

Nov. 1, 1938.

B. S. AIKMAN

2,135,248

COMPRESSOR CONTROL

Filed May 26, 1936

4 Sheets-Sheet 1

Fig. 1.

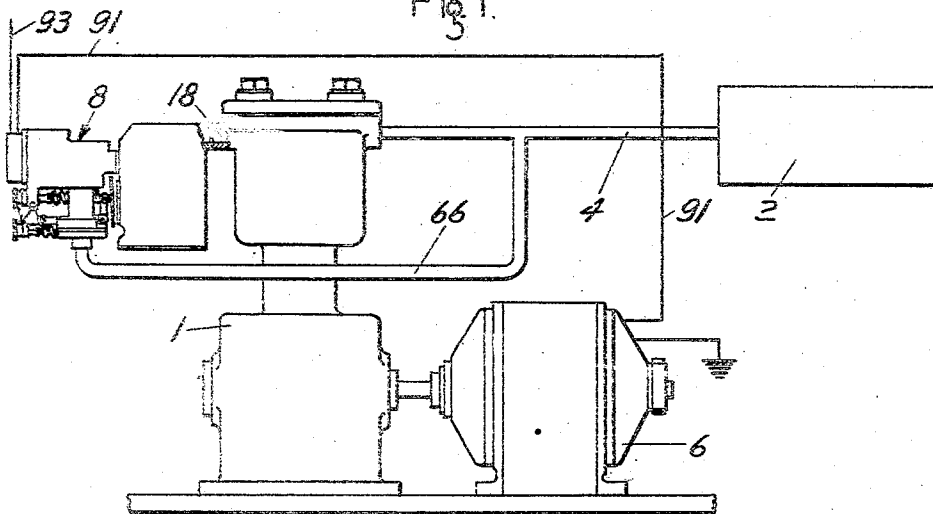


Fig. 2

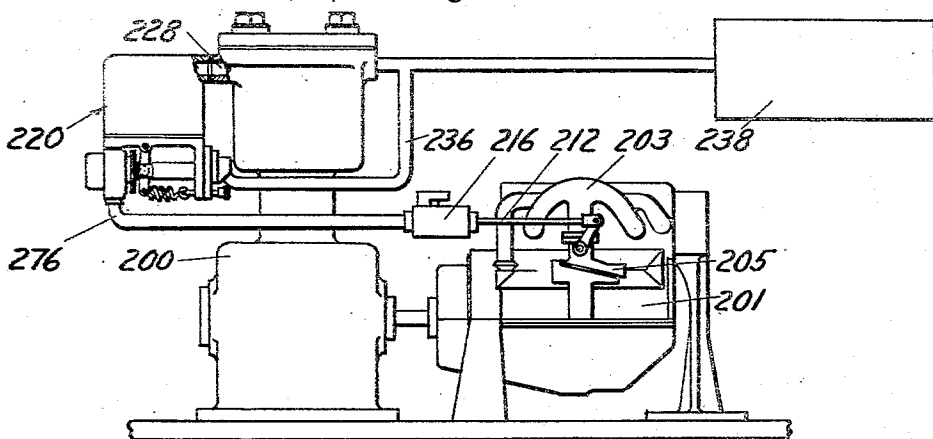
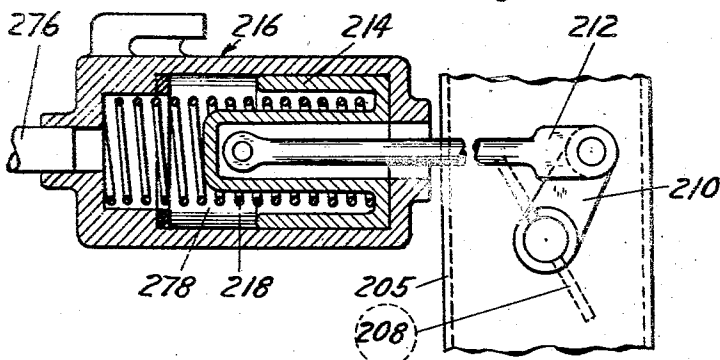


Fig. 3.



