Fig. 1

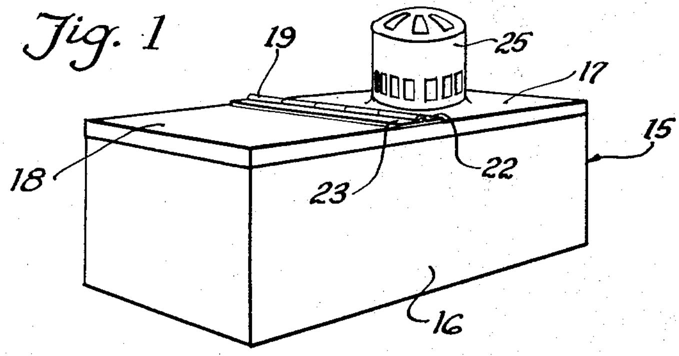
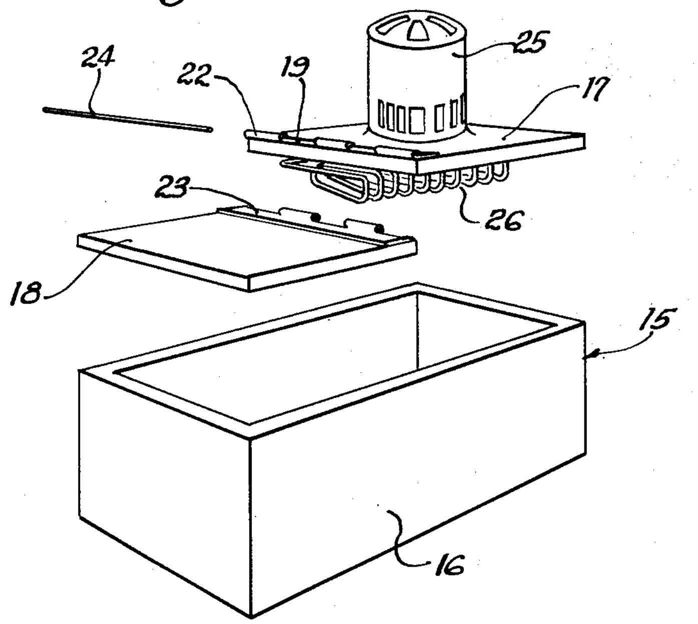


Fig. 2



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March 9, 1954 W. E. BAUER 2,671,603

