

Jan. 31, 1928.

1,657,641

R. P. PESCARA

MOTOR COMPRESSOR APPARATUS

Original Filed June 5, 1925

2 Sheets-Sheet 1

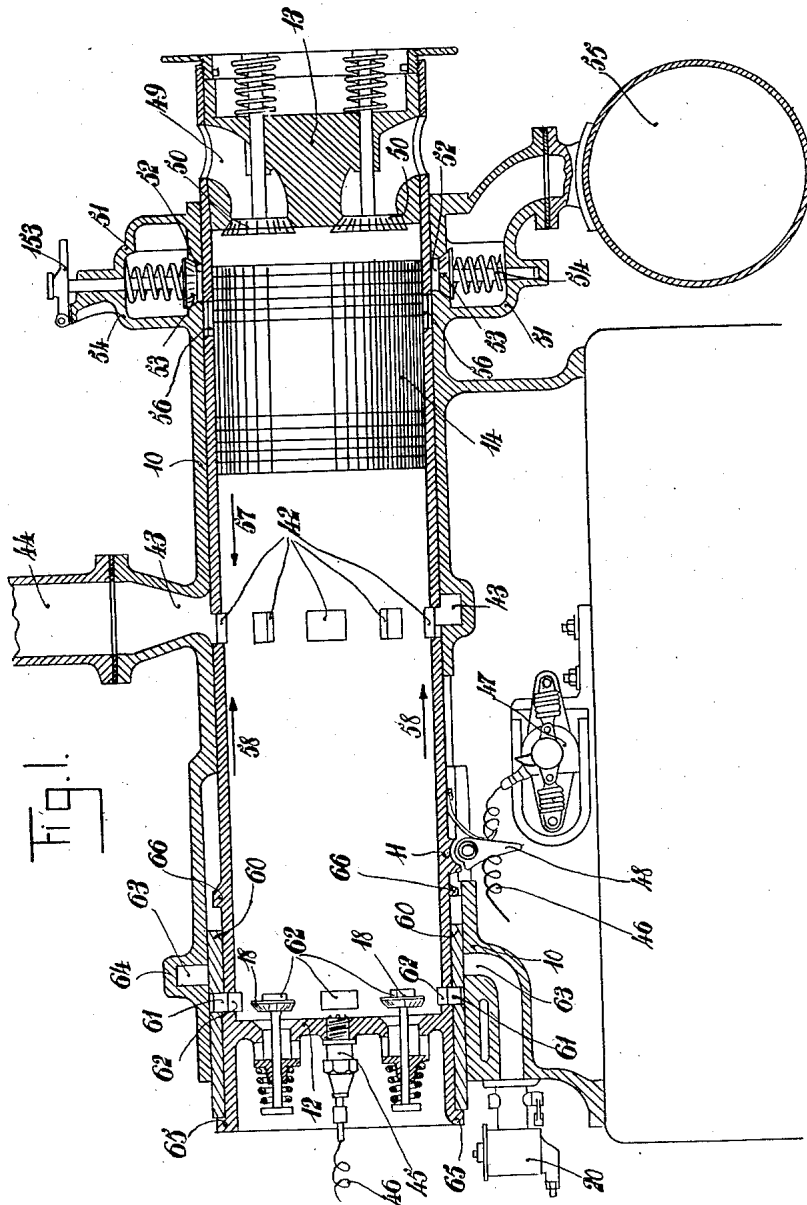


FIG. 1.

