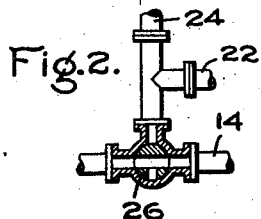
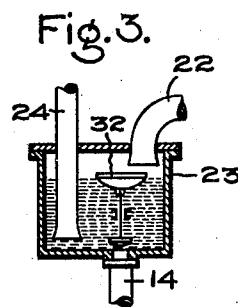
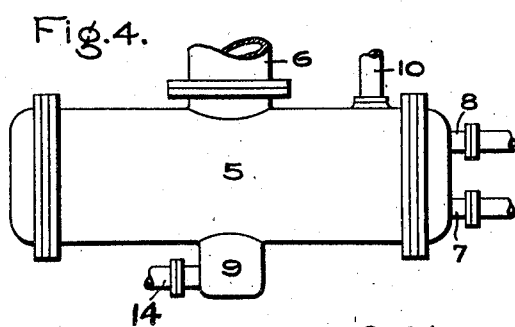
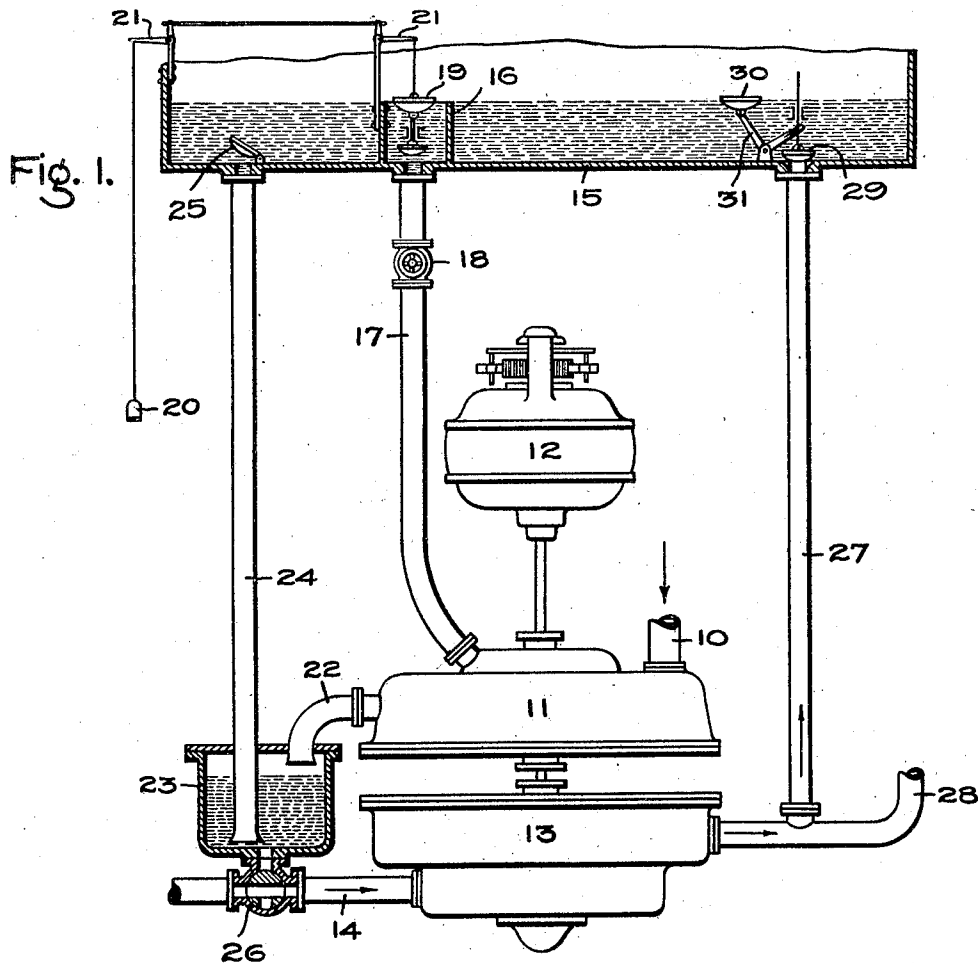


W. KIESER.  
CENTRIFUGAL APPARATUS FOR PUMPING AIR OR GAS.  
APPLICATION FILED JULY 23, 1909.

1,056,688.

