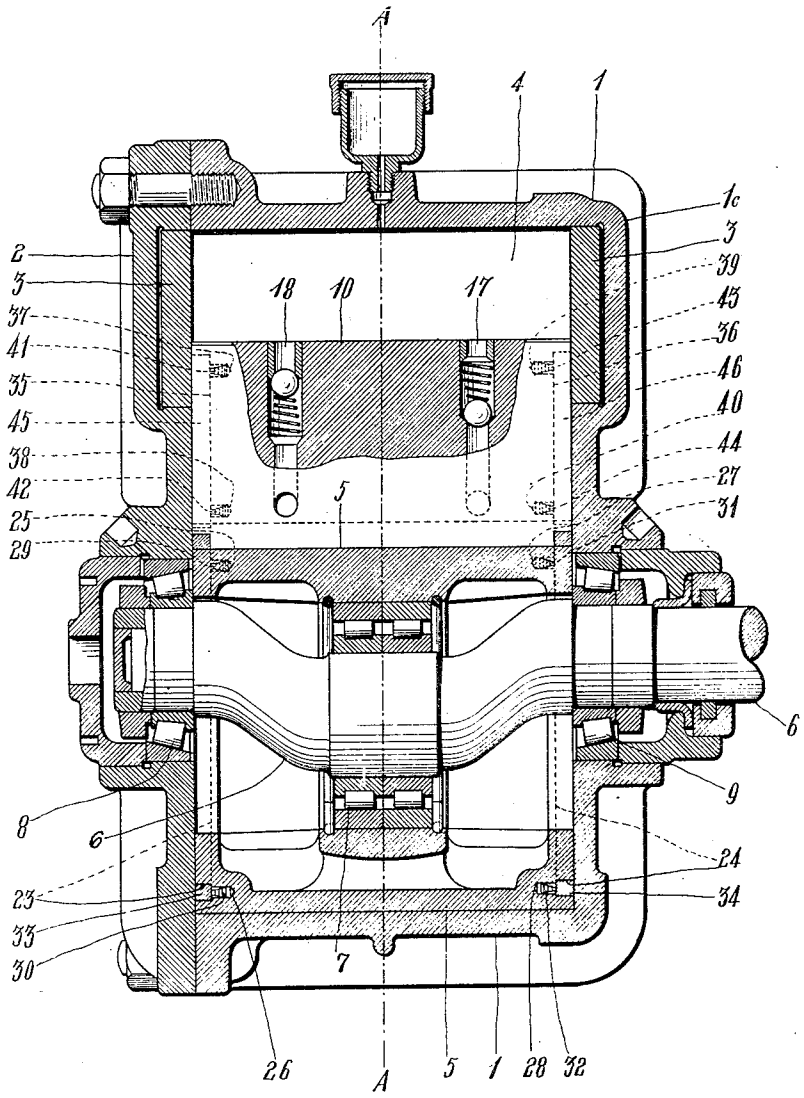
Feb. 21, 1933. G. TAMURA 1,898,153

SUCKING AND COMPRESSING MACHINE

Filed Sept. 11, 1930. 4 Sheets-Sheet 1

Fig. 1



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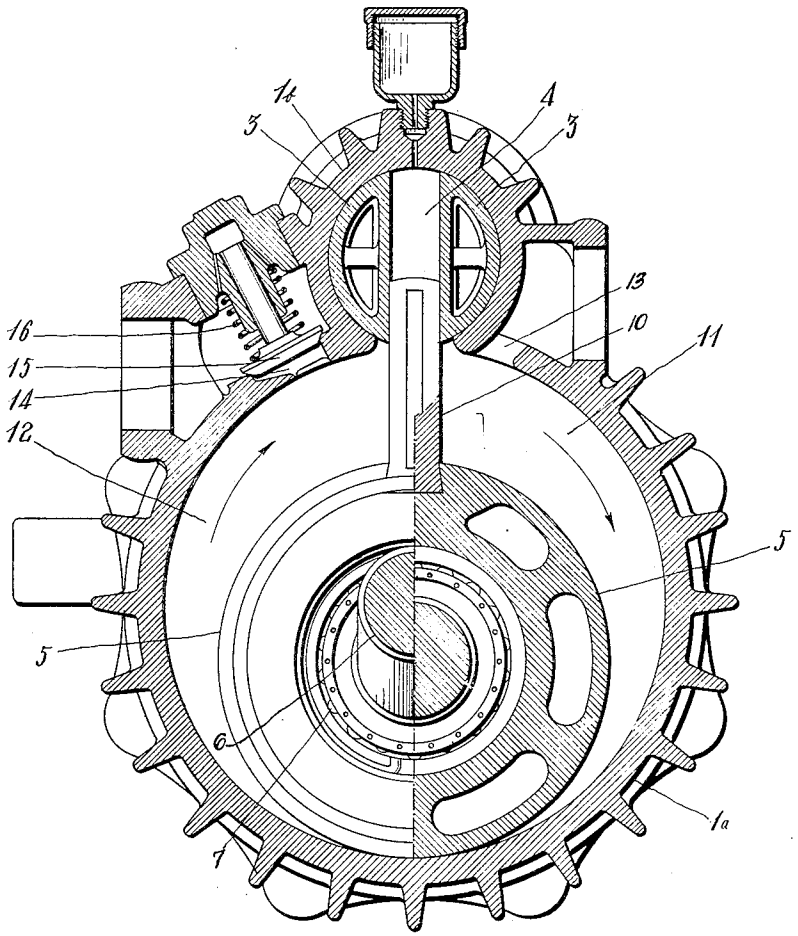
By Irving C. Cathcart
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SUCKING AND COMPRESSING MACHINE

