G. F. KNOX.

REFRIGERATING COMPRESSOR.

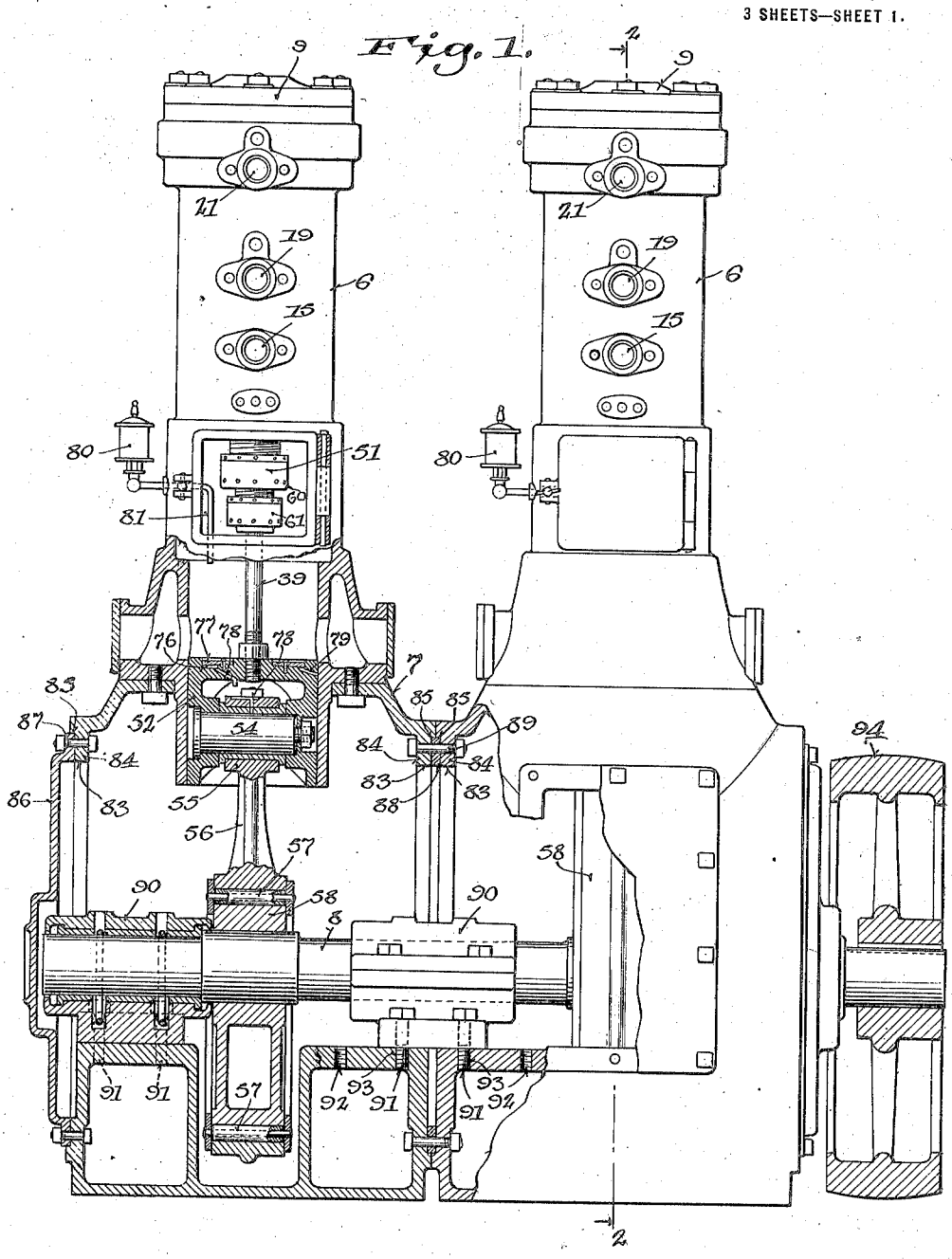
APPLICATION FILED DEC. 17, 1918.

1,321,923.

Patented Nov. 18, 1919.

3 SHEETS—SHEET 1.

Fig. 1.




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3 SHEETS—SHEET 2.

Fig. 2.

