A. CACCIARI.

PNEUMATIC ROTARY PUMP FOR RAREFYING AND COMPRESSING FLUIDS.

APPLICATION FILED NOV. 14, 1919.

1,426,356.

Patented Aug. 22, 1922.

3 SHEETS—SHEET 1.

FIG. 1.

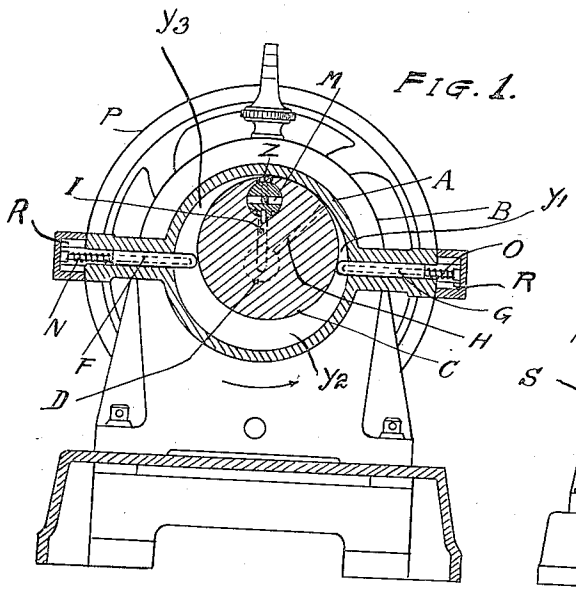


FIG. 5.

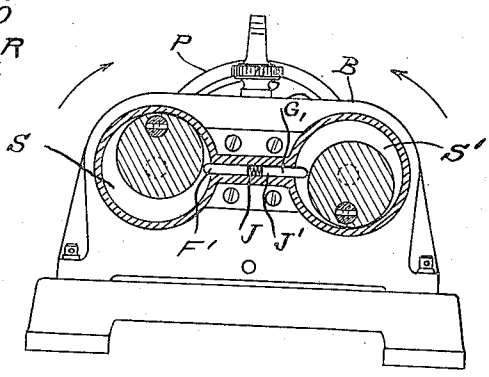
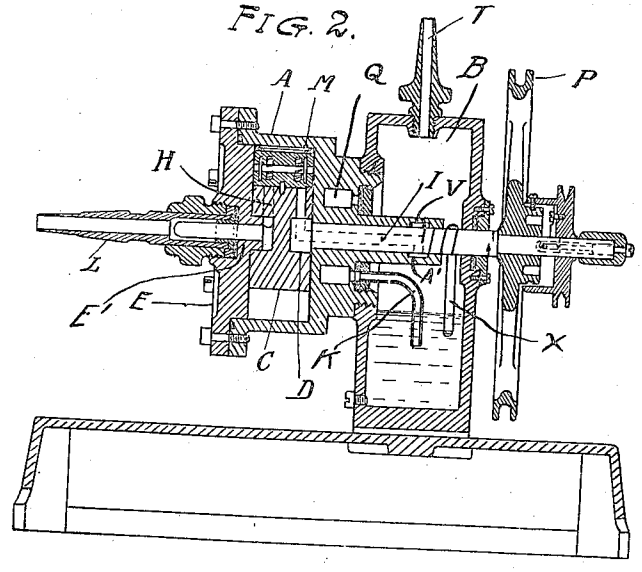


FIG. 2.



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3 SHEETS—SHEET 2.