Filed Sept. 11, 1930 4 Sheets-Sheet 2

Fig. 2



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SUCKING AND COMPRESSING MACHINE

Filed Sept. 11, 1930 4 Sheets-Sheet 3

Fig. 3

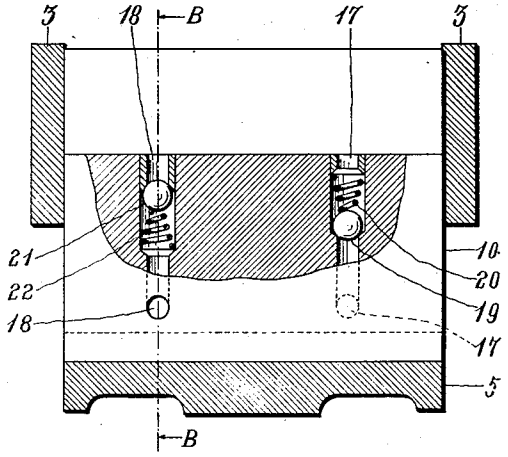


Fig. 4

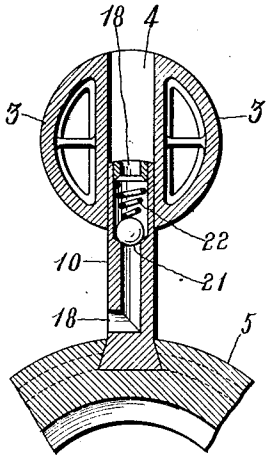


Fig. 5

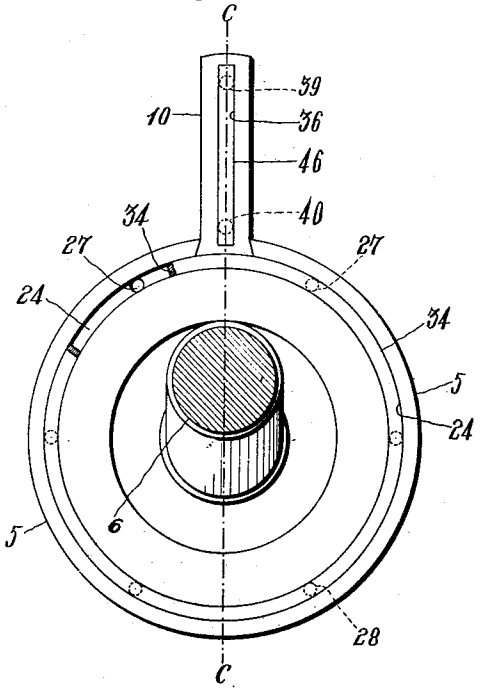
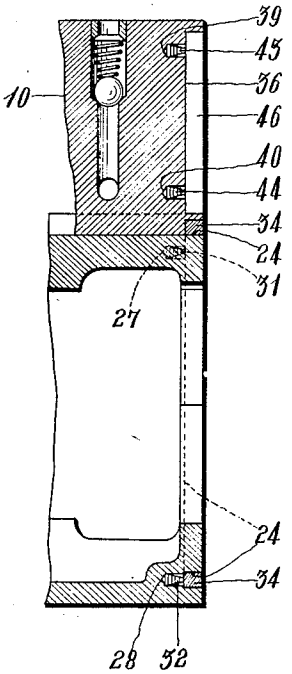


