

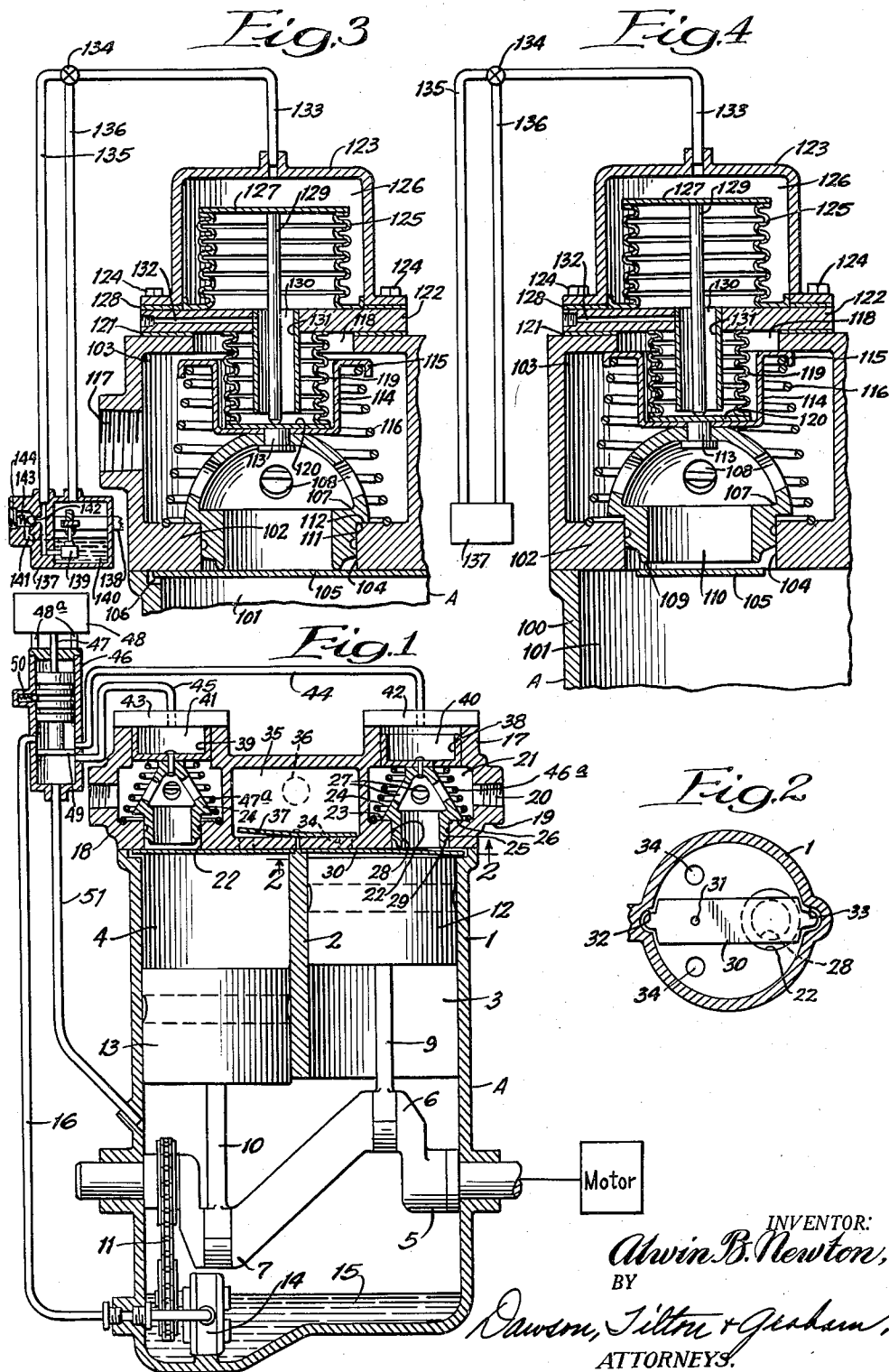
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A. B. NEWTON

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COMPRESSOR UNLOADER

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INVENTOR:

Alwin B. Newton,

BY

Dawson, Tilton & Graham,
ATTORNEYS.

