Nov. 17, 1942. R. E. KING ET AL 2,302,447

COMPRESSOR VALVE

Filed Aug. 30, 1941

Fig. 1.

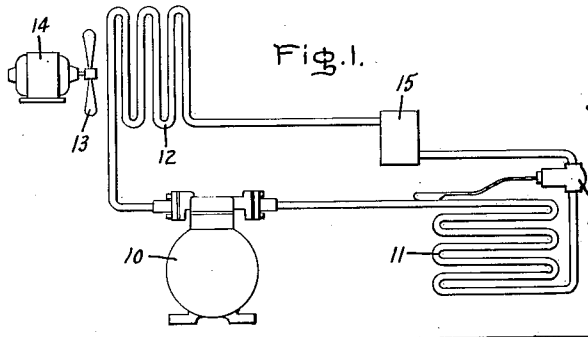


Fig. 3.

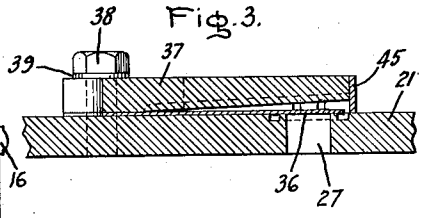


Fig. 2.

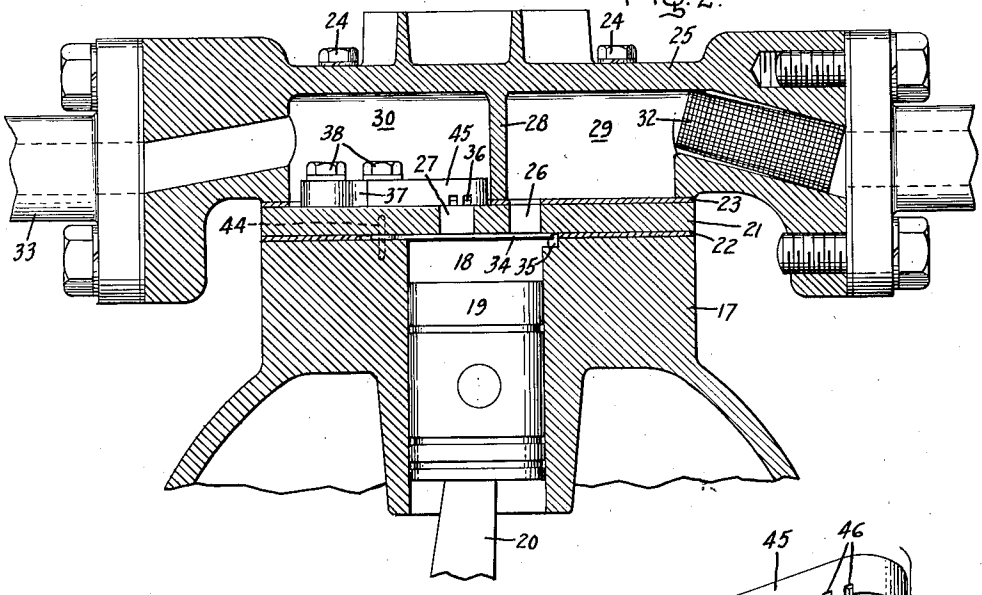


Fig. 5.

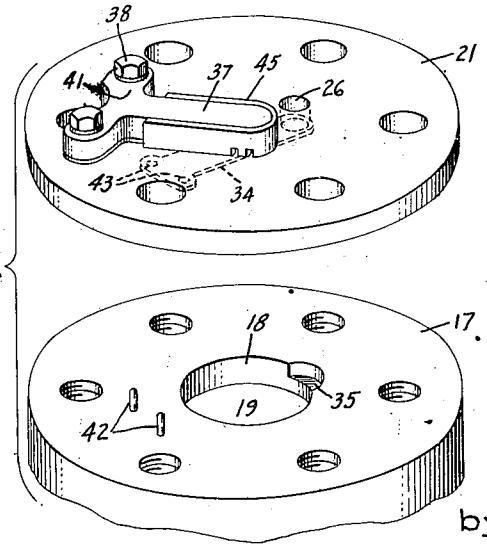
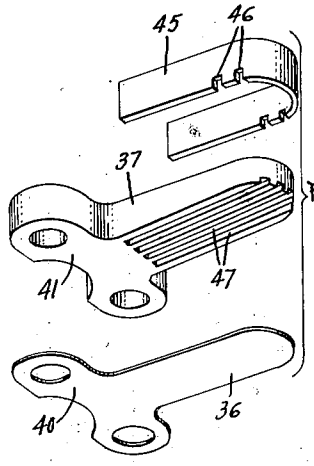


Fig. 4.



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COMPRESSOR VALVE

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Application August 30, 1941, Serial No. 409,008

5 Claims. (Cl. 251—119)

This invention relates to valves for compressors and the like.

