Feb. 7, 1961 R. W. DOEG 2,970,608

REFRIGERATING APPARATUS

Filed June 25, 1958

Fig. 1

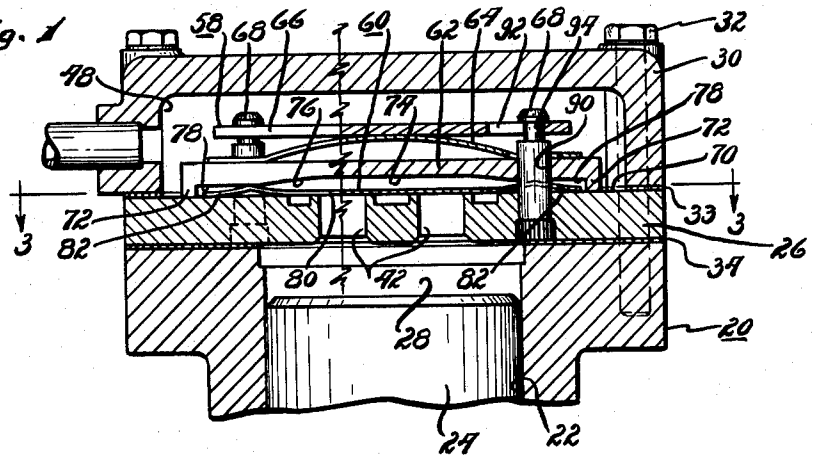


Fig. 2

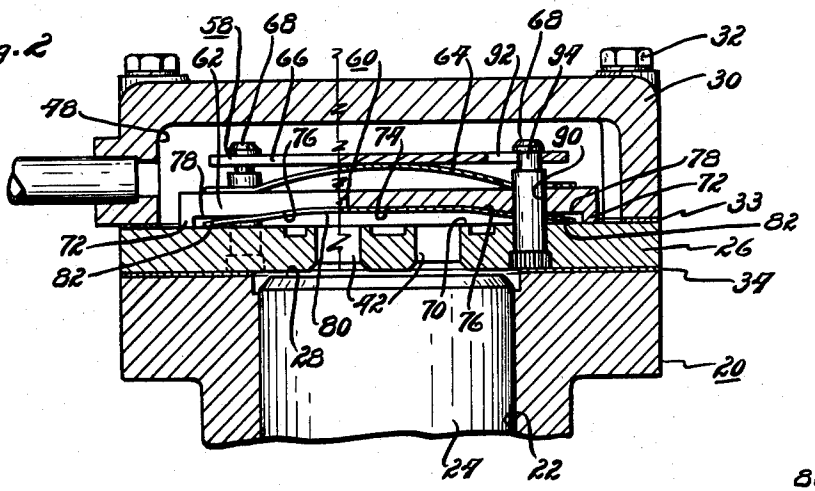


Fig. 3

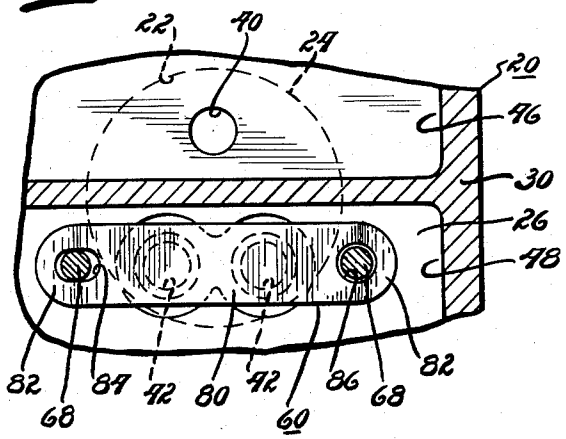
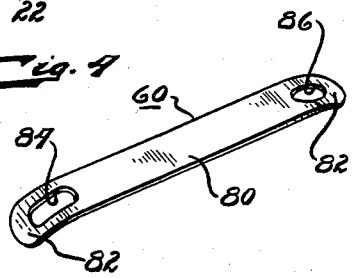


Fig. 4



INVENTOR.
RALPH W. DOEG
BY
Ralph E. Baker
ATTORNEY

United States Patent Office 2,970,608 Patented Feb. 7, 1961

2,970,608

REFRIGERATING APPARATUS

Ralph W. Doeg, Detroit, Mich., assignor to American Motors Corporation, Detroit, Mich., a corporation of Maryland

Filed June 25, 1958, Ser. No. 744,379

5 Claims. (Cl. 137—516.11)

This invention relates to refrigerating apparatus and more particularly to discharge valve mechanisms for use in refrigerant compressors and the like.

