S. LARSSON.

MACHINE, APPLICABLE AS PUMP, COMPRESSOR, OR MOTOR.

APPLICATION FILED DEC. 23, 1919.

1,367,914.

Patented Feb. 8, 1921.

3 SHEETS—SHEET 1.

Fig. 1

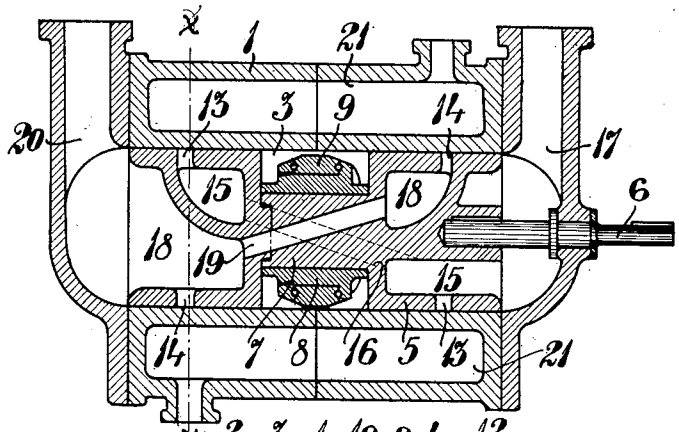


Fig. 2

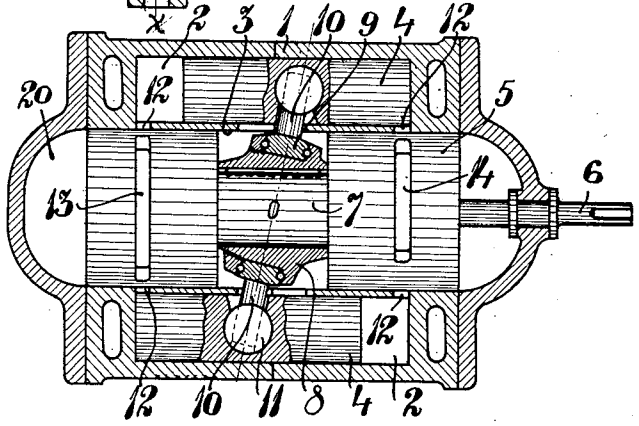
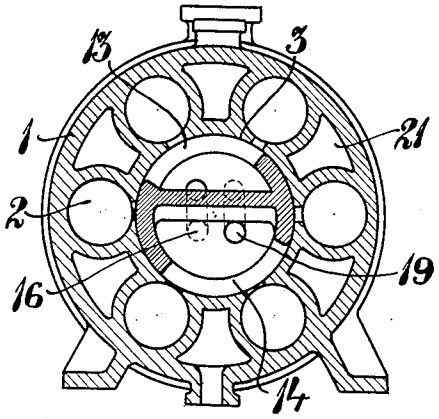


Fig. 3



Inventor

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Fig. 4

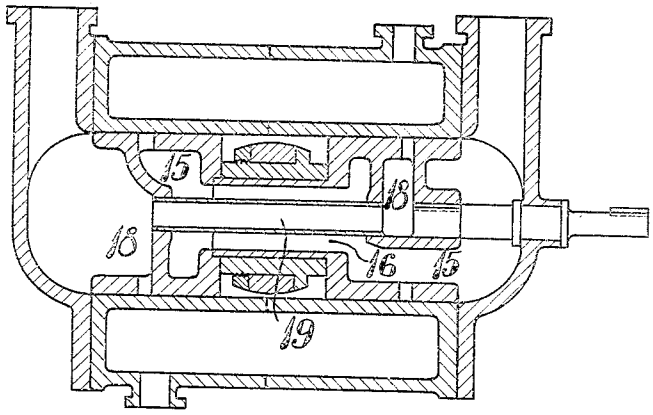
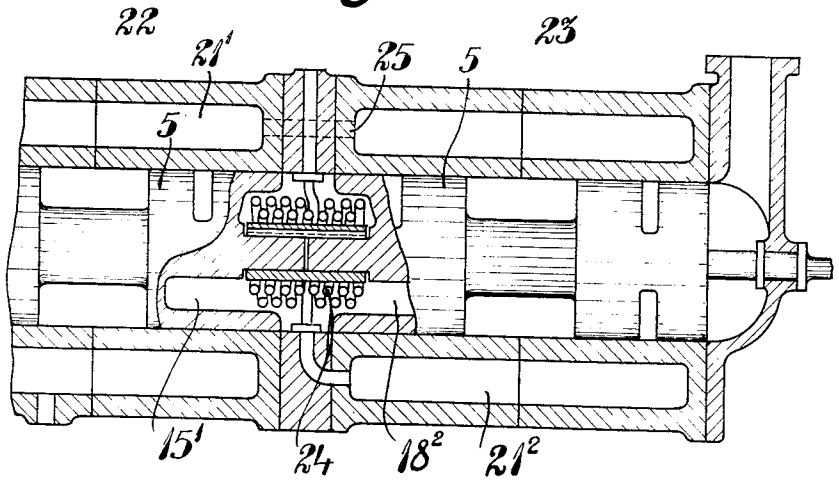


