

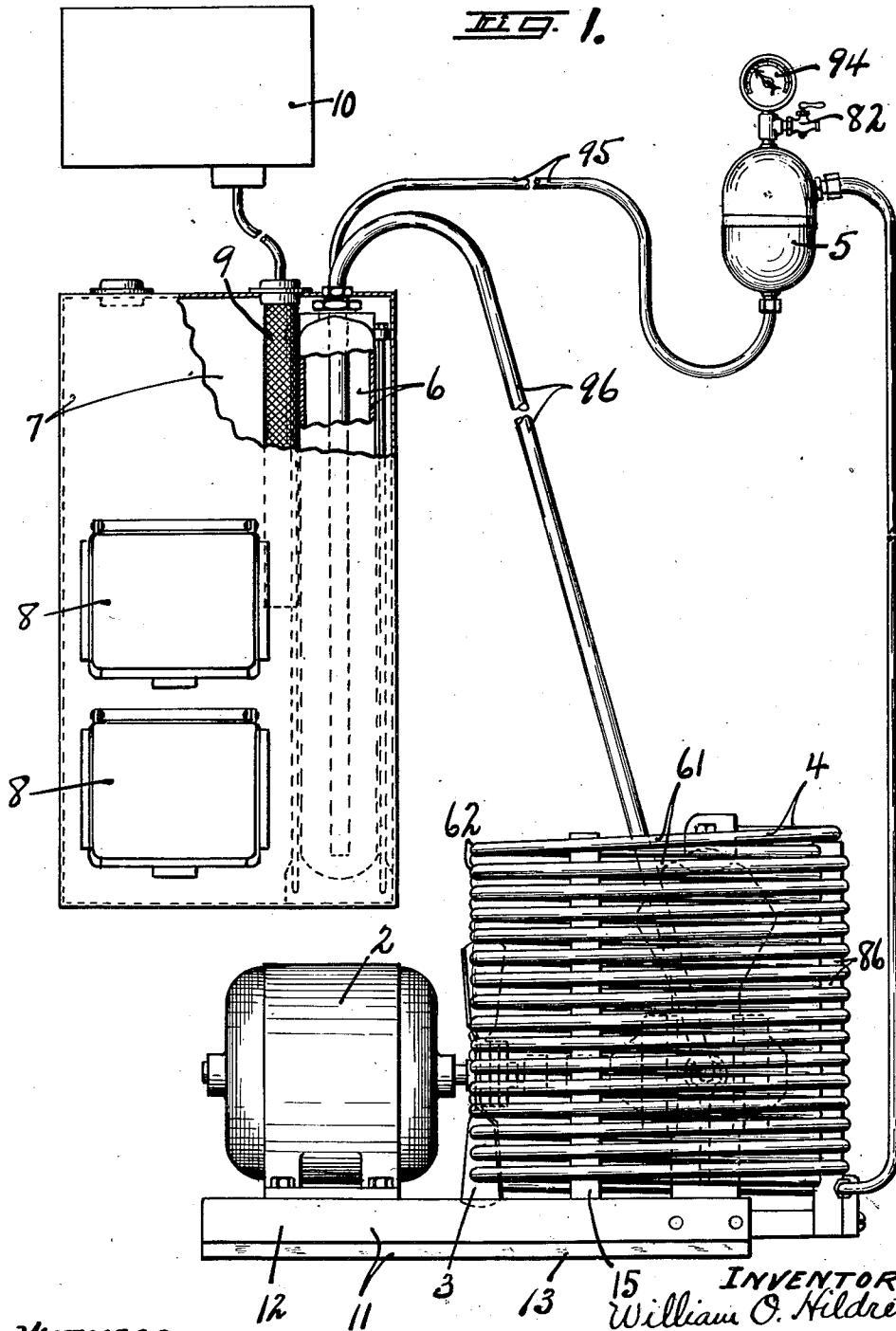
Oct. 1, 1929.

W. O. HILDRETH
REFRIGERATING APPARATUS

1,730,145

Filed April 16, 1926

4 Sheets-Sheet 1



WITNESS
H. H. Hurst

INVENTOR
William O. Hildreth
BY *Elverson Simpson*
ATTORNEYS

Oct. 1, 1929.