Compressors such as those employed in refrigerating machines are frequently provided with flexible valves of the reed type. This type of valve may be constructed of a strip of thin flat spring steel secured to the valve plate so that it covers the intake or exhaust port of the compressor in its normal position and bends away from the port when fluid is flowing therethrough. In order to prevent unnecessary vibration or stressing the valve, it is a common practice to provide some form of backing element to limit the opening movement of the valve. The movement of the valve against the back of the member may become a source of noise, particularly in high speed reciprocating compressors.

It is an object of this invention to provide a valve for compressors and the like and including an improved arrangement for minimizing the noise produced by the valve.

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

For a better understanding of this invention reference may be had to the accompanying drawing in which Fig. 1 is a diagrammatic view of a refrigerating system including a compressor embodying this invention; Fig. 2 is an enlarged sectional view of a portion of the compressor shown in Fig. 1 showing the intake and exhaust valves; Fig. 3 is an enlarged longitudinal sectional view of the exhaust valve shown in Fig. 2; Fig. 4 is an exploded perspective view of the exhaust valve shown in Figs. 2 and 3; and Fig. 5 is an exploded perspective view of the cylinder block and valve plate of the compressor shown in Fig. 2.

Briefly the compressor shown in the drawing comprises a cylinder block having a cylinder therein and a reciprocating piston in the cylinder and a cylinder head having intake and exhaust passages. A valve plate is secured between the block and the head, and on it are mounted the intake and exhaust valves for controlling the intake and exhaust ports formed in the plate. Both valves are of the reed type and comprise flexible strips rigidly secured to the valve plate at one end and free to flex away from their respective ports at the other end. The opening movement of the exhaust valve is checked or damped by an arrangement including a restricted space or chamber formed between the valve and the backing element which limits the opening movement of the valve. This damping action minimizes noise produced by the striking of the valve against the backing member and also minimizes any bouncing of the valve upon opening.

Referring now to the drawing the refrigeration system shown in Fig. 1 comprises a compressor 10 driven by a suitable electric motor (not shown). The compressor is arranged to withdraw liquid refrigerant from an evaporator 11 and to discharge hot compressed refrigerant into a condenser 12 where the refrigerant is cooled by air circulated by a fan 13 driven by a motor 14. The refrigerant is liquefied in the condenser and flows to a liquid receiver 15 and is returned to the evaporator under control of a suitable expansion valve 16. The details of construction of the compressor 10 are clearly shown in Fig. 2. The compressor comprises a cylinder block 17 having a cylinder 18 formed therein and provided with a piston 19 which may be reciprocated by operation of the motor through a suitable crank (not shown) and a connecting rod 20. The cylinder 18 is closed by a valve plate 21 having gaskets 22 and 23 on either side thereof and secured in place by a plurality of bolts 24 which also secure a compressor head 25 to the block 17. The valve plate 21 is provided with an inlet port 26 and an exhaust port 27. The head 25 is hollow and provided with a partition 28 dividing it into an inlet chamber 29 and an exhaust chamber 30. The chamber 29 is connected in communication with the suction line from the evaporator 11 by a suitable connection on the head 25, and the refrigerant passes to the compressor 10 through a filtering screen 32 at the entrance to the chamber 29. The refrigerant discharged from the chamber 30 passes through a connection 33 to the discharge line in communication with the condenser 12.

On the downstroke of the piston 19 an inlet reed valve 34 moves away from the plate 21 so that gas may be drawn into the cylinder 18 from the inlet chamber 29. The opening movement of the valve 34 is limited by a shoulder 35 formed in the wall of the cylinder 18. On the upstroke valve 34 closes the port 26 and an exhaust valve 36 opens to discharge the compressed gas into the chamber 30 and thence through the connection 33 to the condenser. The construction and arrangement of the exhaust valve 36 and the associated structure are clearly shown in Figs. 3, 4 and 5. Valve 36 is of the reed type and is