Fig. 5



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3 SHEETS—SHEET 3.

Fig. 6

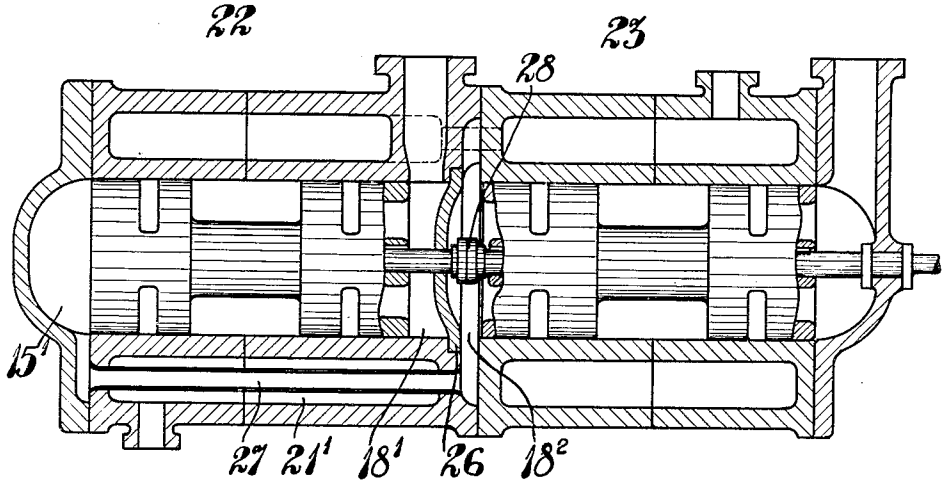
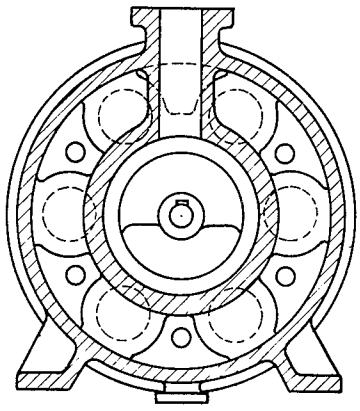


Fig. 7



Inventor,
Sven Larsson.
By Lawrence & Co Atty.

UNITED STATES PATENT OFFICE

SVEN LARSSON, OF STOCKHOLM, SWEDEN.

MACHINE, APPLICABLE AS PUMP, COMPRESSOR, OR MOTOR.

1,367,914. Specification of Letters Patent. Patented Feb. 8, 1921.

Application filed December 23, 1919. Serial No. 346,997.

To all whom it may concern:

Be it known that I, SVEN LARSSON, a citizen of the Kingdom of Sweden, residing at Stockholm, Sweden, have invented new and useful Improved Machines, Applicable as Pumps, Compressors, or Motors, of which the following is a specification.

This invention relates to a machine, applicable as pump, compressor or motor, of the kind which comprises a plurality of axially reciprocating pistons mounted in a cylindrical drum, the reciprocation of the pistons being derived from a rotary driving shaft centrally mounted in the drum and carrying obliquely-acting driving means for the pistons.

In motors of this kind, as heretofore known, the cylinder chambers are at each end of the drum connected to an outer suction chamber along one half of the periphery of the drum, and to an outer discharge chamber along the other half of the periphery of the drum. The suction chambers at opposite ends of the drum are connected together by an outer connection, and a similar connection is provided between the two discharge chambers situated at opposite ends of the drum. Said arrangement of the suction and discharge chambers and of the connections therebetween will render the construction bulky and complicated.

