E. F. PORTER.

PUMP.

APPLICATION FILED MAR. 24, 1919.

1,341,669.

Patented June 1, 1920.

Fig. 6.

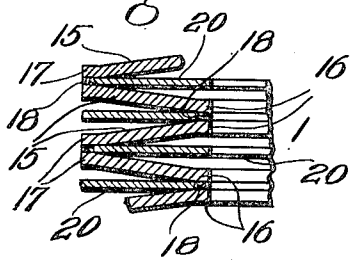


Fig. 5.

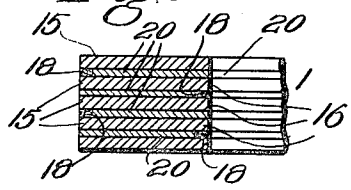


Fig. 4.

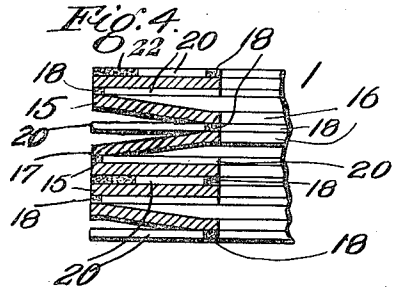


Fig. 3.

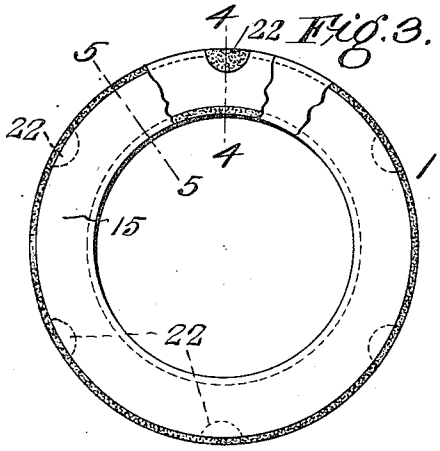


Fig. 7.

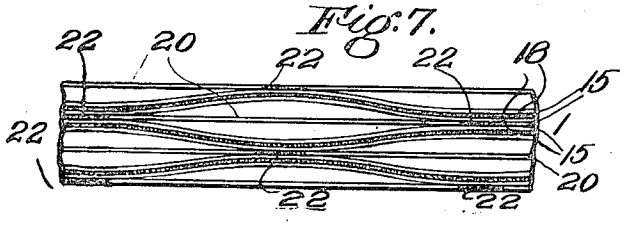


Fig. 2.

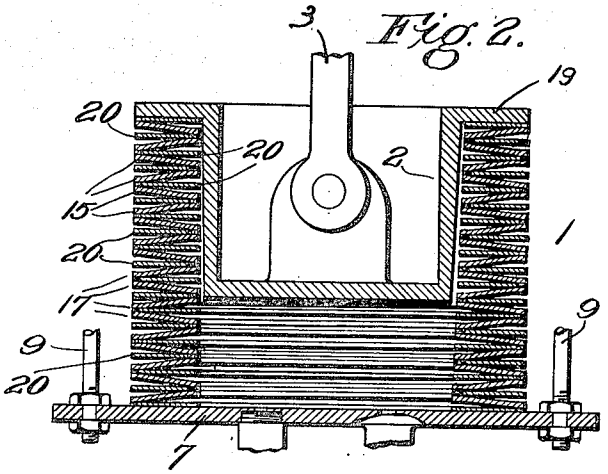
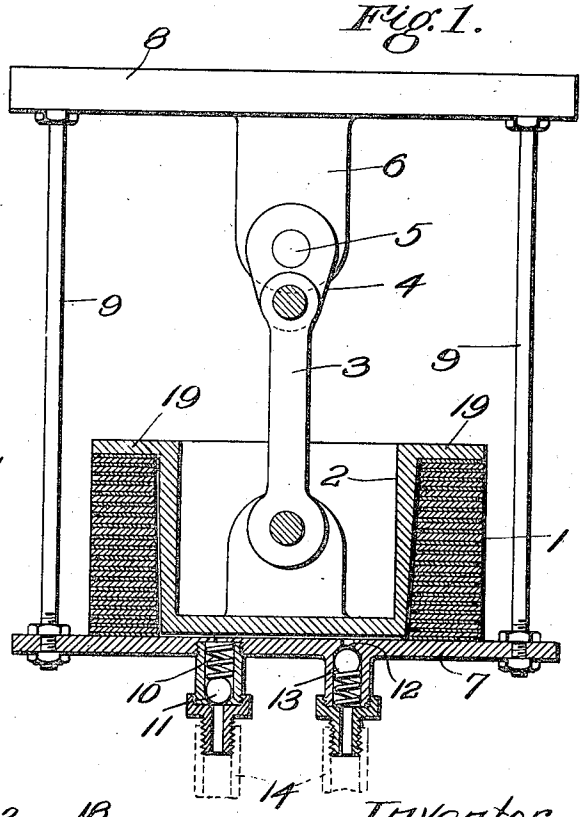


Fig. 1.



