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C. ORR

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VALVE ASSEMBLY

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Fig. 1.

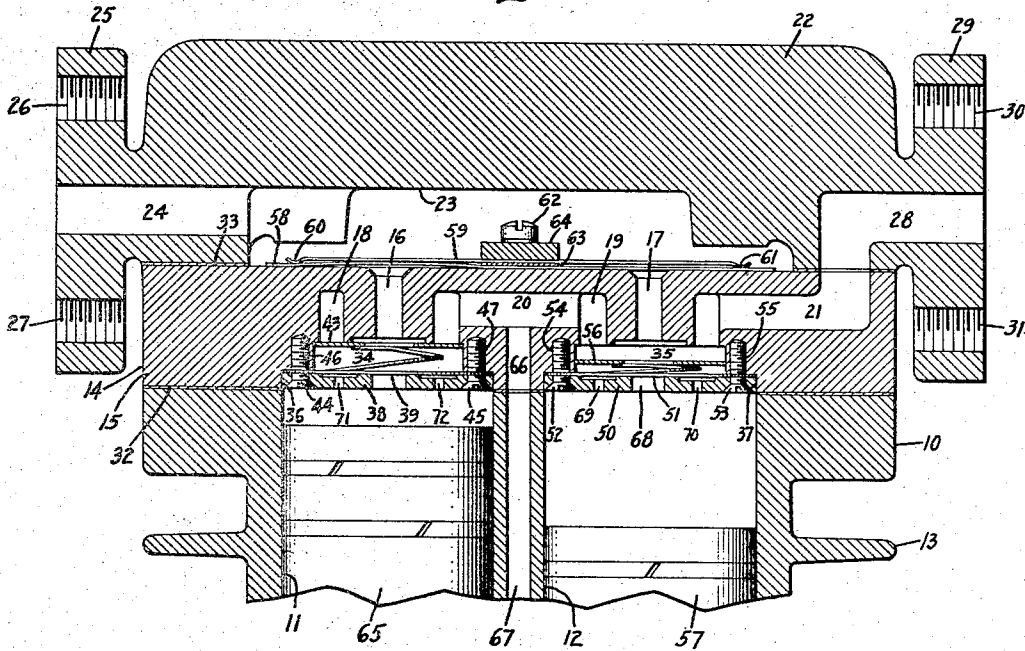
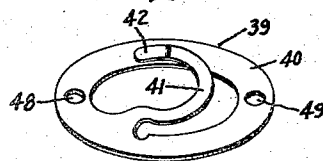


Fig. 2.



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UNITED STATES PATENT OFFICE

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VALVE ASSEMBLY

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2 Claims. (Cl. 251-119)

My invention relates to valve assemblies for compressors or the like.

It is an object of my invention to provide a valve assembly for a compressor, or the like, which is compact and rugged in construction, which requires a minimum number of parts, and which is quiet and efficient in operation. I accomplish this object by providing a valve plate or similar member in which inlet and discharge passages are concentrically arranged, the valve elements for controlling the opening and closing of such passages being preferably arranged on opposite sides of the valve plate.

Further objects and advantages of my invention will become apparent as the following description proceeds and the features of novelty which characterize my invention will be pointed out with particularity in the claims annexed to and forming a part of this specification.

For a better understanding of my invention, reference may be had to the accompanying drawing in which Fig. 1 is a side elevation, partly in section, of the cylinder head of a two-cylinder refrigerant compressor provided with a valve assembly embodying my invention, and Fig. 2 is a perspective view of a helical spring included in the compressor valve assembly, shown in Fig. 1.

Referring to the drawing, I have shown in Fig. 1, the head of a two-cylinder reciprocating type refrigerant compressor provided with a cylinder casing 10 having two vertical cylindrical cylinder bores 11 and 12 therein. The cylinder casing 10 is provided with an integral cooling fin 13 extending from the side walls thereof, which aids in dissipating heat from the cylinder walls to the surrounding air. The upper open ends of the cylinder bores 11 and 12 are closed by a valve assembly 14 embodying my invention. The valve assembly 14 includes a valve plate 15 which extends entirely across the top of the cylinder casing 10 and vertical side walls which are in alignment with the adjacent portions of the vertical side walls of the cylinder casing 10. Two vertical cylindrical discharge passages 16 and 17 are provided in valve plate 15 for the cylinder bores 11 and 12, respectively, each discharge passage being in substantially axial alignment with its cylinder bore. The discharge passages 16 and 17 are surrounded by annular inlet passages 18 and 19, respectively, the inlet and discharge passages having concentric openings communicating with their respective cylinder bores. A horizontal passage 20 formed in the valve plate 15 connects the inlet passages 18 and 19 in se-

ries and an intake passage 21 communicates with the annular inlet passage 19.

