Feb. 7, 1928. 1,658,705

G. CAPRONI

CENTRIFUGAL SUCKING AND FORCING PUMP

Filed Jan. 5, 1925

Fig. 1.

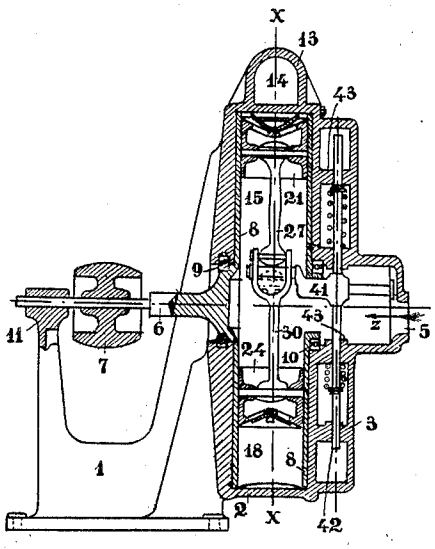


Fig. 2.

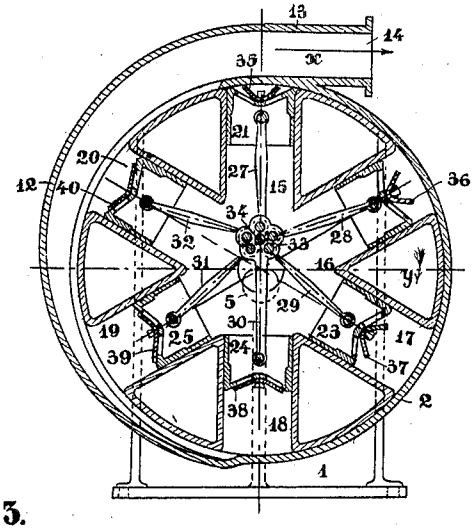


Fig. 3.

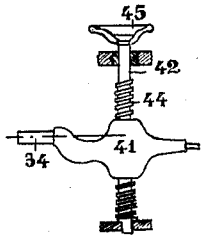


Fig. 4.

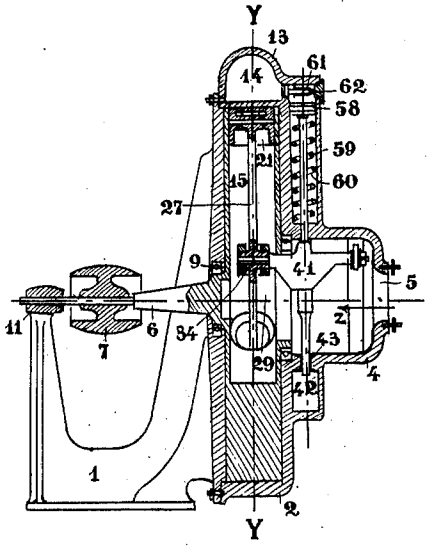
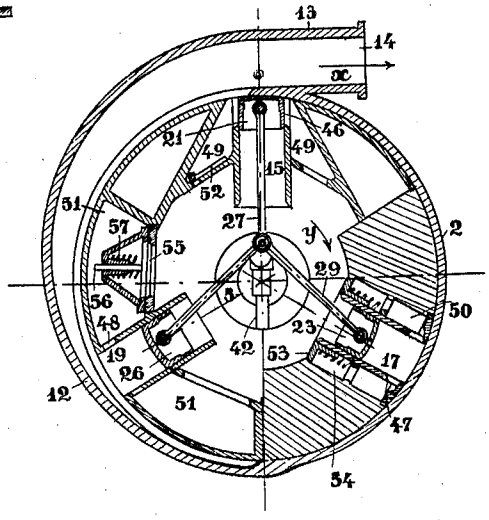


Fig. 5.



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CENTRIFUGAL SUCKING AND FORCING PUMP.

