P. F. ODDIE.

AIR PUMP FOR USE WITH CONDENSERS AND THE LIKE.

APPLICATION FILED APR. 19, 1909.

961,000. Patented June 7, 1910.

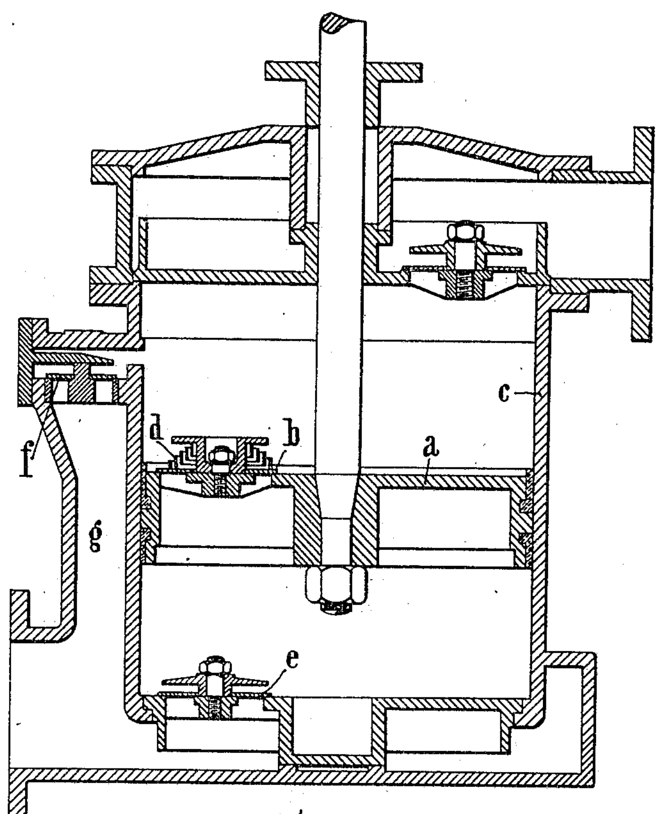

Fig.1.

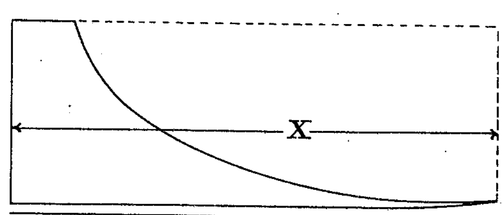

Fig.2.

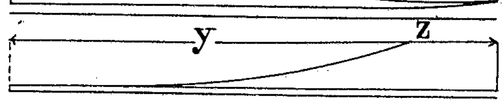

Fig.3.

Witnesses
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UNITED STATES PATENT OFFICE.

PHILIP FRANCIS ODDIE, OF LONDON, ENGLAND.

AIR-PUMP FOR USE WITH CONDENSERS AND THE LIKE.

961,000. Specification of Letters Patent. Patented June 7, 1910.

Application filed April 19, 1909. Serial No. 490,887.

To all whom it may concern:

Be it known that I, PHILIP FRANCIS ODDIE, a subject of the King of Great Britain and Ireland, and resident of London, England, have invented new and useful Improvements in Air-Pumps for Use with Condensers and the Like, of which the following is a specification.

This invention relates to air pumps for use with condensers and the like, and refers to that class of pump known as the triple valve type with foot, bucket and head valves, and has for its object to increase the total volume of air drawn in and discharged at each double stroke, thus enabling either a given sized pump to perform more work, or a given amount of work to be performed by a considerably lighter and smaller pump. Hitherto, in pumps of this class, no air is drawn into the pump on the down stroke the air, vapor and water which have been drawn into the pump during the preceding up stroke, merely passing through the bucket valves into the pump cylinder above the bucket, to be discharged through the head valves on the next up stroke. In my improved air pump however, air and vapor are also drawn in for a considerable period of the down stroke.

Referring to the drawings: Figure 1 is a longitudinal section through the improved air pump. Fig. 2 shows an indicator diagram taken from above the piston. Fig. 3 shows an indicator diagram taken from below the piston.