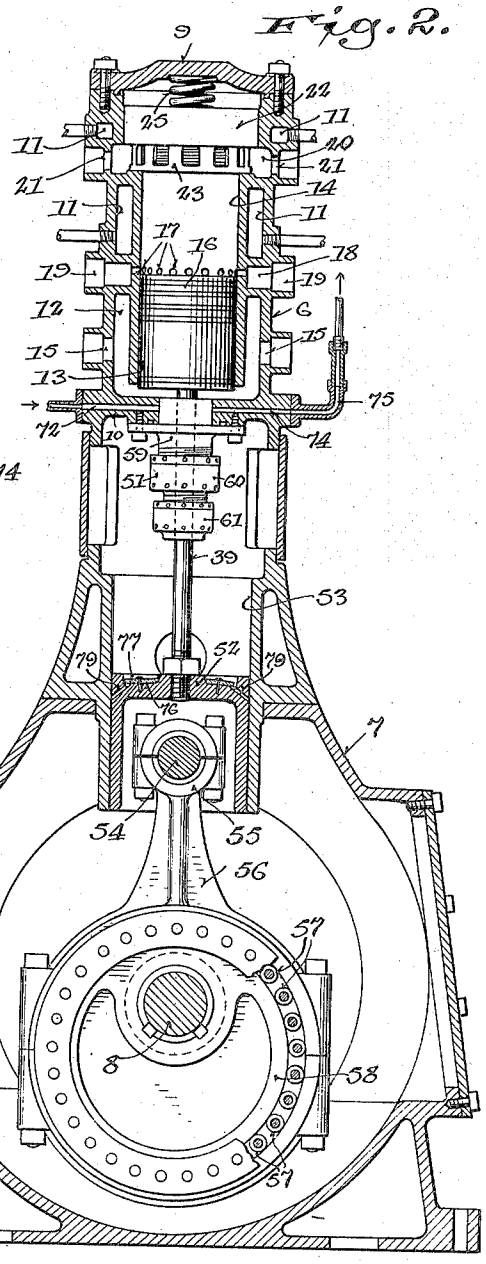
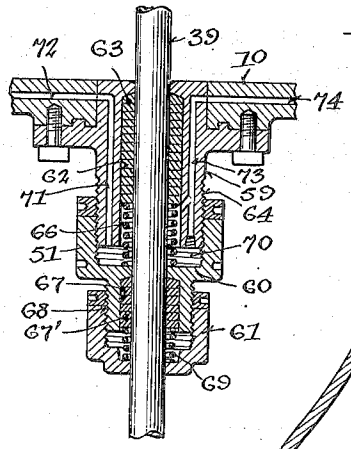



Fig. 5.




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3 SHEETS—SHEET 3.

Fig. 3.