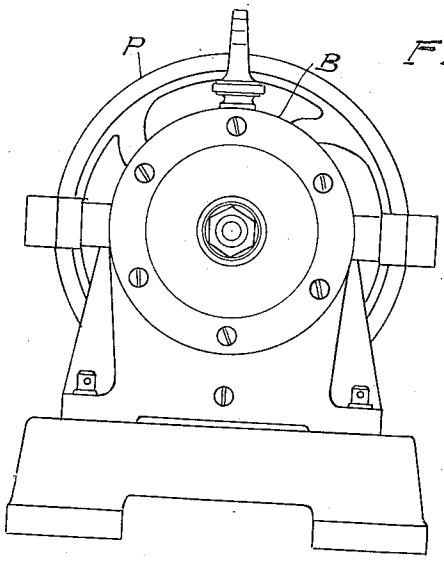
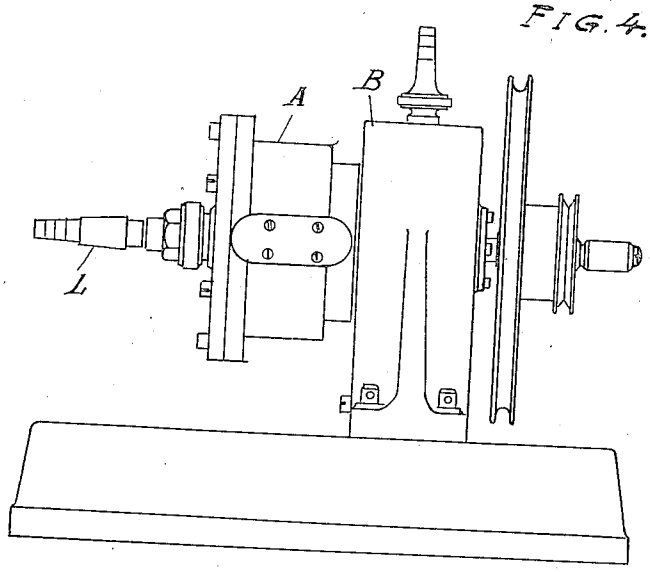


FIG. 3.

FIG. 4.



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3 SHEETS—SHEET 3.

FIG. 7.

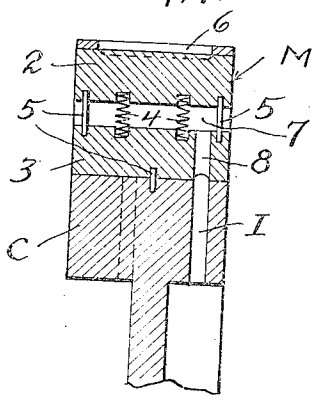
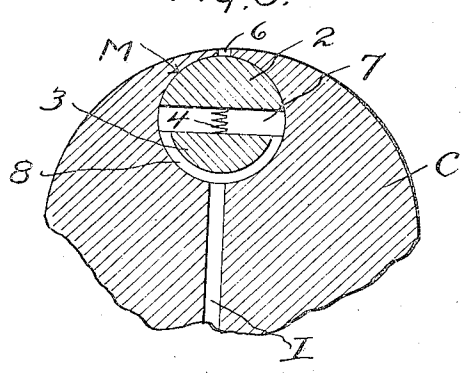


FIG. 8.



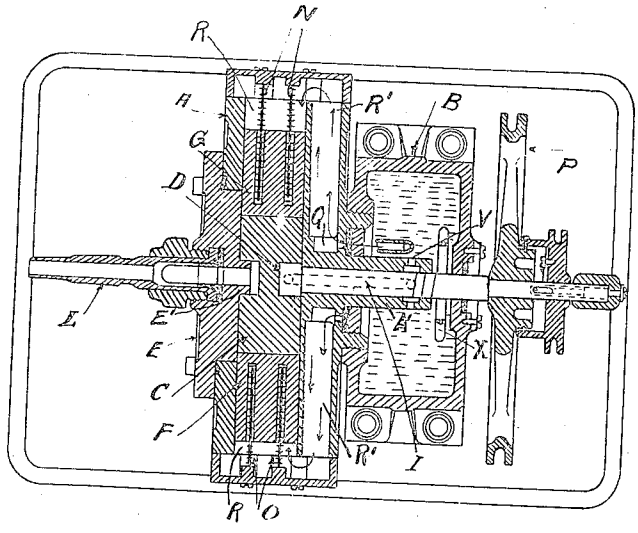


FIG. 6.

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UNITED STATES PATENT OFFICE.

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PNEUMATIC ROTARY PUMP FOR RAREFYING AND COMPRESSING FLUIDS.

1,426,356. Specification of Letters Patent. Patented Aug. 22, 1922.

Application filed November 14, 1919. Serial No. 337,956.