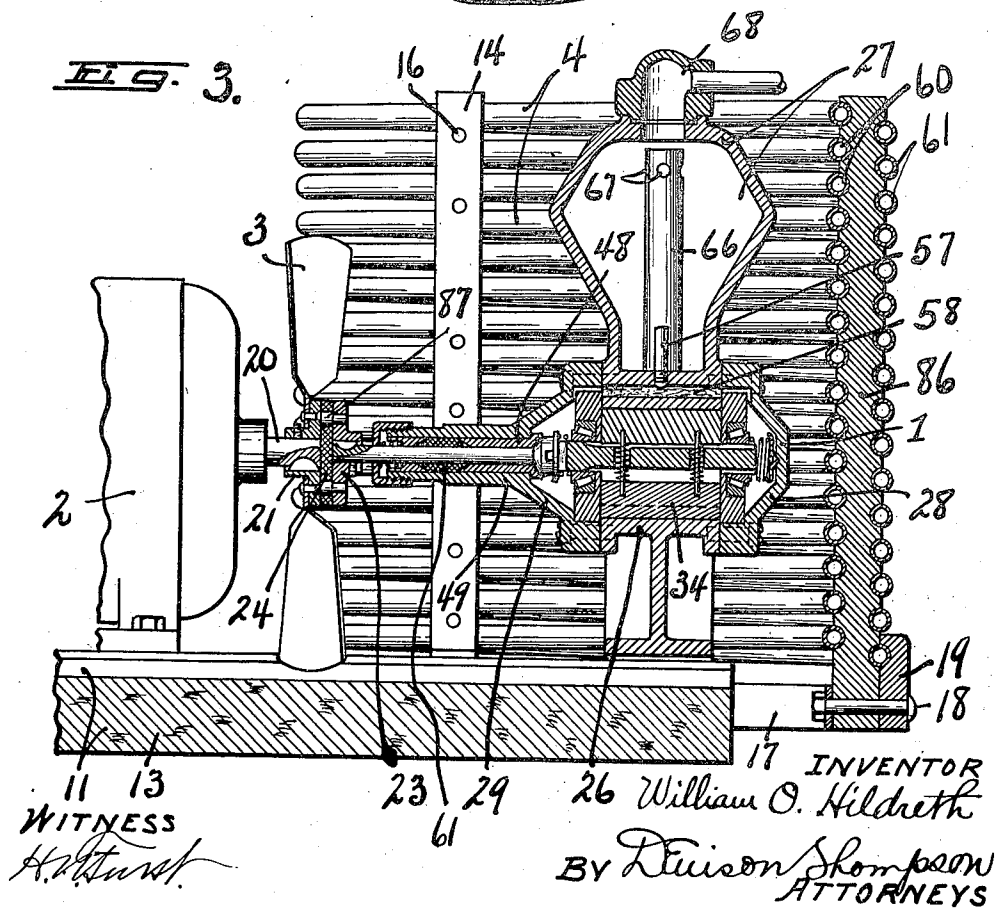
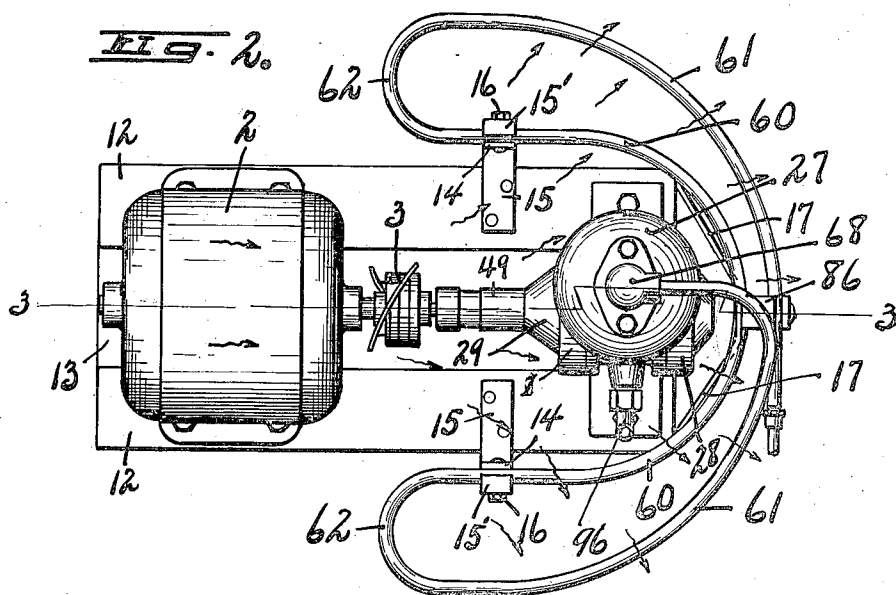
W. O. HILDRETH