Fig. 6



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SUCKING AND COMPRESSING MACHINE

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Fig. 7

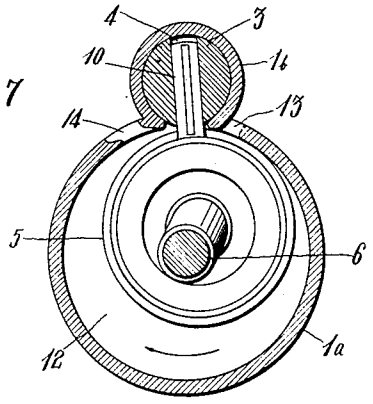


Fig. 8

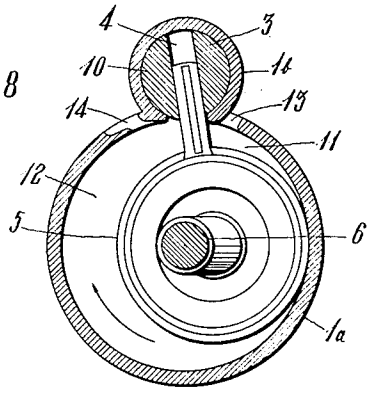
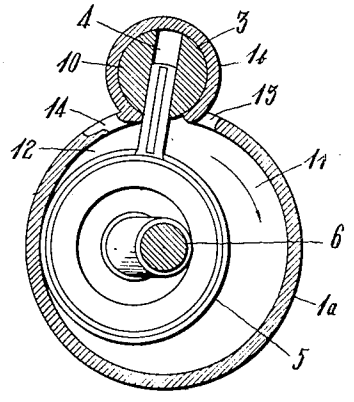


Fig. 9



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Patented Feb. 21, 1933 1,898,153

UNITED STATES PATENT OFFICE

GENTARO TAMURA, OF HIGASHIYODOKAWA-KU, OSAKA, JAPAN

SUCKING AND COMPRESSING MACHINE

Application filed September 11, 1930. Serial No. 481,323.

In the existing sucking and compressing machine which possesses a rolling plunger and partition plate in a cylindrical casing, a partition plate is provided, one end of which is fixed to a swinging plunger supported by a part of said cylindrical casing wall, and the other end of said partition plate is arranged to slide accurately in a slit which is grooved in the rolling plunger, and the inner hollow part of said casing is divided into two parts by the rolling plunger and partition plate, and is made to carry out a sucking or compressing action by rolling the rolling plunger which is driven by an eccentric shaft, along the inner side of said casing and in this way is compelled to decrease the capacity of the machine because of the unavoidable decrease of space between the surface of the rolling plunger and the inner side of the casing.

This invention relates to an improvement in sucking and compressing machines and has for its object the production of a machine which will not only remove such defect as stated above, but one where the capacity of the machine will be greatly increased and where a more effective sucking and compressing action will be produced.

The drawings annexed illustrate the machine and its details, as follows:

Figure 1 is a longitudinal sectional view of the machine.

Figure 2 is a transverse sectional view of the machine along line A—A of Figure 1.

Figure 3 is a front view of the partition plate partly shown in section.

Figure 4 is a sectional view along the line B—B of Figure 3.

Figure 5 is a side view of the rolling plunger and partition plate.

Figure 6 is a sectional view along the line C—C of Figure 5.

Figures 7, 8 and 9 are transverse sections through the rolling plunger showing the changing positions of the rolling plunger while in operation.

As shown in the accompanying drawings, 1 designates the outer casing which is engaged by a side cover 2, which constitutes a cover for the open side of the outer casing 1.