REFRIGERATION APPARATUS

Filed April 14, 1949 5 Sheets-Sheet 2

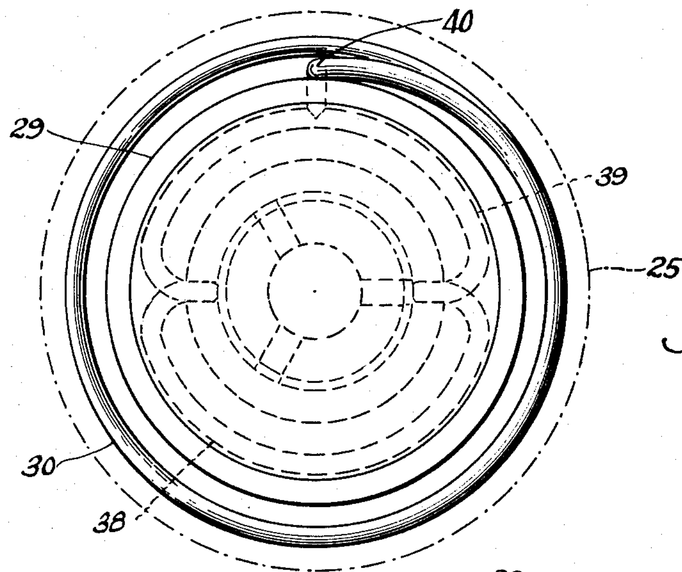

Fig. 4

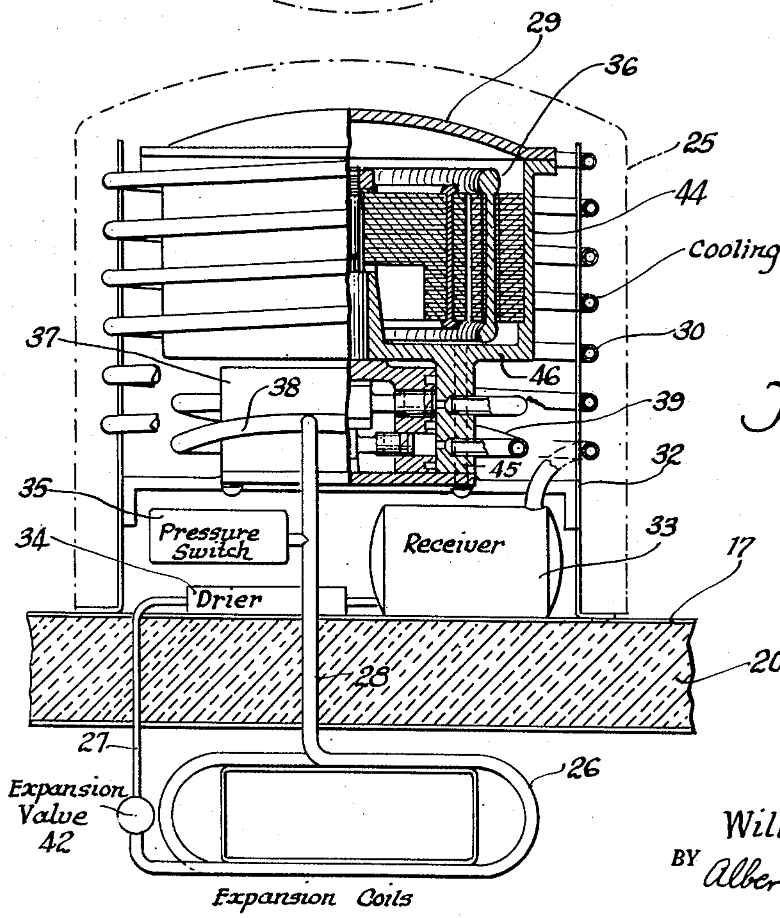

Fig. 3

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Fig. 5

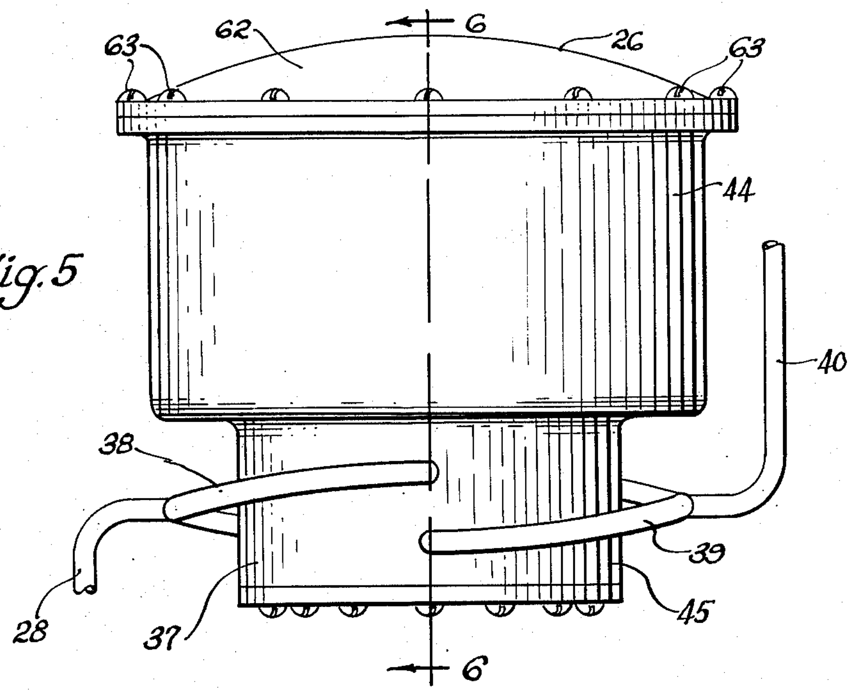
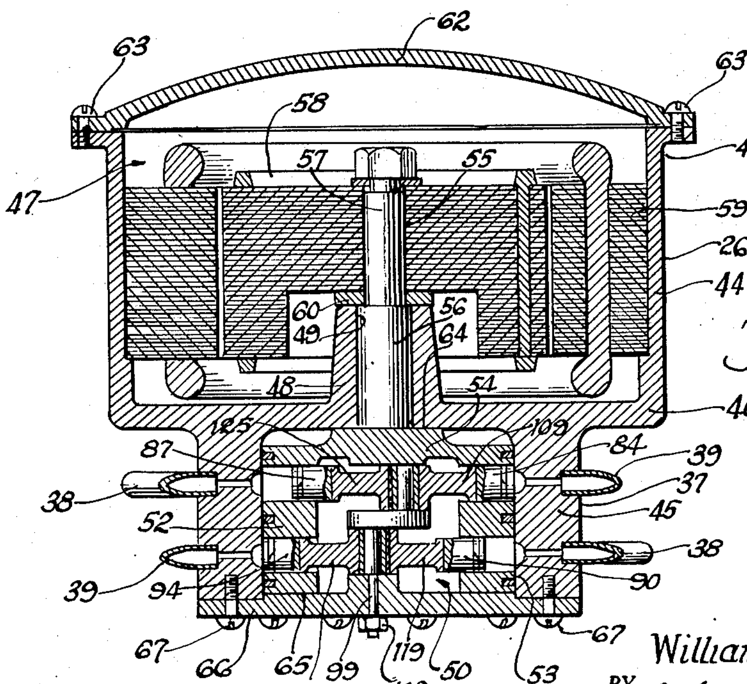