In reed type valves adapted for use in refrigerant compressors, particularly high speed refrigerant compressors for controlling the discharge or outlet ports therein, it is highly desirable that the reed be arranged to flex relatively fast in moving from an open to a closed position. The purpose of this is to prevent the return flow of compressed gases from the discharge chamber back into the cylinder at the moment the piston reaches the top of the discharge stroke as would be the case in a slow closing valve. In general practice the reed is sometimes increased in stock thickness to accelerate the closing action. This practice has the disadvantage of making the valve slap, and consequently is noisy in operation. Also a thicker reed does not readily adapt itself to a flat type discharge port and therefore is more difficult in seating thereon. It is an object of the present invention to provide a reed type valve that is formed of relatively thin stock and arranged to provide a fast closing action that will reseat at the moment the piston attains the end of its discharge stroke, is quiet in operation and which will readily and efficiently seat upon the discharge port to close the port without leakage.

It is another object of the present invention to provide a new and improved reed type closure strip formed of relatively thin strip material in a manner that upon assembly in a compressor the reed will be stressed to seat under a self tension upon an outlet port or ports, and this tension will be further increased in the reed as it is unseated to provide therein a force for a rapid accelerated movement in reseating the reed upon the outlet port or ports.

Another object of the present invention is to provide for the control of an outlet port or ports a new and improved reed type closure strip with associated mechanism arranged therewith to keep the closure strip under a predetermined tension and to confine the flexing of the strip normally to the area directly over the ports.

A further object of the present invention is to provide an improved refrigerant compressor reed type discharge valve and mechanism that is compact for assembly in a limited space.

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

Fig. 1 is a fragmentary view in cross section of a refrigerant compressor and a discharge valve mechanism embodying features of my invention;

Fig. 2 is a view similar to Fig. 1 showing certain parts of the compressor and a discharge valve mechanism in the position they assume on discharge operation;

Fig. 3 is a fragmentary sectional view taken along lines 3—3 of Fig. 1, and

Fig. 4 is a perspective view of the discharge reed valve strip embodying features of my invention.

Referring to the drawing, there is shown a refrigerant compressor cylinder block 20 having a bore 22 in which a piston 24 is adapted to reciprocate to compress gaseous refrigerant. A valve body or plate 26 covers the outer end of the cylinder bore to form therewith a compression chamber 28. Secured upon the valve plate 26 is a cylinder head 30. The valve plate 26 and the cylinder head 30 are assembled and secured to the cylinder block 20 by bolts 32. Suitable gaskets 33 and 34 are interposed between the cylinder block, valve plate and cylinder head to insure fluid tight joints therebetween.

The valve body or plate 26 is formed with an inlet port 40 and a pair of outlet or discharge ports 42. The cylinder head 30 is formed with a pair of cavities to form with the valve plate 26 a suction or inlet chamber 46 and a discharge or outlet chamber 48. The suction chamber 46 communicates through the inlet port 40 with the compression chamber 28 for conducting gaseous refrigerant thereinto under the control of a thin resilient reed suction valve (not shown). Any suitable type of suction valve may be had for controlling the inlet port, such for example as the valve shown in my Patent No. 2,372,938 issued April 3, 1945.

Compressed gaseous refrigerant passes from the compression chamber 28 through the ports 42 into the discharge chamber 48 under the control of my new and improved discharge valve mechanism 58 which includes a resilient reed type valve member or closure strip 60, a member 62 which serves as a pressure plate and valve stop, a leaf spring 64, and a locking plate 66 all of which are assembled and guided on a pair of spaced parallel guide studs or pins 68 that are carried by the valve plate 26. The pins 68 are secured in the valve plate 26 and positioned relative to the discharge ports 42 to locate thereupon the discharge valve mechanism 58 within the discharge chamber 48.