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UNITED STATES PATENT OFFICE.

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PUMP.

1,341,669. Specification of Letters Patent. Patented June 1, 1920.

Application filed March 24, 1919. Serial No. 284,683.

To all whom it may concern:

Be it known that I, EDWIN F. PORTER, a subject of the King of Great Britain, residing at Boston, county of Suffolk, State of Massachusetts, have invented an Improvement in Pumps, of which the following description, in connection with the accompanying drawing, is a specification, like characters on the drawing representing like parts.

This invention relates to pumps and has for its object to provide a novel pump in which all sliding joints, such as exist between the piston and the cylinder walls or between the piston rod and its packing in an ordinary pump, are eliminated thereby producing a pump which is practically hermetically sealed. The advantage which is derived from this construction is that there is no possibility of any leakage occurring and hence the pump can be used successfully in those operations where it is highly important to avoid any leakage of the fluid circulated by the pump.

In carrying out my invention I employ an expansible cylinder element in which the piston element operates, said cylinder element being fastened at one end to the piston element and the piston element being so constructed that when the cylinder element is collapsed or contracted, said piston element will fill the cylinder element.

In order to give an understanding of my invention, I have illustrated in the drawings a selected embodiment thereof which will now be described, after which the novel features will be pointed out in the appended claims.

In the drawings, Figure 1 is a longitudinal sectional view through a pump embodying my invention showing the cylinder in its collapsed or contracted condition;

Fig. 2 is a similar view showing the cylinder expanded;

Fig. 3 is a horizontal section through the cylinder;

Fig. 4 is an enlarged section on the line 4—4, Fig. 3;

Figs. 5 and 6 are sections taken on substantially the line 5—5, Fig. 3, Fig. 5 showing the cylinder in contracted condition and Fig. 6 showing the cylinder in expanded condition;

Fig. 7 is a fragmentary side view of a portion of the cylinder.

The cylinder element of my improved pump is indicated generally at 1 and the piston element is indicated at 2. The cylinder is constructed with cylinder walls which are capable of expanding or extending in an axial direction and the piston element is secured to the cylinder at one end. Means are provided for moving the cylinder and piston relative to each other thereby to expand and contract the cylinder walls and while this might be done by moving either element relative to the other, yet I have shown herein a construction wherein the piston element is connected by a connecting rod 3 to a crank arm 4 fast on a driving shaft 5, the latter being journaled in suitable bearings 6.

One end of the cylinder element is connected to the piston and the other end of the cylinder element is connected to a cylinder head 7 which is preferably fixed. I have herein shown said cylinder head as connected by means of tie rods 9 to a support or base plate 8 on which the bearing 6 is mounted. This cylinder head 7 is provided with an inlet port 10 controlled by an inwardly-opening spring-pressed inlet valve 11 and it also has an outlet port 12 controlled by an outwardly-opening spring-pressed check valve 13. This inlet port 10 and outlet port 12 may be connected to pipes 14 of the circulating system.

The cylinder 1 may be made to expand or contract longitudinally of its length in various ways without departing from my invention. One convenient way is to make the walls of the cylinder from a plurality of rings of relatively thin sheet metal which are superposed one on the other, each ring being connected at its inner edge to the adjacent ring on one side and at its outer edge to the adjacent ring on the opposite side. These sheet metal rings are shown at 15 and they will preferably be quite thin and made of some flexible or ductile material which will withstand repeated bending without cracking or fracturing.

As stated above, each sheet metal ring has its inner edge 16 secured to the inner edge of an adjacent sheet metal ring by a hermetically-tight joint or connection, and has its outer edge 17 secured to the outer edge of the adjacent ring on the opposite side by a hermetically-tight joint or connection. Any suitable way of forming such a joint

or connection might be employed. One convenient way would be to solder together said rings at their inner and outer edges, as shown at 18. In the drawings the rings 15 are shown as of considerable thickness and the solder 18 is also shown as having considerable thickness, but this is done for the purposes of illustration only and not as indicative of the actual structure. It will be understood, of course, that in actual practice sheet metal rings are very thin and that a thin film of solder will be sufficient to unite the rings at their edges. This manner of connecting the rings 15 together makes an expansible cylinder, the walls of which have a structure somewhat similar to that of an accordion, so that the cylinder can be expanded or contracted longitudinally. Since all the joints made by the solder 18 are hermetically tight, the expansion and contraction will be accomplished without producing any openings in the cylinder walls. The flexibility of the metal of which the rings 15 are made permits these rings to flex and give as the cylinder expands and contracts.