Fig. 6



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REFRIGERATION APPARATUS

Filed April 14, 1949 5 Sheets-Sheet 4

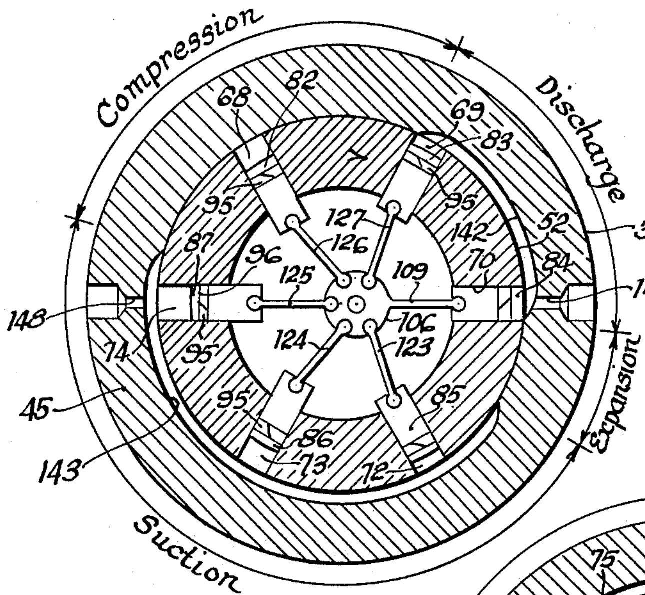

Fig. 8

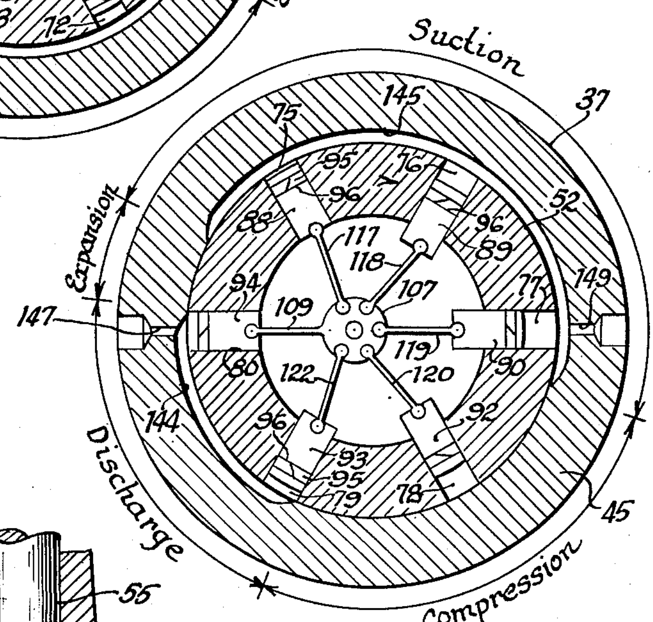

Fig. 9

Fig. 7

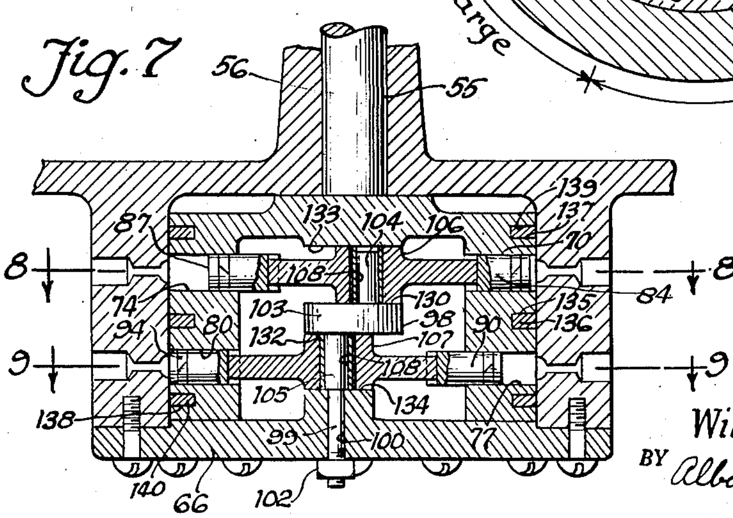

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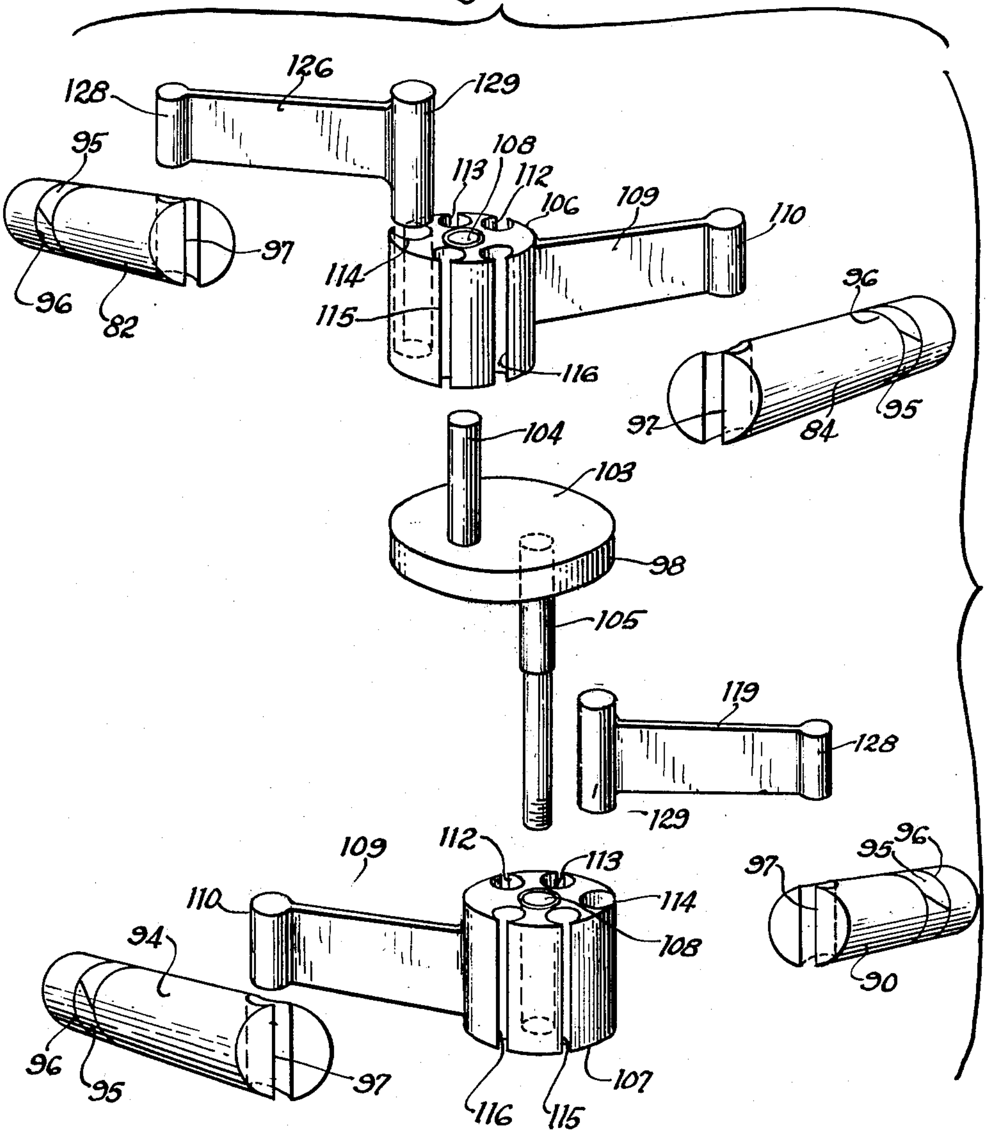
Fig. 10



