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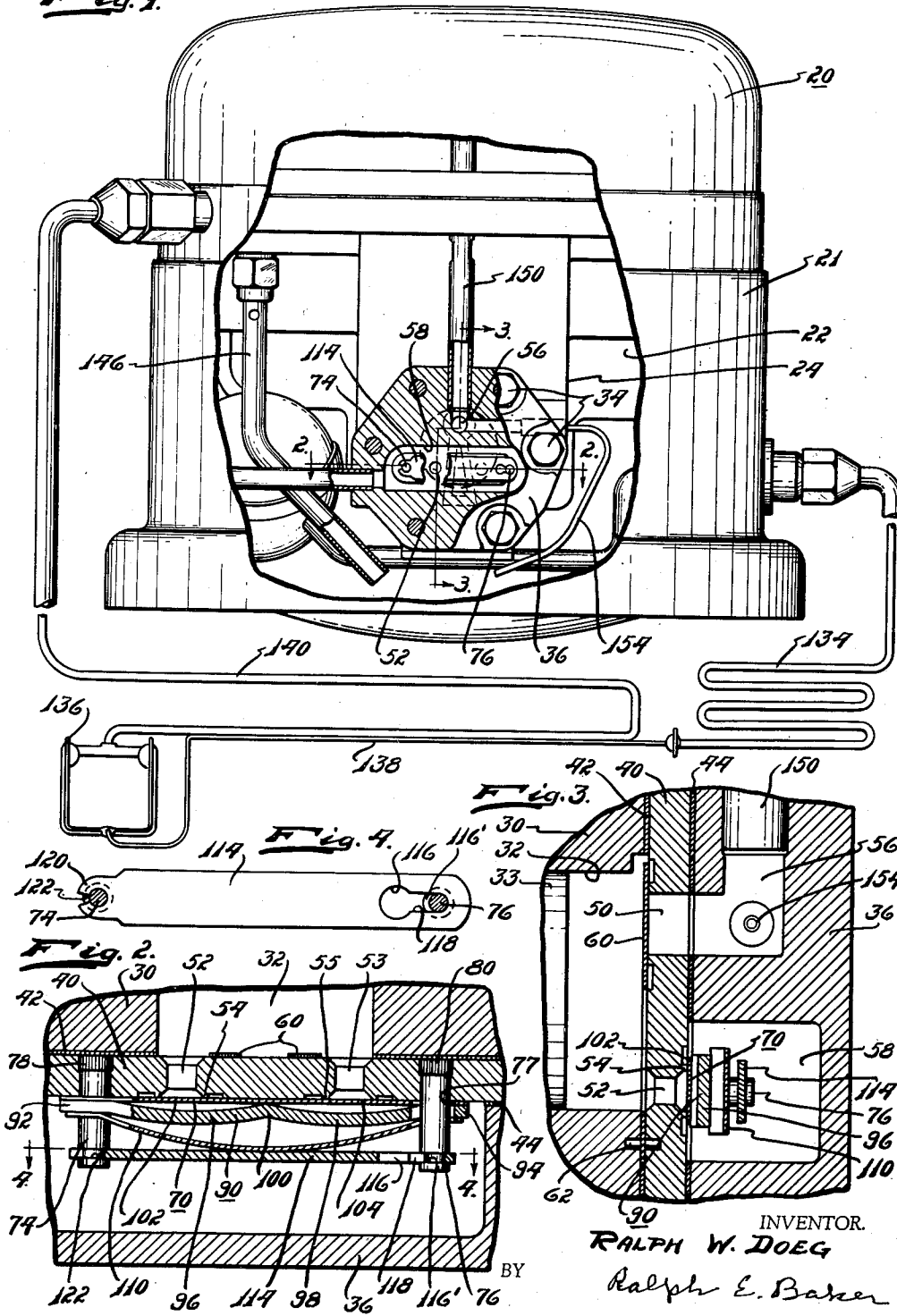
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2,372,938

REFRIGERATING APPARATUS

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Fig. 1.



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REFRIGERATING APPARATUS

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3 Claims. (Cl. 230—228)

This invention relates to refrigerating apparatus, and more particularly to compressors employed in such apparatus.

One of the objects of my invention is to provide an improved discharge valve arrangement for a refrigerant compressor.