1,730,145

REFRIGERATING APPARATUS

Filed April 16, 1926

4 Sheets-Sheet 2



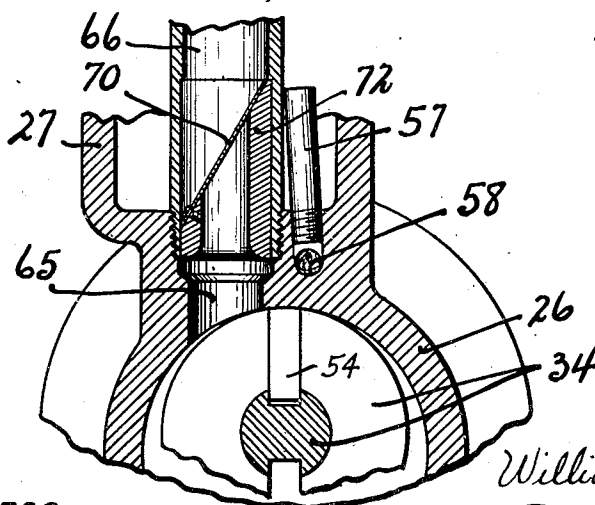
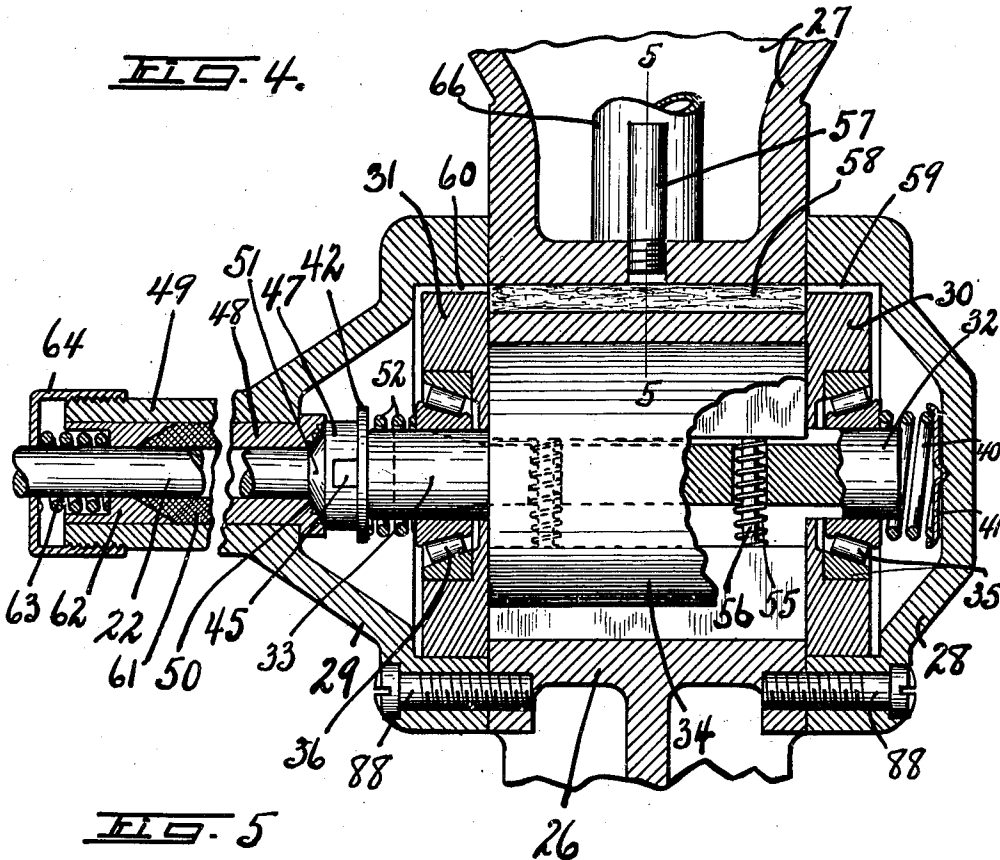
Oct. 1, 1929.

W. O. HILDRETH
REFRIGERATING APPARATUS

1,730,145

Filed April 16, 1926

4 Sheets-Sheet 3



WITNESS
H. H. Hurd

INVENTOR
William O. Hildreth
BY *Quison Simpson*
ATTORNEYS

Oct. 1, 1929.