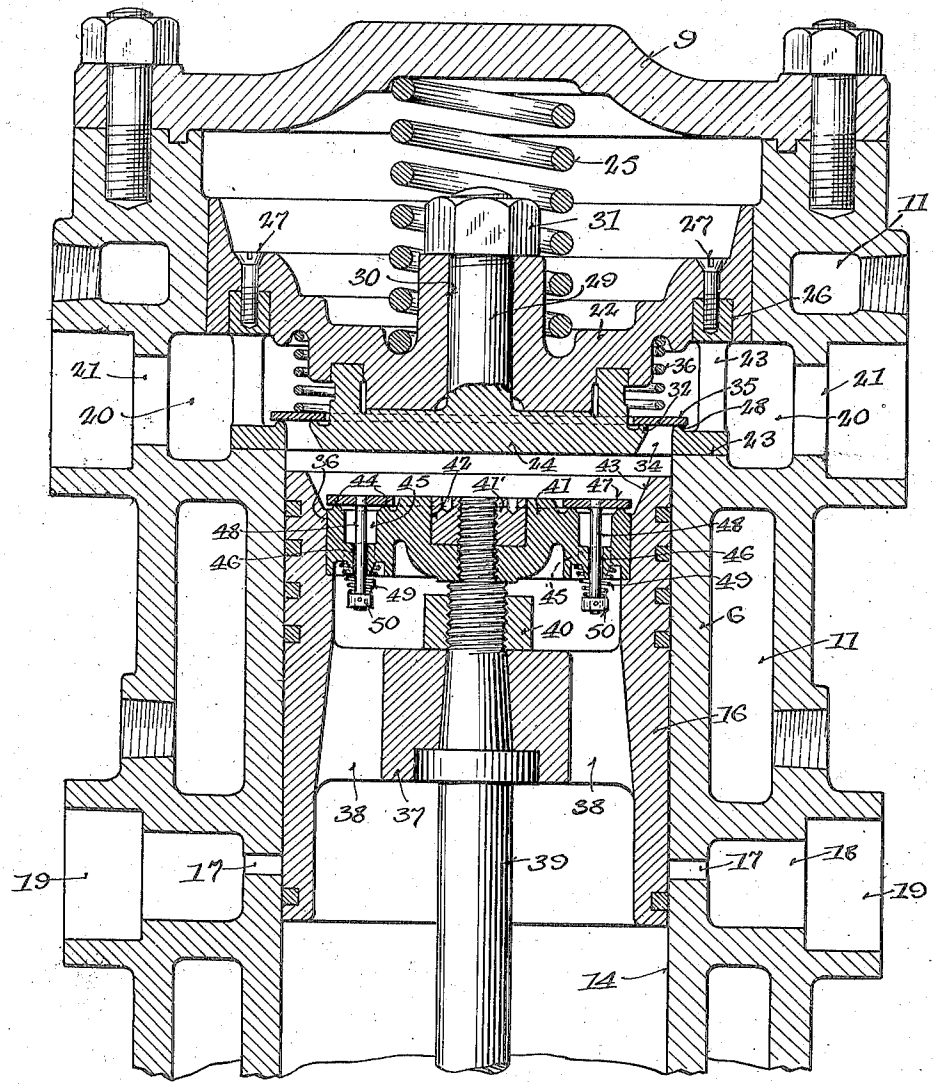
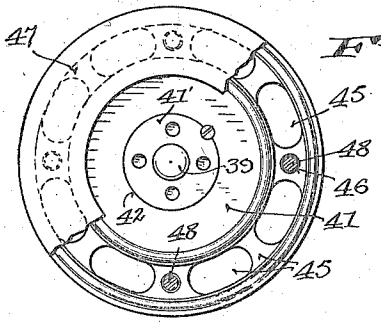



Fig. 4.




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# UNITED STATES PATENT OFFICE.

GEORGE F. KNOX, OF MILWAUKEE, WISCONSIN, ASSIGNOR, BY DIRECT AND MESNE ASSIGNMENTS, TO THE UNIT ICE MACHINE CO., A CORPORATION OF WISCONSIN.

## REFRIGERATING-COMPRESSOR.

1,321,923. Specification of Letters Patent. Patented Nov. 18, 1919.

Application filed December 17, 1918. Serial No. 267,132.

*To all whom it may concern:*

Be it known that I, GEORGE F. KNOX, a citizen of the United States, and resident of Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented new and useful Improvements in Refrigerating-Compressors, of which the following is a description, reference being had to the accompanying drawings, which are a part of this specification.

The invention relates to compressors for refrigerating systems and is more particularly designed to provide a compressor unit whereby several units may be assembled together if desired, so that the necessary capacity may be obtained. This unit feature is valuable and important from a manufacturing point of view, as it reduces manufacturing costs.

Another feature of the invention is the use of a roller bearing eccentric drive from a straight line drive shaft as distinguished from the usual crank shaft. This feature is also of advantage in manufacture as the eccentrics can be carried in stock and the straight shafting can be readily obtained.

A further object of the invention is to provide a new and improved form of compressor in which clearance is reduced to a minimum.

A further object of the invention is to provide a compressor which can operate with two different suction pressures so that certain rooms may be cooled to a low temperature with the consequent lower back pressure and other rooms may be maintained at a higher temperature with the consequent higher back pressure.

With these and other objects in view the invention consists in the several features described in the following specification and shown in the accompanying drawings in which:

Figure 1 is a view of the machines embodying the invention, parts being broken away, and parts being shown in section;

Fig. 2 is a section taken on the line 2—2 of Fig. 1;

Fig. 3 is an enlarged detail sectional view of the upper portion of the compressor;

Fig. 4 is a detail view of the inlet valve, parts being broken away;

Fig. 5 is a detail sectional view of the stuffing box.

In the drawings, the numeral 6 designates the cylinder of the compressor, 7 the crank case, 8 the drive shaft, and 9 the cylinder head cover.