A cylindrical swinging plunger 3 which has a slit along its longitudinal center line, is fitted in the small cylinder 1^b formed upon the top of the casing 1, and the swinging plunger 3 is adapted to be rotated freely, being held at both ends in bearing shaped round sockets which are formed in both side walls 2 and 1^c of the casing.

A rolling plunger 5 is held on a crank shaft 6 provided with ball or roller bearings 7, which are supported by the roller bearings 8 and 9, or other suitable installations placed in both side walls of the casing.

A partition plate 10 is provided, one end of it being made to slide in the slit 4 in the swinging plunger 3, and the other end of it is fixed to the rolling plunger 5. Both sides of the rolling plunger and partition plate are extended to both inner surfaces of the casing wall, and divide the inner space of large cylinder 1^a into two parts 11 and 12 as the rolling plunger engages the bottom of the casing 1.

A suction or intake port 13 and an exhaust port 14 are provided at the junction of the large cylinder 1^a and small cylinder 1^b, and a valve 15 controls the delivery or exhaust port 14 which valve is normally held closed by a spiral spring 16.

As the crank shaft 6 is rotated in the direction illustrated in the figures, the rolling plunger 5 will have a rolling motion on the inner surface of the casing, contacting very closely therewith from the position shown in Figure 7 to the position in Figure 8, Figure 2 and Figure 9 in the order shown. The above mentioned rolling motion of the rolling plunger may be carried out perfectly, by making the difference between the radius of

the rolling plunger 5 and the inner radius of the large cylinder 1ª equal to the eccentricity of the crank shaft.

During the rolling motion of the rolling plunger, the partition plate 10 will slide in the slit 4 of swinging plunger 3, which will swing according to the inclination of partition plate 10.

As the rolling plunger 5 returns again from the initial position illustrated in Figure 7 to the same position after rolling through the positions shown in Figure 8, Figure 2 and Figure 9 in the order named the chamber 11 in the casing will be increased gradually and air (or another fluid) will be sucked into the said chamber from port 13, and after the rolling plunger passes over the port 13, said chamber 11 will be decreased and air in the said space will be compressed. Then the compressed air is delivered from the outlet port 14. The numeral 11 in the figures designates the space constituting an intake chamber and the numeral 12 designates the space constituting a compressing chamber.

Passages 17 and 18 are provided in the partition plate 10, and the upper ports of these passages are opened to the slit 4 on the upper side of said partition plate, and the lower port of one of these passages 17 is opened to the intake or suction chamber 11, and the lower port of the other passage 18 is opened to the compression chamber 12. As shown in Figures 3 and 4, the passage 17 communicating with the intake or section chamber will admit a flow from the suction chamber 11 to the slit 4, at the same time not permitting a counter flow because of the ball valve 19 which will close the passage 17 by means of the spiral spring 20 or another suitable valve arrangement. On the other hand, the passage 18 which communicates with the compression chamber 12 will admit a flow from the slit 4 to the compression chamber but will not admit a counter flow, because of the ball valve 21 which is normally held closed by means of the spiral spring 22 or other suitable valve arrangement.

During the operating of the machine the partition plate 10 performs a backward sliding motion in the slit 4 and air will be sucked into said slit from suction chamber 11 through the passage 17, and on the contrary as the partition plate 10 performs a forward sliding motion in the slit 4, air will be compressed in said slit, and be delivered to the compression chamber 12 through the passage 18. In this way as above mentioned, a low and high pressure which may otherwise be produced in the slit 4 will be neutralized, and a wasting resistance against the sliding motion of partition plate 10 in the direction of both forward and backward movement will be eliminated. Accordingly the driving of the rolling plunger is performed smoothly. Furthermore, the capacity of the machine is increased, by adding the sucking and compressing action in the slit 4, to the proper sucking and compressing action of the machine.