The object of the invention is to provide an improved arrangement of said chambers and connections, whereby a considerable reduction of the dimensions of the machine and a simple construction will be obtained.

The invention is characterized chiefly in that the driving shaft is formed as a rotary slide valve within the drum and that said slide valve is provided with separate suction and discharge passages to alternately bring the cylinder-chambers in communication with a main suction connection at one end of the drum, and a main discharge connection at the other end of the drum.

In the accompanying drawing, several embodiments of the invention are illustrated. Figure 1 shows a vertical longitudinal section of a machine according to one embodiment of the invention. Fig. 2 shows a horizontal longitudinal section through same machine. Fig. 3 shows a cross section on the line X—X in Fig. 1. Fig. 4 shows a longitudinal section through a machine according to another embodiment of the invention. Fig. 5 shows a similar section through a machine according to a third embodiment of the invention. Figs. 6 and 7 show longitudinal section and cross section, respectively, of a machine according to a fourth embodiment of the invention.

In the embodiment shown in Figs. 1–3, the numeral 1 indicates a stationary drum, divided transversely and containing a plurality of cylinder chambers 2 arranged near the periphery of the drum and concentrically with respect to the axis of the drum, the drum being further formed with a central boring 3. Slidably mounted in each cylinder chamber is a piston 4. Fitted in the central boring 3, with true running fit, is a transversely divided rotary slide valve 5. Said slide valve is rigidly secured to a driving shaft 6. The valve 5 is formed between its ends with a portion 7 having a reduced diameter. Securely fastened on the said reduced portion 7 is a cylindrical member 8 the axis of which is inclined to the axis of the slide valve 5. Mounted on the member 8, as by means of ball bearings, is a spider 9 having one radial arm or projection 10 for each piston. The arms 10 are cylindrical in shape, and each of them engages a bore of a plug 11 rotatably and slidably mounted in a transverse hole formed in the respective piston.

The cylinder chambers communicate near each of their ends with the central boring 3 of the drum through holes 12, forming a row of holes around each end portion of the slide valve 5. The slide valve 5 is made hollow to form separate suction and discharge passages adapted to communicate with the cylinder chambers through the said holes 12. To this end the slide valve 5 is formed with two peripheral openings 13, 14 for each of said rows of holes, said openings being situated at diametrically opposite halves of the periphery of the valve. The openings 13 are each connected to a suction chamber 15 within the slide valve 5, while the openings 14 are each connected to a discharge chamber 18 within the said slide valve 5. The suction chambers 15 are connected together by a passage 16, and one of them opens in a main suction connection 17 at one end of the drum. The discharge chambers 18 are similarly connected together by a passage 19, and one of them opens in a main discharge connection 20 situated at the opposite end of the drum.

The interspaces 21 between the cylinder

chambers 2 of the drum may be utilized for cooling purposes.

The machine above described operates substantially as follows:—

Upon the rotation of the shaft 6, the valve 5 is also rotated due to its rigid connection with the driving shaft 6, the valve 5 forming in fact a part of said driving shaft. The obliquely-acting member 8 will due to its rotation with the valve 5 cause the spider 9 with its arms 10 to perform an oscillating movement, substantially in axial direction. The slight peripheral movement of the arms 10 will be compensated by the transverse movement of the plugs 11 in the holes of the pistons. While the slide valve 5 performs one revolution, each piston will perform a complete stroke, the arrangement being such that each cylinder chamber, when acting as suction chamber, will communicate with the suction passages of the slide valve 5, while communicating with the discharge passages of the said slide valve when acting as discharge chamber.

In Fig. 4 I have shown a somewhat modified construction in which the connecting passage for the discharge chambers of the valve 5 is arranged within the connecting passage for the suction chambers of said valve. This will result in the advantage that, for instance when using the machine as a compressor, the gas heated by the compression is prevented from coming into contact with and heating the outer part of the slide valve. The suction chambers 15 are interconnected by means of an axially extending passage 16, and mounted centrally in said passage is a pipe 19 forming the connecting passage between the discharge chambers 18.

In using either of the machines above described as a compressor it may be suitable to connect two or more machines to form a compound construction. In Fig. 5 a compound-compresssor is shown consisting of two machines of the above described type. The left hand machine 22 forms the high pressure compressor, and the right-hand machine forms the low pressure compressor. The discharge chamber 18^2 of the said last-mentioned machine is directly connected with the suction chamber 15^1 of the high-pressure compressor. Mounted in the space formed by said chambers 18^2 and 15^1 is an intermediate cooling device 24 surrounding the abutting ends of the slide valves 5 of the two machines. The cooling device 24 is preferably in communication with the cooling jacket 21^2 of the low pressure compressor 23, while the said cooling jacket 21^2 may be connected to the cooling jacket 21^1 of the high pressure compressor.