W. O. HILDRETH
REFRIGERATING APPARATUS

1,730,145

Filed April 16, 1926

4 Sheets-Sheet 4

FIG. 7.

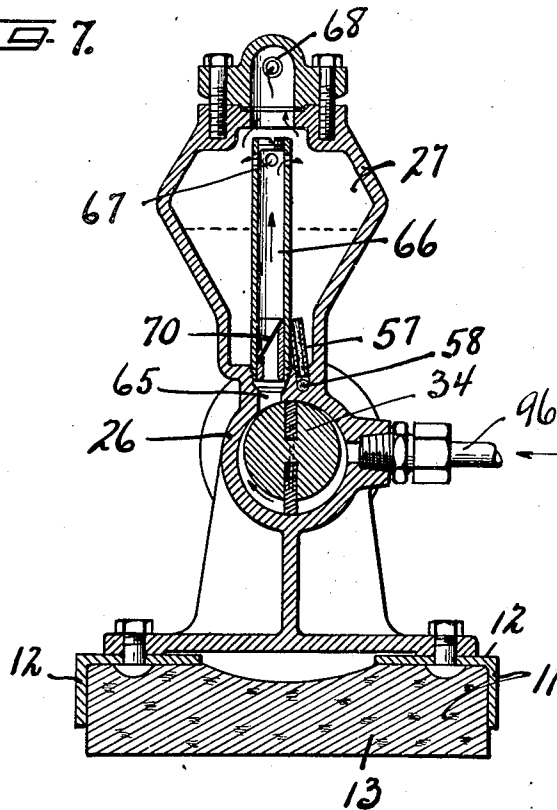
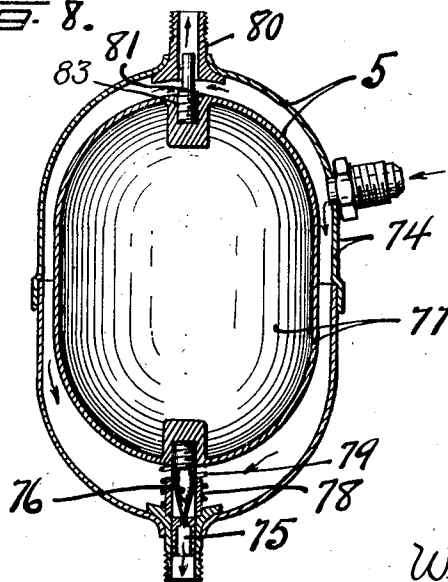


FIG. 8.



WITNESS

H. H. Sturtevant

INVENTOR
William O. Hildreth
BY *Leison Simpson*
ATTORNEYS

UNITED STATES PATENT OFFICE

WILLIAM O. HILDBRETH, OF SYRACUSE, NEW YORK, ASSIGNOR TO THE LAMSON COMPANY, OF SYRACUSE, NEW YORK, A CORPORATION OF MASSACHUSETTS

REFRIGERATING APPARATUS

Application filed April 16, 1926. Serial No. 102,371.

This invention relates to certain new and useful improvements in refrigerating machines.

The main object of the invention is the production of a simple, compact and efficient refrigerating machine that is particularly designed for household purposes, altho adapted for use in many and various places.

A further object resides in the provision of a condensing coil of novel form and arrangement, and which constitutes a guard and partial enclosure for the compressor, separator and air-circulating fan.

Other objects and advantages relate to the details of the construction of the compressor whereby the same is rendered tight against the escape of lubricant and the refrigerating medium, and whereby proper lubrication is effected and the desired relative position of the parts maintained.

In the drawings:

Figure 1 is an elevation of an apparatus of this invention.

Figure 2 is a top plan view of a motor, fan, compressor, separator and condenser.

Figure 3 is a section on line 3—3 Figure 2.

Figure 4 is an enlarged section similar to Figure 3 of the compressor.

Figure 5 is a section on line 5—5, Figure 4.

Figure 6 is a view of the union.

Figure 7 is a vertical section through the separator and compressor.

Figure 8 is a vertical section through the expansion valve apparatus.

In a general way, the structure as illustrated in Figures 1 to 7, comprises a rotary compressor —1— driven from a motor —2— with a fan —3— disposed between the motor and compressor and driven by the motor shaft, a condenser or condensing coil —4— which, as illustrated, is substantially U-shape in horizontal section, an expansion valve —5— in communication with one end of the condenser —4— and also in communication with the upper end of the evaporator —6— disposed within a cooling chamber or brine-tank —7— formed with recesses (not shown) for receiving the usual ice-forming trays,

such recesses being closed by doors —8— in any usual and ordinary manner.