To all whom it may concern:

Be it known that I, ALFONSO CACCIARI, gentleman, subject of the King of Italy, resident of Milan, in the Kingdom of Italy, No. 24 Via Pergolesi, have invented new and useful Improvements in Pneumatic Rotary Pumps for Rarefying and Compressing Fluids, of which the following is a specification.

The object of the present invention is the provision of a pump for exhausting and compressing fluids which will not have the disadvantages that are inherent in the pumps heretofore in use.

It is not new to have pumps for exhausting and compressing fluids having vanes which are pressed against a body rotating in a barrel by a centrifugal force or by the action of a driving fluid such as steam, compressed air, etc., or by the vapor produced by the vacuum.

In the present invention however, in order to prevent looseness which may be caused by the insufficient action of the gas or vapor, the vanes are arranged in slots formed in the barrel walls and are pressed against the cylinders by the action of a liquid such as oil. This liquid is contained in a tank and flows in consequence of the pressure exerted by the vanes themselves while the cylinder revolves, in the case of the pump acting as a compressor, or owing to the pressure exerted on the surface of the liquid in the tank by atmospheric pressure in the case of the pump acting as a vacuum pump.

The employment of the oil is also accompanied by the advantage that the parts concerned are properly lubricated at the same time.

The arrangement is illustrated by way of example in the accompanying drawing showing several methods of carrying out the invention.

Figure 1 is a sectional side elevation of the pump.

Fig. 2 is a section parallel to the pump axis.

Figs. 3 and 4 are external views.

Fig. 5 shows a double acting pump by way of example.

Fig. 6 shows a section on a horizontal plane of the machine, Fig. 1.

Fig. 7 shows a section through the valve of Figs. 1 and 2.

Fig. 8 shows a section through the valve at right angles to Fig. 7.

As shown in the drawings, the pump cylinder A is screwed to the tank B which is bolted to a suitable base. Within the cylinder A is a cylindrical rotary piston C, and closing the open end of the cylinder A there is a head E secured to the cylinder and causing the piston to be snugly fitted therein, the joint between the cylinder A and the head E being fluid tight. The piston is eccentrically mounted at one side on a stub shaft E′ and at the other side on a shaft D mounted in the cylinder A and in the tank B, the piston being splined to the shaft D. The arrangement is such that the most eccentric portion of the piston has a sliding engagement with the internal circular wall of the cylinder A.

Located at diametrically opposite positions in the cylinder A and mounted to slide in sockets provided therein is a pair of abutments or vanes F and G, the latter dividing the cylinder into two compartments to produce two cycles during each complete rotation of the piston.

Adapted to communicate with the cylinder chambers and located at equal angular distances to either side of the most eccentric portion of the piston C are two ducts I and H for the passage of the fluid being operated upon by the pump. The duct H is constituted by a passage through the piston, and a central bore in the stub shaft E′ and terminates in a nozzle L attached to the head E. The duct I located at the opposite side of the most eccentric portion of the piston is constituted by a passage through the piston and a central bore in the shaft D and terminates in a port V provided in a sleeve A′ on the cylinder, which sleeve extends into the tank B, the tank B being provided with a nozzle T. Thus it will be seen that opposite sides of the most eccentric portion of the piston are connected to the nozzles L and T. A valve M whose function will be hereinafter described is interposed between the duct I and its outlet Z. The valve consists of a cylinder divided through the center forming two sections which are forced apart by springs against their respective openings.

The vanes F and G are mounted in extensions of the cylinder A and have, respectively, light springs N and O which urge their inner ends into contact with the surface of the piston. At the rear of the vanes F and G are chambers R which are con-

nected by passages R′, and an annular channel Q in the cylinder to a pipe K extending into a supply of oil provided in the tank B.

The shaft D on its external portion is provided with a flywheel P and a pulley and within the tank B is provided with a slip ring X for lubricating the shaft.

The construction of valve M is clearly shown in Figs. 7 and 8, wherein the members 2 and 3 are forced away from each other by springs 4, said members being guided by rods 5. When air or liquid is compressed by the rotation of piston C, the liquid will enter at an opening indicated at 6 and force the upper member 2 inwardly toward the member 3 against the action of springs 4. The liquid will now be free to enter chamber 7 and thence into channels 8 of member 3 and finally into duct I.