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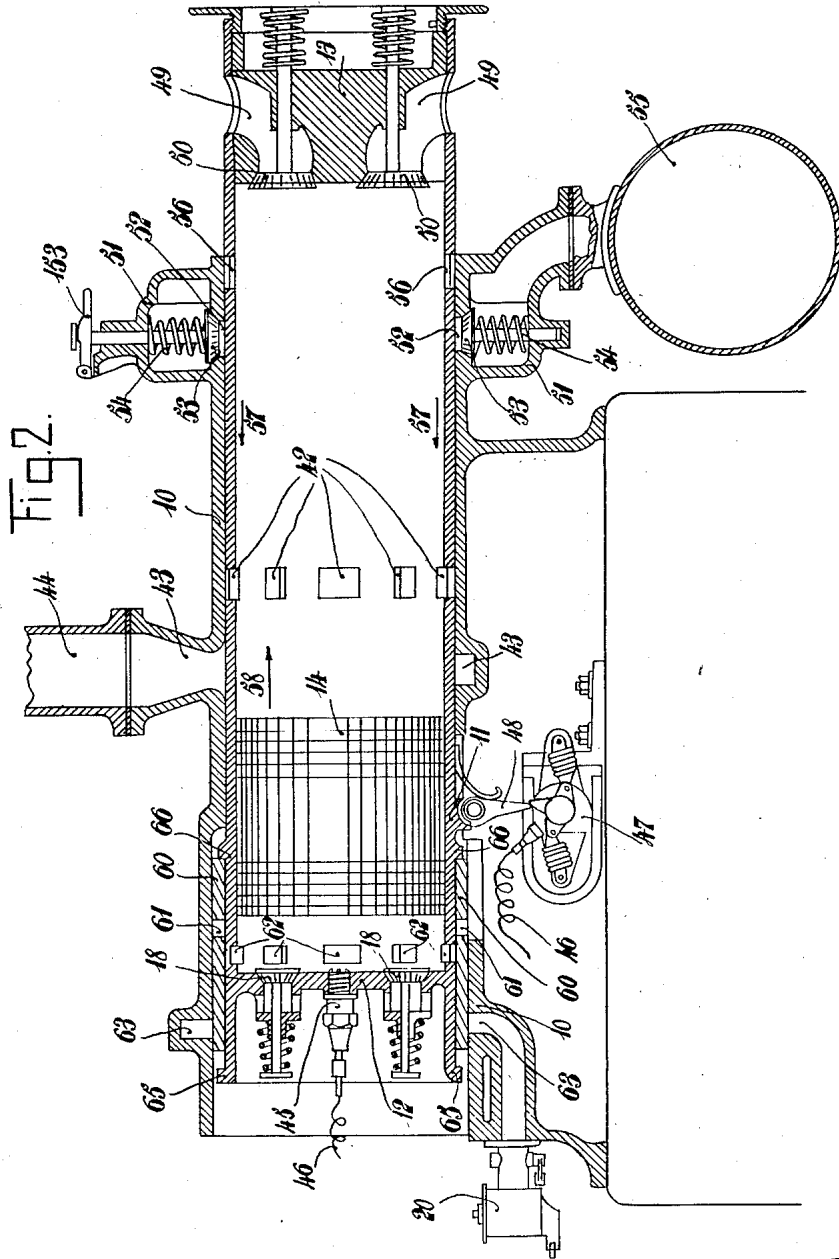
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2 Sheets-Sheet 2



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MOTOR-COMPRESSOR APPARATUS.

Original application filed June 5, 1925, Serial No. 35,250, and in France June 11, 1924. Divided and this application filed January 8, 1927. Serial No. 159,854.

The present application is a division of my application for Patent Ser. No. 35,250, filed June 5, 1925.

This invention relates to machines which are at the same time producers and transformers of energy, without mechanical connection with the outside, such for example as motor-compressor units.

It has as its principal object the nullifying of the harmful effect of vibration due to the inertia of the mass of the oscillating piston.

The invention consists essentially in so mounting in a frame the cylinder of machines of the kind mentioned as to leave said cylinder free to oscillate in the direction of its axis. The cylinder thus acquires an oscillatory movement isochronous with that of the piston whose amplitude has a constant relation with the corresponding stroke of the piston.

The mutual damping of the two oscillatory movements at each end of a stroke is accomplished by means of elastic bodies such as gaseous masses compressed and interposed between the piston and the cylinder ends.

The invention further consists in utilizing the oscillatory movement of the cylinder to ensure, wholly or in part, the general distribution operations of the machine. Among such operations I will quote, by way of example, the opening and closing of the orifices for admitting fresh gas, the opening and closing of the orifices for the exhaust of burnt gas, the ignition of the charge, these functions being fulfilled directly by the movement of the cylinder, provided with suitable ports and sleeves.

The invention thus generally described includes a large number of applications to which naturally the protection of the present patent should be extended, as also to apparatus of all kinds utilizing its principle, and to their separate parts.

The invention will be well understood by reference to the construction hereinafter described and shown in the annexed drawings, which however, as must be clearly understood, are only given by way of example.

