Dec. 20, 1938. G. K. NEWELL 2,141,069

COMPRESSOR UNLOADER

Filed Nov. 13, 1936 2 Sheets-Sheet 1

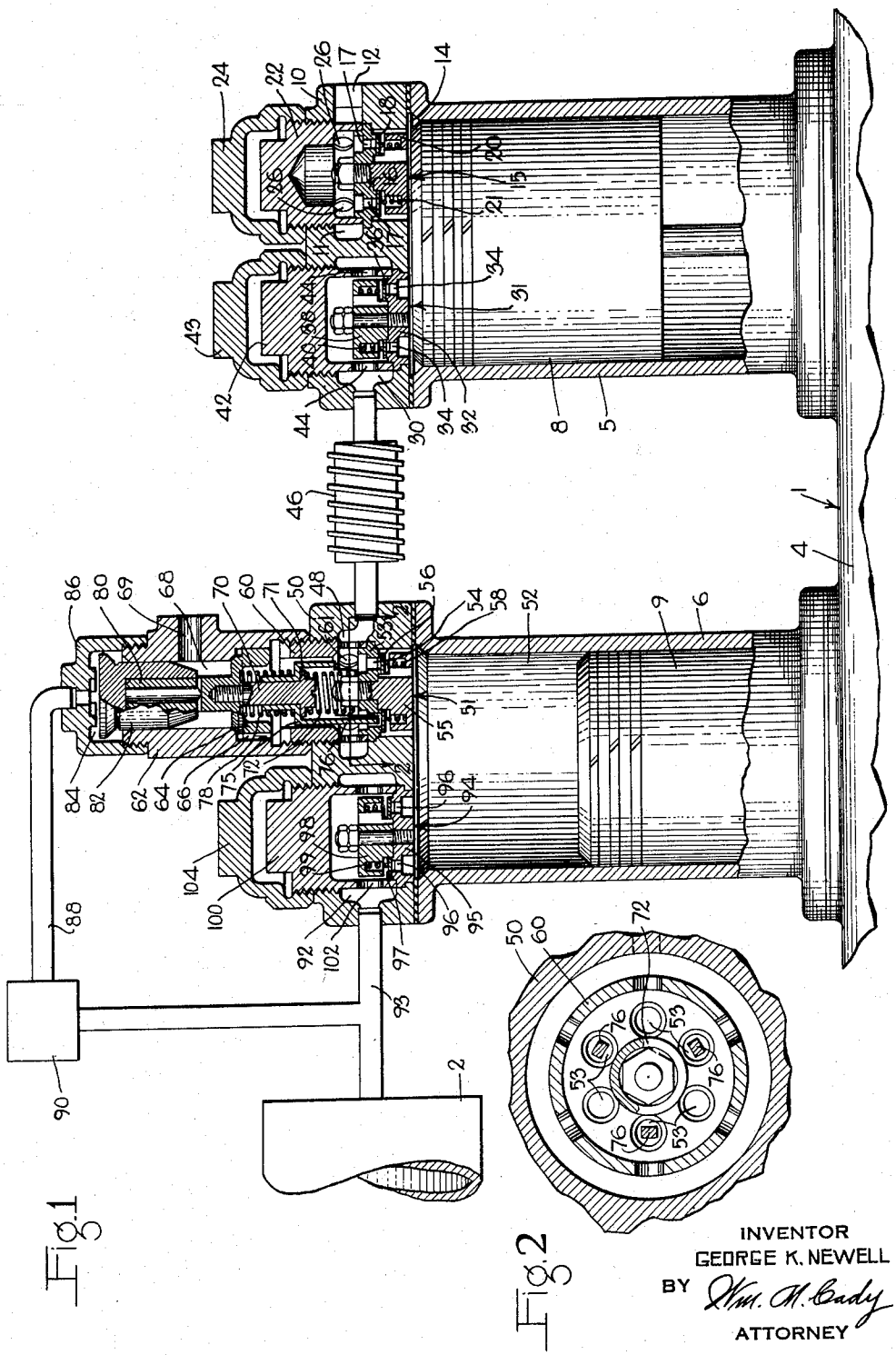

Fig. 1

Fig. 2

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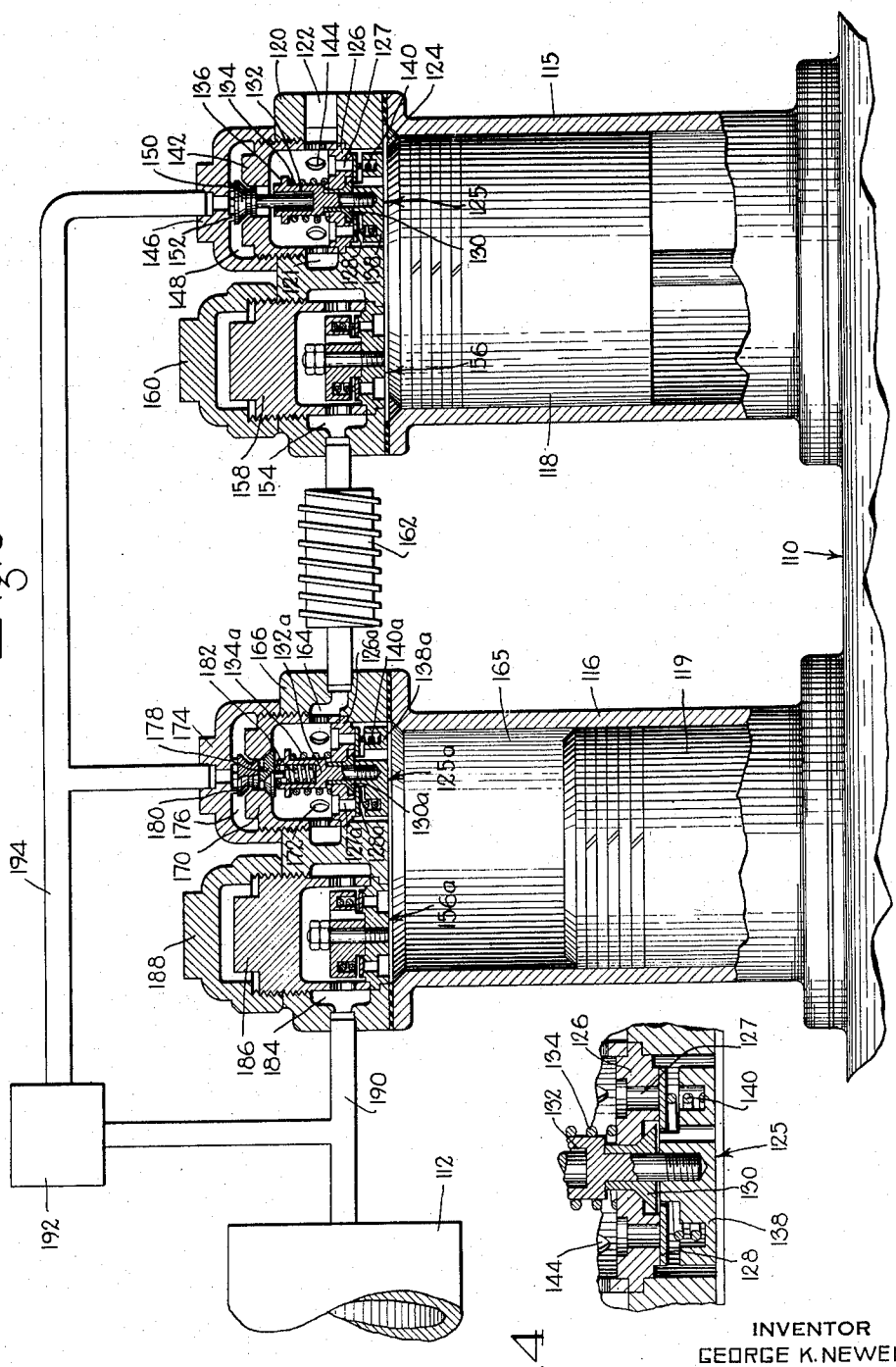

Fig. 3

Fig. 4

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UNITED STATES PATENT OFFICE

2,141,069

COMPRESSOR UNLOADER

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Application November 13, 1936, Serial No. 110,678

4 Claims. (Cl. 230—26)

This invention relates to a fluid compressor and more particularly to unloading means of a type adapted for use on a multi-stage compressor.

It is customary to unload fluid compressors by maintaining the inlet valves unseated and thereby prevent the compressors from compressing fluid. The mechanism by which the inlet valves are held unseated is usually mounted in the inlet chambers of the cylinders to be unloaded. When the compressor is in the loaded condition, and is being operated to compress fluid, the inlet chamber of the high pressure cylinder of a multi-stage compressor is supplied with fluid under pressure by the low pressure cylinder of the compressor. Unless the elements of the unloading mechanism are constructed with a high degree of accuracy, fluid under pressure will leak from the inlet chamber of the high pressure cylinder to the atmosphere past the unloading means associated with this cylinder, thereby reducing the efficiency and the output of the compressor.