The top of the valve plate 15 is covered by a cylinder head block 22, which is provided with a recess 23 in the lower face thereof, entirely surrounding the upper ends of the discharge passages 16 and 17 and the valve mechanism therefor. The recess 23 communicates with a horizontal discharge passage 24 formed in the cylinder head block 22. An integral annular flange 25 is provided on the side of the cylinder head block 22 surrounding the end of the passage 24. The flange 25 is provided with tapped holes 26 and 27 to which may be secured a suitable pipe fitting, or the like, attached to a discharge conduit. An intake passage 28 is provided at the side of the cylinder head block 22 opposite the passage 24, the passage 28 communicating at one end with the intake passage 21 formed in the valve plate 15. It will be seen that the passage 28 does not communicate with the recess 23 formed in the cylinder head block 22. An integral annular flange 29 surrounds the outer end of the passage 28, the flange 29 being provided with tapped holes 30 and 31 to which a suitable pipe fitting, or the like, attached to a suction conduit may be secured.

A gasket 32 is provided between the adjacent surfaces of the cylinder casing 10 and the valve plate 15, in order to prevent the leakage of compressed fluid therethrough. A gasket 33 is also provided between the adjacent surfaces of the valve plate 15 and the cylinder head block 22 in order to prevent the leakage of compressed fluid therebetween. The cylinder head blocks 22 and valve plate 15 are held in this assembled position in the cylinder casing 10 by suitable bolts or the like (not shown).

Cylindrical recesses 34 and 35 are provided in the lower side of the valve plate 15 communicating with the annular inlet passages 18 and 19, respectively, and also communicating with the discharge passages 16 and 17. Counterbores 36 and 37 are formed in the lower end of the recesses 34 and 35 respectively. A disk-shaped valve retainer 38 is seated in the counterbore 36 and a helical compression spring 39 is clamped between the bottom of the counterbore 36 by the valve retainer 38. As shown in Fig. 2, the helical compression spring 39 is provided with an annular base portion 40 and an integral inner C-shaped tongue portion 41. The spring 39 may be stamped from a sheet of spring steel, or the like, and the C-shaped portion 41 bent upwardly, in the position illustrated. The top 42 of the

C-shaped portion 41 is preferably flattened in order to facilitate the support of a flat annular inlet valve element 43 thereon. The valve element 43 seats on flat machined surfaces, formed on the valve plate 15, at the inner and outer peripheries of the lower end of the annular inlet passage 18, the valve element 43 being slidably fitted in the cylindrical recess 34. The helical or C-shaped spring 39 and the valve retainer 38 are held in position in the counterbore 36 by screws 44 and 45, which engage tapped holes 46 and 47, respectively, formed in the valve plate 15, the screws 44 and 45 passing through the holes 48 and 49, respectively, formed in the base portion 40 of the spring 39. A valve retainer 50 and a helical compression spring 51 which are duplicates of the valve retainer 38 and spring 39 are secured in the counterbore 37 by screws 52 and 53, the inner ends of which are threaded in tapped holes 54 and 55, respectively, formed in the valve plate 15. A flat annular inlet valve element 56 is supported on the compression spring 51 in the recess 35 and cooperates with a seat formed by flat surfaces formed on the valve plate 15 at the inner and outer peripheries of the lower end of the inlet passage 19 to open and close the latter. The inlet valve element 56 is a duplicate of the inlet valve element 43 and is slidably fitted in the cylindrical recess 35. The compression spring 51 has been shown in its depressed position, in order to better illustrate the operation thereof during the suction stroke of a piston 57 which reciprocates in the cylinder bore 12.

The counterbored upper ends of the discharge passages 16 and 17 are alternately opened and closed by a flat rectangular valve element 58, made of a thin piece of flexible spring steel, or the like. The valve element 58 is pushed downwardly against the flat upper surface of the valve plate 15 by a flat rectangular steel spring 59 having curved outer ends 60 and 61 which bear against the adjacent portions of the valve element 58. The spring 59 and the valve element 58 are secured to the top of the valve plate 15 by a screw 62 which passes through centrally located holes formed therein and is threaded in a tapped hole formed in the top of the valve plate 15. A washer 63 separates the spring 59 and the valve element 58 at the centers thereof and a spacing block 64 is arranged between the head of the screw 62 and the upper side of the spring 59. A portion of the valve element 58 extending over the upper end of the discharge passage 16 has been shown flexed upwardly thus opening this discharge passage in order to illustrate the operation of the valve element 58 during the compression stroke of a piston 65, which reciprocates in the cylinder bore 11.