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Patented Mar. 9, 1954

2,671,603

UNITED STATES PATENT OFFICE

2,671,603

REFRIGERATION APPARATUS

William E. Bauer, Chicago, Ill.

Application April 14, 1949, Serial No. 87,493

4 Claims. (Cl. 230—58)

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This invention relates to refrigeration apparatus and is disclosed in such adaptation, although it is understood, and may be readily understood by those skilled in the art, that certain parts of the apparatus are susceptible to a broader range of uses.

One of the objects of my invention is to provide compact efficient refrigeration apparatus adapted to mounting on a single removable wall of a refrigerator cabinet, so that the apparatus is readily removable as a complete unit for service or replacement and may be replaced by another unit during a service operation.

It is another object of this invention to provide a unitary, electrically driven, mechanical compressor unit for use in apparatus of the type referred to and wherein the electrical drive parts and mechanical compressor parts are separated.

As another object, it is within the comprehension of my invention to provide a compressor or pump unit adapted to uses including the compression of refrigerating gasses and wherein the number and production cost of parts are both materially restricted.

This invention further has within its purview the provision of refrigeration apparatus embodying a compressor constructed and arranged to minimize noise and vibration.

My invention also comprehends the provision of refrigeration apparatus embodying a compressor unit wherein the construction and arrangement are such that lap sealed joints and the necessity of extreme precision in machining are avoided without effecting leaks or loss of efficiency.

I have additionally provided, in this invention, a mechanical compressor having relatively few parts, which parts are of relatively simple construction and readily assembled.

For effecting the foregoing advantages in my disclosed compressor unit, as well as to provide a unit adapted to uses requiring the production of pressures above or below normal atmospheric pressure, I have utilized a structure embodying a rotary cylinder block having therein a plurality of axially displaced sets of radially disposed cylinder bores, with pistons in the sets of bores opposed in phase for balanced operation; valve action being accomplished by relative movement between the rotary cylinder block and a grooved closure member.

Other objects and advantages of the invention will be apparent from the following description and the accompanying drawings in which similar characters of reference indicate similar parts throughout the several views.

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Referring to the five sheets of drawings,

Fig. 1 is a perspective view of the exterior of an assembled refrigeration apparatus embodying a preferred form of my invention;

Fig. 2 is an exploded perspective view of the refrigeration apparatus shown in Fig. 1, which view depicts a preferred arrangement and selection of separable parts of the apparatus;

Fig. 3 is a fragmentary sectional view of a portion of the apparatus illustrated in Figs. 1 and 2, drawn to a larger scale than Figs. 1 and 2 and having parts cut-away to show details of construction;

Fig. 4 is a top plan view of the refrigeration apparatus illustrated in Fig. 3;

Fig. 5 is a fragmentary side elevational view of a portion of the apparatus depicted in Fig. 3 and drawn to a somewhat larger scale than Fig. 3;

Fig. 6 is a fragmentary side sectional view taken substantially on a line 6—6 of Fig. 5 and in the direction indicated by accompanying arrows;

Fig. 7 is a fragmentary sectional view corresponding to a portion of the structure shown in Fig. 6 but drawn to a larger scale;

Figs. 8 and 9 are respectively top sectional views taken substantially on lines 8—8 and 9—9 of Fig. 7 and illustrating corresponding positions of the parts occurring at one step of the operation of the apparatus, and

Fig. 10 is an exploded view indicating the structure and arrangement of certain internal parts of the apparatus.