Patented Mar. 18, 1913.



Witnesses:  
Marcus L. Byng.  
J. Elihu.

Inventor,  
Walter Kieser,  
by *Albert H. Day*  
Att'y.

# UNITED STATES PATENT OFFICE.

WALTER KIESER, OF BERLIN, GERMANY, ASSIGNOR TO GENERAL ELECTRIC COMPANY,  
A CORPORATION OF NEW YORK.

## CENTRIFUGAL APPARATUS FOR PUMPING AIR OR GAS.

1,056,688.

Specification of Letters Patent.

Patented Mar. 18, 1913.

Application filed July 23, 1909. Serial No. 509,170.

*To all whom it may concern:*

Be it known that I, WALTER KIESER, a citizen of Switzerland, residing at Berlin, Germany, have invented certain new and useful Improvements in Centrifugal Apparatus for Pumping Air or Gas, of which the following is a specification.

This application relates to centrifugal apparatus for pumping air or gas in which a body of water called "throwing water" is caused to form a series of water pistons that inclose between them the air or gas to be operated upon.

The object of the invention is to improve the construction and operation of the apparatus so that its output of water pistons and air can be delivered to a greater height than has heretofore been possible.

On starting a pump of the type described, there is a column of water standing at rest in the discharge pipe of the pump against which the water pistons strike and are destroyed, thus rendering them ineffective to raise the output of the pump to any useful height. The present invention overcomes this difficulty by relieving the outlet or discharge opening of the pump of the opposing pressure of the column or medium during the starting period as distinguished from normal operation so that the pump during said period operates against a very small counter-pressure, which pressure then automatically and gradually increases until the desired height of discharge is attained. This mode of operation avoids the destruction of the water pistons. The initial relief of the counter-pressure may be obtained, for example, by emptying the discharge pipe leading from the pump to the receiving tank or other receptacle during said starting period, a non-return valve being employed to prevent the mass of water already raised from flowing back in case the outlet of the discharge pipe is not located above the highest water level. If the pump is the dry air pump of a condenser system, the relief of the counter-pressure or the emptying of the discharge pipe may be readily and conveniently accomplished by

suitable connections to the condensation pump of said system.

In surface condenser systems for marine engines, the centrifugal air pump and the condensation pump have to be located so low in the ship that the reservoir or tank for the throwing water must frequently be formed between the double-walled bottom of the ship. This arrangement is objectionable because if a leak occurs in the outer wall of the ship's bottom forming part of the throwing water tank, the operation of the system is seriously interfered with. By using the apparatus of my invention, the throwing water tank can be located above the pumps and the pumps installed in the lowest possible region of the ship. The water removed from the discharge pipe of the air pump by the condensation pump before said air pump begins to operate normally is returned to the throwing water tank and the level of the water in said tank is maintained at a substantially uniform height.

In the drawing which represents by way of example some of the embodiments of my invention, Figure 1 is a side view partly in section of the pumps, throwing water tank and their connections; Fig. 2 is a view of a modification of a portion of the system; Fig. 3 is a view of another modification of the same portion of the system; and Fig. 4 is a side view of a surface condenser forming part of the system.

The condenser 5 may be of any suitable type of construction. It has an inlet 6 for the exhaust steam from an engine or turbine and an inlet 7 and outlet 8 for the circulation of the condensing water. The water of condensation collects in the well 9, and a connection 10 is provided for removing the non-condensable gases from the interior of the condenser. The connection or conduit 10 leads to a centrifugal air pump or throwing pump 11 that is driven by an electric or other motor 12. The rotor of the condensation pump 13 is preferably but not necessarily mounted on the same shaft as the rotor of the pump 11. The inlet of the condensation pump 13 is connected with

the well 9 by a conduit 14. The tank 15 containing the supply of throwing water for the pump 11 is located above the pumps. Within the tank 15 is a smaller tank or cistern 16. From the opening in the bottom of the cistern, a conduit 17 leads to the inlet of the air pump 11. A stop valve 18 is located in the conduit 17. The flow from the cistern to said conduit is regulated by a float valve 19 that is ordinarily controlled by the level of the water in the cistern but which can be manually operated when desired by means of the handle 20 through the levers 21 and connecting members.