The piston 2 is provided with a flange 19 which overlies the upper end of the cylinder, the top ring of the cylinder being secured to said flange by means of a hermetically-tight joint. The lower ring 15 of the cylinder is secured to the cylinder head 7 with a hermetically-tight joint. The piston 2 is of a length equal to the cylinder when the latter is collapsed and it has a diameter equal to the interior diameter of the rings 15 so that when the cylinder is collapsed the piston completely fills the cylinder, as shown in Fig. 1. When the piston moves upwardly the cylinder will be extended, as shown in Fig. 2, and a space within the cylinder will be provided which is filled by fluid entering the inlet port 10. During the down stroke of the piston this fluid is forced through the outlet port 12, as will be readily understood,

It is thus seen that the cylinder is a hermetically-sealed chamber which is entirely free from any joints between elements which have a sliding contact with each other, and therefore there is absolutely no possibility of any leakage occurring.

I will preferably employ filling rings 20 situated between adjacent rings 15 and which have a thickness equal to the thickness of the film of solder 18. These rings 20 simply lie loosely between the flexible rings 15 and their purpose is to fill the spaces between the flexible rings 15 when the cylinder is contracted so as to bring said rings into parallel relation, as shown in Figs. 1 and 5. Thus the rings 15 are prevented from any undue strain.

In order that the metal rings 15 may not be subjected to any undue strain during the opening or expanding movement of the cylinder, it is desirable to provide a construction which limits the extent to which the rings may separate from each other.

Various ways of accomplishing this may be provided for. One simple way is to connect the adjacent pairs of soldered outer edges 17 at intervals by means of solder, as shown at 22, these soldered connections 22 being located at different points around the periphery of the cylinder and thus the adjacent pairs of edges 17 are tied together at these points so that the extent to which the rings can separate is limited.

This manner of limiting the expanding movement of the cylinder has the advantage that it equalizes the expansion throughout the length of the cylinder so that none of the disks will be unduly flexed. Therefore, a cylinder constructed as above described not only is provided with means for limiting the expanding movement but also is constructed so that the total expansion will be equally distributed throughout the length of the cylinder.

I will preferably make the piston 2 slightly conical and will also make the interior of the cylinder of a similar conical shape. The reason for this is to avoid any possibility of friction between the piston and the inner edges of the rings of the cylinder as the cylinder expands or contracts.

I claim:

1. In a pump, the combination with a cylinder element comprising a plurality of superposed flat rings, each of which is connected at its inner edge to the inner edge of the next adjacent ring on one side and at its outer edge to the outer edge of the next adjacent ring on the other side, of a cylinder head to which one end of the cylinder is secured, a piston element connected to the other end of the cylinder element, means to move the piston element thereby to expand and contract the cylinder, and means to cause the expanding movement of the cylinder to be equally distributed throughout the length of the cylinder.

2. In a pump, the combination with a cylinder element comprising a plurality of superposed flat rings, each of which is connected at its inner edge to the inner edge of the next adjacent ring on one side and at its outer edge to the outer edge of the next adjacent ring on the other side, of a cylinder head to which one end of the cylinder is secured, a piston element connected to the other end of the cylinder element, means to move the piston element thereby to expand and contract the cylinder, and means connecting the adjacent pairs of connected outer edges at spaced intervals.

3. In a pump, the combination with a cylinder comprising a plurality of superposed flat rings, each of which is connected at its inner edge to the inner edge of the next ad-

jacent ring on one side and at its outer edge to the outer edge of the next adjacent ring on the other side, and filling rings interposed between adjacent flat rings, of a cylinder head connected to one end of the cylinder element and provided with inlet and outlet valves, a piston element connected to the other end of the cylinder element, and means for reciprocating the piston.

4. In a pump, the combination with a cylinder element comprising a plurality of superposed flat rings, each of which is connected at its inner edge to the inner edge of the next adjacent ring on one side and at its outer edge to the outer edge of the next adjacent ring on the other side, of a cylinder head to which one end of the cylinder is secured, a piston element connected to the other end of the cylinder element, means to move the piston element thereby to expand and contract the cylinder, and means to limit the expanding movement of the cylinder and to distribute such expanding movement equally throughout the length of the cylinder.

In testimony whereof, I have signed my name to this specification.

EDWIN F. PORTER.