Another object of my invention is to provide an improved refrigerant compressor in which gas compressed in the compressor cylinder is discharged through a plurality of outlet ports under the control of a single thin resilient closure member which cooperates with the outlet ports in such manner that it operates as a plurality of independent, rapid closing and noiseless valves for said outlet ports.

Another object of my invention is to provide an improved discharge valve assembly for a compressor having a plurality of outlet ports through which compressed gas may be discharged which comprises a single thin resilient closure plate releasably held against said ports by means of a spring pressed relatively thick plate which engages the closure plate on opposite sides of the outlet ports and which has arcuate portions intermediate the points of engagement whereby the closure plate is divided into a plurality of rapid closing and noiseless valves for the outlet ports.

Another object of my invention is to provide an improved refrigerant compressor wherein the compressed gas is discharged through a plurality of outlet ports having extremely narrow valve seats whereby the valves cooperating with said seats operate upon a small differential between the heat and cylinder pressures.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawing, wherein a preferred form of the present invention is clearly shown.

In the drawing:

Fig. 1 is a view in elevation of a motor compressor unit with parts broken away and parts shown in section, and showing the invention applied in a schematic arrangement of a refrigerating system;

Fig. 2 is a view taken along line 2—2 of Fig. 1;

Fig. 3 is a view taken along line 3—3 of Fig. 1; and

Fig. 4 is a view taken along line 4—4 of Fig. 2.

Referring to the drawing, numeral 20 designates a sealed motor compressor unit of the type commonly employed in refrigerating apparatus. It includes a sealed casing 21 which encloses a chamber 22 in which is mounted a motor (not shown) and a compressor, designated by the

numeral 24. The compressor includes a cylinder block 30 enclosing a compression chamber 32 in which a piston 33 reciprocates. Secured to the cylinder block 30 by screws 34 is a cylinder head 36 and a valve plate 40 which is interposed between the cylinder head and the cylinder block. Gaskets 42 and 44 are placed between the valve plate 40 and the cylinder block and the cylinder head, respectively. Provided in the valve plate 40 are an inlet port 50 and outlet ports 52 and 53 which have extremely narrow flanged valve seats 54 and 55, respectively. An inlet refrigerant chamber 56 and an outlet refrigerant chamber 58 are provided in the cylinder head 36. A suction valve 60 of the bifurcated reed type is secured by pins 62 to the valve plate for controlling the flow of low pressure refrigerant to the compressor cylinder.

For controlling the discharge of high pressure refrigerant from the compressor cylinder, I have provided my improved discharge valve mechanism. This includes a thin metallic closure plate 70 which is held in alignment over the outlet ports 52 and 53 by means of guide pins 74 and 76 which extend through openings 77 in the closure plate, said openings being large enough to permit the ends of said closure plate to slide at right angles thereto. These guide pins are secured in position by means of knurled end portions 78 and 80. A relatively heavy plate member 90 is provided for dividing the closure member 70 into two fast acting and noiseless valves in accordance with my invention. This member 90 comprises two flat end portions 92 and 94, two arcuate portions 96 and 98, and an intermediate portion 100 which lies in the same plane as the two flat end portions. This plate member 90 is held in alignment by means of the guide pins 74 and 76 extending through the flat end portions 92 and 94, respectively. The end portions 92 and 94 and the intermediate portion 100 engage the closure member 70 on opposite sides of the outlet ports thereby dividing said member into two valves, 102 and 104, for the outlet ports 52 and 54, respectively. The plate member 90 is normally urged against closure member 70 by means of a spring element 110 which is locked in position upon the guide pins 74 and 76 by means of a stop member 114. This stop member is provided with an enlarged opening 116 with an adjacent slot 118 into which a groove 116 of pin 76 is adapted to slide. The other end of the stop member 114 has two elements 120 which are adapted to be pinched around a groove 122 of the pin 74.