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2,973,133

COMPRESSOR UNLOADER

Alwin B. Newton, Wichita, Kans.
(850 Clubhouse Road, York, Pa.)

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This invention relates to a compressor unloader, and more specifically to an apparatus equipped with pressure-responsive means for regulating the operation of a compressor.

This application is a continuation-in-part of my copending application, Serial No. 502,417, filed April 19, 1955, now U.S. Patent No. 2,761,616.

One object of this invention is to provide means for delaying the loading of a compressor until after the motor driving the compressor is in operation. Another object is to provide apparatus for loading or unloading a compressor after a predetermined interval has elapsed, or after a predetermined condition is satisfied. A further object is to provide means for automatically regulating the capacity of a compressor, or a series of compressors, in accordance with the load thereupon. A still further object is to provide a compressor valve structure having a valve seat movable between operative and inoperative positions with respect to a movable valve member, and pressure-responsive means and fluid pressure means cooperating with the valve seat for coordinating the operation of the valve structure with the operation of compressor driving means. In this connection, it is a specific object to provide automatic control means for interrupting the flow of pressure fluid to the pressure-responsive means upon the occurrence of a predetermined condition. Another object is to provide hermetically sealed means for moving the valve seat of a compressor into and out of operating position. Another specific object is to provide pressure-responsive means cooperable with the valve structure of a compressor unloader, the pressure-responsive means including one or more bellows for moving the valve seat between operative and inoperative positions in response to changes in fluid pressure. Additional objects and advantages will appear as the specification proceeds.

Embodiments of the invention are illustrated in the accompanying drawings, in which—

Figure 1 is a partly diagrammatic sectional side elevation showing a compressor and the unloading apparatus of the invention; Figure 2 is a broken cross-sectional view taken along lines 2—2 of Figure 1; Figure 3 is a partly diagrammatic broken sectional side view of a modified form of the compressor unloading apparatus; and Figure 4 is broken sectional end view of the modified compressor unloading apparatus in unloaded condition.

The compressor A illustrated in Figure 1 comprises a casing 1 which has a top portion divided by wall 2 into a pair of compression chambers 3 and 4. While only a pair of chambers is shown, it is apparent that a greater or smaller number may be provided, depending upon the particular use for which the compressor is to be adapted.

The lower portion of the casing carries a crank shaft 5 which has eccentric portions 6 and 7, and which may be rotated by any suitable means as, for example, by an internal combustion engine. Connecting rods 9 and 10 are slidably attached to the eccentric portions of the crank shaft 5 in the customary manner, as shown in Figure 1. Rods 9 and 10 have bearings securing them

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to pistons 12 and 13 which are slidably mounted within chambers 3 and 4, respectively.

A continuous chain 11 extends about one end of the shaft 5 and is preferably connected to a gear-type pump 14 at the lower portion of casing 1. Since the pump structure is well known in the art, it is believed that a detailed description herein is unnecessary. Pump 14 is immersed in a source of pressure fluid such as a pool of oil or other liquid 15 at the bottom of casing 1, and drives the liquid into conduit 16 upon the rotation of crank shaft 5.

The top portion of casing 1 encloses a pair of valve units 17 and 18 through which fluid must pass to enter compression chambers 3 and 4. Since both of the valve units are substantially identical in structure and operation, only one of these units will be described in detail. Valve unit 17 comprises generally a tubular valve casing 19 having an opening 20 in its side wall leading into suction chamber 21. Another opening or flow port 22 at the lower end of the valve casing places the suction and compression chambers in communication with each other. Extending inwardly within suction chamber 21 and substantially midway between opening 20 and the open lower end of the valve casing is an annular ledge or stop 23.