It is an object of this invention to provide unloading means adapted for use in connection with the inlet valve of the high pressure cylinder of a two stage compressor, and incorporating means operative when the compressor is loaded to prevent the escape of fluid under pressure from the chamber in which the inlet valve of the high pressure cylinder is mounted.

A further object of the invention is to provide improved compressor unloading means of the type described, and which is constructed so as to require a minimum of the parts thereof to be manufactured with a high degree of accuracy.

Another object of the invention is to provide improved compressor unloading means.

Other objects of the invention and features of novelty will be apparent from the following description taken in connection with the accompanying drawings, in which,

Fig. 1 is a fragmentary view, largely in section, of a two stage compressor provided with unloading means embodying this invention,

Fig. 2 is an enlarged sectional view taken substantially along the line 2—2 of Fig. 1,

Fig. 3 is a fragmentary view, largely in section, of a two stage compressor provided with a modified form of unloading means embodying this invention, and

Fig. 4 is an enlarged fragmentary view of the inlet valve assembly employed with the low pressure cylinder of the compressor shown in Fig. 3.

Referring to Fig. 1 of the drawings there is illustrated therein a portion of a fluid compressor 1, which is driven by suitable means, not shown, and which compresses fluid under pressure into a reservoir 2.

The compressor 1 may be of any well known construction, and has a crankcase 4 to which are secured a low pressure cylinder 5, and a high pressure cylinder 6. These cylinders have bores therein in which are reciprocated pistons 8 and 9, respectively, by means of a crankshaft, not shown.

The low pressure cylinder 5 has a head 10 detachably secured thereto and having a chamber 11 therein which is open to the atmosphere by way of a passage 12. An inlet valve assembly indicated generally by the reference numeral 15 is mounted in the chamber 11 to control communication between this chamber and the compression chamber 14 at the upper face of the piston 8.

The inlet valve assembly 15 comprises a seat member 16 having passages 17 extending therethrough, and having a seating face thereon which is adapted to be engaged by an annular valve 18. The seat member 16 has a spring cage 20 secured thereto, while a coil spring 21 extends between the spring cage 20 and the valve 18 and yieldingly presses the valve 18 against the seating face on the seat member 16.

The seat member 16 is held in engagement with a shoulder on a cylinder head 10 by means of a hollow threaded member 22 having passages 26 extending through the wall thereof, while a cover 24 is secured on the threaded member 22.

The cylinder head 10 also has formed therein an exhaust chamber 30 in which is mounted an exhaust valve assembly indicated generally by the reference numeral 31, and comprising a seat member 32 having passages 34 extending therethrough, and having a seating face adapted to be engaged by an annular valve 36. A spring cage 38 is secured to the seat member 32, while a coil spring 40 extends between the spring cage 38 and the valve 36 and yieldingly presses the valve 36 into engagement with the seating face on the seat member 32.

The exhaust valve seat member 32 is held in engagement with a shoulder on the cylinder head 10 by means of a threaded member 42, while a cover 43 is secured on the exposed portion of the threaded member 42 and engages the cylinder head 10 to seal the threaded opening in which the member 42 is mounted. The wall of the threaded member 42 has passages, indicated at 44, extending therethrough.

The exhaust chamber 30 in the cylinder head 10 of the low pressure cylinder 5 is constantly

connected by way of an inter-cooler 46 with the inlet chamber 48 formed in the cylinder head 50 of the high pressure cylinder 6.

The inlet chamber 48 has mounted therein an inlet valve assembly indicated generally by the reference numeral 51 for controlling communication between the inlet chamber 48 and the compression chamber 52 at the face of the piston 9. The inlet valve 51 assembly comprises a seat member 53 having passages 54 extending therethrough and having secured thereto a spring cage 55. The seat member 53 has a seating face thereon which is adapted to be engaged by an annular valve 56, while a spring 58 extends between the spring cage 55 and the valve 56, and yieldingly presses the valve 56 into engagement with the seating face on the seat member 53.

The inlet valve seat member 53 is held in engagement with a shoulder on the head 50 by means of a tubular threaded member 60 having passages 61 extending through the wall thereof.

A body 62 is secured on the exposed portion of the threaded member 50 and has a bore therein in which is mounted a valve piston 64 having a plurality of grooves in the wall thereof, one of the grooves being indicated at 66. The valve piston 64 has a seating face thereon which is adapted to engage a seat formed on the body 62 to cut off communication between the inlet chamber 48 at the lower face of the valve piston, and a bore indicated at 68, which is constantly open to the atmosphere by way of a passage 69.

