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PUMP, MORE PARTICULARLY BEER PUMP

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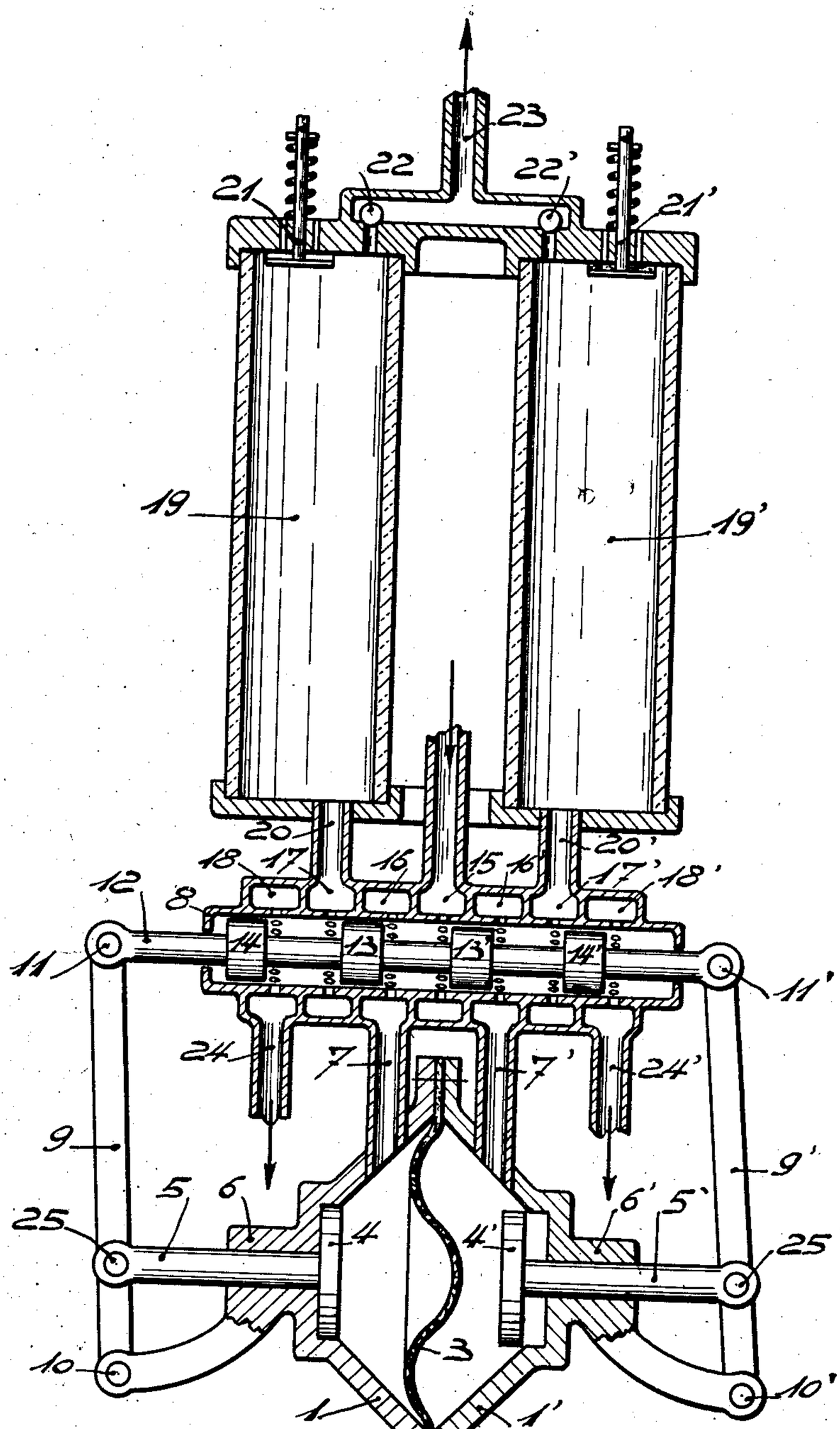

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PUMP, MORE PARTICULARLY BEER PUMP

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This invention relates to hydro-pneumatic pumps operating under direct compression of the gas by a liquid, the liquid itself acting as a piston, and is more particularly, but not exclusively, suitable for pumps for the pumping of beer.

One object of this invention is to maintain all the characteristics of the direct compression of the air by water, i. e. to obtain compressed air which is absolutely pure and dustless.