Within the compression chamber is a movable valve seat member or cage 24 which has the general configuration of a hollow cone having a tubular portion 25 extending downwardly from its base. The tubular portion of the cage has an outer diameter less than the diameter of the cone's base so that at the juncture of the tubular portion and the base of the conical portion, there is an outwardly projecting peripheral ridge 26 adapted for abutting or seating against the annular ledge or stop 23 of the valve casing. As illustrated in Figure 1, the tubular and the conical portions of the cage are in communication with each other. The wall of the cone is provided with a plurality of openings 27, and a flow passage 28 extends through the valve cage to place the suction and compression chambers in communication.

The movable cage is provided at the free end of the tubular portion 25 with an annular valve seat 29. As shown best in Figure 2, an elongated and flexible leaf valve member 30 is secured by rivet 31, or by any other suitable means, to the top wall of compression chamber 3. Preferably, the inner end of valve 30 is tightly fitted in a notch 32 provided in wall 2. The opposite end of the leaf valve is fitted loosely in a recess 33 in the compressor casing wall so that the valve member may flex downwardly within recess 33 to admit gas into chamber 3, and may also flex upwardly within that recess when piston 12 executes its compression stroke. It will be noted that the width of the elongated leaf valve is less than the diameter of opening 22 in the valve casing, but is greater than the diameter of flow passage 28 through the movable valve cage. Moreover, as illustrated in Figure 1, when the valve cage rests upon ledge 23 of the casing, the annular valve seat 29 provided by the movable cage is substantially in line with the lower end of the valve casing, and is positioned to make sealing contact with the flexible valve member.

In the top wall of the compression chamber, on each side of the flexible valve member, is an exhaust port 34 which extends upwardly into exhaust chamber 35. The gaseous fluids compressed in the compression chambers 3 and 4 flow upwardly into this exhaust chamber through the exhaust ports, and leave this chamber through opening 36 in the casing wall. To prevent fluid from re-entering the compression chambers from exhaust chamber 35, I provide a flat valve spring 37 which is centrally riveted or otherwise secured to the wall of the exhaust chamber. Normally, the end portions of the flexible valve 37 cover exhaust ports 34 and seal the exhaust

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chamber. However, as the compressor pistons execute their upward compression strokes, the ends of the flexible exhaust valve alternately flex upwardly to permit entry of the compressed gas into the exhaust chamber.

In the embodiment shown in Figure 1, the movable valve cages are riveted or otherwise fastened to movable cup-shaped pistons 38, 39 which constitute pressure responsive means for shifting the valve cages or seats and which are slidably mounted within the piston chambers 40, 41 of the respective valve casings. Each of the chambers is sealed by covers 42 and 43, respectively, and these covers are apertured so that the chambers communicate with conduits 44 and 45. The valve cage and piston units may be biased upwardly into unloading position by spring means, such as springs 46a and 47a disposed between the cup-shaped pistons and the annular ledges provided by the valve casings.

A valve 46 is interposed between fluid flow conduits 44, 45 and 16 to control the flow of pressure fluid (such as oil) to chambers 40 and 41. Valve 46 is equipped with a valve member 49 which is movable into any of three positions. When the valve member is in the lowest of the three positions, pressure fluid can flow from conduit 16, through valve 46 and into conduits 44 and 45 leading to both of the piston chambers 40 and 41. When the member is in a second or intermediate position, as illustrated in Figure 1, the lower end portion of the member is interposed between the openings for conduits 44 and 45, so that conduit 44 communicates with inflow conduit 16 and conduit 45 communicates with bleed passage 51. Therefore, only one of the compressor units will be loaded when the valve member 49 is in its intermediate position. If the member is raised into its third position, it is believed apparent that both of the compressor units will be unloaded. If desired, a ball detent structure 50 may be provided for maintaining the valve member in any of the selected positions. For automatic control of the valve member, valve stem 47 is connected to a suitable automatic control means diagrammatically represented in Figure 1 by box 48. Relative movement of the control means and valve body is prevented by any suitable means, such as collar 48a which rigidly supports the control means upon the valve casing. The control means may be any device which is responsive to some condition which is affected by the compressor's operation.

