June 5, 1923.

1,457,696

E. T. FORD

COMPRESSOR

Filed June 8, 1920

2 Sheets-Sheet 1

Fig. 1

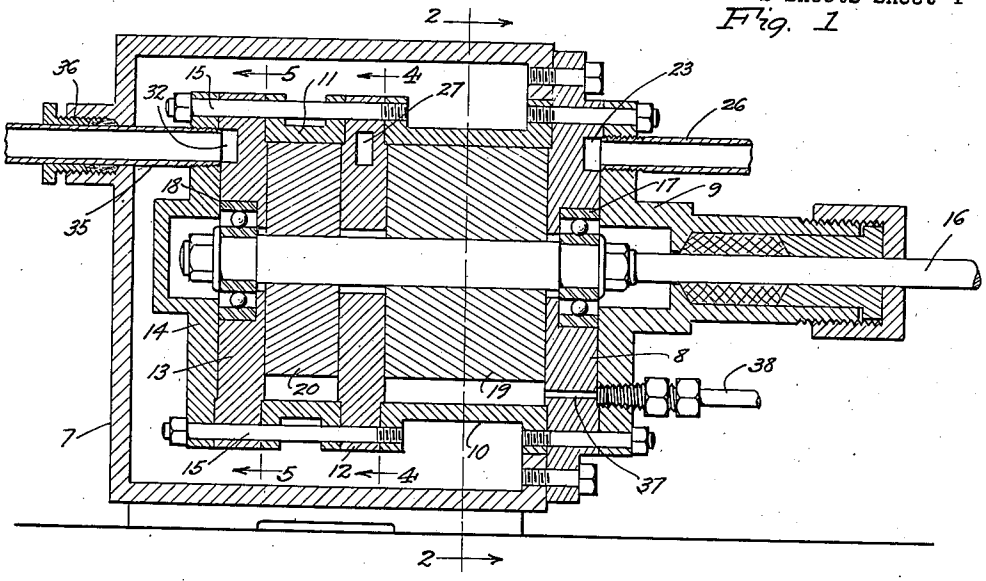


Fig. 2

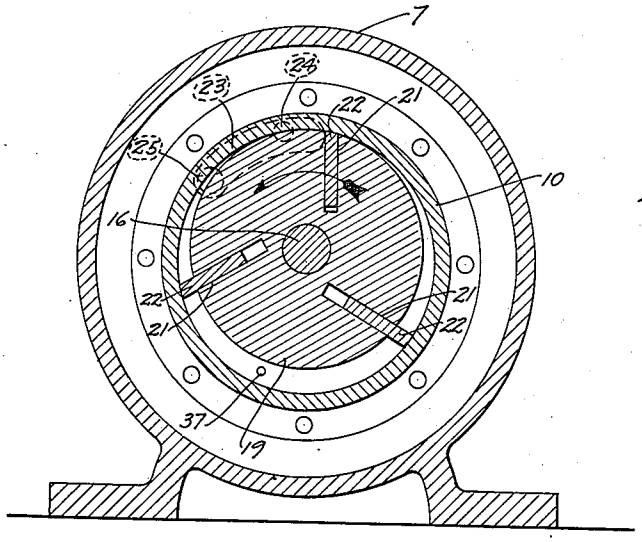
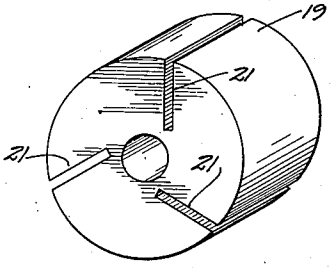