The valve piston 64 has secured thereto a stem 70, while a coil spring 72 extends between a flange 71 on the stem 70 and the seat member 53, and yieldingly urges the seating face on the valve piston 64 into engagement with the seat on the body 62.

A member 75 is slidably mounted on the stem 70 and has fingers 76 which extend through the passages 54 in the seat member 53 and engage the valve 56 to press it away from the seating face on the seat member 53 against the spring 58. The member 75 is yieldingly pressed into engagement with the flange 71 on the stem 70 by means of a coil spring 78.

The valve piston 64 has an upwardly extending stem 80 formed thereon which extends into a bore in a valve piston 82, which is slidable in the bore 68 in the body 62. The valve piston 82 has a seating face thereon which is adapted to engage a seat formed on the body 62 surrounding the bore 68 to cut off communication between the bore 68 and a chamber 84 formed in a cover section 86, which is secured on the body 62.

The chamber 84 is constantly connected by way of a pipe 88 with an unloading device 90 which operates in response to operating conditions of the compressor, such as the pressure of the fluid in the reservoir 2, the speed of the compressor, or other condition, to control the supply of fluid under pressure from the reservoir 2 to the chamber 84, and to also control the release of fluid from the chamber 84. The unloading device 90 may be of any well known construction, and one form of device which I may employ is shown in the application of Burton S. Aikman, Serial No. 4,094, filed January 30, 1935.

The head 50 of the high pressure cylinder 6 has an exhaust chamber 92 formed therein which is constantly connected by way of pipe 93 with the reservoir 2. The chamber 93 has mounted therein an exhaust valve assembly indicated generally by the reference numeral 94, and comprising a seat member 95 having passages 96 extending therethrough, and having a seating face formed thereon which is adapted to be engaged by an annular valve 97. A spring cage 98 is secured to the seat member 95, while a spring 99 extends between the spring cage 98 and the valve 97 and yieldingly presses the valve into engagement with the seating face on the seat member 95.

The exhaust valve assembly 94 is held in position by means of a hollow threaded member 100 having passages 102 extending through the wall thereof, while a cover 104 is secured on the exposed portion of the threaded member 100.

The unloading means provided by this invention is adapted for use on compressors which are driven continuously and unloaded at intervals to prevent them from compressing fluid when the pressure of the fluid compressed thereby increases to a predetermined value, and it is also adapted for use on compressors which are stopped when the pressure of the fluid compressed thereby increases to a predetermined value and which are unloaded at the time they are again started in order to reduce the load on the driving means.

The compressor 1 is shown in the drawings in the loaded condition, and at this time the unloading device 90 connects the chamber 84 to the atmosphere, while the spring 72 presses through the stem 70 to hold the valve piston 64 against the seat on the body 62 to prevent flow of fluid from the inlet chamber 48 to the bore 68, and the stem 80 holds the valve piston 82 away from its seat. At this time the fingers 76 are held away from the valve 56, and the spring 58 holds the valve 56 against the seating face on the seat member 53.

On rotation of the compressor crankshaft, not shown, the pistons 8 and 9 are reciprocated in the cylinders 5 and 6 respectively. On downward movement of the piston 8 fluid supplied from the atmosphere to the inlet chamber 11 in the head 10 of the low pressure cylinder 5 flows through the passages 17, unseats the valve 18, and flows to the compression chamber 14 at the upper face of the piston 8. On subsequent upward movement of the piston 8, the valve 18 is held seated by the spring 21, and the fluid in the compression chamber 14 is compressed, and it moves the valve 36 against the spring 40 away from the seat member 32, and flows through the passages 34 to the exhaust chamber 30 from which it flows by way of the intercooler 46 to the inlet chamber 48 of the high pressure cylinder 6.

On downward movement of the piston 9 of the high pressure cylinder of the compressor, fluid supplied to the inlet chamber 48 flows through the passages 54, unseats the valve 56, and flows to the compression chamber 52 at the upper face of the piston 9. On subsequent upward movement of the piston 9 the fluid in the compression chamber 52 is compressed, and the valve 56 being held seated by the spring 58, this fluid is forced through the passages 96, unseats the valve 97, and flows to the exhaust chamber 92, from which it flows by way of the pipe 93 to the reservoir 2.