In the accompanying drawings Figure 1 is a longitudinal section of a motor compressor unit constructed in accordance with the invention.

Figure 2 is similar to Fig. 1 and shows certain parts in a different position.

In accordance with the invention and referring more especially to its constructional form shown in Figures 1 and 2, supposing it is desired to make a motor compressor unit, this can be done as follows or in some similar way. In a fixed horizontal frame 10, having a smooth cylindrical bore, there is arranged a cylinder 11 having an easy fit within the frame 10. The cylinder 11 is closed at both ends by the cylinder heads 12 and 13 rigidly connected to said cylinder; a gas tight piston 14 is free to oscillate within the cylinder 11.

The face of the piston turned towards the head 12 receives the driving impulse, that facing the head 13 does the work of compression.

To this end, the head 12 carries two spring loaded valves 18 opening inwards, and admitting air from the atmosphere within the cylinder 11. This air is used for scavenging the cylinder 11, as will hereinafter appear.

Between the cylinder 11 and the frame 10 is arranged a sleeve 60, having an easy sliding fit, on the one hand, over the cylinder 11, and on the other hand in the frame 10. The sleeve 60 carries ports 61 capable of registering on the one hand, with ports arranged in the cylinder 11, and, on the other hand, with orifices 63 in the wall of the frame 10, which communicate by means of a circular recess 64 with a carburetter 20. Finally the cylinder 11 is provided externally with two annular stops 65 and 66 adapted to limit the relative movements of the sleeve 60 with respect to the cylinder 11.

The cylinder 11 carries at 42 openings for the exhaust of the burnt gas, which can correspond with openings arranged in the frame 10. The said openings all lead into a circular channel 43 which leads to the exhaust orifice 44.

The ignition of the charge is effected by means of a spark plug 45 arranged in the cylinder head 12 and connected by a wire 46 with a trip magneto 47. The magneto 47 is rigidly attached to the frame of the apparatus and is actuated by means of a pawl fixed to the cylinder 11 and moving with it.

On the compressor side of the apparatus, the cylinder head 13 is provided with con-

duits 49 communicating at one end with the atmosphere and at the other with the interior of the cylinder. Automatic suction valves 50 thus allow the intake of air into the cylinder 11 when a vacuum is there produced by the movement of the piston 14.

The frame 10 carries laterally a circular recess 51 pierced with various openings 52, controlled by automatic discharge valves 53 which are loaded by springs 54. The recess 51 is in communication with a pressure reservoir 55.

The cylinder 11 further carries a series of ports 56 which are capable of registering with the openings 52.

The apparatus operates in the following way.

The reservoir 55 being filled with compressed air the piston 14 is brought so that its right-hand face is level with the ports 56, for example, by inserting a rod through the spark plug opening in the cylinder head. The cylinder 11 is positioned in such a way that its ports 56 correspond with the openings 52 in the frame 10. The spark plug 45 is replaced in position after gasoline has been injected into the cylinder 11. One of the valves 53 may be opened temporarily by means of the lever 153 so that compressed air from the reservoir 55 passes through the openings 52 and the ports 56 and acts on the compressor face of the piston.

This latter is thus forcibly pushed towards the cylinder head 12, in the direction of the arrow 57; after having passed the exhaust openings 42, it compresses in front of itself the air now highly carburetted with gasoline. The cylinder has also received the impulse of the compressed air and has started to move in the direction of the arrow 58. When the piston 14 arrives at the end of its stroke, the pawl 48 acts on the magnet 47. A spark is produced at the spark plug 45 and the explosion of the charge takes place.

From now on the apparatus is in normal working condition and to explain its working more clearly I will examine what happens successively on the motor side and on the compressor side.

Forward stroke—Driving side.

In Fig. 2 the cylinder 11 is impelled by the force of the explosion in the direction of the arrow 57 and the piston 14 in the direction of the arrow 58.

The sleeve 60 occupies the position shown in Fig. 2 and rests against the stop 66. The piston 14 reaches the exhaust openings and just as its face opposite the cylinder head 12 uncovers the openings 42, these have come, owing to the movement of the cylinder 11, into communication with the channel 43. It is to be noted that the passage of the ports 61 and 62 over the orifice 63 is not si-

multaneous and that no communication can take place between the interior of the cylinder and the carburettor 20.

