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2,908,287

COMPRESSOR VALVE STRUCTURE

Filed Sept. 4, 1957

2 Sheets-Sheet 1

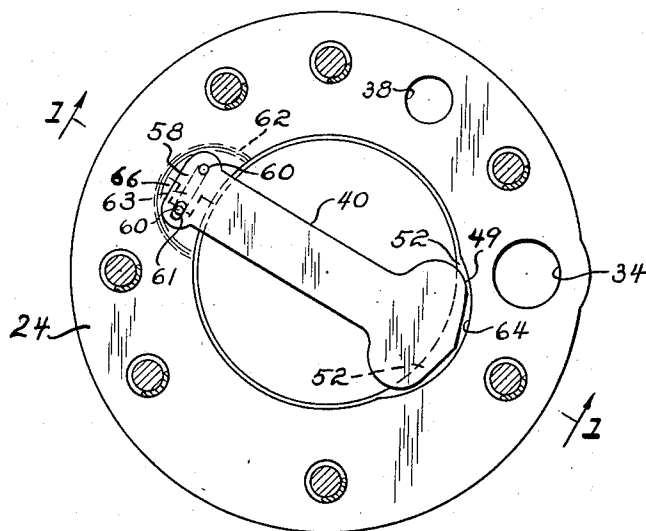
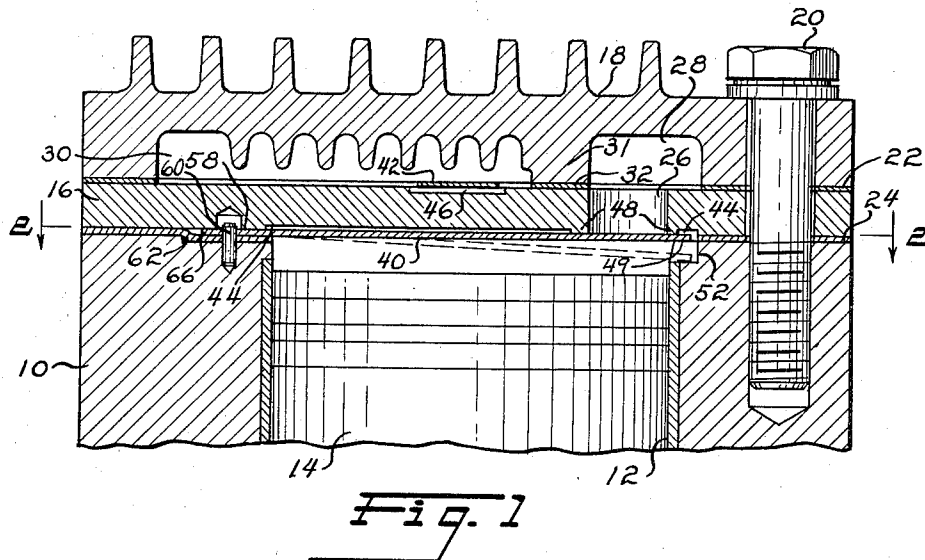


Fig. 2

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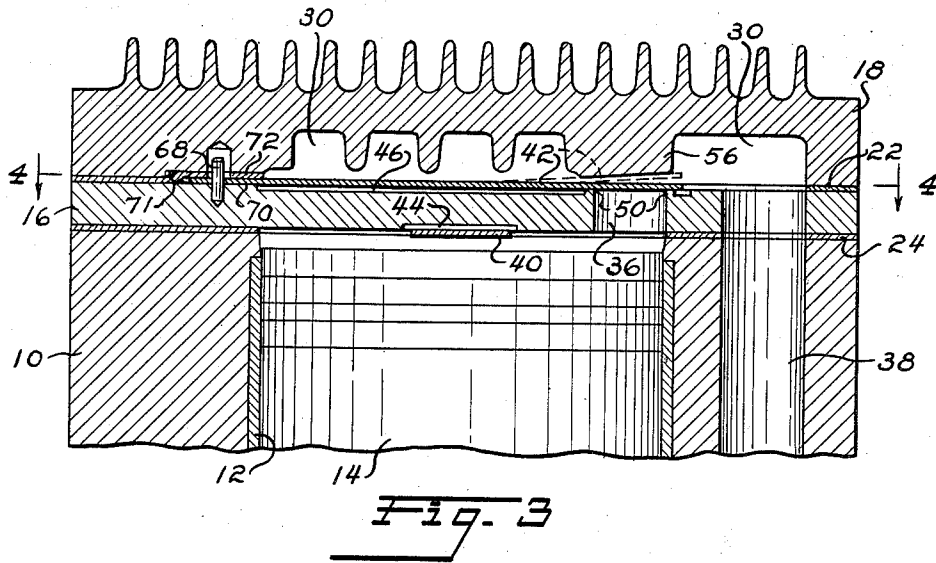