On the occurrence of the condition to which the unloading device 90 is designed to respond, such as an increase to a predetermined value in the pressure of the fluid in the reservoir 2, the unloading device 90 operates to cut off communication between the pipe 88 and the atmosphere, and to supply fluid under pressure from the reservoir 2 to the pipe 88 through which it flows to the chamber 84 at the upper face of the valve piston 82.

On an increase in the pressure of the fluid in the chamber 84, the valve piston 82 is moved downwardly in the bore 88 in the body 62 until the seating face on this valve piston engages the seat on the body 62 surrounding the bore therein, thereby cutting off communication between the chamber 84 and the bore 68 in the body 62.

On downward movement of the valve piston 82 it presses against the stem 80 and moves the valve piston 64 downwardly so that the seating face on this valve piston is moved away from the seat on the body 62, with the result that communication is established between the inlet chamber 48 and the atmosphere by way of the grooves 66 in the periphery of the valve piston 64, past the seat on the body 62 to the bore 68, and thence through the passage 69.

On downward movement of the valve piston 64 the spring 78 is compressed and exerts force on the member 75 to press the fingers 76 against the valve 56 and move this valve away from the seating face on the seat 53 against the spring 58.

The compressor is now unloaded, and if it is operated it will not compress fluid into the reservoir 2 since fluid supplied from the low pressure cylinder 5 to the intercooler 46 flows to the inlet chamber 48 of the high pressure cylinder 6, and therefrom past the valve piston 64 to the bore 68 and through the passage 69 to the atmosphere. As the fluid supplied from the low pressure cylinder 5 to the intercooler 46 may flow freely therefrom to the atmosphere, no pressure will be developed in the intercooler 46, and there will be no opposition to upward movement of the piston 8 of the low pressure cylinder 5.

On downward movement of the piston 9 of the high pressure cylinder 6 while the compressor is unloaded, fluid drawn into the compression chamber 52 past the open valve 56 on the suction stroke of the compressor is forced past the open valve 56 on upward movement of the piston 9 and through the passages 54 to the inlet chamber 48, from which it may flow to the atmosphere past the valve piston 64.

As fluid may flow freely between the compression chamber 52 and the inlet chamber 48, and also between the inlet chamber 48 and the atmosphere past the valve piston 64, no pressure will be developed in the compression chamber 52, and there will be no resistance to movement of the piston 9 in the cylinder 6.

On the occurrence of the condition to which the unloading device 98 operates to load the compressor, such as a predetermined decrease in the pressure of the fluid in the reservoir 2, this device operates to cut off the supply of fluid under pressure from the reservoir 2 to the chamber 84, and to connect the chamber 84 to the atmosphere.

On the release of fluid under pressure from the chamber 84, the force exerted thereby on the valve piston 82 and the valve piston 64 is insufficient to maintain these valve pistons against the opposing force of the spring 72. The spring 72 thereupon moves the valve piston 64 upwardly so that the seating face thereon engages the seat on the body 62 surrounding the bore 68, while the valve piston 82 is moved upwardly so that the seat thereon is moved away from the seat on the body 62.

On movement of the valve piston 64 to the seated position, communication between the inlet chamber 48 and the atmosphere is cut off so that fluid under pressure supplied by the low pressure cylinder 5 to the intercooler 46 can no longer escape to the atmosphere.

In addition, on movement of the valve piston 64 to the seated position, the flange 71 on the stem 70 engages the member 75 and moves it upwardly so that the fingers 76 are moved away from the valve 56 to permit the spring 58 to move the valve 56 into engagement with the seating face on the seat member 53.

With the compressor running under the above conditions, the low pressure chamber 5 will supply fluid under pressure to the high pressure cylinder 6, which in turn will supply fluid to the reservoir 2 in the manner described in detail above.

It will be seen that this invention provides unloading means for a multi-stage compressor, and that the unloading means operates to unload all of the compressor cylinders. It will also be seen that this unloading means incorporates valve means for releasing fluid from the inlet chamber of the high pressure cylinder, together with means operating through this valve means to unseat the inlet valve of the high press re cylinder. When the compressor is loaded this valve means permits the inlet valve of the high pressure cylinder to seat, while the valve means seats to prevent leakage of fluid from the high pressure cylinder inlet chamber to the atmosphere.

In addition, when the compressor is unloaded the escape of fluid from the chamber to which fluid is supplied by the device for controlling the operation of the unloading means is prevented as the valve piston operated by the fluid supplied to this chamber is held against a seat surrounding the bore in which the valve piston is mounted.