Having reference to the exemplary embodiment of my invention which is disclosed in the accompanying drawings for illustrative purposes, it is my preference to provide refrigeration apparatus including a compact mechanical cooling unit adapted to be entirely supported with reference to one removable wall section of a refrigerator cabinet, as depicted in Figs. 1 and 2. To this end, I have provided a refrigerator cabinet 15 including a box portion 16 which opens at the top, a removable wall section 17 of a size to cover a portion of the open box top and a movable cover 18 of a size normally to cover the remainder of the open box top and movably connected to the removable wall section by a hinge 19. As is usual in the structure of refrigerator cabinets, the walls of the box portion 16, as well as the removable wall section 17 and movable cover 18, are of suitable heat insulating construction such, for example, as including a filler of heat insulating material 20, as shown in Fig. 3.

In the normal assembled relationship of the parts of the refrigerator cabinet, as depicted in Fig. 1, the removable wall section 17 is desirably secured in place by removable fastening means (not shown), such as screws or the like. As shown in Fig. 2, the hinge 19 preferably comprises a hinge plate 22 secured to the removable wall section 17 at one edge thereof, a hinge plate 23 secured to the cover and a removable hinge rod 24 by which the hinge plates are normally connected for relative swinging movement.

In order to provide for the removal and/or replacement of the mechanical refrigerating equipment with the removable wall section 17, a part of that equipment is mounted within a housing 25 on the exterior surface of the wall section 17, while an evaporator 26 is carried internally of the wall section, suitable connections for the flow of refrigerant to and from the evaporator being made by pipes 27 and 28 (Fig. 3) extending through the wall section 17. Within the housing is mounted a motor driven compressor unit 29 and a condenser coil 30 carried by a frame 32, which frame is secured to the wall section 17. Also within the housing 25 and connected in the refrigeration system in the usual manner are a receiver 33, a drier 34 and a pressure switch 35. In the refrigeration equipment disclosed, the motor driven compressor unit 29 includes a driving motor 36 and a compressor 37. Also in the disclosed equipment, and as shown in Fig. 3, the low pressure side of the evaporator is connected to the inlet side of the compressor through the pipe 28 and a pipe 38. The pressure switch 35 is connected to the pipe 28 and is operated by the pressure of the refrigerant therein to control the cycles of operation of the compressor unit. On the discharge side of the compressor, a pipe 39 and a pipe 40 conduct the compressed refrigerant to the condenser 30 in which it is cooled and from whence it flows into the receiver 33, through the drier 34 and through the pipe 27 to an expansion valve 42 and through the latter valve to the evaporator.

As an element contributing materially to the compactness and unitary nature of the disclosed structure, I have provided the motor driven compressor unit 29 which, in addition to being compact and housed in a unitary closure, has many unique features which will be discussed as the description progresses. As has been mentioned in the more general portion of the description, it is understood that while being termed a "compressor" in its association with the disclosed refrigeration apparatus, this term is used in a broad sense because the disclosed compressor structure is well adapted to use in other pumping operations such, for example, as a vacuum pump.

Referring more in detail to the structure of my motor driven compressor unit 29, as illustrated in Figs. 3 to 10 inclusive, a unitary housing 43 has cylindrical side wall portions 44 and 45 extending in opposed directions from an integrally formed and radial partition wall 46; the opposite ends of the cylindrical side wall portions opening outwardly away from the partition. The cylindrical side wall portion 44 and the radial partition 46 define a motor housing compartment 47. Centrally of the partition 46 and coaxial with the cylindrical side wall 44 an integrally formed boss 48 projects into the motor housing compartment from the partition 46 and has therein a bearing bore 49. The bearing bore 49 extends between the motor housing compartment 47 and a compressor housing compartment 50 within the cylindrical side wall portion 45, and is in concentric and coaxial relationship to the interior cylindrical surfaces of those compartments.

Inside of the compressor housing compartment 50, a cylinder block 52 has an external cylindrical surface 53 which fits into and has a running fit for rotational movement relative to the cylindrical internal surface of the cylindrical side wall portion 45. In my preferred construction, the cylinder block 52 is in the form of a generally cylindrical and hollow shell having a web 54 providing a closure at one end, and the hollow interior being open at the other end. Also, a shaft 55 is drivingly secured to the web and projects therefrom in coaxial relationship to the cylindrical cylinder block surface 53. A bearing portion 56 on the shaft 55 fits the bearing bore 49, while an extending end portion 57 of that shaft is drivingly connected to a motor rotor 58.

Although any desired type of motor rotor may be used to meet predetermined conditions of operation, my disclosed embodiment of the invention depicts the use of a squirrel cage rotor of relatively conventional form. Secured within the cylindrical internal surface of the side wall portion 44 of the housing is a stator 59 in driving relationship to the rotor 58. Being disposed for vertical operation, in the present instance, a collar 60 provides a thrust bearing and spacer between the end of the rotor 58 and the end of the bearing boss 48. By preference, the open end of the motor housing compartment 47 is closed and sealed hermetically by a cover 62 secured to the end of the cylindrical side wall portion 44 by removable fastening means, such as screws 63.

On the outer end of the web 54 of the cylinder block, a plane circular bearing surface 64 adjacent the shaft 55 provides one end bearing for the cylinder block in opposed relationship to the thrust bearing provided by the collar 60. At the opposite end of the cylinder block, and adjacent the cylindrical wall portion 53, another plane end surface 65 serves as a second end bearing surface for the rotary cylinder block. A second cover plate 66 secured to the open end of the cylindrical side wall portion 45 closes and hermetically seals the compressor housing compartment 50 and presents a plane inner surface portion having running engagement with the end surface 65 of the cylinder block Removable fastening means, such as screws 67, are utilized to hold the cover 66 in place relative to the cylinder wall portion 45.