The thermostatic device is positioned within the screen or case —9— and is in communication with mechanism for actuating an automatic switch, all of which may be enclosed within a receptacle or chamber —10— whereby operation of the motor may be controlled by and in accordance with the temperature within the tank —7—.

As here shown, the motor —2— is mounted on and bolted to a base —11— consisting of two spaced longitudinally extending angle bars —12— mounted on a shock absorbing member as the cork plank —13—. In like manner, the compressor —1— is mounted on and bolted to the angle irons —12—. The condenser —4— in this illustration is formed of a single continuous tube or pipe of copper or other suitable material bent to the form shown, and leads forwardly from the top of the separator —27—, and is then curved laterally and rearwardly so as to extend along the side of the compressor and separator at about the level of the top of the separator and to a point adjacent the fan —3— where it is bent inwardly and then forwardly so as to extend along the side of the compressor and separator and is curved around the front of the motor and separator and extends rearwardly along the opposite side to a point adjacent the fan where it is bent laterally outwardly and then extends forwardly along the side of the compressor and separator, and is curved across the front of the latter, and the bending operation is continued with the pipe inclining slightly downwardly so as to form a multiplicity of connected U-shape pipe sections disposed one above the other and in alignment with the inner and outer U-shape connected upper sections of the pipe, whereby a U-shape condenser is produced which consists of two substantially parallel rows or tiers —60— and —61— respectively of vertically aligned pipes, the inner and outer rows of each tier being connected by curved loops —62— at their rear ends to form what has been termed a "horseshoe condenser" which encloses the motor and separator and opens toward the motor with the fan posi-

tioned adjacent the open side of the condenser.

The condenser —4— is supported from the base —11— by means of uprights —14— having feet —15— secured to the base, these uprights being positioned within the inner vertical row —60— of pipes constituting the condenser. The upright —14— coacts with an upright clamping bar —15'— disposed on the outer side of the inner row —60— of pipes constituting the condenser to maintain the condenser in proper relation with respect to the base and as the clamping member —15'— is formed with cross-grooves or channels adapted to receive each pipe of the inner vertical row —60— of pipes when the upright bar —14— and the clamping member —15'— are drawn together in any suitable manner as by bolts —16—, the pipes are maintained in proper spaced relation by seating themselves in the grooves in the clamping member —15'— designed for that purpose.

Further, a substantially V-shape bracket —17— extends forwardly from the front end of the base —11— and has its opposite ends connected to the angle bars —12— in any suitable manner, as by rivets and this bracket supports a spacing post —86— which extends upwardly between the inner and outer vertical rows —60— and —61— of pipes constituting the condenser at substantially the central portion thereof, and is formed with laterally extending grooves for receiving the pipes of both rows so as to maintain them in proper spaced relation both vertically and horizontally. The post —86— may be secured to bracket —17— in any suitable manner as by bolt —18—, and this bolt may likewise extend through a reinforcing clip —19— resting against the outer surface of the post —86— at the base of the latter, and having a groove at its upper end for receiving the lowermost pipe of the outer row of vertical pipes constituting the condenser to clamp that pipe tightly to the post at a point where it leaves the condenser for connection to the expansion valve —5—.

The motor shaft —20— as here illustrated is formed separately from the compressor shaft and the fan —3— is secured to the motor shaft in any suitable manner, as by riveting to collar —21— set-screwed to the forward end of the motor shaft. In like manner the rear end of the compressor shaft —22— is provided with a collar —23— keyed thereto and between these collars is interposed a flexible disk —24—. Each collar is formed with a plurality of openings of any suitable number, and the interposed flexible disk —24— is formed with openings equal in number to the sum of the openings contained in both of the collars, and shouldered spindles —87— are provided for separately securing each collar to the disk, the reduced portion of the spindle being positioned in the collar

and the larger portion being seated in one of the openings in the disk. In this manner the collar —21— drives the interposed disk —24— and the disk in turn drives the collar —23— and the compressor shaft. The interposed flexible disk compensates for any slight variations in the alignment of the shafts.