The operation of my invention is as follows: When the compressor is idle, no pressure fluid is supplied by the pump 14 to the piston chambers, and the valve cages or valve seat members are maintained in raised position by springs 46a and 47a. When the crank shaft is rotated by the driving means, the reciprocating pistons 12 and 13 will draw fluid through the suction chambers and into the compression chambers as they execute their downward strokes. However, when these pistons move upwardly, the gas will be directed back through the flow passage of the raised valve cages and out through opening 20. Therefore, during the initial revolutions of crank shaft 5, there is no load upon the compressor and there is substantially no work performed by the driving means, such as an internal combustion engine M.

As crank shaft rotation continues, oil or other pressure fluid is driven into the piston chambers 40 and 41 by pump 14. Consequently, the pistons 38 and 39 are forced downwardly to seat the valve cages upon the annular ledges of the valve casings. When the valve cages are in lowered position, as illustrated by the righthand valve unit shown in Figure 1, the flexible valve members will cooperate with the movable valve seat provided by the cages to prevent the discharge of compression fluid from the compression chambers into the suction chambers. When piston 12 moves downwardly, spring valve 30 flexes downwardly within recess 33 to admit gas into compression chamber 3. Since the lateral dimensions of the valve member are greater than the diameter of the

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flow passage through the valve seat member, this flow passage will be closed when the valve member flexes upwardly to seat against the annular seat 29 during the compression stroke of piston 12. Hence, the compressed gas is discharged only through exhaust openings 34 and into exhaust chamber 35. If desired, port 36 may be placed in communication with the condenser of a refrigeration system.

It will be further noted that the portion of the compressor casing defining recess 33 also provides a stop for limiting movement of the spring valve 30 in its first or downwardly flexed position. Similarly, the lower surface of the valve casing about opening 22 provides a second stop for limiting the upward flexure of the valve member when the movable valve seat is in raised position. Consequently, the flexible valve member is capable of moving between a first position and a second or raised position regardless of the position of the valve seat. Since the width of the valve member is less than the diameter of opening 22, however, re-entry of compression fluid into the suction chamber will be prevented only when the valve member is in its second position and the valve seat is in its lowered position.

As pointed out above, the loading and unloading of the compressor may be further controlled by valve 46 and control means 48. For instance, the control means 48 may comprise a conventional thermostatic device which is operably connected to the valve 46 to open (or close) that valve when the internal combustion engine or other driving means reaches a predetermined operating temperature. Alternatively, the control means 48 may be responsive to humidity, pressure or conditions affected by the operation of the compressor. It is to be understood that while Figure 1 shows the valve unit connected by conduits 44, 45 and 16 to a pressure fluid reservoir in the bottom of the compressor casing, these conduits may lead to other pressure fluid sources, such as the crank case of the engine which drives the compressor (as shown in Figures 3-4, in which case the fluid will be supplied by fluid pressure means operated directly by the engine M, such as a lubricating pump).

A modification of my invention is presented in Figures 3 and 4 of the drawings. This embodiment is substantially similar to the form of the invention shown in Figures 1 and 2, except for the pressure-responsive means adapted to move the valve seat member for loading and unloading the compressor A.

Like the structure already described, the present embodiment comprises a compressor casing 100 defining a compression chamber 101, and a valve casing 102 having a suction chamber 103 therein. An opening 104 in the bottom wall of the valve casing places the suction and compression chambers in communication with each other. Directly below the valve casing and within the compression chamber is an elongated valve member 105 which extends across the opening 104. This valve member is substantially identical to the leaf spring valve shown in Figures 1 and 2, and like the previously described valve member has a free end which may flex between two positions within casing 106.