The cylinder 6 is divided into two parts by a partition 10. The upper part of the cylinder has the water jacket compartments 11 and an annular compartment 12, the lower end 13 of the cylinder bore 14 being spaced away from the partition 10. Inlets 15 communicate with the compartment 12 and a pipe of the circulating system may be connected to either one of these inlets, while the other one may be plugged up, two inlets being provided so that the piping may be led off from either side of the machine.

A piston 16 reciprocates in the bore and at the lower end of its stroke uncovers an annular series of ports 17 in the cylinder which communicate with an annular conduit 18 and a pipe of another circulating system preferably operating under a higher back pressure may be connected to either one of the inlets 19 to this conduit while the other may be plugged up, two inlets being provided so that the piping may be led off from either side of the machine.

The upper end of the cylinder is provided with an annular discharge conduit 20 having discharge openings 21 communicating therewith to either one of which piping of the circulating system may be connected and the other one of said openings be closed by a suitable plug.

The cylinder is provided with a so-called safety head consisting of a cylindrical member 22 to which valve seat members 23 and 24 are connected, said head being normally held in position by means of a spring 25 interposed between the member 22 and the cover 9. The valve seat member 23 consists of a ported ring secured at its upper edge in a recess 26 of the member 22 by screws 27 and normally seated at its lower edge 23′ upon a portion of the cylinder adjacent the conduit 20. This member 23 has an upstanding annular rib 28. The valve seat member 24 consists of a disk having a central stem 29 disposed in a bore 30 in the member 22 and clamped thereto by a nut 31, said disk also having an upstanding annular rib 32 and an inclined periphery 33. The ring member 23 is spaced from the

member 24 to form an annular outlet port 34 and the concentric ribs 28 and 32 form a seat for a flat ring valve 35 which is held to its seat by a spring 36 interposed between said valve and the member 22. Under ordinary conditions when the refrigerant gas is compressed to a centain pressure within the cylinder, the valve 35 is raised to permit passage of the compressed refrigerant through the port 34, conduit 20 to the circulating pipe, but if for any reason the pressure in the compressor should become excessive it will act upon the member 23 which being connected with the members 24 and 22 will act to raise said members against the action of the spring 25 and thus establish communication between the cylinder and the discharge conduit.

The piston 16 has an opening 36 in its top and a spider 37 providing passages 38. A piston rod 39 is removably secured to the central portion of the spider by a nut 40 so that the piston may be removed without removing the rod and a piston head member 41 is mounted in the opening 36 and removably secured to the piston and rod by means of a nut 41′ engaging the rod 39 and seated in a central recess 42 in said head. The head is disposed below the top of the piston which has a flared upper end 43. The head is provided with upstanding concentric curved annular ribs 44 and with port openings 45 and guide openings 46. A flat disk inlet valve 47 is seated on the ribs 44 and is provided with a plurality of stems 48 slidably mounted in the guide openings 46.

To cushion the action of the valve 47 and also to act as a stop to limit the opening of the valve, springs 49 are mounted on the stems 48 between the head 41 and the heads 50 of the stems.

The piston rod 39 reciprocates in a stuffing box 51 secured to the partition 10 and carries a cross head 52 slidably mounted in a bore 53 in the lower portion of the cylinder.

The cross head carries a wrist pin 54 upon which the upper end 55 of the eccentric connecting rod 56 is mounted. The lower end of connecting rod 56 is provided with an annular roller bearing 57 mounted upon an eccentric 58 keyed to the shaft 8.

The stuffing box 51 consists of sleeves 59 and 60 and a cap 61. The sleeve 59 is secured to the lower face of the partition 10 and is provided with a bore 62 receiving packing ring 63 and with a lower threaded end 64. The sleeve 60 is provided with an upper threaded cup end 65 engaging the end 64 and a spring 66 is disposed between the lower packing ring 63 and the sleeve 60. The lower end of said sleeve 60 is provided with a bore 67 receiving packing rings 67′ and with a threaded portion 68. The cap 61 has a threaded portion engaging the portion 68 and a spring 69 is interposed between the lower packing ring 67′ and the cap 61. The springs 66 and 67 permit expansion of the packing rings against which they act. The lower end of the sleeve 59 is disposed above the bottom of the cup end 65 to form an oil cup 70. Oil is fed into this cup from a conduit 71 in the sleeve communicating with a conduit 72 in the partition 10. The oil serves to keep the piston rod lubricated and in case it should become heated up the hot oil is allowed to escape from the stuffing box through conduits 73 and 74 and pipe 75 and return to a source of supply (not shown). The construction of the stuffing box also prevents oil working into the compression chamber which is very important in connection with refrigerating machinery. The cross head has an annular recess 76 in its top in which a felt pad 77 is disposed. An oil conduit 73 extends from said recess to a point above the wrist pin so as to conduct oil to a channel 78 in the wrist pin bearing and other conduits 79 conduct oil from the recess to the bore 53. The oil is supplied to pad 77 from an oil cup 80 and pipe 81.