It will be seen, therefore, as valve means is provided to prevent unintended escape of fluid from the inlet chamber of the high pressure cylinder when the compressor is loaded, and as other valve means is provided to prevent unintended escape of fluid from the chamber to which fluid is supplied by the unloading means when the compressor is unloaded, there will be a minimum of leakage of fluid under pressure through the unloading means provided by this invention.

In Fig. 3 there is illustrated a fluid compressor provided with a modified form of unloading means embodying this invention. In this figure of the drawings there is illustrated a fluid compressor indicated generally by the reference numeral 110. This compressor is driven by suitable means, not shown, and compresses fluid under pressure into a reservoir 112. The compressor 110 is similar to the compressor shown in Fig. 1 of the drawings, and has a crankcase to which is secured a low pressure cylinder 115, and a high pressure cylinder 116. These cylinders have bores therein in which are reciprocated pistons 118 and 119, respectively, by means of a crankshaft, not shown.

The low pressure cylinder 115 has a head 120 secured thereto having an inlet chamber 121 formed therein which is constantly connected to the atmosphere by way of a passage 122.

The inlet chamber 121 has mounted therein an inlet valve assembly, indicated generally by the reference numeral 125, to control the flow of fluid between the inlet chamber 121 and the compression chamber 124 at the face of the piston 118. The inlet valve assembly comprises a seat member 126 having passages 127 extending therethrough. The seat member 126 has a

seating face formed thereon which is adapted to be engaged by an annular valve 128. In addition, the seat member 126 has a central bore therein in which is mounted a valve 130 having a conical seating face thereon which is adapted to engage a seat on the seat member 126 surrounding the bore in which the valve is mounted. The valve 130 is of such diameter as to overlap the inner margin of the annular valve 128, and this valve is arranged so that when it is in the seated position, the valve 128 may engage the seating face on the seat member 126.

The valve 130 has a stem 132 extending therethrough, while a spring 134 extends between the seat member 126 and a flange 136 on the stem 132 and yieldingly urges the stem upwardly so that the valve 130 is pressed against the seat member 126.

The stem 132 has a spring cage 138 secured to the lower end thereof, while a coil spring 140 extends between the spring cage 138 and the valve 128 and yieldingly presses the valve 128 against the seating face on the seat member 126.

The seat member 126 is held against a shoulder on the head 120 by means of a hollow threaded member 142 having passages 144 extending through the wall thereof. The member 142 has secured thereto a cover 146, which also engages the face of the head 120 to prevent the escape of fluid under pressure from the chamber 148 intermediate the cover and the member 142.

The member 142 has a bore therein in which is mounted a valve piston 150 having an annular portion which closely fits the bore in the member 142, and having a conical sealing face thereon which is adapted to engage a seat formed on the member 142 surrounding the bore in which the valve piston is mounted.

The valve piston 150 has a round stem which extends into a bore in the upper end of the stem 132. The various parts of the apparatus are arranged and proportioned so that the spring 134 may move the stem 132 upwardly, and move the valve 130 into engagement with the seat on the seat member 126 without moving the valve piston 150 into engagement with projections 152 formed on the cover 146.

The head 120 of the low pressure cylinder 115 has, in addition, an exhaust chamber 154 formed therein in which is mounted an exhaust valve assembly indicated generally by the reference numeral 156, and similar in construction to the exhaust valve assembly 31 employed on the low pressure cylinder 5 of the compressor shown in Fig. 1 of the drawings. The exhaust valve assembly 156 is held against a shoulder on the cylinder head 120 by means of a threaded member 158, while a cover 160 is secured on the member 158.

The exhaust chamber 154 is constantly connected by way of an intercooler 162 with an inlet chamber 164 formed in the cylinder head 166 of the high pressure cylinder 116.

The inlet chamber 164 has mounted therein an inlet valve assembly indicated generally by the reference numeral 125a, and substantially identical in construction with the inlet valve assembly 125 employed on the low pressure cylinder 115.

The inlet valve 125a is held in position against a shoulder on the cylinder head 166 by means of a hollow threaded member 170 having passages 172 extending through the wall thereof. A cover 174 is secured on the member 170 and cooperates therewith to form a chamber 176.

The member 170 has a bore extending therethrough, while a valve 178 is mounted in the inlet chamber 164, and is adapted to engage a seat on the member 170 surrounding the bore therein.

A valve 180 is mounted in the chamber 176 and is adapted to engage a seat formed on the member 170 surrounding the bore therein, and is also provided with an annular portion which closely fits the bore in the member 170. The valves 178 and 180 engage each other, and are proportioned so that when one of these valves is in the seated position, the other is held away from its seat.