The discharge from the throwing air pump 11 passes through the conduit 22 to a closed tank or reservoir 23, Fig. 1, and from said tank through the conduit 24 to the tank 15. The air on reaching the tank 15 is permitted to escape. A non-return or check-valve 25 prevents the contents of the tank 15 from flowing back through the pipe 24. The bottom of the tank 23 is connected with a three-way cock 26 in the supply conduit 14 of the pump 13. The connection between the tank 23 and the pipe 14 can be regulated by a float-controlled valve 32, Fig. 3, if desired, this arrangement rendering the action of the apparatus more automatic. A branch conduit 27 leads from the discharge conduit 28 of the condensation pump 13 to the tank 15. The flow through the conduit 27 is regulated by a valve 29 controlled by the float 30, through the medium of the bell-crank 31.

Fig. 2 shows a modification in which the tank 23 is omitted, the pipe 22 being connected directly to the pipe 24 and valve 26.

The method of operation of the apparatus is as follows:—It may be assumed that prior to starting up the pipes 17, 24 and 27, as well as the pumps 11 and 13, are full of water, the three-way cock 26 being turned 90° in a counter-clockwise direction from the position shown in Fig. 1 so as to permit communication between the tank 23 and the pump 13, (communication between the condenser 5 and the pump 13 being interrupted) the valve 18 is closed and the valves 25 and 29 are held closed by the body of water in tank 15. The float valve 19, on the other hand, which is arranged in cistern 16, may, by reason of the high water level in the cistern, keep the inlet to pipe 17 open. With this condition of things at starting, the height of water in the pipes 10, 14 and 28 will, of course, correspond to the pressure of the water columns in the pipes 24 and 27. On beginning to rotate the throwing pump 11 and the condensation pump 13 under conditions outlined in the preceding paragraph, the water present in the pipes 17 and 10 as well as that in the pump 11, is forced into the tank 23 from which it is drawn by the pump 13. In case the pump 13 is adapted to

draw off more of the water than, or just as much as, the pump 11 delivers, the tank 23 as well as the pipes 24 and 14 will, in a short time, be emptied of water so that in the pipe 24, tank 23, pump 11, pipe 27 and pipe 14, a pressure will prevail that corresponds closely to the momentary condenser pressure. The water delivered by the condensation pump 13 passes through the pipe 28 since flow through the pipe 27 is prevented by the valve 29. This valve is weighted in such a manner that it rises and falls only when a change occurs in the level of the throwing water in the tank, but cannot be moved by the pressure difference existing in the pipes 10 and 27. If, on the other hand, the pump 13 discharges less than is delivered to it by the pump 11, the excess delivery is forced through the pipe 24 into the tank 15, so long as water is present in the pipes 17 and 10 as well as in the pump 11. If this water is removed, the pump 13 can draw the water from the pipes 14 and 24 and the tank 23, as above described. When the character of the discharge from the pipe 28 indicates that a condition has been reached such that the pump 11 no longer has to overcome a counter-pressure, the valve 18 is opened and the valve or cock 26 turned to shut off communication between tank 23 and the pipe 14 so that by the aid of the water flowing from tank 15 through the pipe 17 the uncondensed gases drawn through the pipe 10 from the condenser 5, are discharged together with the throwing water, through the pipe 22 into the tank 23 from which latter the said gases escape through the pipe 24 and elevated tank 15.

In the arrangements shown in Figs. 1 and 3, the discharged air in the tank 23 rises to the top thereof and presses on the water so that in the arrangement of Fig. 3, the valve 32 is closed. The throwing water with its entrained air is forced gradually upward through the pipe 24 by the air pressure in the tank 23, Figs. 1 and 3, or in the arrangement of Fig. 2, said water together with the air is forced by the pump gradually higher and higher in the pipe 24 so that in either case the pump 11 has to overcome only a gradually rising pressure. This counter-pressure is caused, in the embodiment shown in Fig. 1, by an elastic medium, namely the separated air that by reason of its elasticity and gradually rising pressure, prevents the flowing together of the consecutive water pistons inclosing between them the air to be removed from the condenser.

