Sept. 12, 1933. J. G. C. MANTLE 1,926,208

DIAPHRAGM PUMP

Filed Feb. 23, 1929

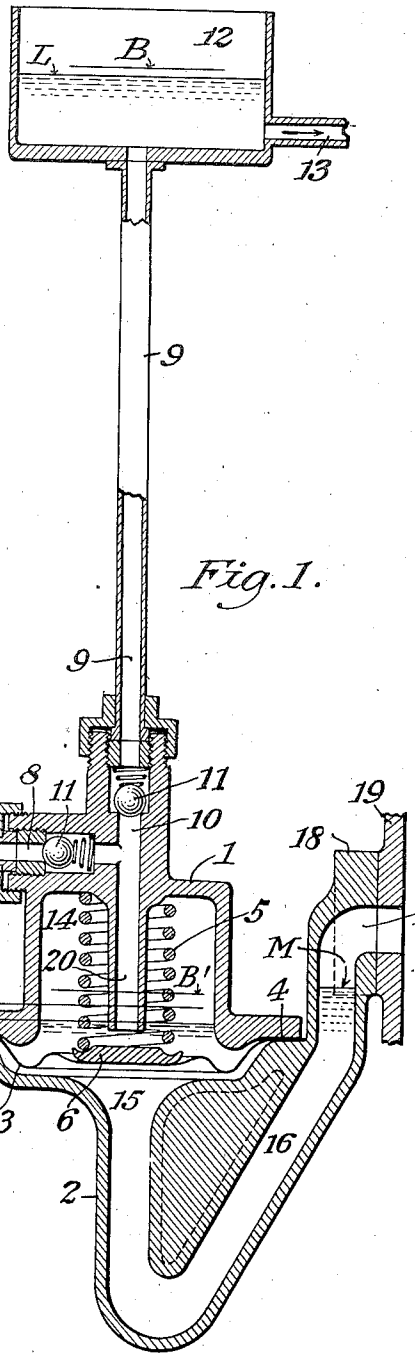


Fig. 1.

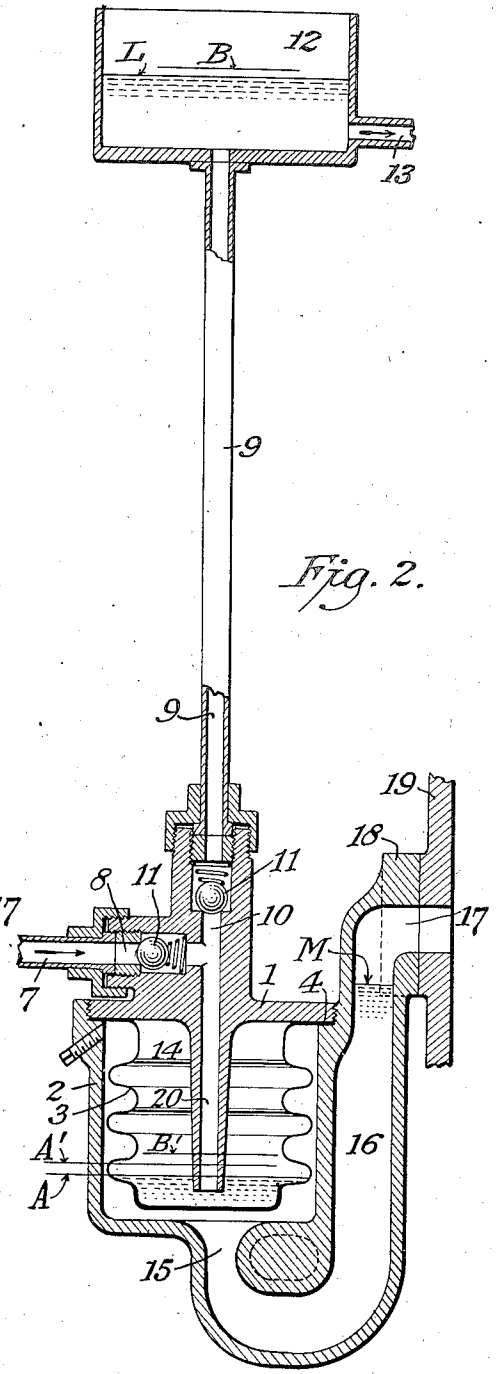


Fig. 2.

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Patented Sept. 12, 1933 1,926,208

UNITED STATES PATENT OFFICE

1,926,208

DIAPHRAGM PUMP

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Application February 23, 1929
Serial No. 341,865

4 Claims. (Cl. 103—44)

This application is a continuation in part of my application for Pumping system for internal combustion engines, filed Jan. 27, 1923, Serial No. 615,271, now abandoned.