The compressor of this invention comprises a substantially cylindrical casing —26—, which casing in this illustration is integral with the pear-shape separator casing —27—. Cylinder heads —28— and —29— respectively are secured to the opposite ends of the cylindrical casing —26— in any suitable manner, as by bolts —88—. Each of these heads is formed with a circular recessed portion of a diameter adapted to tightly receive the packing and supporting plates —30— and —31— respectively, but these recesses are of slightly greater depth than the thickness of the end plates —30— and —31— respectively, and these plates are of somewhat greater diameter than the internal diameter of the cylindrical chamber within the casing —26— so as to fit against the ends of the casing —26— and form a closed chamber, except for the center openings in the plates through which the stub shafts —32— and —33— respectively formed integrally with the cylindrical rotor —34— extend, each end head being formed in its outer surface with a recess adapted to receive the roller or other anti-frictional bearings —35— and —36— substantially as illustrated. Each of these bearings in the usual manner comprises an outer ring, an inner ring and an interposed anti-frictional member as a roller, the inner rings substantially fitting the stub-shafts —32— and —33— respectively.

The plate —30— is maintained against the adjacent surface of the casing —26— by coil spring —40—, one end of which rests against the inner ring of the bearing —35— and the other end of which is positioned within a concave cap —41— resting against the inner surface of the head —28— and preferably the head is formed with a recess and the cap with a small central protuberance adapted to seat in the recess to maintain the spring in proper alignment. The pressure of the fluid lubricant contained in separator chamber —27— assists in holding the packing plates against the ends of the casing —26— as hereinafter described.

The stub shaft —33— is connected to the compressor shaft —22— by an interposed union —42— which permits relative longitudinal movement of the two shafts. This union —42— as best shown in Figure 6 consists of a disk —44— having flanges —45— and —46— projecting from its opposite faces, and preferably the flanges are disposed at right angles to each other. One of these flanges —46— is adapted to seat in a recess in

the end of a stub shaft while the other flange —45— seats in a recess in the enlarged forward end —47— of the compressor shaft —22—. The compressor shaft —22— is journaled in a bushing —48— fitted tightly with-
 5 in an extension —49— on the cylinder head —29—, the bushing being enlarged at its forward end so as to form a flange adapted to contact with the internal surface of the forward end of the extension —49— so as to prevent rearward movement of the bushing. The forward end of the bushing —48— is formed with a concave or conical ground surface —50— for tight engagement with a similarly formed ground surface —51— on the enlarged end —47— of the shaft —22— to form a tight joint to prevent leakage of the refrigerant around the driving shaft, and the helical spring —52— surrounding the shaft —33— has one end in contact with the inner ring of the bearing —36— and its other end in contact with the disk —44— of the union —42—, whereby the plate —31— is held against the end of the casing —26— and the ground cone surfaces —50— and —51— on the compressor shaft are held tightly together. The end plates —30— and —31— are free to turn and are restrained only by the friction due to the pressure of the springs —40— and —52— and the head pressure transmitted through the lubricant in the separator or reservoir —27—. The spring pressure behind the plates —30— and —31— also allows the plates to yield and relieve undue pressure that might result from the passage of "slugs" of liquid refrigerant through the pump. The rotor —34— is made enough shorter than the length between the end faces of the casing —26— to allow for the presence of two oil films, one at each end of the rotor and as movement of the end plates —30— and —31— is limited by the opposite end faces of the casing external pressure on these plates will not exert any frictional pressure upon the ends of the rotor —34—. The rotor —34— may include any desired number of blades —54—, in this instance two are shown radially movable in longitudinal grooves or recesses in the cylinder of the rotor, and is here illustrated normally held in running relation with the interior of the casing —26— by helical springs —55— carried by pins —56— which may, as shown, extend into recesses in the inner edges of the respective blades —54—. The springs —40— and —52— also serve to take up any wear in the roller bearings, and thus keep the rotor in its original position, and this is of considerable importance in this type of rotary pump as the rotor should make a gas-tight contact with the bore of casing —26— along a line at the top of the bore.

Lubricant is fed to the bearings for the rotor from separator —27— through a stand pipe —57— which extends some distance up-

wardly into the separator or reservoir —27— so as to form a trap for the lubricant. The lubricant flows through pipe —57— into a longitudinal conduit —58— through casing —26— which may contain any suitable wick-
 70 ing to grooves —59— and —60— in the respective cylinder heads, and from these grooves flows to the bearings for the compressor shaft and rotor.

