Sept. 6, 1966 J. PASQUALI ETAL 3,270,684

PISTON MACHINE

Filed Dec. 3, 1963 3 Sheets-Sheet 1

Fig. 1

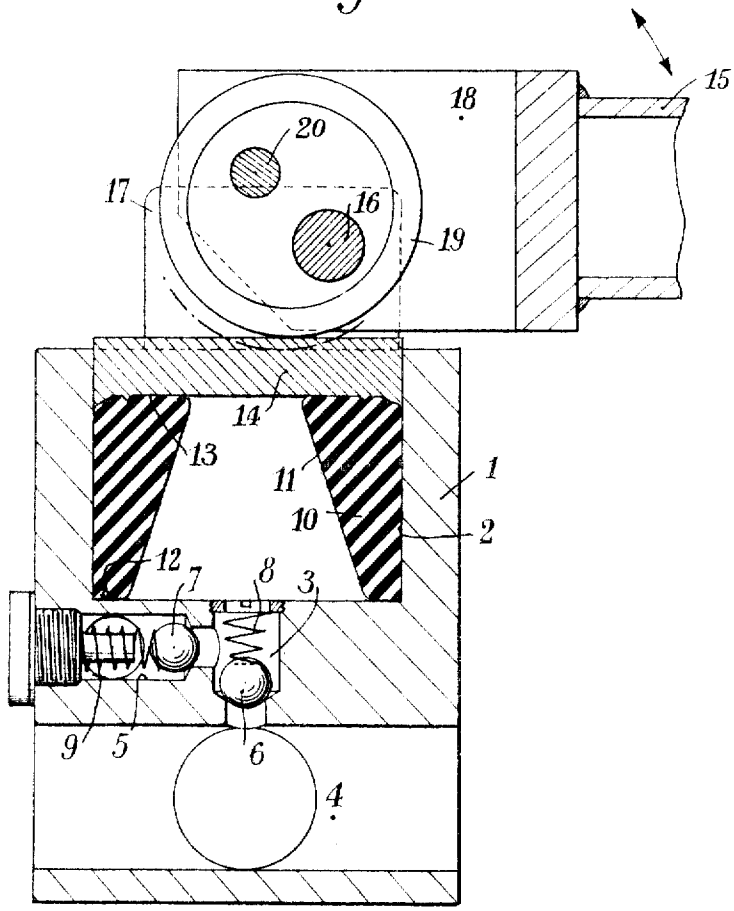


Fig. 2

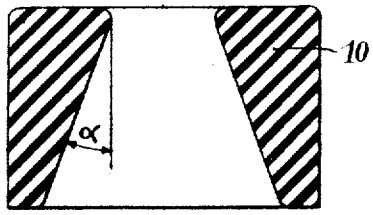
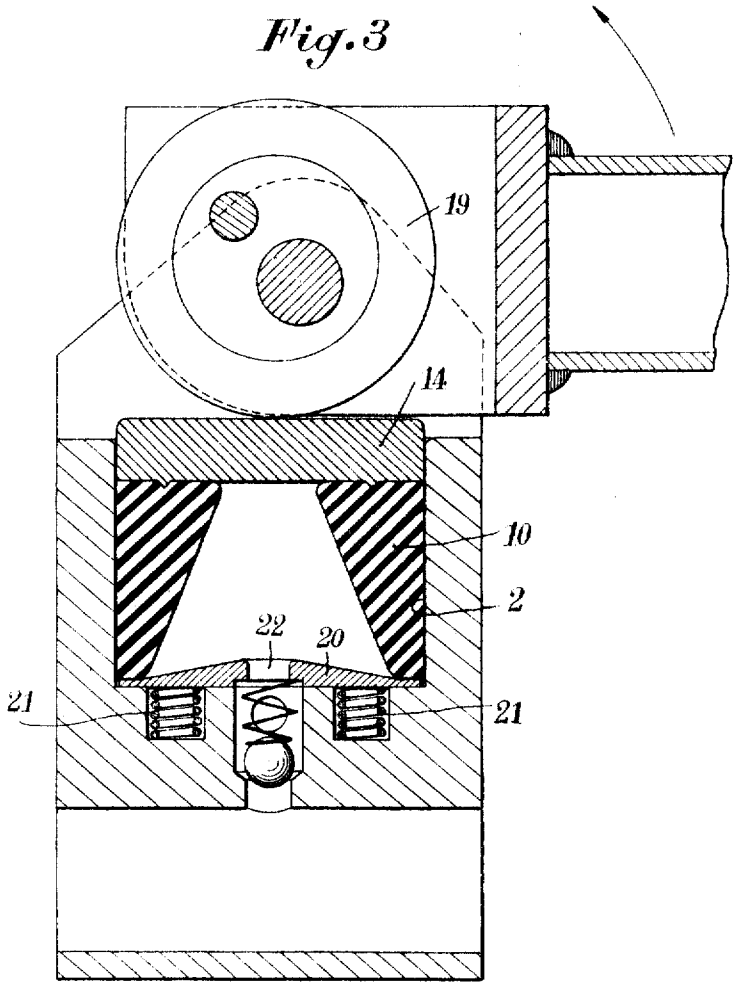