From the description thus far presented, it may be understood that the driving power of the motor, which includes the rotor 58 and the stator 59, effects rotational movement of the cylinder block 52 within the compressor housing compartment 50. Thus, the cylinder block, in the present instance, is a moving part of the compressor. While various numbers and arrangements of cylinders and pistons may be utilized for accomplishing the desired pumping action as a result of the cylinder block rotation, it is my preference to illustrate a system which provides relatively balanced, multi-cylinder operation.

As shown in Figs. 6, 7, 8 and 9, the cylinder block 52 includes two sets of radial cylinder bores (Figs. 8 and 9) separated axially of the cylinder block. In the present instance, each set includes six cylinder bores equally spaced circumferentially of the cylinder block, with the cylinder bores of the two sets aligned axially of the cylinder block. One set, as depicted in Fig. 8, includes cylinder bores 68, 69, 70, 72, 73 and 74. The other set as shown in Fig. 9, comprises cylinder bores 75, 76, 77, 78, 79 and 80. Each of the cylinder bores extends through the cylindrical side wall of the cylinder block in a direction radial to the rotational axis of the cylinder block.

Pistons 82, 83, 84, 85, 86 and 87 are mounted for reciprocating movement in the cylinder bores 68, 69, 70, 72, 73 and 74 respectively; while the cylinder bores 75, 76, 77, 78, 79 and 80 have pistons 88, 89, 90, 92, 93 and 94 respectively, mounted for reciprocating movement therein. Preferably, each of the pistons is provided with a piston ring 95 extending circumferentially thereof in a groove 96 near the outer end of the piston.

As shown in Figs. 6 to 10 inclusive, the several pistons are of like construction, so that a description of one will suffice for the others. Each such piston, in the present instance, comprises a solid metal cylinder, the outer end of which is preferably curved to conform to the cylindrical outer surface of the cylinder block when the piston is in its normal position in one of the cylinder bores. At the inner end, each piston has an arcuate bearing slot 97, the axis of the arcuate surface of which passes through and is perpendicular to the longitudinal axis of the piston. Also, the arcuate bearing slot has an arcuate extent greater than 180 degrees, but less than 360 degrees, with the axis of the arc positioned so that the slot opens outwardly at the inner end of the piston.

As a part of the additional structure utilized in the disclosed ensemble for effecting reciprocation of the pistons in sequential order in the sets thereof and with the movements of the sets of pistons dephased for force balancing purposes, I utilize a stationary crank shaft 98 which, in the present instance, is non-rotatably secured to and supported from the cover plate 66 by a shaft extension 99 extending through a bore 100 in the cover plate and secured in place by fastening means, such as a nut. In the disclosed structure, the crank shaft 98 has a circular crank arm portion 103 from which crank pins 104 and 105 project in opposite directions; said crank pins being disposed with their axes spaced apart. The shaft extension 99 is coaxial with the crank pin 105 and the bore 100 in the cover plate 66 is spaced to one side of the axis of shaft bearing 56, so that when properly positioned, as shown in Fig. 7, a center line between the axes of the crank pins coincides with the axis of shaft 55. Thus, the crank pins 104 and 105 are normally disposed in predetermined positions on opposite sides of the axis of rotation of the cylinder block. Also, in the assembly, each of the crank pins 104 and 105 of the crank shaft is aligned axially of the cylinder block with one of the sets of cylinder bores.

Bearing collars 106 and 107 are of similar construction, and each has a central bearing bore 108 extending therethrough and rotatable on one of the crank pins of the crank shaft. Integrally formed on the bearing collar and projecting in a direction radial to the axis of the central bearing bore 108 is a single connecting rod 109. At the end remote from the bearing collar, the connecting rod 109 has an arcuate end bearing portion 110 integrally formed thereon, with the axis of the arcuate surface thereof substantially parallel to the axis of the central bearing bore 108. The arcuate bearing portion 110 fits into the arcuate bearing slot 97 of one of the pistons; the arcuate extent of the bearing portion and the thickness of the connecting rod being so proportioned to the arcuate extent and bearing slot opening in the piston that the connecting rod and piston are adapted to limited relative swinging movements. At equally spaced positions circumferentially of the bearing collar from the longitudinal center line of the connecting rod 109, arcuate bearing slots 112, 113, 114, 115 and 116 extend through the peripheral margin of the bearing collar with the axes of their arcuate surfaces in substantially parallel relationship to the axes of the central bearing bore 108. The diameters, arcuate extents and positions of the arcuate bearing slots radially of the bearing collar are such that those slots open outwardly of the collar in a direction radial thereto and each has an arcuate extent of more than 180 degrees but less than 360 degrees.