Fig. 3



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COMPRESSOR

Filed June 8, 1920 2 Sheets-Sheet 2

Fig. 4

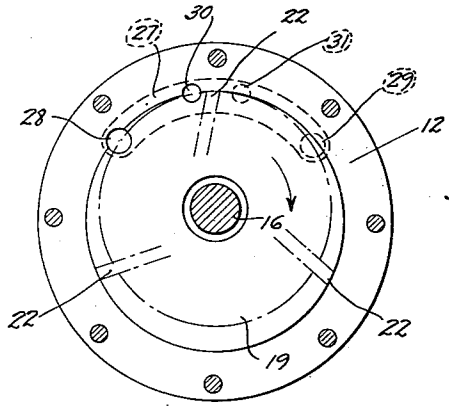


Fig. 5

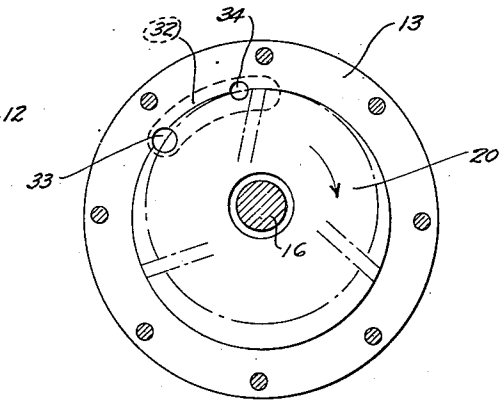
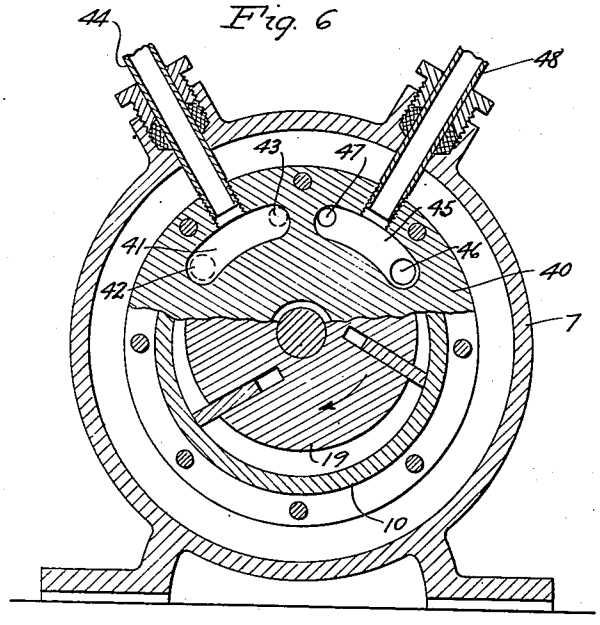


Fig. 6



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Patented June 5, 1923. 1,457,696

UNITED STATES PATENT OFFICE.

ETHELBERT T. FORD, OF LOS ANGELES, CALIFORNIA, ASSIGNOR TO FORDARTIC REFRIGERATION COMPANY, OF LOS ANGELES, CALIFORNIA, A CORPORATION OF CALIFORNIA.

COMPRESSOR.

Application filed June 8, 1920. Serial No. 387,395.

To all whom it may concern:

Be it known that I, ETHELBERT T. FORD, a citizen of the United States, residing at Los Angeles, in the county of Los Angeles and State of California, have invented new and useful Improvements in a Compressor, of which the following is a specification.

This invention relates to a rotary compressor having an impeller with sliding blades, and pertains particularly to a compressor having a rotor operated within a cylindrical chamber and disposed eccentric thereto.

The particular embodiment of my invention described herein is adapted for use in compression refrigerating systems of small capacities, and it is an object of this invention to provide such a compressor and means to lubricate the same as will require no skilled attention, is efficient, durable, simple in construction and compact. Another object of this invention is to provide a compressor having a plurality of compression chambers, each chamber forming a unit, and being so constructed that the units may be arranged for multiple or series operation.

These objects will be more fully understood, as will also other objects and corresponding accomplishments of my invention, from the following detailed description of a preferred embodiment thereof. For the purpose of this description, reference is had to the accompanying drawings, in which:

Fig. 1 is a vertical sectional view through a compressor with two units arranged to act in series, thereby forming a two stage compressor; Fig. 2 is a section taken on the line 2—2 of Fig. 1 looking in the direction of the appended arrows; Fig. 3 is an isometric view of one of the rotors; Fig. 4 is a section taken on the line 4—4 of Fig. 1 looking in the direction of the appended arrows; Fig. 5 is a section taken on the line 5—5 of Fig. 1 looking in the direction of the appended arrows; and Fig. 6 is a section taken through a modified form, in which the units act in multiple, a portion of the section being taken through the center plate dividing the unit chambers.