Operation.

The pump will be considered as an air compressor for the purpose of explaining the operation.

When the rotation of the shaft D and the piston is started, the springs N and O hold the vanes F and G against the piston so that (considering the parts in the position shown in Fig. 1 and the piston rotating counterclockwise), the air which is permitted to enter the cylinder, through the nozzle L and the duct H, is confined to the space Y_1 in the cylinder between the most eccentric portion of the piston and the vane G. At the same time the air which has previously entered the space between the vanes G and F, is compressed in the space Y_3, i. e. between the most eccentric portion of the piston and valve F. After a predetermined compression of the air in space Y_3 is effected, the valve M automatically unseats itself and permits the compressed air to pass through the duct I to the space within the tank B from which said compressed air forces a certain volume of air through the nozzle T to the receptacle for the compressed air.

The air in the space Y_3 being completely exhausted by the rotation of the piston, and the space Y_2 being previously filled with air passing through the nozzle L and the duct H, the operation of compressing the air in the lower part of the cylinder continues with the next one-half revolution of the piston, i. e., the air is compressed in the space between the most eccentric portion of the piston and vane G.

After the operation of the pump is started and the compressed air fills the tank B, the oil therein is forced up through the pipe K, the annular channel Q and the chambers R, and tends to force the vanes F and G out against the piston with just the right amount of pressure, the oil being non-compressible acts on each vane with the same force as that with which the compressed air acts on an area of oil in the tank equal to the area of the rear of the vane.

When the pump is used to create a more or less partial vacuum, the oil acts in the same manner; the atmospheric pressure on the oil in the tank exceeds the pressure within the cylinder and therefore the oil forces the vanes outwardly.

The oil in addition to performing the function above described, serves to keep the parts properly lubricated, thus reducing wear to a minimum and also obturates the opening through which the vanes slide.

Fig. 5 shows the arrangement of the vanes as applied to a double acting pump in which there are two independent and distinct cylinders S and S′ each having its own piston and each piston being removed in position just one-half cycle from the other piston. Carrying out the invention herein-disclosed in an engine of this kind the vanes F′ and G′ are mounted in alinement in a guideway formed between the cylinders, being end to end and having a spring J′ urging them outwardly toward their respective pistons. Between the ends of the vanes, however, there is a space J communicating with the oil in the tank B′ so that the difference in pressure between the tank B′ and the cylinders S and S′ causes the vanes to be forced, with the proper pressure (according to working conditions of the pump), into contact with the pistons as they revolve.

I claim as my invention:—

1. A rotary pump for gases comprising a frame; a cylinder secured to said frame; a rotary piston eccentrically mounted in said cylinder and provided with a valve adapted to prevent back flow of compressed fluid; a vane mounted to slide in a socket provided in said frame and adapted to engage the surface of the piston; a tank containing a supply of oil and provided with a pipe which communicates with said frame and a port in the piston communicating with said tank.

2. A rotary pump for gases comprising a cylinder; a rotary piston eccentrically mounted in said cylinder and provided with a valve adapted to prevent back flow of compressed air; vanes slidably mounted in slots in said cylinder and adapted to contact at all times with said piston; spring means for holding the vane in contact with the piston; and auxiliary means for forcing said vane against the piston with proper pressure according to working conditions of the pump brought into operation upon the functioning of the pump and comprising a non-compressible liquid.

3. A rotary pump for gases comprising a frame; a cylinder secured to said frame; a rotary piston eccentrically mounted in

said cylinder and provided with a valve adapted to prevent back flow of compressed air; a vane mounted to slide in a socket provided in said frame and adapted to engage the surface of the piston; a chamber provided at the rear of said slot and communicating therewith; a tank containing a supply of oil and provided with a nozzle; a port in the piston communicating with said tank, there being a difference in pressure between the gas contained in said tank and the interior of the cylinder during operation of the pump; and means connecting the tank with the chamber to the rear of the vane so that the oil in the tank is forced through said means and against said vane due to said difference in pressure during the operation of the pump.

In testimony whereof I affix my signature.

ALFONSO CACCIARI.