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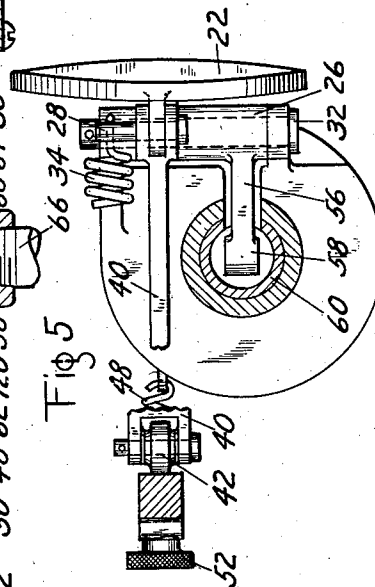
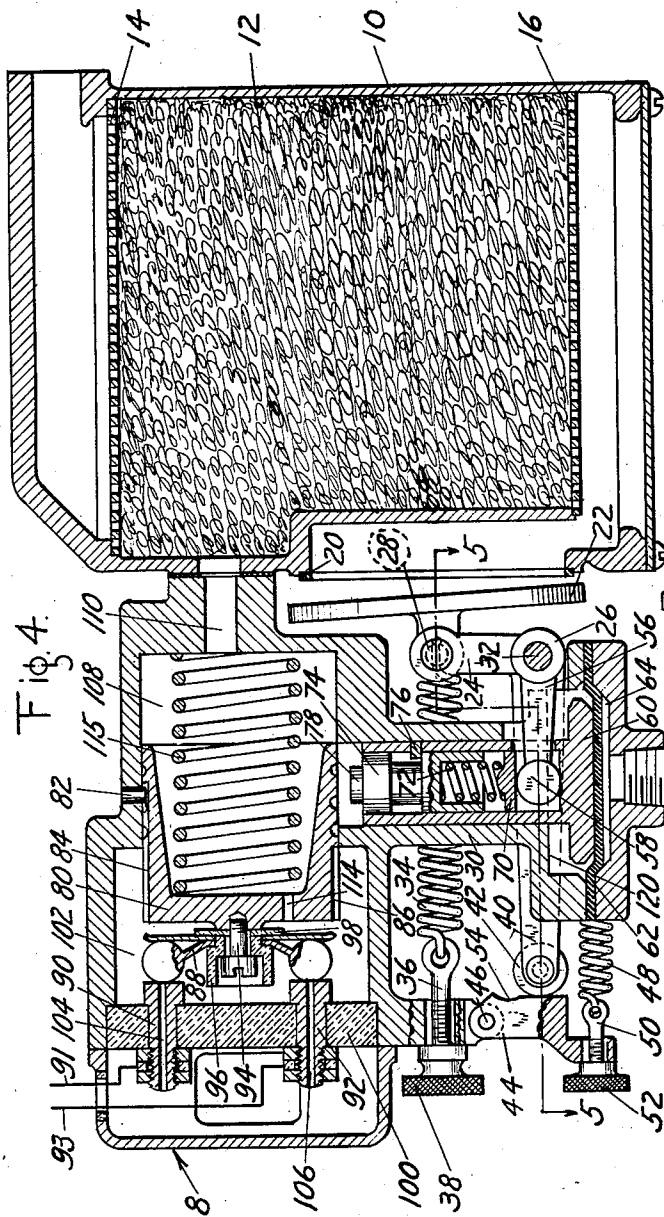
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4 Sheets-Sheet 2



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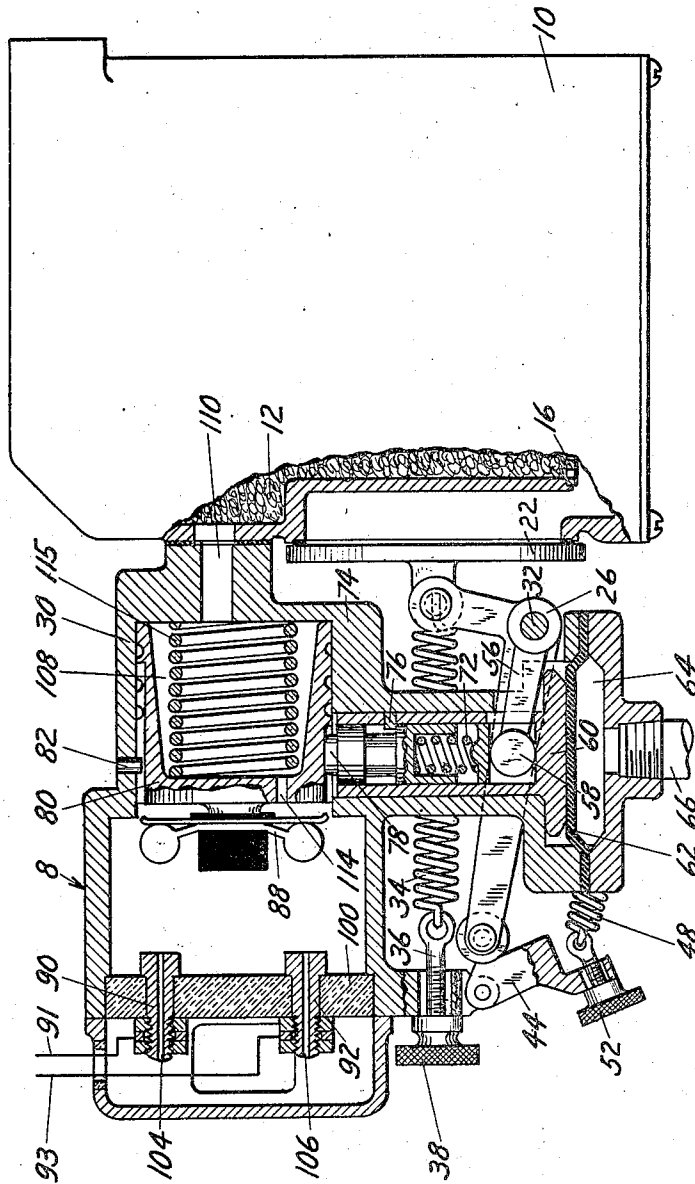
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4 Sheets-Sheet 3