A further object of the invention is to provide a hydro-pneumatic pump of small dimensions which can be set up in any suitable position such as above a sink, whereby the discharge water from the pump can be used over again.

A still further object of the invention is to provide a hydro-pneumatic pump capable of rapid action and giving an efficiency of over 95%.

A still further object of the invention is a pump in which no water can enter the air pipes even during interruption in the working thereof.

The invention consists essentially in arranging before the compression chamber or compression chambers (there are usually two such chambers) a precompressing or control chamber which acts as a servo-hydro-motor into which supply water is first led and subsequently ejected into the compression chamber where the direct compression of the air by the water is effected. Where two compression chambers are provided, the water is passed into each chamber alternately.

The control chamber regulates the working of the whole pump and, at the same time, prevents the entrance of more water than that required for the normal working of the pump.

In order that the invention may be fully understood, I will now describe one embodiment thereof by way of example by reference to the accompanying drawing which shows diagrammatically one form that the invention may take.

The precompressing or control chamber is formed of two conical portions 1 and 1′ connected together by flanges 2, 2′ in such manner as to retain therebetween a flexible diaphragm or membrane 3 which prevents direct communication between the two portions 1, 1′. The diaphragm 3 is made sufficiently flexible so as to be able to move easily to-and-fro from one half portion to the other under the action of the water pressure which may be applied to either side thereof as hereinafter described.

In each conical part 1, 1′ of the control chamber is slidably arranged a plunger 4, 4′ connected to a rod 5, 5′ slidable in packings 6, 6′. The outer ends of the rods 5, 5′ are pivoted at 25, 25′ respectively to levers 9 and 9′ respectively, the lower ends of which are pivoted at 10 and 10′ respectively to arms projecting from the aforesaid chamber. The upper ends of the said levers 9 and 9′ are connected at 11, 11′ to the piston valve rod 12 which carries a plurality of piston or slide valves 13, 13′ and 14, 14′ slidable in the distributor casing 8. On reciprocation of the rod 12 all the said valves are moved simultaneously.

The distributor casing 8 is formed with a series of apertures for the passage of the compressing liquid, namely, a central aperture 15 and symmetrically disposed apertures 16, 16′, 17, 17′, 18, 18′. The aperture 15 serves for the inlet of water to the distributor casing; the apertures 16 and 16′ are connected to the conical parts 1 and 1′ respectively of the control chamber by pipes 7, 7′ respectively. The apertures 17, 17′ are connected to pressure chambers 19, 19′ by means of pipes 20, 20′ respectively. The apertures 18, 18′ are connected to the water discharge by means of pipes 24, 24′ respectively.

As will be seen from the above description, the pressure chambers 19, 19′ only carry inlet valves 21, 21′ and air outlet valves 22, 22′ for conveying the compressed air through the pipe 23 to the desired place of use.

The improved pump operates in the following manner:—

Assuming that the pump is empty and the piston valves 13, 13′, 14, 14′ are in the left hand end position shown in the drawing, water under pressure enters through the pipe 15 and the apertures 16 and the pipe 7 into the part 1 of the control casing. The flexible membrane or diaphragm 3 is thus moved, under the action of water pressure, towards the right, forcing the air in the part 1′ through the pipe 7′, the apertures 16′ and 17′ and the pipe 20′ into the compression chamber 19′.

As soon as the diaphragm contacts with the plunger 4′, the latter is moved to the right together with the rod 5′ and consequently the lever 9′ is swung on the pivot 10′ with the result that the piston valves 13, 13′, 14, 14′ are displaced from their left end position in the distributor casing to their right end position. The result of this is that water under pressure now flows through the aperture 16′ and the pipe 17′ into the other half 1′ of the control chamber, whilst the part 1, which was previously connected to the water supply, now communicates through the apertures 16 and 17 and the pipes 7 and 20, with the compression chamber 19. The diaphragm 3 is now moved to the left, thus forcing the water, which has entered the part 1 of the control chamber, into the compression chamber 19.

The volume of the precompression or control chamber should be slightly less than the volume of either of the compression chambers 19 and 19′.

The water, forced into the compression chamber 19, mixes with the air present in the chamber, compresses it and forces it through the outlet valve 22 and the pipe 23 to the required place,

for example, an air-storage tank. The diaphragm 3 is, during this operation, moved against the plunger 4 with the result that the latter is displaced, together with the rod 5, to the left and consequently returns the valves 13, 13', 14, 14' to their end left position, whereupon the above sequence of operations is repeated.