Within suction chamber 103 is a movable valve cage or valve seat member 107. The hollow cage is provided with a semi-spherical upper portion and a tubular lower portion of reduced diameter. As shown in the drawings, the upper portion of the cage is equipped with a plurality of openings 108, and the bottom of the cage is open to provide an annular valve seat 109. Hence, the cage provides a continuous flow passage 110 therethrough for the flow of pressure fluid between the suction and compression chambers. It is to be noted that the cage is equipped intermediate the length thereof with a lateral ridge 111 adapted to rest upon annular ledge 112 of the valve casing, and that the outer surface of the cage's tubular lower portion slidably and sealingly engages the wall of the casing extending about opening 104.

Above the valve cage, and secured thereto by stud or rivet 113, is a cup-shaped member 114 equipped with an outwardly extending lip 115 along its top edge. A helical compression spring 116 extends between the outwardly projecting lip or flange 115 and the lower inner surface of the valve casing, and urges the cup-shaped member and the valve cage into the raised position shown in Figure 4.

The valve casing has a side opening 117 for the inflow of compression fluid and a top opening 118 directly above the valve cage and cup-shaped member. The diameter of the latter opening is smaller than the diameter of flange 115 so that the upper wall of casing 102 provides a stop for limiting the upward movement of the valve cage assembly. Within the cup-shaped member 114 and extending upwardly through top opening 118 is a suction chamber sealing bellows 119. The bellows has the conventional accordion-folded side walls and is provided with a rigid bottom plate 120. Preferably, the bellows is formed from metal and has its open end soldered or otherwise sealingly secured to a connecting plate 122 directly thereabove. A domelike cover or hood 123 is secured to both the connecting plate and the valve casing by means of bolts 124 or by any other suitable connecting means. A second bellows 125, larger than bellows 119, is mounted within cover chamber 126, and is provided with a rigid top plate 127 and the conventional accordion-folded metal sides. Most desirably, the lower edge of bellows 125 is turned outwardly and upwardly, and is sealingly secured to the inner surface of cover 123. As shown in the drawings, gaskets 121 and 128 may be provided between the connecting plate, the cover and the valve casing.

A depending shaft 129 is welded or otherwise secured to the top plate of the upper bellows 125, and extends downwardly through both of the bellows to engage the bottom plate of lower bellows 119. Preferably, the central opening 130 of the connecting plate is enlarged and is fitted with a sleeve 131 which extends downwardly about the lower portion of the shaft 129 to guide the movement of the shaft and to protect the flexible wall of the lower bellows. It will be seen that the upper and lower bellows are, therefore, in communication with each other and have their interiors sealed from both the suction chamber 103 provided by the valve casing, and the pressure chamber 126 provided by the cover. If desired, the connecting plate 122 may be equipped with a bleed passage 132 to provide outside reference pressure for the communicating bellows.

A fluid flow conduit 133 communicates with chamber 126 and is connected at its opposite end through an automatic valve diagrammatically represented in Figures 3 and 4, and indicated by number 134. This valve 134 corresponds with the control means 48 and valve structure 46 shown in greater detail in Figure 1, and constitute means for directing pressure fluid carried by conduit 135 either into conduit 133 or into bleed passage 136.

Pressure fluid for loading the compression structures shown in Figs. 3 and 4 may be pumped from a reservoir in the compressor casing (as in Fig. 1), or from any other source, such as the crank case of an engine driving the compressor. Numeral 137 generally designates such an engine or motor crank case structure, represented somewhat diagrammatically and on a reduced scale in the drawings. As the crankshaft 138 rotates, the fluid pressure means comprising pump 139 drives oil from reservoir 140 into passage 135. In the illustration given, a relief pressure-adjusting means is shown interposed along bleed passage 141 for regulating the maximum fluid pressure within chamber 126, and at the same time, for establishing maximum operating suction pressure. The pressure-adjusting means comprises a ball valve 142 which is urged by spring 143 in a position closing passage 141. The tension of spring 143 may be selectively varied by adjustment of threaded cap 144.