Fig. 3

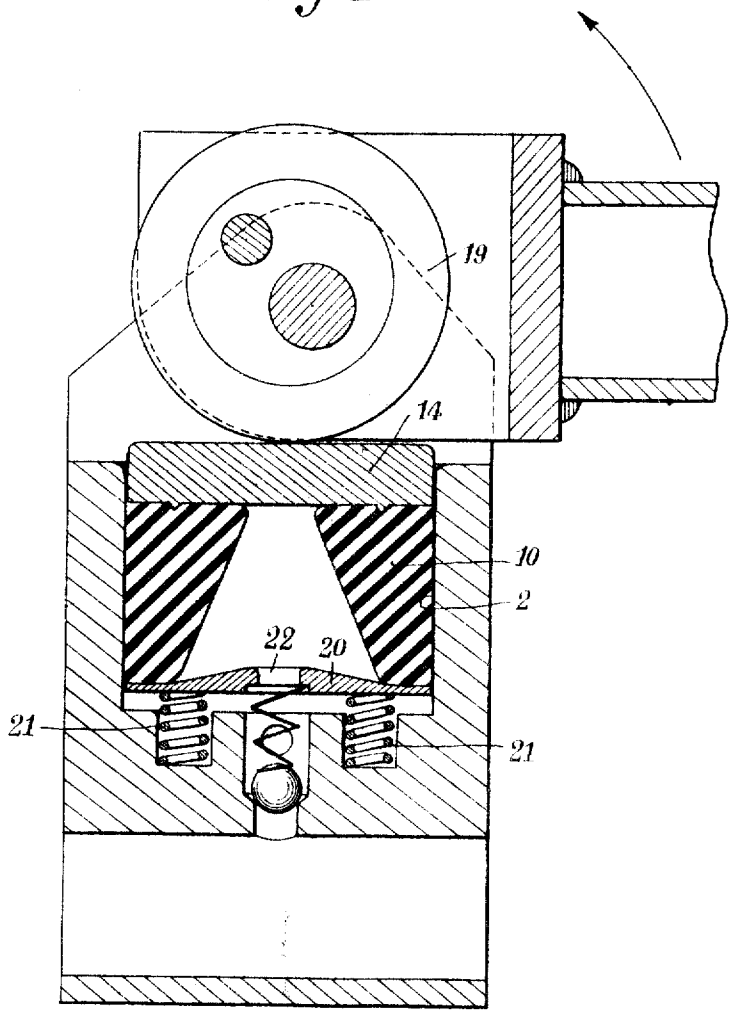


Sept. 6, 1966 J. PASQUALI ETAL 3,270,684

PISTON MACHINE

Filed Dec. 3, 1963 3 Sheets-Sheet 3

Fig.4



United States Patent Office

3,270,684

Patented Sept. 6, 1966

3,270,684

PISTON MACHINE

Jean Pasquali, 6 Rue du Square, Bois d'Arcy, France; Yvon Prauthois, 74 Ave. de la 2ème D.B., Argentan, France; and Marcel Dordain, 23 Rue des Capucins, Argentan, France

Filed Dec. 3, 1963, Ser. No. 327,618

Claims priority, application France, Dec. 11, 1962, 918,233, Patent 1,352,188; June 10, 1963, 937,553, Patent 1,352,188

3 Claims. (Cl. 103—148)

Piston machines are known wherein the suction and discharge chamber consists of a cavity formed in the front face of an elastic pad disposed within a cylinder between a push member to which a reciprocating motion is imparted and a cylinder bottom provided with suction and discharge orifices, said front face bearing against said bottom and having its aforesaid cavity in direct communication with said orifices.