In the arrangement of Fig. 2, there is no contact between the water pistons and air and a stationary opposing wall of water, but on the contrary the water column causing the counter-pressure has the same direction and rate of movement as the water pistons and the air. This also results in a very

gradual increase in counter-pressure corresponding to the delivery of the pump 11. The throwing water delivered through the pipe 24 replaces the water constantly flowing out of the tank 15 to the pump 11 so that the valve 19 cannot close the entrance to the pipe 17. The quantity of water flowing out of the tank 15 at the start, valve 18 being open, lowers the level in said tank so that the valve 29 is opened and the contents of the tank are replenished through the branch pipe 27. When normal operating conditions are thus established, the pump 11 works against the desired counter-pressure. If the throwing air pump or the condensation pump suddenly stops for any cause, the water still flows from the cistern 16 into the pipe 17 and the pump 11, until the float valve 19 shuts off the entrance to the pipe 17. On starting up the pumps in the manner above described, the valve 19 instead of the valve 18, must then be opened and kept opened. This is done by means of the handle 20 until the cistern 16 has been filled to the level of the water in the tank 15. This fact will be evident to the attendant when the rising water lifts the valve and relieves the handle of its weight. Then the handle is released in order that the now floating valve 19 may automatically close the entrance to the pipe 17 again on the sudden stopping of the pumps.

In accordance with the provisions of the patent statutes, I have described the principle of operation of my invention, together with the apparatus which I now consider to represent the best embodiment thereof; but I desire to have it understood that the apparatus shown is only illustrative, and that the invention can be carried out by other means.

What I claim as new and desire to secure by Letters Patent of the United States is,

1. In combination, a throwing pump, means for supplying the pump with throwing liquid; a connection for supplying gaseous fluid to the pump to be acted upon by said liquid, a second pump, and means co-operating with the second pump for relieving the counter-pressure on the discharge side of the throwing pump when starting said pump into operation.

2. In combination, a throwing pump, a reservoir for the throwing liquid which is located above the pump, a conduit between the reservoir and the inlet side of the pump, a conduit for supplying gaseous fluid to the pump to be acted upon by said liquid, a connection between the discharge side of the pump and the reservoir, and means including a pump for relieving the counter-pressure in said connection before starting the throwing pump into normal operation.

3. In combination, a throwing pump, a reservoir for throwing liquid which is arranged above the pump, a conduit between

the reservoir and inlet side of the pump, a conduit for supplying gaseous fluid to the pump to be acted upon by said liquid, a connection between the discharge side of the pump and said reservoir, a pump for reducing the counter-pressure in said connection before starting the throwing pump into normal operation, and a valve for controlling communication between the pump and said connection.

4. In combination, a throwing pump, a shaft on which the rotor of the pump is mounted, a motor for driving the shaft, a reservoir for the throwing water that is arranged above the pump, a conduit between the reservoir and the inlet side of the pump, a conduit for supplying gaseous fluid to the pump to be acted upon by said liquid, a connection between the discharge side of the pump and the reservoir, and means for relieving the counter-pressure in said connection before starting the throwing pump into normal operation, said means including a rotary pump having its rotor mounted on said shaft adjacent the throwing pump.

5. In combination, a throwing pump, a reservoir for the throwing water which is arranged above the pump, a conduit between the reservoir and the inlet side of the pump, a valve for regulating the flow through said conduit, a conduit for supplying gaseous fluid to the pump to be acted upon by said liquid, a connection between the discharge side of the pump and the reservoir, a pump for reducing the counter-pressure in said connection before starting the throwing pump into normal operation, a valve for controlling communication between the inlet side of the pump and said connection, a conduit leading from the discharge side of the pump, a branch conduit extending between the last mentioned conduit and the reservoir, and means controlled by the height of the water in the reservoir for regulating the flow through the branch conduit into said reservoir.

6. In combination, a throwing pump, a shaft on which the rotor of the pump is mounted, a motor for driving the shaft, a reservoir for the throwing water which is arranged above the pump, a conduit between the reservoir and the inlet side of the pump, a valve for regulating the flow through said conduit, a conduit for supplying gaseous fluid to the pump to be acted upon by said liquid, a connection between the discharge side of the pump and the reservoir, a rotary pump for reducing the counter-pressure in said connection before starting the throwing pump into normal operation, the rotor of said pump being mounted on said shaft adjacent the throwing pump, a valve for controlling communication between the inlet side of the pump and said connection, a conduit leading from the discharge side of

the pump, a branch conduit extending between the last mentioned conduit and the reservoir, and a valve controlled by the height of the water in the reservoir for regulating the flow through the branch conduit into said reservoir.