This invention relates to diaphragm pumps of the kind in which, although continuously operated, the eduction of the liquid ceased whenever the pressure in the fluid in the pump exceeds a predetermined pressure.

The object of the invention is to provide a pump of this kind which is more efficient and yet of a simpler form.

Hitherto, pumps of this kind were either provided with a by pass or, with a mechanism which, although continuously operated, is connected to the diaphragm in such manner as to actuate it only during the induction strokes and when the pressure in the fluid in the pump does not exceed the predetermined pressure, the diaphragm, either by its own resiliency or actuated by a spring, performing an eduction stroke whenever and only when the pressure in the fluid in the pump does not exceed the predetermined pressure. In my pump the diaphragm is continuously operated and although it has no by pass yet, during the unceasing operation of the diaphragm, the eduction of liquid ceases whenever the pressure in the liquid exceeds a predetermined pressure.

Diaphragm pumps are operated either by mechanical means, as, for instance, by a cam on the cam-shaft of an engine, or by fluid pressure.

Referring to the drawing:

Figure 1 is a sectional view of a pump, embodying my invention, operated by a pulsating-pressure fluid of high pressure; and

Figure 2 is another form of such a pump which is adapted for operation by a pulsating-pressure fluid of comparatively low pressure.

Referring to either Figure 1 or Figure 2, for the corresponding parts have the same numbers, 1 is the upper portion of the body of the pump, 2 is the lower portion of the same, 3 is the diaphragm and which serves as the pumping element of the pump and has its flanged end clamped between the upper and lower portions 1 and 2 of the body of the pump, 7 is a pipe connected to the inlet 8 of the pump, 9 is a pipe connected to the outlet 10 of the pump, 11 are valves opening and closing the inlet and outlet of the pump, 12 is a receptacle to which the upper end of pipe 9 is connected, 13 is an outlet for the liquid from the receptacle 12, 14 is a space in the pump above the liquid which is normally in the pump and the volume of this space after the diaphragm has completed a maximum eduction stroke is appreciably greater than that swept by the diaphragm during that stroke, 15 is a passage in the lower portion 2 of the pump which extends downwardly from the diaphragm, 16 is a communicating passage extending downwardly from the inlet 17 and which has a flange 18 for connecting it to the source 19 of gaseous fluid of pulsating pressure, and 20 is a downwardly extending extension of the outlet 10 the lower end of which is below the surface of the liquid normally within the pump.

Referring to Figure 1 only, 6 is a plate abutting the diaphragm and serving to distribute the pressure of the spring 5 thereon.

When either of the pumps, shown in Figures 1 and 2, are connected to a source of gaseous fluid of pulsating pressure, there ensues an up and down motion of the diaphragm. The upward movement occurs during the period of the higher pressure of the pulsating fluid and is caused by that pressure. The downward movement occurs during the period of the lower pressure of the pulsating fluid and is caused either by the resiliency of the diaphragm itself or by a spring 5 actuating it in downward direction. The downward movements of the diaphragm constitute its induction strokes, and the upward movement its eduction strokes.

If the gaseous fluid has a high temperature or other properties injurious to the diaphragm, the lower portion 2 of the pump is filled with oil, or other suitable liquid of non-heating conducting nature, up to the level M. Then the heated or otherwise injurious gaseous fluid contacts only with the upper surface at M of the liquid and the pressure pulsations are transmitted through the liquid to the diaphragm and as the downward movement of heat in a liquid is exceedingly slow and as the outer surfaces of the passages 15 and 16 continually radiate heat, there is practically no heat from the gaseous operating fluid transmitted to the diaphragm.

The normal position of the diaphragm at the commencement of an eduction stroke is that shown in the drawings. The extent of the up and down movements of the diaphragm which constitutes its induction and eduction strokes, or in other words the length of stroke of the pumping element, is that indicated by the difference in the levels A and A' of the liquid. The level A' is the level of the liquid at the end of the eduction strokes which corresponds to the mean level L in the receptacle during the time when the pressure in the liquid in the pump does not exceed, but is more or less below, the prede-

termined pressure and during this time the liquid is passing, by some means or other, from the receptacle through the outlet 13. The receptacle 12 may be a carburetor attached to an internal combustion engine. Now should the flow of the liquid through 13 be stopped, the diaphragm continues its movements as before, the level of the liquid in the receptacle rises till it reaches B and the level of the liquid surrounding the outlet 20 in the pump, at the end of an eduction stroke, is then B' should the receptacle 12 be a carbureter equipped with a float-valve the flow of liquid is stopped in the pipe 9. At this level B' the pressure of the liquid in the pump is that of the predetermined pressure and although the diaphragm continues its induction and eduction strokes, there is no increase of pressure in the liquid. During the induction stroke, although the pressure decreases, it is always above the normal pressure which corresponds to the mean level L, and this pressure suffices to prevent the opening of the inlet valve until the mean level is again at L. During the eduction strokes the pressure increases until it reaches that corresponding to the level B' and consequently during the period that the level in the receptacle is B, or during the period wherein the flow through 13 or through pipe 9 is stopped, there is merely a pulsating pressure in the pump, which never exceeds that of the predetermined pressure.