The connecting rod 109 of the bearing collar 107 connects the piston 94 to the bearing collar 107 and thence to the crank pin 105, while connecting rods 117, 118, 119, 120 and 122 respectively provide movable operating connections between the bearing collar 107 and their pistons 88, 89, 90, 92 and 93 of the same set. In the other set, the connecting rod 109 on the bearing collar 106 is connected to the piston 84, while pistons 85, 86, 87, 82 and 83 are respectively connected to the bearing collar through connecting rods 123, 124, 125, 126 and 127. By preference, the connecting rods 117, 118, 119, 120, 122, 123, 124, 125, 126 and 127 are similar in size and structure. Each has an arcuate end bearing portion 128 adapted to fit into the bearing slot 97 of one of the pistons. Also, each has at its opposite end an arcuate bearing portion 129 having an axis parallel to that end bearing portion 128 and of a size to fit into one of the arcuate bearing slots in one of the bearing collars. Preferably, the length of each bearing portion 128 conforms substantially to the diameter of the piston which it adjoins and the opposite end surfaces thereof conform to the curvature of the piston surface. Also, the length of each arcuate bearing portion 129 is substantially equal to the axial length of the bearing collar which it adjoins. In the assembly, as depicted in Fig. 7, the bearing collars fit snugly between opposed bearing faces 130 and 132 of the crank arm portion of the crank shaft and bearing surfaces 133 and 134 on the inner cylinder block surface and inner cover plate surface respectively, so that those bearing surfaces hold the inner ends of the connecting rods in place in an axial direction.

In the assembly of the compressor, the connecting rods 123, 124, 125, 126 and 127 are assembled with their bearing collar 106 and their respective pistons in the cylinder block. Then the crank pin 104 is inserted into the central bearing bore 108 and the connecting rods 117, 118, 119, 120 and 122 are assembled with their respective pistons in the cylinder block and the bearing collar 107, after which the crank shaft is positioned and secured relative to the cover plate 66.

Between the sets of cylinder bores in the cylinder block and circumferentially of the outer surface of that block, a ring groove 135 is provided which carries an extension type sealing ring 136. Also, near the opposite ends of the cylinder block, peripheral ring grooves 137 and 138 are provided, which latter ring grooves carry expansion type sealing rings 139 and 140 respectively.

From the foregoing description, it may be readily understood that during rotary movement of the cylinder block, the pistons of each set are reciprocated sequentially between extended and retracted positions relative to the cylinder bores. When the pistons are in a fully extended position relative to the cylinder bores, it is my preference that the outer ends thereof shall be substantially flush with the outer surface of the cylinder block. At the other ends of the piston strokes, the pistons, of course, remain in their respective cylinder bores, although retracted to provide a substantial displacement volume in respect to the diameters thereof. Furthermore, the positioning of the crank pins 104 and 105 on opposite sides of the axis of rotation of the cylinder block displaces the phases of movements of adjacent pistons of the two sets by 180 degrees, thereby balancing the forces on opposite sides of the cylinder block.

While it is expected that a substantial portion of the interior of the cylinder block will be filled with oil during operation of the compressor to lubricate the moving parts and to aid in providing an effective gas tight seal between the parts with only normal machining limits and fits therebetween, the sealing rings 136, 139 and 140 provide running seals between the cylinder block and housing at their opposed wearing surfaces. These factors, together with the fact that the outer housing is hermetically sealed, prevents gas leakage.

In the disclosed structure, the valve action necessary for making effective use of the piston movements is accomplished without the use of additional parts, cams and the like. In the present instance, I have provided arcuate circumferential slots 142 and 143 facing inwardly of the housing side wall portion 45 in alignment for communication with the ends of the cylinder bores during rotation of the cylinder block, which slots, in the present instance, each extend around less than 180 degrees of the cylinder block and are placed at circumferentially spaced positions. In like manner, similar slots 144 and 145 in the inner surface of the housing side wall portion 45 are aligned for communication with the cylinder bores of the other set during rotation of the cylinder block. Assuming the direction of cylinder block rotation indicated by arrows in Figs. 8 and 9, and when the disclosed mechanism is utilized as a compressor, the slots 142 and 144 serve as discharge slots, while the slots 143 and 145 serve as intake slots. Communicating with the discharge slots 142 and 144 respectively are discharge passages 146 and 147 in the housing side wall portion 45 and on opposite sides thereof. Also, on opposite sides of the housing side wall portion 45, intake passages 148 and 149 extend through the compressor side wall portion and communicate with inlet slots 143 and 145.

As viewed in Figs. 8 and 9, the designated direction of rotation of the cylinder block is clockwise. At the end of each discharge stroke, the piston is, of course, moved to an extended position such that the end thereof is substantially flush with the outside wall of the cylinder block. As the piston progresses, it is retracted from that position. In my preferred compressor structure which is disclosed, the initial movement of retraction of the piston occurs when the cylinder bore is out of communication with both valve slots, so that a preliminary pressure reduction is effected in the cylinder bore. As the retracting movement continues to completion, the cylinder bore is in communication with the inlet slot, so as to effect a pressure reduction, or suction in the inlet slot and its communicating passage. There is then, in my preferred construction, a substantial period during which the cylinder bore is out of communication with both slots, in order that the pressure in the cylinder bore will be built up before the discharge into the discharge slot and its communicating passage are effected by the opening of the cylinder bore into that discharge slot. With this arrangement, the intake period for each cylinder is of greater extent than the discharge period. It, however, enables the building up of a pressure in the cylinder bore which equals or exceeds that in the discharge passage before the cylinder bore is opened into the discharge slot for communication with that passage.