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In centrifugal pumps presently in use the pressure used is only that developed by the centrifugal force, so that for a pump, of a given diameter, the rotary speed must increase with the head to be overcome. It follows that, if the head is very strong, it will not be possible, in practice, to bring the peripheral speed of the pump to the required value, and then it is necessary to connect two or more pumps in series in order to be able to develop the pressure required.

In pumps of this kind there is a minimum speed below which they cannot be run and on the other hand it is difficult to be able to adjust the capacity and the speed of the pump according to the special requirements of each plant, so that in practice the pumps must be designed and constructed for a certain speed rate in connection with the capacity and head to be overcome.

According to this invention said difficulties are overcome by causing the action of the centrifugal force to cooperate with that of the pressure plungers, so that both effects may add themselves and in this way it will be seen that the rotary speed of the pump becomes independent from the head to be overcome, for, while remaining lower than the speed that a pump, working only by centifugal force should have, the residual part of the pressure is supplied through the work of the plungers. It can be therefore changed, in a simple and easy way, by varying the driving torque, and also the discharge and the head.

On the other hand these types of centrifugal sucking and forcing pumps allow also, in an easy manner, to alter the discharge by changing the useful stroke of the plungers, as it will be seen better in the specification hereunder, referring to the accompanying designs which represent two different forms of execution of the sucking and forcing centrifugal pump according to the present invention and precisely:

Fig. 1 is a vertical cross section of a first form of execution of the pump along a diametral plane passing through the axis of the driving shaft of the pump itself;

Fig. 2 is a vertical section of the pump according to the line X X of Fig. 1;

Fig. 3 shows, in a larger scale a form of a device for the regulation of the stroke of the plungers;

Fig. 4 shows a vertical longitudinal section of a second form of execution of the pump along a plane passing through the axis of the driving shaft;

Fig. 5 is a vertical section of the pump according to the line Y Y of Fig. 4.

The same reference numerals are applied to corresponding parts in all the figures of the drawing.

As it may be seen from the drawing, the pump consists of a foundation plate 1 bearing the stationary casing 2, within which is lodged the revolving part of the pump and which is closed on the front with a cover 3 supplied with a hub 4 wherein which is provided the inlet opening 5 for the attachment of the suction pipe; the liquid flows into the pump through this opening along the path shown by the arrow *z*.

On the foundation plate is mounted the driving shaft 6 to which the movement is transmitted by means of a belt wound round a pulley 7, or in any other convenient manner whatsoever. On one of its ends the shaft 6 bears the revolving part 8 of the pump which is supported with ball bearings 9, 10 resting respectively on the bottom and on the cover of box 2. The other end of the shaft 6 is journaled within a ball bearing 11 borne by the foundation plate 1.

The stationary casing 2 carries, in the usual way, the outlet conduit 12 beginning at the lower end and running in a spiral form and ending at the top in the connection 13 with its opening 14 for the attachment to the pressure conduit wherein the water arrives, following the direction indicated by the arrow *x*.

The revolving part 8 is supposed to rotate in the direction shown by the arrow *y* and it includes a plurality of cylinders, six in the example shown by the drawing, 15, 16, 17, 18, 19, 20 within which run radially plungers, 21, 22, 23, 24, 25, 26 connected by means of links 27, 28, 29, 30, 31, 32 to a central piece 33, which is the expanded head of the link 30 and which turns around a stationary eccentrical pin 34.

When the revolving part 8 begins to revolve the plungers will move, running within their respective cylinders, in the same way as it happens in explosion motors with radial cylinders, only here the shaft 6 is a driving shaft instead of being a driven one.

At the bottom of the plungers there are sucking and pressing valves 35, 36, 37, 38,

39, 40 which in the drawing is shown as a clack leather valve, but which might be of any other suitable type. During the half right turn, plungers 21, 22, 23, the suction stroke takes place, that is to say the liquid pushed by the centrifugal force passes behind the plungers lifting the valves and filling the cylinder chambers. When the cylinders arrive below, on the vertical diameter, the suction stroke is ended, the valve closes itself, as it is shown in cylinder 18 of Fig. 2, and there begins the expulsion phase which is accomplished in the half turn to the left during which the cylinder chambers communicate with the eduction conduit 12.