Fig. 3

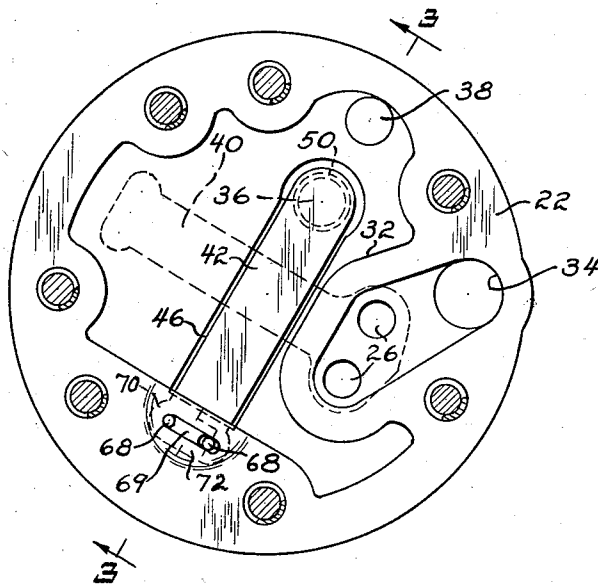


Fig. 4

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COMPRESSOR VALVE STRUCTURE

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2 Claims. (Cl. 137—525.3)

This invention relates to compressors and more particularly to an improved valve structure for compressors.

Heretofore compressors of the reciprocating piston type have utilized resilient valve strips which cooperate with inlet and outlet ports in a valve plate to control the passage of fluid to and from the compressor cylinder. The strips are usually fixed at one end by being squeezed between the plate and cylinder block or head and are free at the other end to be flexed to open and close the ports by pressure differentials on the opposite sides of the valves as fluid is drawn into and pushed out of the cylinder. With the described arrangement it will be apparent that valve flexing is rapid and continuous and that the maximum strain on the valve strips occurs at the near proximity of their fixed ends where they are flexed over the edge of the block or head upon movement to open position. Where there is metal-to-metal contact at this point of maximum strain, the life of the valve is of relatively short duration due to the fatigue and stresses resulting from the valves being continuously bent over the unyielding metallic edge of the head or block.

A principal object of the present invention is to prolong valve life by providing a valve structure which eliminates the metal-to-metal contact of the valves with the corner of the head or block over which the valve flexes upon movement to open position.

More specifically, it is an object of the present invention to eliminate the above described metal-to-metal contact of the valves with the head or block by providing a yielding pad between the valves and the head or block.

It is a further object of the invention to provide a valve structure for compressors whereby the gaskets fitting between the valve plate and head or block not only perform their normal function as seals but also provide the yielding pad for the engaged end of the valve strip.

Other objects and their attendant advantages will become apparent as the following detailed description is read in conjunction with the accompanying drawings wherein:

Fig. 1 is a sectional view taken diametrically through the upper end of a compressor unit and illustrating an inlet valve arranged in accordance with the present invention;

Fig. 2 is a plan view on a reduced scale taken substantially along the line 2—2 of Fig. 1;

Fig. 3 is a sectional view similar to Fig. 1 but showing the outlet valve arranged in accordance with the present invention; and

Fig. 4 is a plan view on a reduced scale taken substantially along the line 4—4 of Fig. 3.

Referring to the drawings, Figs. 1 and 3 illustrate a compressor embodying the valve structure of the invention. The compressor includes a cylinder block 10 having a cylinder 12 provided therein and reciprocating piston 14 operating in the cylinder. The upper end of the cylinder 12 is closed by a valve plate 16 and above this is a cylinder head 18 which is attached to the block by a plurality of bolts 20 engaging threaded holes in the block through registering holes in the plate and head as

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shown in Fig. 1. Upper and lower gaskets 22, 24 are interposed between the valve plate and the head and block.