If conduits 135 and 136 are connected to the lubricating pump of a driving motor, then the compressor will remain in unloaded condition (Figure 4) until the motor

develops lubricating pressure greater than the pressure of the compression fluid within the valve casing. More specifically, the force of spring 116 and the pressure within suction chamber 103 will hold the valve cage in a first or raised position until the oil pressure within pressure chamber 126 is sufficient to overcome the forces suspending the movable valve seat. When the valve seat member is spaced from the flexible spring valve 105, as shown in Figure 4, compression fluid may flow in both directions through flow passage 110, and consequently the compressor will perform no work.

As the compressor driving means continues its operation, oil will flow through passages 135 and 133 and fill pressure chamber 126. Finally, when the force of the oil upon bellows 125 exceeds both the force of the compression fluid upon bellows 119 and the upward force of spring 116, plate 127 of the upper bellows will be driven downwardly towards the valve cage. The depending shaft carried by the pressure-responsive bellows abuts lower plate 120 so that as the upper bellows contracts, the shaft, the cup-shaped member 115 and the valve seat member 107 will be shifted downwardly. When the valve cage or valve seat member reaches the second or lowered position shown in Figure 3, the flexible valve member 105 will engage the annular seat of the valve cage as the compressor piston executes its upward stroke, and will prevent compression fluid from re-entering the suction chamber. Therefore, the compressor will be in loaded condition.

Since the compressor will be loaded only when valve 134 is open and when, at the same time, downward force exerted by the pressure fluid is greater than the upward force exerted by the compression fluid within the suction chamber plus the upward force of spring 116, the maximum operating suction pressure may be easily controlled by adjustment of the oil relief pressure means. Should the force exerted by the suction pressure plus the force of spring 116 exceed the force exerted by the selected maximum oil pressure as controlled by ball 142, bellows 119 will contract and the valve seat will move upwardly to unload the compressor. Thus, by adjusting the operating pressure of ball 142 by adjustment means 144, the maximum possible operating suction pressure of the compressor can be controlled.

Control of the compressor's maximum suction pressure is especially important where, for example, the means for driving the compressor comprises an internal combustion engine. Since such an engine normally has a falling torque curve as its speed is reduced, overloading of the compressor cannot be tolerated. Hence, by providing a control upon the maximum suction pressure, the torque required to drive the compressor will be automatically prevented from exceeding a predetermined amount.

While Figures 3 and 4 show only single compressor valve units broken away from the remainder of the compressor structure, it will be understood that a plurality of compressor cylinders might be grouped together, each of the cylinders being loaded and unloaded by individual valve structures, as represented in Figure 1 by units 17 and 18. Control valve 134 will then operate to sequentially load and unload the cylinder in response to conditions affected by the compressor's operation, as described above. If sequential loading and unloading of the cylinders is desired in order to limit the torque requirements of the power source and to prevent the occurrence of too high a suction pressure, springs 116 may be of different strengths in different valve units so that as the suction pressure decreases, the cylinders will be successively loaded, one after the other. Further, it will be noted that the springs 116 in one or more of the valve units may be omitted entirely. In such a case, where the spring force component is a sufficiently large portion of the force which opposes the bellows 125, a cylinder without the spring would be loaded by the ad-

justed oil pressure even though the suction pressure is relatively high. In a compressor having multiple compression cylinders, the power demands of the loaded cylinder lacking the spring 116 would be relatively low, and this cylinder would operate to reduce the suction pressure to a point where the sequential loading of the remaining cylinders would not require an undue or prohibitive increase in driving torque or power. If desired, the valve assembly of the first cylinder of the group may be provided with a fixed valve seat so that, like conventional compressor cylinders, the first cylinder will be permanently loaded during compressor operation.