A spring 182 extends between the valve 178 and the bottom of the bore in the stem 132a of the inlet valve 125a, and yieldingly presses the valve 178 to the seated position. The spring 182 is substantially weaker than the spring 134a associated with the stem 132a of the valve assembly 125a, so that when the spring 182 has moved the valve 178 to the seated position, it will not exert sufficient force on the stem 132a to move it against the spring 134a, and move the valve 130a away from its seat.

The cylinder head 166 of the high pressure cylinder 116 has an exhaust chamber 184 formed therein in which is mounted an exhaust valve assembly indicated generally by the reference numeral 156a, and substantially identical in construction with the exhaust valve assembly 156 employed on the low pressure cylinder 115. The exhaust valve assembly 156a is held against a shoulder on the cylinder head 166 by a threaded member 186, while a cover 188 is secured on the threaded member 186. The exhaust chamber 184 is constantly connected by way of a passage and pipe 190 with the reservoir 112.

The compressor 110 has an unloading device 192 associated therewith. This unloading device may be of the same construction as the device 90 employed in connection with the compressor shown in Fig. 1 of the drawings, and controls the supply of fluid under pressure from the reservoir 112 to the chambers 176 and 148 of the high and low pressure cylinders 116 and 115, respectively, and also controls the release of fluid under pressure from these chambers.

The compressor 110 is shown in the drawings in the loaded condition, and at this time the spring 134 associated with the inlet valve assembly 125 of the low pressure cylinder 115 operates through the stem 132 to move the valve 130 to the seated position to permit the spring 140 to hold the valve 128 in engagement with the seating face on the seat member 126. At this time the valve piston 150 is held away from its seat.

In addition, at this time the spring 134a associated with the inlet valve assembly 125a of the high pressure cylinder 116 holds the stem 132a in a position to hold the valve 130a against its seat on the seat member 126a and permit the spring 140a to hold the valve 128a against the seating face on the seat member 126a, while the spring 182 holds the valve 178 against the seat on the member 170, and holds the valve 180 away from its seat.

With the compressor running, on downward movement of the piston 118 of the low pressure cylinder 115, fluid from the atmosphere will be drawn into the compression cylinder 124 above the piston 118 from the inlet chamber 121 past the valve 128, which is moved away from its seat against the spring 140. On upward movement

of the piston 118 the valve 128 is held seated and this fluid is compressed and flows past the exhaust valve assembly 156 to the intercooler 162 and to the inlet chamber 164 of the high pressure cylinder 116. At this time, as the valve 178 is held in the seated position, fluid cannot escape from the inlet chamber 164 to the chamber 176, and thence by way of the pipe 194 to the unloading device 192, through which it could escape to the atmosphere.

On downward movement of the piston 119 of the high pressure cylinder 116, fluid supplied by the low pressure cylinder 115 to the inlet chamber 164 flows therefrom past the inlet valve assembly 128a to the compression chamber 165, and on subsequent upward movement of the piston 119 the fluid in the compression chamber 165 is compressed and flows past the exhaust valve assembly 156a to the exhaust chamber 164, and thence by way of the pipe 198 to the reservoir 112.

On the occurrence of the condition to which the unloading device 192 is intended to respond, this device operates to cut off communication between the pipe 194 and the atmosphere, and to supply fluid under pressure from the reservoir 112 to the pipe 194. On the supply of fluid under pressure to the pipe 194 fluid flows to the chamber 148 in the head 120 of the low pressure cylinder 115, and moves the valve piston 150 downwardly into engagement with the seat on the member 142 surrounding the bore in which the valve piston is mounted.

On downward movement of the valve piston 150 the stem thereof presses against the stem 132 and moves it downwardly against the spring 134, while the valve 130 is moved away from its seat and presses against the valve 128 and moves it away from the seating face of the seat member 126 against the spring 140.

In addition, on the supply of fluid under pressure to the pipe 194 fluid flows to the chamber 176 of the high pressure cylinder 116, and moves the valve 180 into engagement with the seat on the member 170, and this valve presses against the valve 178 and moves it away from its seat.

On slight downward movement of the valve 178 it engages the upper end of the stem 132a so that on further downward movement of the valve 178, the stem 132a is moved downwardly against the spring 134a and moves the valve 130a away from its seat on the seat member 126a. On this movement of the valve 130a, the valve 128a is moved away from the seating face on the seat member 126a against the spring 140a.

The compressor is now unloaded and on downward movement of the piston 118 of the low pressure cylinder 115, fluid from the atmosphere will be drawn into the compression chamber 124 past the open valve 128, and on subsequent upward movement of the piston 118 this fluid will be forced past the open valve 128 into the inlet chamber 121, and thence to the atmosphere by way of the passage 122.