securely held on the plate 21 with a backing member 37 by two cap screws 38 provided with lock washers 39. The valve 36 comprises an elongated flexing portion having a rounded end which is secured at its base to a cooperating portion 40 which is the portion of the valve that is secured rigidly to the plate 21 by a similarly shaped portion 41 of the backing member 37. The backing member thus comprises one portion for holding the valve against the valve plate and another portion conforming in shape to the valve and which curves away from the valve plate to limit the opening movement of the valve. The relative positions of the intake and exhaust valves are shown in Fig. 5 where it can be seen that the intake valve 34 is held in place by two pins 42 secured in the block 17 and fitting in corresponding holes 43 in the valve and holes 44 in the valve plate 21 as shown in Fig. 2. The elongated portion of the exhaust valve 36 conforms in shape to the corresponding portion of the backing member 37 but is slightly smaller. A closure member 45 comprising a U-shaped strip is secured by welding or in any other suitable manner about the elongated portion of the backing member 37 and encloses the valve in a small closed space or chamber between the plate 21 and the backing member. The strip 45 has been shown in engagement with the valve plate 21. However, it may be spaced slightly therefrom for a distance about equal to the thickness of the valve 36. The closure member 45 and the backing member 37 cooperate to form a damping chamber about the valve 36 and trap gas or other fluid above the valve and check the movement of the valve 36 toward and away from the backing member 37. The degree of damping is determined by the size of a plurality of restricted openings or orifices 46 formed on either side of the strip 45 and providing communication between the chamber 30 and the chamber formed below the backing member 37. The openings 46 must of course be sufficiently large to accommodate the fluid discharged from the cylinder 18 to the chamber 30 without any undesirable increase in head pressure. It has been found that there may be some tendency for the exhaust valve to stick to its backing member, and, in order to avoid this, a plurality of longitudinal grooves 47 are provided in the backing member which open into the chamber below the backing member around the rounded end of the valve 36. These grooves minimize sticking and do not interfere with the damping of the valve movement.

It has been found that a reed type exhaust valve as shown in the drawing provided with the damping arrangement including the backing member 37 and U-shaped strip 45 minimizes bouncing or fluttering and that the valve is open for the full length of the exhaust period so that there is no decrease in the effective capacity of the compressor as is the case when the valve bounces.

From the foregoing it is readily apparent that a simple and effective arrangement for preventing the bouncing or fluttering of a reed type exhaust valve has been provided, thereby minimizing noise and increasing the effective capacity of the compressor.

While this invention has been described in connection with an exhaust valve for a refrigerant compressor, other applications will readily be apparent to those skilled in the art, and it is, therefore, not desired to limit this invention to the particular construction shown and described and it is intended in the appended claims to cover all modifications within the spirit and scope of the invention.

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

1. A valve assembly for compressors comprising a valve plate or the like having a passage therein for the discharge of a fluid, a flexible discharge valve for closing said passage, means including a backing member for clamping a portion of said valve on said plate and for limiting the flexing movement of the remaining portion of said valve away from said plate, and means for trapping a volume of fluid between said remaining portion of said valve and said backing member upon opening of said valve for damping the movement of said valve against said backing member, said last mentioned means being arranged to form a closed space and having at least one restricted opening for limiting the discharge of fluid from said space.

2. A valve assembly for compressors comprising a valve plate or the like having a passage therein for the discharge of a fluid, a flexible discharge valve for closing said passage, means including a backing member for clamping a portion of said valve on said plate and for limiting the flexing movement of the remaining portion of said valve away from said plate, and means for trapping a volume of fluid between said remaining portion of said valve and said backing member upon opening of said valve for damping the movement of said valve against said backing member, said last mentioned means including a closure arranged on said backing member and closely surrounding said remaining portion of said valve, said closure member forming a chamber between said plate and said backing member and having a restricted opening adjacent the edge of said valve for discharging fluid from said chamber and for determining the degree of damping of said valve.

3. A valve assembly for compressors comprising a valve plate or the like having a passage therein for the discharge of a fluid, an elongated flexible valve for closing said passage, said valve being arranged to bend on a transverse axis during its operation, a backing member having a portion conforming to the shape of said valve for limiting the opening movement of said valve, and a closure member arranged on said backing member and about the edge of said valve to trap fluid between said valve and said backing member for damping the movement of said valve, said closure member forming a closed space between said backing member and said plate and having at least one restricted opening for discharging fluid from the space between said valve plate and said backing member and for determining the degree of damping of said valve.

4. A valve assembly for compressors comprising a valve plate or the like having a passage therein for the discharge of a fluid, a flexible discharge valve for closing said passage, means including a backing member for clamping a portion of said valve on said plate and for limiting the flexing movement of the remaining portion of said valve away from said plate, means providing a closed space about said valve and between said backing member and said valve plate for trapping a volume of fluid between said remaining portion of said valve and said backing member upon opening of said valve for damping the movement of said valve against said backing member and having at least one restricted open-

ing for the discharge of fluid from said space, and means including a plurality of recesses in said backing member adjacent said valve for minimizing the sticking of said valve to said backing member.

5. A valve assembly for compressors comprising a valve plate or the like having a passage therein for the discharge of a fluid, an elongated flexible valve having a rounded end for closing said passage, a backing member having a portion for clamping said valve onto said plate and another portion for limiting the opening movement of said valve, said valve being arranged to bend on a transverse axis during its operation and said other portion of said backing member conforming to the shape of the bendable portion of said valve, and a U-shaped strip arranged on said backing member and about the edge of said valve to trap fluid between said valve and said backing member for damping the movement of said valve, said strip having at least one restricted opening therein on each side of said valve for discharging fluid from the space between said valve plate and said backing member and for determining the degree of damping of said valve.

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