As illustrated in Figures 5 and 6, the circular grooves 23 and 24 are provided in both sides of the rolling plunger 5, close to the circumference of said plunger, and several spring sockets 25, 26, 27 and 28 are bored in the said grooves, in which are arranged the spiral springs 29, 30, 31 and 32. Then the packing rings 33, and 34 are installed in said circular grooves. Also the upright grooves 35 and 36 are formed in both sides of partition plate 10, and the lower ends of said grooves are closed to the circular grooves 23, and 24 of the rolling plunger, and are provided with the spring sockets 37, 38, 39 and 40 in which are mounted spiral springs 41, 42, 43 and 44 for engaging the packing bars 45 and 46.

When the rolling plunger with the partition plate has been installed in the casing, the spiral springs 29, 30, 31, 32, 41, 42, 43 and 44 will be slightly compressed, and the packings 33, 34, 45 and 46 will contact very closely with the inside of the casing wall because of the elastic force of said springs. In this way, the plunger 5 and partition plate 10 will be protected from wear, and also a perfect fit will be obtained to prevent leakage, between the suction and compression chambers while the machine is running.

This machine is not only used as an air compressor, as above mentioned but it should be obvious that it may be made available as a vacuum pump and a compressing or sucking machine for any fluid, by eliminating the delivery valve 15 which is situated on the delivery port 14, or leaving the valve as it is, and if necessary, adding a suitable check valve in the suction port 13. Furthermore, it is possible to utilize the new machine as a prime mover, by attachment with or without a suitable valve arrangement to the suction and delivery port, and letting the delivery port 14 be an inlet port for power generative gas or vapour such as compressed air, steam, gas produced from any fuel, etc., and having the rolling plunger driven by expansion of said gas in the casing.

In this invention, as above mentioned, the inner space of the casing is divided into two parts by installing a rolling plunger and a partition plate in said casing which performs a sucking or compressing action by closely rolling the plunger along the inner surface of the casing. The lower end of the partition plate is fixed to the rolling plunger which is adapted to slide in the slit which is formed in the swinging plunger. Therefore, there is no necessity for providing a slit or guide in the rolling plunger for the sliding of the partition plate, as required in existing machines, and it will not be necessary to reduce the

diameter of the plunger and the inner diameter of the casing. Accordingly, a maximum amount of space may be provided in the casing thereby increasing the capacity of the machine to a remarkable extent.

Furthermore, as the partition plate 10 is provided with two passages 17 and 18 communicating with each valve, which valves are adapted to permit only entering or delivering of air, as already mentioned, the machine can be run very smoothly, by neutralizing a high or low pressure which might otherwise be produced in the slit 4, during the operation of the machine.

One of the important elements of this invention lies in the packing rings 33 and 34 which are provided on both sides of the rolling plunger, and the packing bars 45 and 46 mounted on both sides of the partition plate. By means of this structure the suction or intake compartment 11 is perfectly cut off from the compression chamber 12, without causing the side surface of the plunger and partition plate to contact against the inner surface of the casing. Only the packing rings will engage the inner surface of the casing. The plunger and partition plate will in this way be protected from wear, and leakage will be prevented.

What I claim as new is:

1. A machine of the class described comprising a casing, a rolling plunger mounted therein, a swinging plunger mounted adjacent said rolling plunger, intake and exhaust valves carried by said casing, a partition plate carried by said rolling plunger, said swinging plunger provided with a slit formed therein for receiving said partition plate, said plate being slidably mounted within said slit, said intake and exhaust valves being independent of said partition plate, said partition plate dividing said casing into an intake compartment and a compression compartment, means formed in said partition plate for controlling the flow of pressure from said intake compartment to the slit formed in said swinging plunger and preventing the return flow of pressure to said intake compartment, and means formed in said partition plate for controlling the flow of pressure from said slit in said swinging plunger to said compression compartment and preventing the return flow from said compression compartment to said slit.

2. A machine of the class described comprising a casing, a rolling plunger mounted therein, a swinging plunger mounted adjacent said rolling plunger, a partition plate carried by said rolling plunger and working transversely through said swinging plunger, said partition plate dividing said casing into an intake and a compression compartment, said partition plate provided with a port for forming a communication between said intake compartment and said swinging plunger, means formed in said port for preventing a return flow through said port, said partition plate provided with a second port forming a communication between said compression compartment and said swinging plunger, means for preventing a return flow through said second port, and intake and exhaust means communicating respectively with said intake and compression compartments.

In witness whereof I have signed this specification.

GENTARO TAMURA.