In carrying out my invention I make use of a bucket *a*, provided with valves *b* in the ordinary way, and working in a cylinder *c*. These valves however are loaded with springs *d* or otherwise, so that a certain amount of resistance is necessary to cause them to open. I prefer to make these springs of such a strength that they will not open until they are acted on by a pressure equal to one third or one half of the atmospheric pressure acting on the area of the valve underneath. The foot or suction valves *e*, on the contrary, are made extremely light, and open with the least possible resistance. In addition to these foot or suction valves communicating with the space below the bucket, I provide one or more additional suction valves *f* controlling a passage *g* leading from the suction chamber to that part of the barrel that is above the bucket. In contradistinction to the bucket valves, the additional suction valve or valves is or are made to open with the least possible resistance.

In operation, as the bucket ascends there is a diminution of pressure in the air pump cylinder between the bucket and the foot valves, which therefore open, air, vapor and water being drawn in from the suction chamber in the usual way, while the contents above the bucket are being discharged through the head valves, also in the usual way. As the bucket descends, there is a diminution of pressure between the head valves and the bucket and an increase of pressure between the bucket valves and the foot valves. In the ordinary pump of this type this increase of pressure below the bucket causes the bucket valves to open directly after the commencement of the down stroke. In my invention however, the valves being loaded, this opening of the bucket valves is delayed till the contents below the bucket have been sufficiently compressed to overcome the resistance of the loaded valves. A very slight diminution of pressure above the bucket causes the additional suction valve controlling the channel connecting the suction chamber with the upper part of the air pump cylinder, to open at once, and air is drawn from the suction chamber or the condenser to the upper part of the barrel. This continues until the fluid is so far compressed under the bucket as to open the bucket valves, and with pumps for high vacua and with valves loaded with the pressure mentioned above, this would take place after about three quarters of the down stroke has been accomplished. As soon as the bucket valves open on the down stroke, the additional suction valve naturally closes, and the air, vapor and water below the bucket are discharged through the bucket valves into the space above the bucket, and this quantity, together with the air, vapor and water drawn in on the down stroke through the additional suction valve is discharged on the up stroke through the head valves. The displacement of the pump is thus considerably increased. The displacement per double stroke in the three valve type of air pump as hitherto constructed can never be more than the area of the piston multiplied by the length of stroke, while in the improved type, the displacement per double

stroke is the area multiplied by the length of stroke, plus the area multiplied by that part of the down stroke that is accomplished before the bucket valves open. In other words, the suction period per double stroke in the ordinary pump would be represented by the line x, while the suction period in my improved type per double stroke is represented by x plus y; z being the point when the bucket valves commence to open, Figs. 2 and 3. The displacement of the pump will increase as the vacuum increases since the bucket valves will open later with higher vacua, and the suction valve will be open for a longer period. On the other hand should a sudden inflow of water enter the pump, no difficulty or disturbance will occur as the bucket valves will open at any part of the stroke as soon as the predetermined pressure is raised, allowing the water to pass to the other side of the bucket. Thus the known advantages of the ordinary three valve air pump are maintained, while securing nearly double the capacity. The channel F may either be connected as shown on drawing, with the main suction inlet, or it may be connected to the upper part of the condenser, so that air is drawn from the coolest part through an auxiliary suction valve into the upper part of the pump, while vapor and water are drawn through the foot valves.

I claim:—

1. In an air pump, the combination of a cylinder having head valves and foot valves and provided with a channel connecting the upper part of the cylinder with the suction chamber of the pump, a suction valve in said channel, and a piston provided with loaded bucket valves arranged to offer a greater resistance to opening than does the suction valve, substantially as described.

2. In an air pump, the combination of a cylinder having head valves and foot valves and provided with a channel connecting the upper part of the cylinder with the suction chamber of the pump, a suction valve in said channel, and a piston provided with spring loaded bucket valves, the load on said bucket valves being such that the suction valve opens with far less resistance than the bucket valves, substantially as described.

In testimony, that I claim the foregoing as my invention, I have signed my name in presence of two witnesses, this sixth day of April 1909.

PHILIP FRANCIS ODDIE.

Witnesses:
H. D. JAMESON,
F. L. RAND.