It is to be understood that the difference between the diameter of the larger bellows 125 and the diameter of the smaller bellows 119 generally corresponds with the difference between the normal pressure of the oil delivered by the fluid pressure means 139 and the desired maximum operating pressure of the compression fluid within the suction chamber. For example, if the lubricating oil pressure of the driving means is one-half the desired maximum suction pressure, then the area of plate 127 should be no less than twice the area of plate 120. Therefore, during normal compressor operation, the downward force upon the upper plate will exceed the upward force upon the lower plate (including the force of spring 116) of the pressure-responsive means, and the valve seat will remain in its lower operative position. Should the suction pressure momentarily exceed the selected maximum, the valve seat will move upwardly to relieve the excess pressure by temporarily unloading the compressor. Where the compressor is provided with multiple cylinders, sequential loading and unloading of those cylinders may be obtained by providing the respective valve units with bellows 125 of successively greater diameter or area. It is to be noted that if oil pressure during normal compressor operation substantially exceeds the gas pressure within the suction chamber, then the upper bellows 125 and shaft 129 may be eliminated so that the oil pressure directly opposes the suction pressure at bellows 119. Under such conditions, the loading and unloading of the compressor will result from the oil pressure being alternately greater and less than the suction pressure.

While in the foregoing specification an embodiment of the invention has been set forth in considerable detail for purposes of making an adequate disclosure thereof, it will be apparent to those skilled in the art that numerous changes may be made in those details without departing from the spirit and scope of my invention.

I claim:

1. In a compressor unloading apparatus, a plurality of compressor units each having a compression chamber therein, a valve casing having a plurality of suction chambers each communicating with one of said compression chambers through a flow port, a movable valve member adjacent each of said flow ports, a plurality of valve seats each being shiftable between two positions and each being cooperable with one of said valve members for closing said port only when said seat is in one of said two positions, pressure-responsive means cooperating with each of said seats to position the same for independently loading and unloading each of said compressors, a motor for driving said compressor units, pressure fluid pumping means operably connected to said motor, pressure fluid passage means for delivering pressure fluid from said pump to said pressure-responsive means, said pressure-responsive means comprising a plurality of pairs of opposing and internally communicating bellows of unequal size, the smaller of said bellows of each pair being disposed within each of said suction chambers for exposure to the suction pressure therein and the larger of said bellows of each pair being subjected to pressure fluid delivered by said pressure fluid passage means, said valve seats each being connected to a pair of bellows for movement into an unloading position when the larger of

said bellows is compressed and into a loading position when the smaller of said bellows is compressed, the size differential of said paired bellows being different for successive pairs for the sequential unloading and loading of a plurality of compressor units.

2. A compressor unloading apparatus comprising a compressor having a compression chamber therein, a valve casing having a suction chamber communicating with said compression chamber through a flow port extending therebetween, a valve seat having an outer periphery sealing said port and having a flow passage therethrough for the flow of compression fluid between said suction and compression chambers, said seat being movable between first and second positions, a movable valve member cooperable with said valve seat only when said seat is in said second position for controlling the flow of compression fluid through said flow passage, biasing means for urging said valve seat towards said first position, pressure-responsive means operatively connected to said seat for moving said seat between said first and said second positions, a fluid pressure source, pressure fluid passage means extending between said source and said pressure-responsive means, and fluid pressure means for driving fluid from said source to said pressure-responsive means along said pressure fluid passage, said pressure-responsive means comprising a pair of communicating bellows, one of said bellows being exposed to the pressure fluid carried by said passage means and the other of said bellows being exposed to compression fluid within said suction chamber, and means connected with said seat and with both of said communicating bellows for moving said seat into said second position when said first-mentioned bellows is compressed and for moving said seat into said first position when said second-mentioned bellows is compressed.