To enable said elastic pad to operate under satisfactory conditions, the piston machine of the type briefly set forth hereinabove is characterized, according to the present invention, in that the cavity constituting said suction and discharge chamber of the pump within said piston is a frustoconical passage formed through said piston, the small end or base of said cavity being adjacent to the aforesaid push member whilst its large end or base is coincident with the cylinder bottom.

With this through passage the pad undergoes a regular deformation during the operation of the device, without producing any separation between its lateral cylindrical wall and the corresponding cylinder wall, and between its end faces and the registering push-member and cylinder faces.

In addition, it was found that the operation of this pad could be further improved by forming between its frustoconical portions and the relevant end faces of the pad slightly rounded edges facilitating the pad distortion during the compression and delivery cycles.

It was also observed that particularly good results could be obtained by using a pad having a height corresponding substantially to two thirds of its diameter, the small base of the frustoconical cavity having a diameter corresponding substantially to one-third of the pad outer diameter whilst the lateral surfaces of said frustoconical cavity are inclined by about 20° with respect to the longitudinal axis of said cavity.

It was also observed in certain cases, notably when the pump is stopped in a position wherein the maximum pad compression is attained, that the pump priming is particularly difficult when the device is started again; in fact, the inherent resiliency of the pad is not sufficient under these conditions for driving the bearing plate which remains stuck thereagainst and does not follow the movements of the pump control cam; as a result, the cam rotation is unable to produce any change in the capacity of the suction and delivery chamber.

Now, according to another feature characterizing this invention, it has been found that this inconvenience could be avoided very easily by simply providing on the side of said suction and delivery orifices a small plate on which the front face of the elastic pad is caused to bear, said small plate having orifices formed therethrough to provide the necessary communication between said cavity and the suction and delivery orifices of the pump, and being responsive to the action of spring means constantly urging said plate against the front face of the pad or piston.

During normal operation this small plate remains stationary between the cylinder bottom and the front face of the elastic pad, the spring force being insufficient to compress the pad; on the other hand, if the pump was stopped

beforehand in a position such that the pad receives its maximum compression and has therefore no inherent elasticity, when the pump is started again, during the first piston stroke the small plate and the spring means acting thereon cause the pad to slide within the cylinder so as to constantly keep its front face in contact with the bearing plate; thus, a first suction effect is produced, the pad cavity is filled with the fluid thus drawn in, and during the first delivery stroke this fluid will strongly compress the lateral faces of the frustoconical cavity and restore immediately the elasticity of the cavity wall to permit its proper operation.

The attached drawings illustrate diagrammatically, by way of example, two typical forms of embodiment of the invention. In the drawing:

FIGURE 1 is a sectional view showing a first form of embodiment;

FIGURE 2 is a sectional view showing a piston having given particularly satisfactory results; and

FIGURES 3 and 4 are sectional views illustrating another form of embodiment, during two different cycles of operation of the device.

The pump body **1** has formed therein a cylinder **2** communicating through a duct **3** with the suction chamber **4** and the delivery chamber **5** provided both with ball valves **6, 7** acting as non-return valves responsive to return springs **8** and **9**. Slidably mounted in the cylinder **2** is a piston **14** and a pad **10** of elastic material, a frustoconical central cavity **11** being formed through this pad, as shown. The front face **12** of this pad bears against the cylinder bottom and its rear face **13** engages the front face of piston **14**; this piston **14** is subjected to reciprocating sliding movements in the cylinder when a control arm **15** is caused to oscillate about its pivot pin **16** carried by a strap **17** rigid with the pump body **1**; to this end, the arm **15** carries in its strap **18** an eccentric cam **19** mounted on said pin **16** and engaging the rear face of piston **14**; the eccentricity of cam **19** may be modified by rotating this cam about the pivot pin **16**, this movement also changing the displacement of piston **14** which is caused by the control arm **15**, and therefore the pump output; thus, a pin **20** engaged through the strap **18** of control arm **15** and also through the eccentric cam **19** will drive this cam.