Exhaust then takes place by the orifice 44. To this orifice is adapted a tube several meters long, in which the exhaust gases expand and acquire a great velocity. Their inertia thus creates, in the cylinder 11, a considerable degree of vacuum which sucks in, through the automatic valves 18, a large quantity of fresh air which scavenges the interior of the cylinder 11 and expels the burnt gases. The exhaust openings 42 are calculated so as to remain open during the whole of the movement of the piston 14 backwards and forwards, between the ports 42 and the end of its stroke towards the head 13. Towards the end of the stroke, the movement of the cylinder 11 is restrained and, at the dead point, the sleeve 60 slides by inertia from the stop 66 to the stop 65, towards the position shown in Fig. 1.

Compressor side.

On the compressor side, the piston 14 and the head 13 of the cylinder 11 move towards each other, and produce at first a compression of the air contained in the cylinder space between the piston 14 and the cylinder head 13. This air, being unable to escape through the orifices 42 which are not in communication with the atmosphere except after the passage of the piston 14, is immediately driven into the reservoir 55 through the ports 56 and the openings 52, as soon as the pressure becomes sufficient to raise the weighted valves 53. Almost on arriving at the end of the stroke, the piston and cylinder damp their mutual movement on a gaseous mass which remains imprisoned between them and stores up enough energy to ensure the return of the piston 14 to the other end of its stroke.

Return stroke—Motor side.

The piston 14 and cylinder 11 are thus returned (Fig. 1) respectively in the direction of the arrows 57 and 58 by the gas buffer. The piston 14 first drives before it the burnt gases which have followed it beyond the exhaust ports 42. But as beyond said ports these gases meet with a strong current of fresh air coming toward them, they are unable to pass into the part of the cylinder comprised between the ports 42 and the cylinder head 12. They are driven out through the ports 42 which are still open as already explained above.

At this moment, the valves 18 are closed and the ports 61 and 62 coincide. The position of these ports is calculated with regard to the openings 63 in such a way that when the piston 14 is near the exhaust openings 42, the three openings 61, 62, 63 coincide. As there is still a certain amount of

vacuum in the motor side of the apparatus kept up by the inertia of the gases in the exhaust tube, a certain quantity of very highly carburetted air passes from the carburettor 20 into the cylinder 11 through the openings 61, 62, and 63. The carburettor 20 is so adjusted as to give a much richer charge than is customary, for the reason that this air, very rich in combustible, mixes with the pure scavenging air previously admitted through the valves 18. During this period the piston 14 passes beyond the ports 42 which no longer communicate with the exhaust owing to the movement of the cylinder 11 in an opposite direction.

The piston 14 and the cylinder 11 continue their movement, the ports 61 and 63 cease to be in communication and the cylinder space is closed. At the end of the movement of the piston and cylinder, the sleeve 60, sliding on the cylinder, is again urged by inertia against the stop 66 and occupies the position shown in Fig. 2, so that the openings 61 and 62 cease in turn to coincide.

The carburetted air enclosed between the cylinder and piston is compressed until the moment when the pawl 48 actuates the magneto 47 and a fresh explosion of the charge is produced.

Compressor side.

The air-buffer enclosed between the piston 14 and the cylinder 11, on the side of the cylinder head 13, expands at once. The movement of these two parts next produces a slight vacuum which causes the automatic valves 50 to lift.

Through the conduits 49, the cylinder 11 then fills with air, until the cessation of the movement at the instant of the explosion. It is interesting to note that the arrangement of the valves 50 in the cylinder head 13 offers certain advantages. Thus their opening takes place when the buffer of air has reached its full expansion, that is to say, when no acceleration is acting on the different oscillating bodies. Their closing, on the other hand, coincides with the comparatively sudden stoppage of the cylinder 11 and its sudden departure in an opposite direction due to the effect of the explosion. It is easy to see that the sudden acceleration caused by the movement of the cylinder 11 results in forcibly seating the intake valves 50 and in bringing about an extremely rapid closing of the conduits 49.

The movements of the piston 14 and the cylinder 11 continue in this way indefinitely, ensuring the intake of carburetted air during one stroke of the cylinder and piston, and preventing any communication with the carburettor during the return, in the opposite direction, of these members.