The closure strip 60 is disposed upon a flat planular surface 70 of the valve plate 26 and beneath the member 62. The member 62 overlies the closure strip and extends beyond the terminal ends of the closure strip to rest by a pair of leg sections 72 upon the surface 70 of the valve plate. A face of the member 62 intermediate the leg sections 72, opposed to the surface 70, is formed with an inwardly offset surface or wall section 74 which extends in a substantially space parallel relation to the surface 70. The opposed ends of surface or wall section 74 join opposed downwardly inclined wall surfaces 76 that extend to and join shoulder sections 78. The shoulder sections 78 extend in space parallel relation with the surface 70 to provide a recess or space therebetween slightly greater than the thickness of the closure strip 60 to allow longitudinal sliding movement for the closure strip extended thereinto. The surface or wall section 74 provides a stop to limit the opening action of the closure strip as it unseats and moves away from the discharge ports 42. The closure strip in the opening action will tend first to engage the inclined surfaces 76 by a rolling engagement thereagainst, see Fig. 2, by moving upwardly therealong towards abutment against the stop surface 74. This arrangement permits for a quieter opening action and tends to eliminate any tendency of the closure strip to slap against the surface 74.

The closure strip 60 is formed of a single strip of resilient material preferably of stock of approximately .006 inch thick. The outer marginal end sections are bent from the central section 80 to form opposed outwardly downwardly directed leg sections 82. The legs 82 are shown, see Fig. 4, preferably bent to extend as an arcuate section from the central body, however it will be obvious that the legs may be formed as a straight flat section extending angularly from the central body sec-

tion. Each leg 82 is identically formed in opposed relation so that when rested upon the surface 70 the central body section 80, before assembly thereon of the stop member 62, will extend substantially in space parallel relation with the surface 70. Apertures 84 and 86 are formed in the closure strip at the junction of the legs to the central body section for receiving and locating the strip on the pins 68. The aperture 84 is elongated longitudinally of the closure strip to allow for longitudinal sliding and expansion movement for the closure strip.

In assembling the valve 58, the closure strip 60, by the apertures 84 and 86, is received upon the vertical pins 68 with the legs 82 extending downwardly to rest upon the surface 70. The member 62 is assembled upon the pins 68, received through apertures 90, to rest and bear upon the closure strip 60. Pressure is applied upon the member 62 by the leaf spring 64 which is held under tension by the rigid locking plate 66. The locking plate 66 is formed with suitable key slots 92 adapted to receive a respective reduced neck section 94 formed on each pin 68 to lockingly secure the plate 66 upon the pins 68.

The pressure applied by the leaf spring 64 upon the member 62 will force the member downwardly which movement is limited by the legs 72 as they come to rest upon the surface 70. The shoulder sections 78 will engage and press downwardly upon the closure strip preferably along the line defining the juncture of the legs with the central body 80. This pressure or force will cause a substantial flattening out of each leg against the surface 70. This flattening action tends to flex the legs in an upward direction which stresses and forces a compression upon the central body 80 to bow or arc in a downward direction towards and against the surface 70. As the bowing is limited by the surface 70 the central body 80 tends to substantially flatten out along the surface 70 over and upon the discharge ports 42. The central section 80 of the closure strip 60 is thus seated under pressure upon the discharge ports.

During the compression stroke of the piston the pressure of the compressed gases will be greater than the resistance offered by the closure strip to force the unseating and lifting of the section 80 upwardly off the discharge ports towards and against the stop surface 74 to allow the compressed gases to flow through the ports 42 into the discharge chamber 48. The section 80 when seated upon the ports 42 exerts an initial force of ½ pound against the seat and this force is further increased as the section 80 is unseated during the compression stroke so that the moment the piston completes its compression stroke the section 80 will rapidly reseat itself moving in a rapid accelerating manner.

By the present arrangement there is provided a discharge valve and assembly that provides a relatively fast opening and closing action particularly adapted for compressors that operate at relatively high speeds at approximately 3600 r.p.m. The preloading arrangement provides a valve that offers relatively little resistance to the force of the compressed gases to effect a rapid opening action and provides an arrangement for an effective build up of pressure or force to accelerate the closing action in a rapid manner so that a closing of the discharge ports is had before the piston has appreciably begun its travel downwardly on the suction stroke. By eliminating the need of extraneous springs and the like the assembly may be made more compactly thereby requiring a smaller space in the cylinder head. Further, by forming the reed or closure strip of relatively thin stock a quieter valve operation is had.

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. A discharge valve for refrigerant compressors comprising a valve plate having a substantially flat planular surface and a pair of outlet ports extending therethrough, a closure strip overlying and controlling said outlet ports, said closure strip formed of relatively thin resilient material having a body section and a pair of leg sections formed integrally therewith, said leg sections extending oppositely from opposed ends of said body section in a downward outward direction therefrom, means to mount said closure strip to said valve plate relative to said outlet ports, said closure strip mounted with said leg sections extended towards said planular surface to resist the movement of said body section thereupon, and pressure means applied to said leg sections in a direction whereby said legs are flexed to impose a force to urge said body section to assume a position upon said planular surface to close said outlet ports.