Referring more particularly to Figs. 1 to 5 inclusive, a housing for the compressor is indicated by 7, and secured to one end thereof by bolts is a head 8. A stuffing box member 9 and a cylinder 10 for the low compression chamber are secured to the head by means of bolts. Secured to cylinder 10 is a high pressure unit cylinder 11 with the chamber therein separated from the low pressure chamber by means of a center plate 12. Closing the outer end of the high pressure chamber is a plate 13 covered by a head 14. Plates 12 and 13, cylinder 11 and head 14 are preferably secured to cylinder 10 by means of bolts 15. The compression chambers are spaced from the housing so that a water jacket is formed.

Extending through the stuffing box member 9 is a shaft 16 journalled in a bearing 17 in head 8 and a bearing 18 in plate 13, and carrying impellers. The shaft is eccentric to the chamber cylinders 10 and 11. Keyed upon shaft 16 are rotors 19 and 20, one being disposed in the low pressure chamber and one in the high pressure chamber. The rotors for the impellers are cylindrical and of such dimensions that they have a line of contact with the internal cylindrical walls of the chambers. As the impellers are of like construction, except as to their width, it is sufficient to describe the construction of one.

Pockets 21 are formed in the rotor and are disposed at an angle to the radii thereof. Slidably disposed in the pockets are blades 22. The blades are inclined forwardly in the direction of rotation. By inclining the blades forwardly, the component of the force tending to push the blade out of the pocket is materially decreased. The blade slides freely in the pocket and the tendency is for the blade to move tangentially. A reaction occurs against the back of the pocket and this has a component in a direction longitudinal of the blade.

Thus, by properly designing the inclination of the pockets, the pressure of the blades against the wall of the chamber may be designed for most efficient operation. With radial blades the pressure is sufficient to wear the chamber elliptical in a short time and with blades inclining backwardly the wear is also great. With an inclination forwardly to the radii, the pressure of the blades on the wall is reduced and the life of the compressor is increased.

On the outer side of the head 8 is an arcuate channel 23 communicating with the low pressure chamber adjacent the line of

contact of the rotor with the chamber wall by means of an auxiliary inlet port 24, and also by means of a main inlet port 25 disposed further on in the direction of rotation of the impeller. In the stuffing box member 9 is an opening registering with the channel 23, and threaded in said opening is a supply pipe 26 for the induction of fluid to the compressor. Formed in the center plate 12 is an arcuate passage 27 extending on both sides of the lines of contact of the rotors with the cylinder walls. On the advance side of the passage 27 is a port 28 communicating with the passage 27 and the low pressure chamber. Connecting the passage 27 and the high pressure chamber on the other side of the line of contact is a port 29.

Referring particularly to Figs. 2 and 4, rotation of the impeller in the direction of the arrow will induce fluid first through the auxiliary port 24, and then through the main port 25. Port 24 prevents a vacuum being formed between the line of contact and the main port 25, thereby increasing the efficiency of the compressor. There is an intake of fluid back of a blade until the succeeding blade passes over the main intake port. Thereafter there is a compression of the fluid in the space between the blades, and eventually this space is placed in communication with the passage 27 in the center plate by reason of registering with port 28. The fluid then travels through the passage 27 to the port 29 and into the high pressure chamber. In order to prevent the trapping of fluid after a blade has passed the port 28, a small auxiliary port 30 adjacent the line of contact of the rotors is provided connecting the passage 27 and the low pressure chamber. In order to prevent a vacuum being formed back of the blades in the high pressure chamber as they pass the point of contact, an auxiliary port 31 connects the passage 27 and the high pressure chamber. The operation of the compression of the fluids in the high pressure chamber is similar to that in the low pressure chamber. On the outer face of plate 13 is an arcuate channel 32 adjacent the line of contact. This channel is closed by the head 14. A main outlet port 33 connects the channel with the high pressure chamber in advance of the line of contact. This port serves as the outlet port for the compressor chamber. An auxiliary outlet port 34 adjacent the line of contact connects channel 32 and the high pressure chamber, and serves to prevent pocketing of fluid between the outlet port 33 and the line of contact. An opening in the head 14 registers with the channel 32 and threaded therein is a discharge pipe 35 passing through the end wall of the housing 7 and packed by a gland 36.