With reference to Fig. 1 the valve plate is provided with an inlet port 26 which may be one of a pair of side-by-side ports as illustrated in Fig. 4 which communicate with an inlet chamber 28 in the cylinder head 18. The chamber 28 is isolated from a discharge chamber 30 in head 18 by means of a depending wall 31 in the head which sealingly bears on a closed portion 32 of upper gasket 22 and leading into chamber 28 is an inlet passage 34 which is connected to atmosphere preferably through the usual filter (not shown). As shown in Fig. 3, a discharge port 36 in the valve plate 16 connects the cylinder 12 with discharge chamber 30 in head 18 which in turn is connected with a reservoir (not shown) via the discharge passage 38 illustrated in Figs. 3 and 4. The inlet and discharge ports 26, 36 are controlled respectively by leaf or strip type inlet and discharge valves 40, 42 which are clamped at one end in a manner to be fully described herein after with their free ends overlying recesses 44, 46 formed on the opposite faces of the valve plate 16. The contours of the recesses conform generally to the shape of the respective valves but are oversized as illustrated in Fig. 4 to insure freedom of movement of the valves without danger of sticking and adjacent the end of each recess there is an annular ridge surrounding the inlet and discharge ports 26, 36 to provide valve seats 48, 50 on which the free ends of the valves 40, 42 seat as shown in Figs. 1, 3, and 4.

With reference to Fig. 1, the port 26 and the free end of valve 40 are so positioned with respect to cylinder 12 that the tip 49 of the valve 40 projects slightly beyond the cylinder 12. A recess 52 is formed in the cylinder member to accommodate said projecting tip, and the lower side of this recess constitutes a stop for limiting the downward movement of the free end of the valve 40. As illustrated in Fig. 3, the upward movement of the discharge valve 42 is limited by a boss 56 integral with the cylinder head 18 and having a profile substantially conforming to the curvature of the valve 42 as it flexes to open position.

The construction so far described is substantially conventional, and in compressors utilizing a conventional construction it has been customary to restrain the fixed end of the valves by some means which usually involves either resiliently or fixedly clamping the valve ends against the upper surface of the block or the lower surface of the head with the valves being restrained on both sides in metal-to-metal contact whereby they must bend or flex over a metallic corner or edge during their opening movement. Since this is the point of maximum valve stress, the unyielding metallic corner of the head or block limits the life of the valve which can be materially increased by providing a yieldable pad which covers the entire restrained area of the valve between it and the metallic edge over which the valve flexes in its opening movement.

In accordance with the invention, there is provided an economical and efficacious means for anchoring the restrained end of the valve by utilizing portions of the gaskets 22, 24 which provides the desired pad with substantially no additional cost over the conventional means for anchoring the inner end of valve strips.

Referring first to the inlet valve 40 illustrated in Figs. 1 and 2, it will be observed that its end 58 is enlarged and suitably apertured to receive guide pins 60 which extend into the cylinder block. Preferably one pin-receiving aperture is of slot-like form as indicated at 61 and has a width sufficient to accommodate its pin 60 so that the valve is restrained from pivoting laterally about the pins while at the same time the slots eliminate the necessity of placing the pins in the block so as to be in exact registry with the apertures which would be the

case if each aperture were round. Surrounding the guide pins 60 in the block 10 is a recess 62 having a depth preferably greater than the thickness of the valve 40 for purposes more fully explained hereinafter. The gasket initially is formed flat and is provided with an elongated transverse slot 63 which registers with the pins 60 which project upwardly a sufficient distance to accommodate the gasket in its flat condition with the valve 40 thereover prior to assembly of the head and plate to the block. The area of recess 62 is sufficiently large to accommodate the end 58 of the valve, and the gasket in its flat condition substantially covers the entire area of the recess. The gasket, adjacent the free end of the valve, is cut away as shown at 64 in Fig. 2, so as not to interfere with the movement of the free end in the recess 52.

Prior to final assembly of the head, plate, and block the gasket 24 in its flat condition is laid atop the block with the aligning pins 60 projecting through the slot 63 in the gasket. The valve 40 is then assembled over the pins with the end 58 lying atop the gasket. When the plate 16 and head 18 are assembled and bolted in place the lower surface of the plate, to the left of the relieved area 44 in Fig. 1, forces the end 58 of the valve down onto the gasket causing the portion thereof lying over the recess 62 to be displaced downwardly out of the plane of the gasket to substantially fill the recess below the valve end 58. The displaced portion of the gasket is indicated at 66 in Fig. 1 and it will be observed that this portion 66 provides a pad below the valve which eliminates over the entire area of the underside of the clamped portion of the valve any metal-to-metal contact of this part with the edge of the cylinder block.