While I have illustrated a preferred embodiment of my invention, many modifications may be made without departing from the spirit of the invention, and I do not wish to be limited to the precise details of construction set forth, but desire to avail myself of all changes within the scope of the appended claims.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent of the United States, is:

1. In a compressor or the like adapted to use in refrigeration apparatus, the combination comprising a housing having an internally cylindrical side wall and end walls presenting oppositely disposed plane surface portions, one of said end walls having a bearing therein coaxial with the internally cylindrical surface, a cylinder block having a cylindrical outer surface and plane end surfaces dimensioned to provide a running fit with the cylindrical surface and plane surface portions of the housing, said cylinder block also being interiorly hollow and having an integrally formed shaft projecting axially from only one end thereof which is fitted for rotation in said bearing, said cylinder block having therein axially separated sets of cylinder bores with the sets each in coplanar relationship and extending radially from the hollow interior through the cylindrical surface thereof, said cylinder block also having a peripheral groove between the outer ends of said sets of cylinder bores and a sealing ring mounted in said groove for engagement with the cylindrical surface of the housing, a stationary crank shaft having crank pins in the general planes of the sets of cylinder bores and positioned eccentrically of the axis of the cylinder block on opposite sides of said axis, sets of pistons each mounted for sliding movement in the cylinder bores of said sets, and means including a bearing collar and connecting rods for connecting the pistons of the sets to the crank pins so that rotation of the cylinder block effects reciprocation of the pistons.

2. In a compressor as defined in claim 1, said bearing collar comprising a body portion having a central crank shaft bearing therein and having one of said connecting rods integrally formed thereon and projecting from the body portion in a direction radial to the crank shaft bearing, said body portion also having in the periphery thereof and spaced peripherally of the body portion with reference to the integral connecting rod a plurality of arcuate bearing slots opening radially of the body portion and having an arcuate extent of more than 180 degrees, and others

of said connecting rods having at the ends thereof integral cross pin portions fitting into the arcuate bearing slots to provide force transmitting connections permitting limited relative movements of the bearing collar and said others of the connecting rods.

3. In refrigeration apparatus, a motor driven compressor unit comprising, in combination, a housing having coaxial cylindrical wall portions extending oppositely from a radial partition wall, opposite ends of said cylindrical wall portions being open, said radial partition wall having a bearing therein which is also coaxial with the cylindrical wall portions, a cylinder block having a cylindrical outer surface of a size to have a relatively close running fit in one of the cylindrical wall portions and having a shaft projecting axially from only one end thereof in concentric relationship to the cylindrical surface, said shaft fitting into said bearing to support the cylinder block for rotation in said one of the cylinder wall portions, a motor rotor drivingly secured to said shaft on the end thereof opposite the cylinder block and within the other cylindrical wall portion of the housing, a stator secured within said other cylindrical wall portion in driving relationship to the rotor, an end cover sealing the end of the housing in which the rotor is mounted, a second end cover for sealing the end of the housing in which the cylinder block is mounted, said cylinder block having a hollow interior and cylinder bores extending radially from the hollow interior through the cylindrical outer surface thereof, a stationary crank-shaft secured to the second end cover and extending into the hollow interior of the cylinder block, pistons mounted for sliding movement in the cylinder bores, connecting rods connecting the pistons to the crank shaft so that the pistons are reciprocated in the cylinder bores during rotary movement of the cylinder block, and segmental and circumferentially separated inlet and discharge channels in said one of the cylindrical wall portions in aligned relationship to the cylinder bores axially thereof and having inlet and discharge ports communicating therewith, said cylinder bores being divided into two sets separated axially of the cylinder block, the cylinder bores of each set being equal in number, equally spaced apart and in aligned relationship axially of the cylinder block to those of the other set, and said crank shaft having crank pin portions disposed to dephase the movements of adjacent pistons in the sets of cylinder bores substantially 180 degrees.

4. In a compressor or the like adapted to use in refrigeration apparatus, the combination comprising a housing having an internally cylindrical side wall and end walls presenting oppositely disposed plane surface portions, one of said end walls having a bearing therein coaxial with the internally cylindrical surface, a cylinder block having a cylindrical outer surface and plane end surfaces dimensioned to provide a running fit with the cylindrical surface and plane surface portions of the housing, said cylinder block also being interiorly hollow and having a shaft projecting axially from one end thereof which is fitted for rotation in said bearing, said cylinder block having therein axially separated sets of cylinder bores wherein the cylinder bores of each set are in coplanar relationship and extend radially from the hollow interior through the cylindrical surface thereof, a stationary crank shaft having crank pins in the general planes of the sets of cylinder bores and each positioned eccentrically of the axis of the cylinder block, sets of pistons each mounted for sliding movement in the cylinder bores of said sets, and means including a bearing collar and connecting rods for connecting the pistons of the sets to the crank pins so that rotation of the cylinder block effects reciprocation of the pistons, each of said pistons having a cylindrical body with an end facing inwardly of the cylinder block, the inner end of said cylindrical body having a bearing slot of arcuate section therein and extending laterally of the body axis, the arcuate extent of said bearing slot being greater than 180 degrees, and said connecting rods each having on an end thereof an integral cross pin portion of a size to fit said bearing slot, said cross pin and bearing slot providing a force transmitting connection between the connecting rod and piston and through which they are relatively movable to a limited extent.

WILLIAM E. BAUER.

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