neck 16, inertia of the moving column of water and other conditions uniting to cause such water to be drawn to the standpipe from chamber 5 to the neck portion 16 rather than from the space beyond the outlet 3; third, the air chamber 15, which I have found by experiment to exert a marked influence upon the effective operation of the pump; and fourth, the neck portion 16, forming a somewhat contracted space surrounding the pipe 4 for a considerable distance back from the mouth thereof.

It will be noted that since this pump has no piston or valves interfering with natural free circulation of the water, the natural or "thermo-siphon" circulation of the water is not interfered with in any way, the effect of the pump being added to that of the natural circulation.

I have found this pump to be particularly effective on very high speed engines, or engines having a large number of cylinders, so that the exhaust impulses succeed each other with extreme rapidity. When pumping against the small head which commonly exists in circulating systems of explosion engines, no check valve in the discharge is necessary; but when the engine is required to pump against a head of more than a few feet, I may provide a check valve 6 in the discharge pipe as indicated in Fig. 2. Such check valve is of particular use in starting up against a considerable head. If the pump is operated by an engine running at high speed it may happen that this valve will remain open practically all the time while the engine is running at full speed.

I commonly continue the contracted portion 14 beyond the outlet 3 for some distance, employing for the purpose a special fitting 17 which is larger at its receiving than at its discharging end. Also to adjust the action of the pump to different engines, I at times provide a regulating cock 18 in pipe 9 so that by this cock I may regulate the effective action of the beat of the exhaust on the liquid in the standpipe.

It will be understood that the pump herein described is not limited in application to use as a circulating pump or to operation by the exhaust of explosion or steam engines. It may be used for the handling of various fluids, including water or other fluid carrying considerable quantities of sand or sediment. It is particularly suitable for use as a bilge pump. The entire absence of working parts makes it particularly suitable for handling strong acid or alkalies as it may be made of chemically inactive material or may be provided with a chemically inactive lining.

The pump herein illustrated and described is likewise illustrated and described and claimed broadly but not specifically in my application for Letters Patent filed March 1st, 1906, Sr. No. 303,598.

1. In pumping apparatus such as described, a chamber having an outlet and one or more inlets, said inlets relatively restricted with respect to said outlet, and means for transmitting pulsating pressure from an engine exhaust or other source of pulsating fluid-pressure to liquid within said chamber.

2. In pumping apparatus such as described, a chamber having an outlet and one or more inlets, said inlets relatively restricted with respect to said outlet, the upper portion of said chamber closed and forming an air chamber, and means for transmitting pulsating pressure from an engine exhaust or other source of pulsating fluid-pressure to liquid within said chamber.

3. In pumping apparatus such as described, a chamber having a relatively free outlet and one or more relatively restricted inlets, and a passage within said chamber adapted for connection to an engine exhaust or other source of pulsating fluid-pressure, and opening toward said outlet.

4. In pumping apparatus such as described, a chamber having a relatively free outlet and one or more relatively restricted inlets, the upper portion of said chamber closed and forming an air chamber, and a passage within said chamber adapted for connection to an engine exhaust or other source of pulsating fluid-pressure, and opening toward said outlet.

5. In pumping apparatus such as described, a chamber having an air-space at one end and an outlet at the other, and a passage within said chamber adapted for connection to a source of supply of motive fluid and opening toward said outlet, said chamber having a neck portion surrounding said passage and connecting said air-space and outlet, and having one or more inlet openings in said neck portion.

6. In pumping apparatus such as described, a chamber having an air-space at one end and an outlet at the other, a passage within said chamber adapted for connection to a source of supply of motive fluid, said chamber having a contracted portion between said outlet and the mouth of said passage, and having a neck portion connecting said contracted portion and air space, and having one or more inlet openings in said neck portion.

7. In pumping apparatus such as described, a chamber forming at one end an air

space and having an outlet at the other end and one or more inlet openings in its sides, said chamber provided with a passage having a mouth directed toward said outlet, said passage adapted for connection to a source of supply of motive fluid.

8. In pumping apparatus such as described, a chamber comprising an air space and a liquid space and having an outlet, one or more lateral inlets, and a passage adapted for connection to external operating means and having a mouth directed toward said outlet, in combination with a supply chamber surrounding said first chamber and communicating therewith through said inlets.

9. In pumping apparatus such as described, the combination of a main chamber, a supply chamber surrounding the same, and an operating passage within said main chamber, said main chamber having an outlet and having also one or more inlet openings connecting it with said supply chamber.

10. In a liquid circulating system, the combination of a source of supply of liquid, a liquid-conveying circuit comprising outgoing and return conduits, and pumping means in such circuit consisting of a chamber having an inlet receiving liquid from the circuit and having an outlet, separated from said inlet, connected to such circuit, and having also a closed air space, said chamber having also a passage projecting into the liquid-space of the chamber toward said outlet and adapted for connection to an engine exhaust or the like.

11. An internal combustion engine comprising a cooling jacket and a circulating system therefor comprising an exhaust-operated pump having an air and water chamber having an inlet and an outlet, the former relatively restricted with respect to the latter, and having a standpipe connected to the engine exhaust and directed to discharge toward said outlet, a valveless conduit connecting said inlet to the discharge port of the engine jacket, and a conduit connecting the outlet to the inlet port of the engine jacket.

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

GEORGE J. MURDOCK.

Witnesses:
J. J. ROBINSON,
H. M. MARBLE.