7. In combination, a throwing pump, a reservoir for the throwing water which is arranged above the pump, a cistern located within the reservoir, a conduit between the cistern and the inlet side of the pump, a valve in said conduit, a float valve arranged in the cistern that controls the flow between it and the inlet end of said conduit, a conduit for supplying gaseous fluid to the throwing pump to be acted upon by said water, a connection between the discharge side of the throwing pump and the reservoir, a pump for relieving the counter-pressure in said connection before starting the throwing pump into normal operation, and a valve for controlling communication between the pump and said connection.

8. In combination a throwing pump, a reservoir for the throwing water which is arranged above the pump, an open cistern located within the reservoir with its top at substantially the normal level of the water in the reservoir, a conduit between the cistern and the inlet side of the pump, a valve in said conduit, a valve that regulates the flow between the cistern and the inlet end of the conduit, a float in the cistern that normally controls the action of said valve, means for manually controlling the valve under certain conditions, a conduit for supplying gaseous fluid to the throwing pump to be acted upon by said water, a connection between the discharge side of the throwing pump and the reservoir, a pump for reducing the counter-pressure in said connection before starting the throwing pump into normal operation, and a valve for controlling communication between the pump and said connection.

9. In combination, a throwing pump, a reservoir for the throwing water supply which is arranged above the pump, a conduit between the reservoir and the inlet side of the pump, a conduit for supplying gaseous fluid to the pump to be acted upon by said water, a closed tank, a conduit leading from the discharge side of the pump to the upper portion of the tank, a conduit leading from the lower portion of the tank to the reservoir, a pump for relieving the counter-pressure on the discharge side of the throwing pump before starting the throwing pump into normal operation, a conduit extending between the lower portion of the tank and the inlet of the pump, and a valve for controlling the flow from the tank to said conduit.

10. In combination, a throwing pump, a reservoir for the throwing water supply

which is arranged above the pump, a valve controlled conduit extending between the reservoir and the inlet side of the pump, a conduit for supplying gaseous fluid to the pump to be acted upon by said water, a closed tank adjacent the pump, a conduit leading from the discharge side of the pump into the upper portion of the tank, a conduit leading upward from the lower portion of the tank to the bottom of the reservoir, a check-valve to prevent water from flowing from the reservoir into said conduit, a pump for relieving the counter-pressure on the discharge side of the throwing pump before starting said throwing pump into normal operation, a suction conduit for the pump, and a connection between the lower portion of the tank and the suction conduit including a three-way valve which controls the flow through said suction conduit and from the tank through said conduit to the pump.

11. In a condenser system, the combination of a surface condenser, a throwing pump, a shaft on which the rotor of the pump is mounted, a motor for driving the shaft, a conduit extending between the condenser and the inlet of the pump for removing the uncondensed gases from said condenser, a throwing water reservoir arranged above the pump, a connection between the reservoir and the pump for supplying it with water, a well which receives the water of condensation from the condenser, a rotary condensation pump arranged below the throwing pump with its rotor mounted on said shaft, a conduit connecting the inlet side of the condensation pump with the well, a connection between the discharge side of the throwing pump and the throwing water reservoir, and a valve for controlling communication between said inlet conduit and said connection so that the condensation pump may be used to reduce the counter-pressure in said connection before starting the throwing pump into normal operation.

12. In combination, a vessel to be exhausted, a throwing pump, a reservoir and conduit for supplying liquid to the pump, a connection for conveying gas from the vessel to the throwing pump, a conduit for conveying the fluid discharged by the pump to the reservoir, a second pump, a conduit connecting the discharge side of the throwing pump with the suction side of the second pump, and valve means in the conduit for controlling the passage of fluid from one pump to the other.

13. In combination, a surface condenser, a throwing pump, a reservoir and conduit for supplying liquid to the pump, a connection for conveying uncondensed gases from the condenser to the suction side of the pump, a conduit conveying throwing liquid and gases to the reservoir, a second pump

which normally receives condensation water from the condenser, a conduit connecting the discharge side of the throwing pump with the suction side of the second pump, valve means for disconnecting the condenser and second pump and connecting said pumps for the purpose of starting, and means for driving the pumps.

In witness whereof, I have hereunto set my hand this 7th day of July 1909.

WALTER KIESER.

Witnesses:

OSKAR DAHLKE,  
ERICH PASKE.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."