Similarly when the piston 119 of the high pressure cylinder 116 is reciprocated, fluid under pressure flows between the compression chamber 165 and the intercooler 162 past the valve 128a, which is held away from its seat, and insufficient pressure is developed to cause fluid to be compressed past the exhaust valve assembly 156a into the exhaust chamber 164.

It will be seen that while the compressor is in the unloaded condition, the valve piston 150 and the valve 180 are held firmly against their seats so as to prevent the leakage of fluid from the chambers 148 and 176, respectively.

On the occurrence of the condition which causes the unloading device 192 to operate to effect loading of the compressor, this device operates to cut off the supply of fluid under pressure to the pipe 194, and to release fluid therefrom. On the release of fluid from the pipe 194 fluid is reelased from the chambers 148 and 176. On the release of fluid from the chamber 148, the spring 134 expands and operates through the stem 132 to move the valve 130 into engagement with the seat member 126 to permit the valve 128 to be moved to the seated position by the spring 140. In addition, on this movement of the stem 132, the valve piston 150 is moved away from its seat.

On the release of fluid from the pipe 194 fluid is released from the chamber 176, and the spring 134a expands and moves the stem 132a upwardly until the valve 130a engages the seat member 126a, while the valve 128a is moved to the seated position by the spring 140a.

In addition, on this movement of the stem 132a force is exerted through the spring 182 to move the valve 178 into engagement with the seat on the member 170, while the valve 180 is moved away from its seat.

The low pressure piston now operates to compress fluid into the intercooler 162 and the inlet chamber 164 of the high pressure cylinder 116, while the high pressure piston compresses fluid into the reservoir 112.

It will be seen that each of the cylinders has a valve subject to the pressure of the fluid supplied by the unloading device, and that on an increase in the pressure of the fluid supplied by this device, these valves are moved to their seated positions to prevent the leakage of fluid supplied by the unloading device through the bores in which these valve pistons are mounted.

In addition, it will be seen that the unloading means for the high pressure cylinder has a valve through which the unloading means operates to hold the inlet valve open, and which, when the unloading means is conditioned to load the compressor, engages a seat to prevent leakage of fluid from the inlet chamber of the high pressure cylinder to the atmosphere through the unloading device.

While two embodiments of the improved compressor unloading means provided by this invention have been illustrated and described in detail, it should be understood that the invention is not limited to these details of construction, and that numerous changes and modifications may be made without departing from the scope of the following claims.

Having now described my invention, what I claim as new and desire to secure by Letters Patent, is:

1. In a valve assembly for a fluid compressor, a seat member having ports therethrough and having a central bore therein, an annular inlet valve engageable with a seat on said seat member to control the flow of fluid through said ports, and an element positioned in said central bore and adapted to engage a seat surrounding said bore, said element having a portion overlying the inner margin of said annular inlet valve and engageable therewith upon movement of said element away from its seated position to move said annular valve away from its seat on said seat member.

2. In a valve assembly for a fluid compressor, a seat member having ports therethrough and hav-

ing a central bore therein, an annular inlet valve engageable with a seat on said seat member to control the flow of fluid through said ports, an element positioned in said central bore and adapted to engage a seat surrounding said bore, said element having a portion overlying the inner margin of said annular inlet valve and engageable therewith upon movement of said element away from its seated position to move said annular valve away from its seat on said seat member, and means yieldingly urging said element to the seated position.

3. In a valve assembly for a fluid compressor, a seat member having ports therethrough and having a central bore therein, an annular inlet valve engageable with a seat on said seat member to control the flow of fluid through said ports, an element positioned in said central bore and adapted to engage a seat surrounding said bore, said element having a portion overlying the inner margin of said annular inlet valve and engageable therewith upon movement of said element away from its seated position to move said annular valve away from its seat on said seat member, and means yieldingly urging said inlet valve to the seated position.

4. In a valve assembly for a fluid compressor, a seat member having ports therethrough and having a central bore therein, an annular inlet valve engageable with a seat on said seat member to control the flow of fluid through said ports, an element positioned in said central bore and adapted to engage a seat surrounding said bore, said element having a portion overlying the inner margin of said annular inlet valve and engageable therewith upon movement of said element away from its seated position to move said annular valve away from its seat on said seat member, a spring seat carried by said element, and a spring extending between said spring seat and said annular valve for yieldingly pressing the inlet valve to the seated position.

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