It will be understood that, in the position of the valves shown in the drawing, water under pressure flowing into the part 1 of the control chamber causes the water from the part 1' to be expelled by the movement of the diaphragm 3. The compression chamber 19 is connected to discharge, the water therein flowing out through the pipe 20, the apertures 17, 18 and the outlet pipe 24. The discharge water draws in air at atmospheric pressure through the inlet 21 and consequently the cycle is continued until the pressure of the compressed air is equal to the water pressure.

If the volume of the precompressing or control chamber formed by the parts 1 and 1' and the volume of the compression chambers are suitably calculated, the volumetric efficiency of the pump may be made as high as desired notwithstanding the small dimensions of the compression chambers.

As the flexible diaphragm is placed in the path of the water entering under pressure and, as it at the same time, controls the working of the whole pump, it is absolutely impossible for water to enter the air tank even should the pump for any reason be stopped.

It is to be understood that, whilst I have hereinbefore described one embodiment of my invention, modifications may be made therein. For example, the servo-hydro-motor or control chamber may be of quite a different type; for instance, instead of a flexible diaphragm, a piston, freely movable in a closed cylinder, may also be used, or, again, the piston valve distributor may be replaced by any other known type of distributor which gives the same result. Furthermore, the invention may be applied to only a single compression chamber instead of two compression chambers as described.

I claim:

1. In a hydro-pneumatic pump of the type referred to including a compression chamber and a distributor device for controlling the supply of pressure water thereto from a source of water supply, the provision of a control chamber located externally of said compression chamber, said chamber communicating with said supply source and said compression chamber, and being operable by the supply water prior to its entrance into the compression chamber to control the operation of said pump.

2. In a hydro-pneumatic pump of the type referred to, including a compression chamber and a distributor device for controlling the supply of pressure water thereto from a source of water supply, the subcombination of: a control chamber located externally of said compression chamber, said chamber being operable by the supply water prior to its entrance into the compression chamber to control the operation of said pump; and means, operable by said chamber, for automatically actuating said distributor device.

3. In a hydro-pneumatic pump of the type referred to, including a compression chamber and a distributor device for controlling the supply of pressure water thereto from a source of water supply, the subcombination of: a control chamber located externally of said compression chamber, said control chamber being operable by the supply water prior to its entrance into the compression chamber to control the operation of said pump; and a link mechanism, connecting said control chamber to said distributor device, whereby, on actuation of said control chamber, said distributor device is also positively actuated.

4. In a hydro-pneumatic pump of the type referred to, including a compression chamber and a distributor device for controlling the supply of pressure water thereto from a source of water supply, the provision of a control chamber for controlling the operation of the pump, said chamber having therein a flexible diaphragm dividing said chamber into two separate water-tight compartments, each of said compartments communicating with said compression chamber and said source of water supply, whereby on the supply of water to each of said compartments alternately, said diaphragm is moved to force water in the other compartment into said compression chamber to actuate said pump.

5. In a hydro-pneumatic pump of the type referred to, the subcombination of: a pair of compression chambers; a distributor device communicating with each of said chambers and with a source of water supply and having a plurality of valve slides therein and a control device for actuating said valves, said control device comprising a water-tight casing having a flexible diaphragm therein dividing said casing into two parts each of which parts is in communication through said distributor device alternately with each of said compression chambers and with said source of water supply; and a plunger in each of said casing parts operatively associated with said valves in said distributor casing, the arrangement being such that, with said valve slides in one end position thereof, water is supplied to one of said casing parts to cause displacement of said diaphragm to force water present in said other casing part into one of said compression chambers, whereby, at the same time, the plunger in said casing part is moved to displace said valve slides and put said other casing part into communication with said source of water supply.

6. In a hydro-pneumatic pump of the type referred to, including at least one compression chamber and a distributor device having a plurality of slide valves therein for controlling the supply of water to said compression chamber from a source of water supply, the provision of a control chamber for controlling the operation of said pump, said control chamber including a water-tight casing having a flexible diaphragm therein dividing said casing into two separate compartments, each of said compartments communicating through said distributor device with said compression chamber and said source of water supply; and a plunger in each of said compartments positively connected to said valves in said distributor, whereby water supplied to one compartment of said casing moves said diaphragm to force water present in said other compartment into said compression chamber with simultaneous actuation of the plunger therein positively to actuate said valves in said distributor device to direct the supply water to said last-mentioned compartment and thus reverse the movement of said diaphragm.

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