It is not necessary to explain the operation of this pump since it is the same as that of a conventional pump with the only difference that the successive decrease and increase of the volume of the cylinder chamber on the front end of the piston, which is due to the sliding movements of this piston, will further cause variations in the dimensions of the central cavity of pad **10** as a consequence of its elastic deformation, according as this pad is compressed or not.

The pad illustrated in FIG. 2 has a diameter of 60.2 millimeters and a height of 39 mm. plus two or three tenths of mm., the small base of the frustoconical cavity having a diameter of 20 mm., and the angle α formed between its lateral faces and its longitudinal axis is 20°; rounded edges are formed between the inner frustoconical cavity and the end faces of this pad, and also between the cylindrical outer lateral surface and the rear face **13** in which the small aperture of said frustoconical cavity is formed; preferably, the radius of these rounded edges is about 2 mm.

The pump illustrated in FIGS. 3 and 4 of the drawing differs from the pump shown in FIG. 1 in that there is provided between the bottom of cylinder **2** and the front face of pad **10**, adjacent the suction and delivery orifices, a small plate **20** constantly urged by coil compression springs **21** against said pad; this plate is provided with a central orifice **22** whereby the inner frustoconical cavity of the pad may communicate freely with the suction and delivery orifices of the pump.

Should the pump stop in the position illustrated in FIG. 3, the pad **10** is compressed home and has therefore practically no elasticity left therein, so that when the pump is started again the pad remains flattened as shown in FIG. 4; in this case the springs **21** acting upon the plate **20** cause the pad **10** to slide within the cylinder **2**, thereby constantly keeping the piston **14** in contact with the control cam **19**; as a result, immediately as the piston resumes its stroke, the capacity of the cylinder chamber increases and produces a suction; during the return stroke, the fluid drawn in the frustoconical cavity of the pad is strongly compressed and by acting upon the lateral walls of said frustoconical cavity it restores its initial shape as well as its inherent elasticity.

Besides, it will be readily understood that the forms of embodiment of the invention which are described hereinabove with reference to the accompanying drawing are given by way of example only and should not be construed as limiting the invention since many modifications may be brought thereto without departing from the spirit and scope of the invention as set forth in the appended claims.

Thus, notably, the shape and disposal of the plate intended for constantly maintaining the bearing plate or piston in contact with the eccentric cam may differ considerably from those illustrated; besides, the piston diameters may be considerably larger or smaller than the 60.2 mm. dimensions contemplated in the example illustrated in FIG. 2; however, in this case all the other dimensions should preferably be altered within substantially similar proportions.

What we claim is:

1. A piston machine comprising a cylinder provided with a bottom having suction and delivery orifices, a piston slidably mounted in said cylinder, and a pad of elastic material of relatively great thickness in which a frustoconical cavity having its large end opening toward said bottom is formed, said pad being slidably fitted in said cylinder between said piston and said bottom, wherein said cavity is also open at its small end adjacent to said piston and slightly rounded edges are provided between the frustoconical surface of said cavity and the end faces of said pad.

2. A machine as set forth in claim **1**, wherein the height of said pad is substantially equal to the two-thirds of its outer diameter, the diameter of the small end of its frustoconical cavity being substantially one-third of that of said outer diameter, the lateral surfaces of said frustoconical cavity forming an angle of about 20° with the longitudinal axis of said cavity.

3. A piston machine comprising a cylinder provided with a bottom having suction and delivery orifices, a piston slidably mounted in said cylinder, and a pad of elastic material of relatively great thickness slidably fitted in said cylinder between said piston and said bottom, suction and delivery valves on the bottom of said cylinder controlling said suction and delivery orifices, said pad being provided with a frustoconical cavity extending therethrough, a small plate on the bottom end of said cylinder engaging the lower face of said pad adjacent the large end of said cavity, said plate being provided with a perforation to provide a free communication between said cavity and the suction and delivery orifices, and spring means constantly urging said small plate against said pad.

References Cited by the Examiner

UNITED STATES PATENTS

2,929,332	3/1960	Pierce	103—148
2,974,599	3/1961	Dolza	103—148 X

FOREIGN PATENTS

1,192,901	4/1959	France.

MARK NEWMAN, *Primary Examiner.*

WARREN E. COLEMAN, *Examiner.*