A vertical passage 66 formed in the valve plate 15 communicates with the passage 20 therein and with a vertical passage 67, formed in the cylinder casing 10 between the cylinder bores 11 and 12. The lower end of the vertical passage 67 communicates with the crank case of the compressor, or with any other suitable lubricant reservoir.

In the operation of the machine described above, the pistons 65 and 57 are reciprocated in the cylinder bores 11 and 12, respectively, by an electric driving motor, or other suitable means. Vaporized refrigerant, or other compressible fluid is supplied to the intake passage 28 and passes therefrom through the passage 21 to the annular

inlet passage 19 and from there through the passage 20 to the annular inlet passage 18. Oil or other lubricant entrained in the incoming gaseous refrigerant is separated therefrom in the passage 20 and flows by gravity through the passages 66 and 67 to the crankcase or other lubricant reservoir. When the piston 57 moves downwardly on the suction stroke, to the position indicated on the drawing, the fluid pressure on the lower side of the valve element 56 is decreased. When the pressure of the gaseous refrigerant in the inlet passage 19 exceeds the pressure of the gas in the cylinder bore 12 by a predetermined value, the inlet valve element 56 and its supporting compression spring 51 are forced downwardly to the position illustrated, thus opening the inlet passage 19. Gaseous refrigerant then enters the recess 35 from the inlet passage 19 and passes downwardly through the open center of the annular valve element 56, then mainly through a hole 68 formed in the center of the valve retainer 50 and into the cylinder bore 12. When the reciprocating piston 57 again moves upwardly in the cylinder bore 12, the gaseous refrigerant is compressed thereby in the cylinder bore and is forced upwardly therefrom through the hole 68 and also through holes 69 and 70 in the valve retainer 50 into the recess 35. When the pressure on the lower side of the valve element 56 exceeds the pressure of the gaseous refrigerant in the inlet passage 19 the valve element 56 is again moved upwardly and is seated on the valve seats formed on the valve plate 15 surrounding the lower end of the inlet passage 19. The holes 69 and 70 are preferably placed directly below the lower surface of the valve element 56 in order that the pressure of the gaseous refrigerant compressed in the cylinder bore 12 may be rapidly transmitted to the valve element 56, thus insuring a rapid closing movement thereof. A corresponding pair of holes 71 and 72 are provided in the valve retainer 38 in order that the lower side of the inlet valve element 43 will be directly exposed to gaseous refrigerant compressed in the cylinder bore 11. The piston 65 in the cylinder bore 11 is illustrated in its position when nearing the completion of a compression stroke. The pressure of the gaseous refrigerant compressed thereby flexes a portion of the discharge valve element 58 extending over the discharge passage 16 upwardly, thus allowing the compressed gaseous refrigerant to escape from the discharge passage 16 into the recess 23 formed in the cylinder head block 22. The compressed gaseous refrigerant then passes therefrom through passage 24 to a discharge conduit, or the like, which communicates with the end of the passage 24. Gaseous refrigerant is thus alternately drawn into and compressed in the cylinder bores 11 and 12, the compressed gaseous refrigerant passing therefrom through the discharge passages 16 and 17 to the recess 23 from which it flows through the passage 24.

While I have shown a particular embodiment of my invention in connection with a compression refrigerating machine, I do not desire my invention to be limited to the particular construction shown and described, and I intend in the appended claims to cover all modifications within the spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States, is:—

1. A valve assembly for a compressor, or the like, comprising a valve plate having a discharge passage therein and an annular inlet passage therein surrounding said discharge passage, said

valve plate having a recess therein communicating with said inlet and said discharge passages and having a counterbore at the lower edge thereof, means including an annular inlet valve element located at the lower end of said annular inlet passage for opening and closing said inlet passage, means including a helical compression spring for supporting said inlet valve element in said recess, said compression spring having the base portion thereof extending into said counterbore, a valve retainer extending across the lower end of said recess, and means for supporting said base portion of said spring and said valve retainer in said counterbore.

2. A valve assembly for a compressor, or the like, comprising a valve plate having a discharge passage therein and an annular inlet passage

therein surrounding said discharge passage, said valve plate having a recess therein communicating with the lower end of said annular inlet passage and having a counterbore at the lower edge thereof, means including an annular inlet valve element located in said recess for opening and closing said inlet passage, means including a compression spring having a base portion arranged in said counterbore and an integral tongue portion extending upwardly from said base portion for supporting said inlet valve element in said recess, a valve retainer extending across the lower end of said recess and into said counterbore, and means for supporting the base portion of said compression spring and said valve retainer in said counterbore.

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