To provide for assembling the units together the crank cases of each unit have open ends 83 with annular flanges 84 and an annular recess 85. A cover plate 86 fits into the outer annular recess 85 of each unit and is secured to the adjacent flange 84 by bolts 87. When adjacent units are lined up the recesses 85 register with each other to form a pocket for a spacing ring 88 and the units are secured together by bolts 89 passing through the flanges 84 adjacent the ring 88 and through said ring. Shaft journals 90 are adapted to be secured to the crank case by bolts 91 and two sets of bolt holes 92 and 93 are provided. The end shaft journal is secured to the crank case by the bolts passing through the holes 92 and 93 while the intermediate bearing is secured to the crank cases of adjacent units by the bolts passing through the sets of holes 93 in said units. If only a single unit is desired the intermediate bearing becomes an end bearing and is secured to the crank case of its unit in the same manner as the bearing at the other end of crank case. The drive pulley 94 is mounted on one end of the shaft 8.

With the construction above described the refrigerant at a low back pressure flows into the compartment 12 and beneath the piston and during the downward movement of the piston this refrigerant lifts the valve 47 and flows into the compression chamber. When the piston reaches the end of its stroke the refrigerant at higher back pressure flows through the ports 17 and into the compression chamber, thereby raising the

pressure of the refrigerant in said chamber. On the upward stroke, the piston shuts off the ports 17, the valve 47 is held down by pressure of the refrigerant and when the desired pressure has been obtained the compressed refrigerant overcomes the action of the spring 36 and the valve 35 opens and the refrigerant is delivered to the conduit 20 from whence it passes to the circulating pipes of the system. As the top of the piston is recessed to correspond with the face of the disk of the member 24 the end 43 of the piston moves up into the annular port 34 so as to diminish the clearance space as much as possible.

What I claim as my invention is:

1. A refrigerant compressor unit of the class described including a crank case provided with open ends and an intermediate eccentric pit formed by spaced apart platforms in the crank case, bearing members adjustably secured to said platforms, a drive shaft journaled in said bearing members, and end plates for closing the open ends of said crank case, whereby a plurality of said units may be connected together with the open end of each unit secured to the adjacent open end of the adjacent unit, and said bearing members straddling the adjacent platforms of adjacent units.

2. A refrigerant compressor comprising, in combination, a series of units, each unit having a crank case provided with open ends, means for securing the crank cases of adjacent units together at their adjacent open ends, a drive shaft common to all the units, shaft journals mounted in the crank case of the units, and means for securing the journals to the crank case either as end journals or intermediate journals.

3. A refrigerant compressor comprising, in combination, a series of units, each unit having a crank case provided with open ends and an annular flange and annular recess adjacent each end, a ring disposed in the registering recesses of adjacent units, and bolts passing through the flanges of adjacent units and said ring to secure the units together.

4. A refrigerant compressor comprising, in combination, a series of units, each unit having a crank case provided with open ends and an annular flange and annular recess adjacent said ends, a ring disposed in the registering recesses of adjacent units, bolts passing through the flanges and adjacent ring, a drive shaft common to all the units, and shaft journals detachably secured to said crank case either as an end journal or as an intermediate journal between adjacent units.

5. A refrigerant compressor comprising, in combination, a series of units, each unit having a crank case provided with open ends and an annular flange and annular recess adjacent said ends, a ring disposed in the registering recesses of adjacent units, bolts passing through the flanges of adjacent ring, a drive shaft common to all the units, shaft journals detachably secured to said crank case either as an end journal or as an intermediate journal between adjacent units, and end plates for closing the outer open ends of the end units of each series.

In testimony whereof, I affix my signature.

GEORGE F. KNOX.