Referring to Figs. 3 and 4, the manner of clamping the end of the discharge valve 42 is substantially the same as that described for the inlet valve with guide pins 68 being provided to register with a slot 69 in the gasket and with apertures in the clamped end 70 of the valve 42. Since the discharge valve 42 flexes upwardly to open position, a recess 71 is provided in the head 18 and the initially flat gasket 22 is laid over the valve prior to assembly. When the head is bolted to the block, the end 70 of the valve forces the portion 72 of the gasket into the recess to provide a pad for the valve in its direction of flexure and over its entire clamped area exactly as in the case of the inlet valve 40.

It will be apparent to those skilled in the art that with the gasket serving not only as a seal but also as the means for clamping and cushioning the valve ends, the depth of the recesses 62, 71 should be less than the combined thickness of the valve and gasket and this combined thickness in turn should be not greater than the depth of the recess plus the thickness of the gasket. Were this not so, there would be the possibility that the valve seated on the depressed portion of the gasket would project sufficiently above the cylinder edge to prevent the plate 16 from being clamped into sealing engagement with the gasket around the top of the cylinder 10 or around the bottom of the head 18. Expressed another way, sealing engagement of the gasket with the head or block will be assured provided the valve thickness is not greater than the depth of the recess and provided the gasket has a substantially uniform thickness over its entire area. Inasmuch as the gasket yields in compression when clamped, the difference between the thickness of the valve and the depth of the recess is very nearly if not completely taken up by that portion of the gasket registering with the recess so that the valve end is effectively clamped. It will be apparent from the foregoing, however, that the clamping pressure on the valve will be less than the clamping pressure on the sealing portion of the gasket.

From the foregoing description it will be observed that the restrained ends of the valves are satisfactorily anchored without ever being in metal-to-metal contact with the corner or edge of the head or block over which the

valves flex to open position. Should the gasket material be sheared between the vertical wall of the recess and the inner edge of the valve, this will not in any way affect the function of the gasket either as a seal or as a pad for the restrained end of the valve. Additionally, since the gasket is of an inherently yielding nature, upon a tendency of the valves to move towards open position, the pad yields initially to permit some slight movement of the valve bodily towards open position before the valve actually flexes. This function alone materially increases the life of valve over the increase afforded by the semi-resilient edge provided by the pad over which the valves flex. By providing a pad under or over the entire restrained area of the respective valves the free ends thereof seat firmly against their seats due to their inherent resiliency reacting against the semi-resilient gasket pad without any tendency of the valve to sag or cock away from the seats which might be the case were only a small area of the restrained ends of the valve to be engaged by clamping means or if the valve were engaged loosely on pins with a dependence on a gasket of the exact thickness of the valve to permit clamping of the valves in place between the valve plate and block or head.

It will be apparent that the constructional details of the compressor and of the valves and seats are exemplary only and that these may vary within wide limits without, however, departing from the scope and limits of the appended claims.

What is claimed is:

1. In a compressor comprising a ported valve plate, a cooperating part adapted to receive said valve plate and a gasket of yielding material providing a seal between said valve plate and said part, a resilient strip valve arranged parallel to said plate and having a substantially unrestricted free end portion overlying said port to close the same, the opposite end portion of said valve being clamped between said valve plate on the one side and said gasket on the other, said cooperating part being relieved to provide a recessed area at least coextensive with the clamped portion of said valve and having a depth greater than the thickness of said valve, and said recessed area having means for mounting said opposite end portion of the valve against lateral movement with respect to said cooperating part, the portion of said gasket overlying said recess being yieldable and forced therinto by the clamped portion of said valve when said valve plate is moved into sealing engagement with said gasket and said cooperating part.

2. In a compressor a member defining a chamber, a valve plate overlying the member, the valve plate being provided with port means therethrough, a resilient strip valve having a restrained end portion and a substantially unrestricted free end overlying said port to close the same, a recess in said member to receive the restrained end portion of said valve and having means for preventing lateral movement of said valve with respect to said member, a gasket of yielding material interposed between said member and said plate and having a portion extending over said recess, said portion of the combined thickness of the restrained end portion of said valve and the gasket not exceeding the depth of said recess plus the thickness of the gasket, said gasket being interposed between the restrained end of said valve and said recess whereby when said gasket is in sealing relationship with said valve plate and said member said restrained end portion of said valve depresses the overlying portion of said gasket into said recess to provide a yielding pad between said end portion and said member.

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