The distributing device shown in Figures 1 and 2 is applicable to any of the distrib-

uting openings which have to be uncovered during a part or whole of the stroke of the piston 14, but which have to remain closed during the stroke in the opposite direction of said piston.

I claim:

1. In an apparatus comprising a frame, a cylinder, a free piston reciprocating in said cylinder, said cylinder being mechanically free to reciprocate with respect to said frame, and a distributing device for said cylinder, said device comprising ports in said cylinder and orifices in said frame, said ports and orifices being adapted to register at one point of each travel of the cylinder.

2. In an apparatus comprising a frame, a cylinder, a free piston reciprocating in said cylinder, said cylinder being mechanically free to reciprocate with respect to said frame, and a distributing device for said cylinder, said device comprising ports in said cylinder and orifices in said frame, said ports and orifices being adapted to register at one point of each travel of the cylinder, and a movable device adapted to block communication between the ports and orifices when they are in register during movement of the cylinder in one direction.

3. In an apparatus comprising a frame, a cylinder, a free piston reciprocating in said cylinder, said cylinder being mechanically free to reciprocate with respect to said frame, and a distributing device for the ports of said cylinder, said device comprising a sleeve arranged between the cylinder and the frame and having an easy sliding fit relative to the cylinder and to the frame.

4. In an apparatus comprising a frame, a cylinder, a free piston reciprocating in said cylinder, said cylinder being mechanically free to reciprocate with respect to said frame, and a distributing device for the ports of said cylinder, said device comprising a sleeve arranged between the cylinder and the frame and having an easy sliding fit relative to the cylinder and to the frame, said cylinder and frame having ports controlled by said sleeve.

5. In an apparatus comprising a frame, a cylinder, a free piston reciprocating in said cylinder, said cylinder being mechanically free to reciprocate with respect to said frame, and a distributing device for the ports of said cylinder, said device comprising a sleeve arranged between the cylinder and the frame, and having an easy sliding fit relative to the cylinder and to the frame, said sleeve having ports capable of registering with other ports arranged in the cylinder and also with orifices in the wall of said frame.

6. In an apparatus comprising a frame, a cylinder, a free piston reciprocating in said cylinder, said cylinder being mechanically free to reciprocate with respect to said

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frame, and a distributing device for the ports of said cylinder, said device comprising a sleeve arranged between the cylinder and the frame and having an easy sliding fit relative to the cylinder and to the frame, said cylinder having stops for limiting the extent of motion of said sleeve.

7. In an apparatus comprising a frame, a cylinder, a free piston reciprocating in said cylinder, said cylinder being mechanically free to reciprocate with respect to said frame, and a distributing device for the ports of said cylinder, said device comprising a sleeve arranged between the cylinder and the frame and having an easy sliding fit relative to the cylinder and to the frame, one of said stops ensuring registration of ports in the sleeve with ports in the cylinder.

8. In an apparatus comprising a frame, a cylinder, a free piston reciprocating in said cylinder, said cylinder being mechanically free to reciprocate with respect to said frame, and a distributing device for the ports of said cylinder, said device compris-

ing a sleeve arranged between the cylinder and the frame and having an easy sliding fit relative to the cylinder and to the frame, said sleeve having ports capable of registering with other ports arranged in the cylinder and also with orifices in the wall of said frame, stops being provided on the cylinder for limiting the movement of the sleeve relative to the cylinder, one of said stops ensuring registration of the openings in the sleeve with those in the cylinder.

9. In an apparatus comprising a frame, a cylinder, a free piston reciprocating in said cylinder, said cylinder being mechanically free to reciprocate with respect to said frame, and a distributing device for said cylinder, said device comprising ports in said cylinder and orifices in said frame, said ports and orifices being adapted to register at one point of each travel of the cylinder during the passage of the piston over said ports.

RAUL PATERAS PESCARA.

CERTIFICATE OF CORRECTION.

Patent No. 1,657,641.

Granted January 31, 1928, to

RAUL PATERAS PESCARA.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 2, line 47, for the word "condition" read "conditions", and lines 126 and 127, for "reward" read "regard"; and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 21st day of February, A. D. 1928.

Seal.

M. J. Moore,
Acting Commissioner of Patents.