Figs. 6 and 7 show also a compound compressor consisting of two machines embodying this invention. In this case, the discharge chambers 18^1, 18^2 of the two compressors are situated side by side and are only separated by a wall 26. The discharge chamber 18^2 of the low pressure compressor communicates with the suction chamber 15^1 of the high pressure compressor by a pipe 27 extending lengthwise through the cooling jacket 21^1 of the high pressure compressor. In this case the said cooling jacket 21^1 of the high pressure compressor will thus effect the intermediate cooling. This construction permits a decrease of the resulting axial pressure as the axial pressures will in part counter-balance each other. The shafts or slide valves of the two compressors may be securely fastened together by a coupling 28.

It is obvious that more than two machines may be connected to form compound machines in any of the manners above described. If desired, certain machines of a compound machinery may be connected together in one of said manners, while the other machines may be connected together in the other manner.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. In a machine of the kind described, the combination of a stationary drum containing a central boring and axially disposed cylinder chambers, axially reciprocating pistons in said chambers, a rotary slide valve in said central boring containing separate inlet and outlet passages, a cover at one end of the drum containing a common inlet for said inlet passages, another cover at the other end of the drum containing a common outlet for said outlet passages, and means carried by said rotary slide valve adapted to reciprocate said pistons.

2. In a machine of the kind described, the combination of a plurality of axially reciprocating pistons, a stationary drum having a central boring and other borings axially disposed and adapted to receive said pistons said other borings forming a cylinder chamber at each end of said pistons and communicating with said central borings through holes at each of their ends, a rotary slide valve mounted in said central borings and having separate inlet and outlet passages adapted to alternately communicate with said cylinder chambers, and means carried by said rotary slide valve and adapted to reciprocate said pistons.

3. In a machine of the kind described, the combination of axially reciprocating pistons, a rotary drum having a central boring and other borings adapted to receive said pistons and forming cylinder chambers at each end thereof, said chambers communicating with said central boring through radial ports, a cover at one end of the drum containing an inlet, another cover at the

other end of the drum containing an outlet, a rotary slide valve in said central boring having separate inlet and outlet passages to alternately set said cylinder chambers into communication with said inlet and said outlet, and means carried by said rotary slide valve and adapted to reciprocate said pistons.

4. In a machine of the kind described, the combination of a stationary drum having a central boring and axially disposed cylinder chambers, reciprocating pistons in said chambers, a rotary slide valve in said central boring having separate inlet and outlet passages, the outlet passage being disposed within the inlet passage, and means carried by said slide valve and adapted to reciprocate said pistons.

5. In a compound compressor, the combination of a plurality of stationary drums arranged in alinement with each other and having each a central boring and axially disposed cylinder chambers, reciprocating pistons in said chambers, a rotary slide valve in each of said central borings having separate inlet and outlet passages, the outlet passage of one slide valve being directly connected to the inlet passage of the adjacent slide valve and means carried by said slide valves and adapted to reciprocate said pistons.

6. In a compound compressor, the combination of a plurality of stationary drums arranged in alinement with each other and having each a central boring and axially disposed cylinder chambers, reciprocating pistons in said chambers, a rotary slide valve in each of said central borings having separate inlet and outlet passages, the outlet passage of one slide valve being directly connected to the inlet passage of the adjacent slide valve, a cooling device arranged in a chamber formed by the said interconnected outlet and inlet passages, and means carried by said slide valves and adapted to reciprocate said pistons.

7. In a compound compressor, the combination of a plurality of stationary drums arranged in alinement with each other and having each a central boring and axially disposed cylinder chambers, reciprocating pistons in said chambers, a rotary slide valve in each of said central borings having separate inlet and outlet passages, the outlet passages of two adjacent slide valves opening in the ends of said slide valves facing each other, a partition separating said chambers from one another, cooling jackets disposed between the cylinder chambers of the drums, the outlet passage of one slide valve being connected to the inlet passage of the adjacent slide valve by means of a connection extending through the cooling jacket of the drum corresponding to the said last mentioned slide valve.

In testimony whereof I have signed my name.

SVEN LARSSON.