Communicating with the low pressure chamber where the volume between blades is greatest is a port 37 extending through the head and connected to a lubricant supply pipe 38. This port should be at least a distance from the inlet port equal to or greater than the distance between blades. This location avoids taking the lubricant into the suction space. The lubricant has bubbles of gas entrained and if delivered into the suction space, the bubbles will expand, thereby displacing some of the induced fluid and decreasing the capacity of the compressor. Lubricant passes into the chamber through port 37. Some of this lubricant will be carried along with the fluid being compressed and passes into the high pressure chamber. The lubricant entering the chambers also serves as a seal to prevent the compressed fluid from leaking from the places of higher pressure to those of lower pressure.

It is obvious that the construction as shown is such as to provide leak tight joints between the several parts and affording practically no opportunity for the compression fluid to escape to the atmosphere. The construction of the rotor is such that it may be operated at high speed and is adapted to be directly connected to an electric motor.

In refrigerating systems of small capacities, it is often desirable to freeze ice, and to cool certain containers. The temperature at which the containers or coolers are to be maintained is usually higher than the freezing point of water, and it is not advisable to reduce the temperature in the cooler. In order to provide for a single compressor acting upon separate refrigerating coils, the center plate between the compression chambers is changed.

Referring particularly to Fig. 6, the structure with the exception of the center plate is substantially the same as that for the two stage compressor just described. The center plate has an elongated arcuate passage 41 provided with a main outlet port 42 communicating with the chamber 10 and an auxiliary outlet port 43 to prevent pocketing of the compressed fluid. Communicating with the passage 41 is a pipe 44 extending through the housing 7 and suitably packed. Pipe 44 is a discharge pipe. Fluid compressed in chamber 10 will not be delivered to chamber 11 but will pass out through pipe 44. An inlet for chamber 11 is provided. This inlet comprises an arcuate passage 45 having a main inlet port 46 communicating with chamber 11 and an auxiliary inlet port 47 adjacent the line of contact of the rotor. Communicating with passage 45 is an intake pipe 48 passing through the housing and suitably packed. Discharge pipe 44 can be connected to one set of refrigerating coils, and the discharge pipe 35 in the end of the housing can be connected to another set of refrigerating coils. The temperature maintained by one

set of refrigerating coils may be different from that maintained by the other set of refrigerating coils.

What I claim is:

1. A compressor comprising in combination a high pressure chamber and a low pressure chamber, a rotor for each chamber eccentrically disposed therein so as to contact with its chamber wall and having blades maintaining contact with the chamber walls, a plate separating the high pressure and the low pressure chamber, said plate having a passage therein provided with a main suction port opening into the low pressure chamber in advance of the line of contact of its rotor and an auxiliary suction port opening into said low pressure chamber adjacent said line of contact and behind said main suction port, said passage having a main discharge port opening into said high pressure chamber behind the line of contact of its rotor and an auxiliary discharge port in advance of said main discharge port and adjacent to said line of contact.

2. A compressor comprising in combination, a rotor chamber, a rotor eccentrically disposed in said chamber and in contact with the wall thereof, blades slidably disposed in pockets in said rotor, said chamber having side walls, one of said walls having a main inlet port communicating with said chamber behind the line of contact of said rotor and an auxiliary inlet port in advance of said main inlet port and adjacent to said line of contact, the other of said walls having a main outlet port in communication with said chamber in advance of said line of contact and an auxiliary outlet port adjacent said line of contact and behind said main outlet port.

3. A compressor comprising in combination, a rotor chamber, a rotor disposed in said chamber eccentric thereto and in contact therewith, blades slidably disposed in pockets in said rotor, said chamber having side walls, one of said walls having a main inlet port communicating with said chamber behind the line of contact of said rotor and an auxiliary inlet port in advance of said main inlet port and adjacent to said line of contact, the other of said walls having a main outlet port in communication with said chamber in advance of said line of contact and an auxiliary port adjacent said line of contact and behind said main outlet port, and a lubricating conduit communicating with said chamber.

In witness that I claim the foregoing I have hereunto subscribed my name this 3rd day of June, 1920.

ETHELBERT T. FORD.