The increase in head pressure transmitted through the lubricant adds to the pressure between the surfaces —50— and —51— so that to a considerable extent the pressure preventing leakage between the packing surfaces at the joint will increase automatically with the head pressure which tends to cause the leakage.

Within the extension —49— at the rear of the bushing —48— there is positioned a suitable compressible packing —61— which partially seats in the under-cut portion in the rear of the bushing and in an under-cut portion at the forward end of the gland —62— at the rear of the packing, such gland being held in place by compression spring —63— and cap —64— threaded onto the extension —49— and adapted to maintain the spring under the desired degree of compression.

The compressed refrigerating medium and lubricant flows from the pump through outlet —65— into the pipe —66— extending vertically within the separator —27— and terminating near the upper end of the separator in a closed end, such pipe being provided near its upper closed end with one or more radial openings —67— constituting an outlet for the compressed refrigerating medium and lubricant. The lubricant settles in the separating chamber while the compressed refrigerant escapes through the outlet —68— into the condenser —4—. The free flow of the compressed refrigerant and lubricant from the pump through pipe —66— is obstructed by a valve —70— in the form of a thin metallic disk having one end secured to the collar —72— within the lower end of pipe —66— with the disk extending diagonally across pipe —66— and into contact with the opposite wall of the collar —72— so as to close the inlet pipe —66— except under pressure exerted by compressed refrigerant or lubricant under pressure, under which circumstances the disk —70— is of sufficient flexibility so as to yield in accordance with the pressure and permit the passage of the refrigerating medium and lubricant.

As before stated, the refrigerating medium after passing through condenser —4— comes to the expansion valve —5— which controls its flow to tank —6—. This expansion valve, as illustrated in Figure 8, comprises a casing —74—, in this instance of substantially circular cross-section and oval form in vertical cross-section. The lower portion of the casing —74— is formed with an outlet —75—

controlled by valve —76— carried by the float —77—. As shown, the valve has a stem threaded into an internally threaded recess in the lower end of the float. With the construction here shown, a certain amount of liquid refrigerating medium is trapped in the lower end of the casing —74— by reason of the fact that the valve —76— is movable in a pipe or tube —78— concentric with the outlet —75— and projecting some distance upwardly within the chamber within the casing —74—. Spring —79— is provided interposed between the lower portion of the casing —74— and the lower end of float —77— and surrounding pipe —78— and valve —76— for supporting or partially supporting float —77—. In other words, the spring is of about sufficient strength to carry the weight of the float and assists in the initial upward movement of the float, altho it is not strong enough to maintain the float in a position where valve —76— would remain open. The upper end of casing —74— is provided with a threaded nipple —80— to which a gage —94— and relief valve —82— may be connected, if desired. And within the nipple —80— there is positioned the upper end of a guide rod —81— depending into the chamber within casing —74— and threaded into a recess —83— formed in the upper portion of the float —77—. This rod —81— guides the float in its movement.

The refrigerant flows from the expansion valve —5— through pipe —95— to evaporator —6— from which it is returned through pipe —96— to the inlet of the compressor.

The operation of this refrigerating apparatus will be well understood by those familiar with the art, and altho I have shown and described a specific construction, together with details of construction of the apparatus and parts thereof, I do not desire to restrict myself to the particular details of this disclosure, as various changes and modifications may be made within the scope of the appended claims.

I claim:

1. An apparatus of the class described comprising a cylindrical casing, cylinder heads at opposite ends of and secured to the casing, end plates of greater diameter than the internal diameter of the casing and extending across the opposite respective ends of the casing and located within the respective cylinder heads, bearings in said end plates, a rotor within said casing having a shaft journaled in respective bearings in the end plates, and springs for maintaining the end plates in contact with the casing.

2. An apparatus of the class described comprising a cylindrical casing, cylinder heads at opposite ends of and secured to the casing, end plates of greater diameter than the in-

ternal diameter of the casing and extending across the opposite respective ends of the casing and located within the respective cylinder heads, bearings in said end plates, a rotor within said casing having shafts journaled in respective bearings in the end plates, springs for maintaining the end plates in contact with the casing, a compressor shaft for driving one of the rotor shafts, means connecting the compressor shaft to the rotor shaft for simultaneous rotary movement of the shafts while permitting relative longitudinal movement, a bearing for the compressor shaft and cone surfaces on the bearing and the compressor shaft held in contact by one of said springs.