The cycle is completed upon the arrival of the cylinders on the vertical diameter and at the upper end of it, as it may be seen for cylinder 15 which is about to begin its downward run and its valve already reopens itself.

The length of the cylinder's stroke depends on the value of the eccentricity of pin 34 and it would vanish, that is to say the plungers would not exert any pressure and the pump would work only by centrifugal force, if the axis of pivot 34 were brought to coincide with the axis of shaft 6.

Now the pin 34 is borne by an arm 41 mounted upon a rod 42 guided within water tight ball bearings 43 arranged in special boxes of cover 3. The position of the rod 42 can be regulated in many different ways, one of which is shown by way of example in Fig. 3.

From the latter it may be seen that the rod 42 is supplied with a threaded portion 44 which passes into a nut hole of arm 41, and through a small hand wheel 45 placed outside the rod 42 can be rotated either in one direction or in the other thereby lifting or lowering the pin 34. In this manner the pressure and the amount of discharge can be easily regulated at will.

Instead of arranging the valves in the bottom of the plungers they may be arranged outside the cylinder in concamerations set at intervals between the successive cylinders, as it is shown by way of example in the Figures 4 and 5. This pump is supposed to have three cylinders only,—15, 17, 19 with three different types of valves; the cylinders are supplied on the peripheral walls, near their bottom, with openings 46, 47, 48 through which they suck the water from the adjoining concamerations 49, 50, 51.

The valves 52 applied to the concamerations 49 of the cylinder 15 are hinged clack valves. The valves 53 applied to the concamerations 50 of the cylinder 17 are annular lifting valves with an axial movement and loaded by a coil spring 54. The valves 55 applied to the concamerations 51 of the cylinder 19 are also lifting valves whose stem 56 is suitably guided and the valve is loaded with a spring 57. These valves may have also other forms without the least change in the working of the pump, which substantially remains the same, like that of the pump first described differing only in the path of the water sucked which passes through the cylinder walls instead of the plunger bottoms.

Fig. 4 shows also a second system of adjusting the eccentricity of the pin 34 which may be very convenient in many cases. It is seen from it that rod 42 on its upper portion bears a plunger 58 running within a cylinder 59 in whose interior is lodged a helicoidal spring 60, which tends to keep the plunger and pin 34 lifted. On the top of the cylinder there is provided a little chamber 61 which can communicate with the outlet conduit 14 but the communication opening is closed by a small valve 62 loaded by a spring suitably gauged so as to prevent rough changes, checking the movements of the plunger 58.

The liquid when its pressure is such as to lift the valve 62, reaches above said plunger 58 presses it down lowering the pin 34 and thus diminishing the discharge of the pump according to the power which the motor can develop. The spring 60 may be so tensioned that the motor will adjust itself automatically to all the conditions of the work.

Claims:

1. In a sucking and forcing pump of the kind set forth, whereby the liquid is sucked while the cylinders cover in their rotation one-half of the casing and is expelled while the cylinders cover in their rotation the other half of the casing, the combination of an inlet opening corresponding to the rotating axle of the pump, an outlet conduit communicating with that half portion of the casing periphery wherein the compression and expulsion of the liquid are effected, and of valves which open in such a way as to allow the liquid arriving from the inlet conduit, to reach the outlet conduit always moving radially from the center to the periphery, said arrangement causing the centrifugal force to cooperate in helping the suction action of the pistons, while to the effect of the centrifugal force is added the pressing action of the plungers for producing the ejection of the liquid.

2. An embodiment of the centrifugal sucking and forcing pump according to claim 1, characterized in that the valve at the bottom of each plunger is a sucking and pressing valve, whereby the liquid is enabled to flow radially from the center to the periphery of the pump both in the suction and in the ejection phases.

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