2. A discharge valve for refrigerant compressors comprising a valve plate having a substantially flat planular surface and a pair of outlet ports extending therethrough, a closure strip overlying and controlling said outlet ports, said closure strip formed of relatively thin resilient material having a body section and a pair of leg sections formed integrally therewith, said leg sections extending oppositely from opposed ends of said body section in a downward outward direction therefrom, means associated with said valve plate to hold said closure strip relative to said outlet ports, said closure strip positioned upon said valve plate with said leg sections extended towards said planular surface to resist the movement of said body section towards said surface, and resilient means for applying pressure upon and to move said means whereby said means engages to substantially flatten said leg sections upon said planular surface to thereby cause said leg sections to urge said body section towards and in contact with said planular surface to close said outlet ports.

3. A discharge valve for refrigerant compressors comprising a valve plate having a substantially flat surface and outlet ports extending therethrough, a closure strip overlying and controlling said outlet ports, said closure strip formed of relatively thin resilient material and having a body section and a pair of leg sections formed integrally therewith, said leg sections being preformed to said body section to extend in opposed relation from opposed ends of said body section normally in a downward outward direction therefrom and towards said planular surface, pressure means engaging said closure strip at the line of juncture of said legs to said body section, said pressure means urging said closure strip towards said planular surface by flexing said legs from its preformed position to a substantially flat position upon said planular surface so that said legs effect a bowing of said body section to assume physical engagement with said planular surface to substantially flatten thereupon to close said outlet ports, said body section flexible away from said outlet ports by pressure of fluid discharging therethrough, and supporting means carried by said valve plate for said pressure means.

4. A discharge valve for a refrigerant compressor comprising a valve plate having a substantially flat surface and a pair of laterally positioned ports extending therethrough, a relatively thin resilient closure strip overlying and controlling said ports, said closure strip having an intermediate substantially flat section and opposed marginal end sections being preformed to said flat section to extend arcuately in a downward outward direction therefrom and toward said flat surface of said valve plate, a movable member carried by said valve plate and adapted to overlie the closure strip so that said closure strip is intermediate said movable member and said flat surface, means formed on said movable member to engage upon said closure strip at the respective line of juncture of said marginal ends and intermediate section, pressure means

upon said movable member to urge and hold said member in pressure relation upon said closure strip in manner to cause said marginal ends to flex from its normal preformed position to a substantially flat position upon said planular surface to thereby effect a bowing action upon said intermediate section in a direction to physically engage upon said planular surface to close said ports, said intermediate section flexible away from said ports by pressure of fluid discharging therefrom, and said member having stop means to limit thereagainst the movement of said intermediate section away from said ports.

5. A discharge valve for a refrigerant compressor comprising a valve plate having a substantially flat surface and a pair of laterally positioned ports extending therethrough, a relatively thin resilient closure strip overlying and controlling said ports, said closure strip having an intermediate substantially flat section and opposed marginal end sections being preformed to said flat section to extend arcuately in a downward outward direction therefrom and towards said flat surface of said valve plate, a movable member carried by said valve plate and adapted to overlie the closure strip so that said closure strip is intermediate said movable member and said flat surface, means formed on said movable member to engage upon said closure strip at the respective line of juncture of said

marginal ends and intermediate section, pressure means upon said movable member to urge and hold said member in pressure relation upon said closure strip in manner to cause said marginal ends to flex from its normal preformed position to a substantially flat position upon said planular surface to thereby effect a bowing action upon said intermediate section in a direction to physically engage upon said planular surface to close said ports, said intermediate section flexible away from said ports by pressure of fluid discharging therefrom, said member having stop means to limit thereagainst the movement of said intermediate section away from said ports, and means carried by said movable member to physically abut said valve plate to limit the movement of said movable member upon said closure strip by said pressure means.

References Cited in the file of this patent

UNITED STATES PATENTS

1,607,324	Voss	Nov. 16, 1926
2,000,735	Arnold	May 7, 1935
2,372,938	Doeg	Apr. 3, 1945
2,752,943	Doeg	July 3, 1956

FOREIGN PATENTS

548,560	France	Oct. 25, 1922