3. An apparatus of the class described comprising a cylindrical casing, cylinder heads at opposite ends of and secured to said casing, an end plate at one end of the casing, an anti-frictional bearing carried by said end plate, a rotor within the casing provided with a rotor shaft journaled in said anti-friction bearing, a compressor shaft having a tapered surface, a bearing for the compressor shaft having a complementary tapered surface, a union connecting the compressor shaft to the rotor shaft for simultaneous rotary movement of said shaft while permitting relative longitudinal movement of the shafts, and spring means for maintaining the end plate in substantial contact with the adjacent end of the casing, and for maintaining the tapered surface on the compressor shaft in contact with the tapered surface on the bearing.

4. An apparatus of the class described comprising a cylindrical casing, cylinder heads at opposite ends of and secured to said casing, an end plate at one end of the casing, an anti-frictional bearing carried by said end plate, a rotor within the casing provided with a rotor shaft journaled in said anti-friction bearing, a compressor shaft having a tapered surface, a bearing for the compressor shaft having a complementary tapered surface, a union connecting the compressor shaft to the rotor shaft for simultaneous rotary movement of said shafts while permitting relative longitudinal movement of the shafts, spring means for maintaining the end plate in substantial contact with the adjacent end of the casing and for maintaining the tapered surface on the compressor shaft in contact with the tapered surface on the bearing, a second end plate at the opposite end of the casing, an anti-friction bearing carried by said end plate, a rotor shaft journaled in said bearing, and spring means for maintaining said end plate in substantial contact with the casing.

5. An apparatus of the class described comprising a cylindrical casing, cylinder heads at opposite ends of and secured to the casing, end plates of greater diameter than the internal diameter of the casing and extending across the opposite respective ends

of the casing and located within the respective cylinder heads, bearings in said end plates, a rotor within said casing having shafts journaled in respective bearings in the
 5 end plates, springs for maintaining the end plates in contact with the casing, a compressor shaft for driving one of the rotor shafts, and means connecting the compressor shaft to the rotor shaft for simultaneous rotary
 10 movement of the shafts while permitting relative longitudinal movement.

6. An apparatus of the class described comprising a cylindrical casing, cylinder heads at opposite ends of and secured to the casing,
 15 end plates of greater diameter than the internal diameter of the casing and extending across the opposite respective ends of the casing and located within the respective cylinder heads and free to move with respect to
 20 the casing, bearings in said end plates, a rotor within said casing having shafts journaled in respective bearings in the end plates, and springs for normally maintaining the end plates in contact with the casing.

25 7. An apparatus of the class described comprising a cylindrical casing, cylinder heads at opposite ends of and secured to the casing, an end plate at one end of the casing free to move with respect to the casing, a
 30 bearing carried by said end plate, a rotor within the casing provided with a rotor shaft journaled in said bearing, a compressor shaft formed with a ground surface, a bearing for the compressor shaft having a complementary
 35 ground surface for contact with the ground surface on the shaft, and spring means for normally maintaining said complementary ground surfaces in contact and for maintaining the end plate in contact with
 40 the casing.

8. An apparatus of the class described comprising a cylindrical casing, cylinder heads at opposite ends of and secured to the casing, an
 45 end plate at one end of the casing free to move with respect to the casing, a bearing carried by said end plate, a rotor within the casing provided with a rotor shaft journaled in said bearing, a compressor shaft formed
 50 with a ground surface, a bearing for the compressor shaft having a complementary ground surface, a union connecting the compressor shaft to the rotor shaft for simultaneous rotary movement of said shafts while
 55 permitting relative longitudinal movement of the shafts, and spring means for maintaining the end plate in substantial contact with the adjacent end of the casing and for maintaining the complementary ground surfaces
 60 on the compressor shaft and its bearing in contact.

9. An apparatus of the class described comprising a cylindrical casing, cylinder heads at opposite ends of and secured to the casing, an
 65 end plate at one end of the casing free to move

with respect to the casing, a bearing carried by said end plate, a rotor within the casing provided with a rotor shaft journaled in said bearing, a compressor shaft formed with an
 70 outwardly projecting flange having a ground surface, a bearing for the compressor shaft having an outwardly extending complementary ground surface for contact with the ground surface on said flange, and spring
 75 means for normally maintaining said complementary ground surfaces in contact and for maintaining the end plate in contact with the casing.

In witness whereof I have hereunto set my hand this 9th day of April, 1926.

WILLIAM O. HILDRETH.

70

75

80

85

90

95

100

105

110

115

120

125

130