The operation of my improved discharge valve

mechanism is as follows. Refrigerant gas is compressed in the chamber 32 as the piston 33 executes its up stroke. When this compressed gas attains a pressure slightly in excess of the head pressure in the chamber 58, the valves 102 and 104 are raised from their seats, arching upward to allow the compressed gas to escape into the discharge chamber 58. At the end of the piston stroke, the valves return of their own accord to their respective seats without chattering to immediately close the outlet ports as the piston starts its downstroke. There is no leakage back of gas past the valves as the piston starts its down stroke since the valves return to their seats quickly and without rebounding several times thereon. This highly desirable behavior of the valves 102 and 104 is made possible by my improved arrangement and construction. In the first place, the valves are rendered noiseless because of their extreme thinness and because of the small lift they undergo when raised from their seats. Their return impact with the valve seats is, therefore, slight with little resulting noise. Then, in addition, any attempt on the part of the valves to rebound from their seats upon impact therewith to produce a succession of impacts is frustrated by the ends of the valves sliding endwise on the pins 74 and 76. That is, any energy of rebound is absorbed by the endwise movement of the valves. This is made possible because of the relatively short length of the individual valves whereby the rebound energy is readily transmitted to the ends thereof. The valves because of their construction are also adapted to close rapidly of their own accord without waiting for the piston to proceed part way on its down stroke in order to build up a pressure differential. The short length of the valves makes this possible, the shorter the length the more readily the valve plate restores itself to its seat. Because the valves are noiseless in operation, it thereby becomes possible to utilize very narrow seats for the valves since broad seats are no longer necessary to cushion the impact of the valves with their seats. Due to the knife edge character of the seats, a small differential between the head and the cylinder pressure will operate the valves.

The compressed gas discharged into the outlet chamber 58 is conducted to a condenser 134 to be liquefied. The condensed liquid is conveyed to an evaporator 136 under the control of a small diameter tube or capillary 138. From the evaporator, refrigerant gas is returned to the compressor unit 20 through a conduit 140 which is preferably in heat exchange relation with the small diameter tube 138. This low pressure gas is admitted to the chamber 22 through a conduit 146 which extends below the level of the lubricant contained in the chamber. From the chamber 22 the low pressure refrigerant is delivered to the inlet chamber 56 through a conduit 150. This refrigerant is then admitted upon the suction stroke of the piston 33 to the compression cylinder 32 under the control of the suction valve 60. If desired, a small amount of lubricant may be metered into the inlet chamber 56 by means of

a short capillary tube 154 which extends below the level of the lubricant in the chamber 22. This lubricant is carried into the compressor cylinder by the incoming refrigerant gas and serves to eliminate "dry knocking" of the piston within the cylinder.

It will be seen from the foregoing description that I have provided a discharge valve mechanism for a compressor which is quiet and fast acting in operation and which operates upon a small differential between the cylinder and head pressures. I have accomplished this by using a plurality of discharge ports having narrow flanged seats with which a single resilient closure plate cooperates as a plurality of relatively independent valves.

Although only a preferred form of the invention has been illustrated, and that form described in detail, it will be apparent to those skilled in the art that various modifications may be made therein without departing from the spirit of the invention or from the scope of the appended claims.

I claim:

1. In a compressor, the combination with means providing a compression chamber, said means having a plurality of outlet ports communicating with the interior of said chamber, a thin resilient closure plate covering said outlet ports exteriorly of said means, and a relatively thick retaining plate engaging said closure plate on opposite sides of said outlet ports and having arcuate portions intermediate the points of engagement, said retaining plate being releasably held against said closure plate at the several points of engagement for dividing said closure plate into a plurality of independently operating valves for said outlet ports.

2. In a compressor, the combination with means providing a compression chamber, said means having a plurality of outlet ports communicating with the interior of said chamber, a thin resilient closure plate covering said outlet ports exteriorly of said means and held in alignment thereover by a plurality of fixed guide pins, a relatively thick retaining plate adapted to engage said closure plate on opposite sides of said outlet ports and having arcuate portions intermediate the points of engagement directly over said outlet ports, said retaining plate being held in position by said guide pins, and a spring member locked on said guide pins for releasably urging said retaining plate against said closure plate at the several points of engagement.

3. In a compressor, the combination with means providing a compression chamber, said means having a plurality of spaced apart outlet ports communicating with the interior of said chamber, a thin resilient closure plate extending across both of said outlet ports, a retaining plate formed to engage said closure plate on each end thereof beyond the edges of said ports and to engage said closure plate at a point where the closure plate extends between said ports and means for yieldingly securing said retaining plate to said first named means.

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