It will now have been understood that in this pump there is provided a means, operating during the unceasing induction and eduction strokes of the diaphragm, and which means does not include a by pass, preventing both induction and eduction of liquid whenever the pressure in the liquid in the pump exceeds a predetermined pressure; also that induction of fluid is then prevented by the increased pressure in the fluid; also that eduction of fluid is then prevented by the increased pressure increasing the liquid-containing capacity of the pump. In other words in this pump a pressure in the liquid above the normal pressure automatically increases its liquid-containing capacity up to a maximum capacity corresponding to the predetermined limit of pressure in the liquid; and although the movements of the diaphragm continue uninterruptedly yet there is no flow of liquid either to or from the pump until the pressure in the liquid is again below that of the predetermined limit.

It will be readily understood that the proportionate volume of the space 14 to that of the volume of a maximum stroke of the diaphragm determines the predetermined pressure in the liquid, or, the head of liquid above the outlet valve of the pump also, that the movements of the diaphragm, constituting induction and eduction strokes, may be either of uniform or of non-uniform amplitude. In its usual application the strokes are of practically uniform amplitude. Although a fluid of pulsating pressure, when available is a preferred way of imparting the movements to the diaphragm, on account of its extreme simplicity yet any suitable and well known mechanical means giving uniform movements may be employed for that purpose.

It is well known that an air pocket in the pumping chamber lessens the efficiency of the pump both in regard to its lifting capacity, and also its output; also that this loss in efficiency is proportionate to the volume of the air-pocket to that of the pumping chamber. Therefore, in these respects my pump is an exceedingly efficient one. Nevertheless, for the special purposes for which it is suited it is an exceedingly efficient pump, on account of its extreme sensitiveness to the increase of pressure which operates to regulate the pressure in the fluid to within a very close limit and to do so independently of, and without assistance from, a valve located beyond the outlet valve of the pump itself. In many forms of diaphragm pumps, the means in the pump, alone, does not suffice to limit the pressure, or, stop the eduction of liquid and they are dependent upon the closing of a valve located beyond its own outlet valve, as for instance, the float-valve of the carburetor, whereas with this form of diaphragm pump when connected with a carburetor it is of advantage to remove both the float valve and the float controlling it and so prevent the troubles caused by the occasional sticking of float or valve.

Having thus fully described the invention, what I claim as new and desire to secure by Letters Patent is:—

1. In a diaphragm pump, a pumping chamber, a diaphragm therein for delivering fluid to a tank or the like by induction and eduction strokes, said chamber being provided with a compensating chamber automatically preventing the delivery of fluid to the tank without interrupting the oscillations of the diaphragm when the pressure in the pumping chamber exceeds a predetermined value, a chamber closed at one end by said diaphragm and containing liquid adapted to contact said diaphragm to transmit pulsations to said diaphragm.

2. A diaphragm pump comprising a casing, a diaphragm separating said casing into a plurality of chambers, one of said chambers forming a pumping chamber provided with a compensating chamber for automatically preventing the delivery of fluid to a tank without interrupting the oscillations of the diaphragm when the pressure in the pump exceeds a predetermined value, and another of said chambers having a fluid therein which is adapted to contact said diaphragm and transmit pulsations thereto.

3. A diaphragm pump comprising a casing provided with a valved inlet and a valved outlet, a diaphragm separating said casing into a plurality of chambers, one of said chambers forming a pumping chamber provided with a compensating chamber, and another of said chambers having fluid therein which is adapted to transmit pulsations to the diaphragm, said diaphragm being adapted to oscillate continuously, said compensating chamber being adapted to prevent delivery of a liquid to a tank when a predetermined pressure is reached without interrupting the oscillations of the diaphragm.

4. In a diaphragm pump, a pumping chamber adapted to normally contain a liquid, a flexible member forming part of the pumping chamber and also serving as a pumping element, the said member continuously oscillating, the movements in one direction constituting induction strokes and the movements in the opposite direction constituting eduction strokes, and means whereby the pressure of the liquid in the pumping chamber is increased and thereby prevents induction of liquid during said induction strokes whenever the pressure of the liquid in the pumping chamber exceeds a predetermined pressure, another chamber closed at one end by said flexible member, said last mentioned chamber being adapted to contain a liquid which functions to transmit a pulsating pressure to said flexible member.

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