3. A compressor unloading apparatus comprising a compressor having a compression chamber therein, a valve casing having a suction chamber communicating with said compression chamber through a flow port extending therebetween, a valve assembly operatively associated with said port and including a valve element movable between a first position wherein fluid is permitted to flow in either direction between said suction and compression chambers and a second position wherein fluid is permitted to flow only in one direction from said suction chamber to said compression chamber, pressure-responsive means operatively connected to said valve element for moving the same between said first and second positions, means for delivering pressure fluid to said pressure-responsive means, said pressure-responsive means comprising a pair of opposing and internally communicating bellows of unequal size, one of said bellows having its exterior exposed to pressure fluid delivered by said pressure fluid delivery means and the other of said bellows having its exterior exposed to compression fluid within said suction chamber, said valve element being operatively connected to said pressure-responsive means for movement into said second position when said one bellows is compressed and for movement into said first position when said other bellows is compressed.

4. The structure of claim 3 in which the size differential of said two communicating bellows is indirectly related to the predetermined normal pressure of said pressure fluid and the predetermined maximum pressure of said compression fluid.

5. The structure of claim 3 in which said one bellows is larger in size than said other bellows.

6. A compressor unloading apparatus comprising a compressor having a compression chamber therein, a valve casing having a suction chamber communicating with said compression chamber through a flow port extending therebetween, a valve assembly operatively associated with said flow port and including a valve element movable between a first position wherein fluid is permitted to flow in either direction between said suction

and compression chambers and a second position wherein fluid is permitted to flow only in one direction from said suction chamber to said compression chamber, pressure-responsive means operatively connected to said valve element for moving the same between said first and second positions, a pressure fluid source, pressure fluid passage means extending between said source and said pressure-responsive means, and fluid pressure means for driving fluid from said source to said pressure-responsive means along said pressure fluid passage means, said pressure-responsive means comprising a pair of opposing and internally communicating bellows of unequal size, the larger of said bellows having its exterior exposed to pressure fluid carried by said passage means and the smaller of said bellows having its exterior exposed to compression fluid within said suction chamber, said valve element being operatively connected to said pressure-responsive means for movement into said second position when the larger of said bellows is compressed and for movement into said first position when the smaller of said bellows is compressed.

7. The structure of claim 6 in which the size differential between said larger and smaller bellows is indirectly related to the predetermined normal pressure of said pressure fluid and the predetermined maximum pressure of said compression fluid within said suction chamber.

8. The structure of claim 6 in which a control valve is interposed along said pressure fluid passage means for regulating the flow of pressure fluid from said source to said pressure chamber, said valve being equipped with automatic control means for regulating the flow of pressure fluid in response to changes in conditions resulting from the operation of said compressor.

9. A compressor unloading apparatus comprising a compressor having a compression chamber therein, a valve casing having a suction chamber communicable with said compression chamber, a movable valve seat within said suction chamber and having a flow passage therethrough, said seat being movable between a first position and a second position, a movable valve member cooperable with said valve seat only when said seat is in said second position for controlling the flow of compression fluid through said flow passage between said suction

and compression chambers, said valve casing also providing a pressure chamber for receiving pressure fluid therein, and pressure-responsive means extending between said suction and pressure chambers, said pressure-responsive means comprising a pair of opposing and internally communicating bellows of unequal size, the larger of said bellows projecting into said pressure chamber for external exposure to the pressure fluid contained therein, and the smaller of said bellows projecting into said suction chamber for external exposure to the compression fluid contained therein, connecting means connecting opposite ends of said communicating bellows so that the expansion of one produces a contraction of the other, said valve seat being connected to said bellows for movement into said first position when the larger of said bellows is expanded and the smaller of said bellows is contracted and for movement into said second position when the larger of said bellows is contracted and the smaller of said bellows is expanded, whereby, a relatively low fluid pressure within said pressure chamber is capable of controlling the flow of compression fluid under relatively high pressure within said suction chamber.

10. The structure of claim 9 in which the size differential of said two communicating bellows is indirectly related to the predetermined normal pressure of said pressure fluid within said pressure chamber and the predetermined maximum pressure of said compression fluid within said suction chamber.

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