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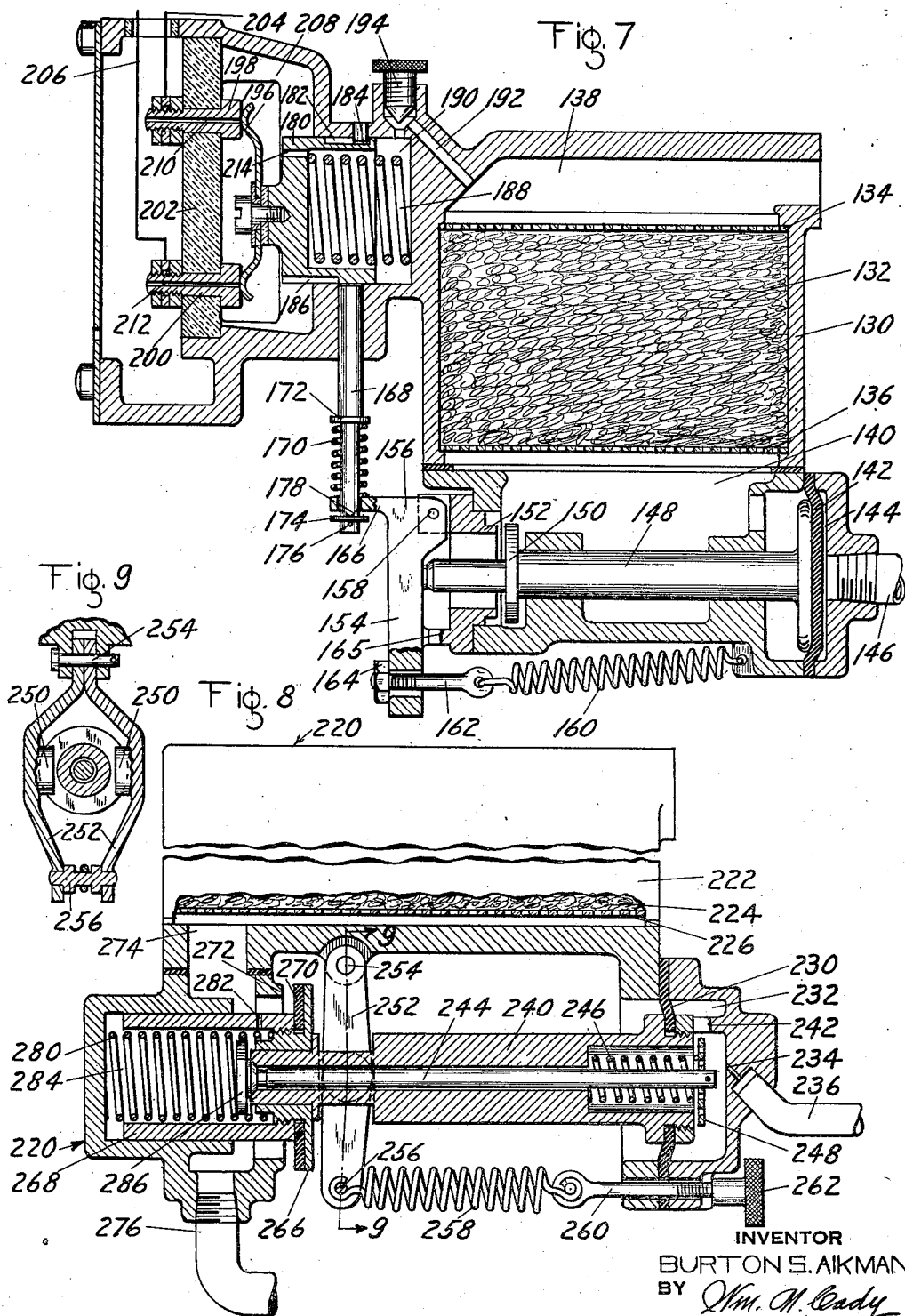
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COMPRESSOR CONTROL

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UNITED STATES PATENT OFFICE

2,135,248

COMPRESSOR CONTROL

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Application May 26, 1936, Serial No. 81,862

3 Claims. (Cl. 230-4)

This invention relates to a control system for a fluid compressor and for the compressor driving means, and more particularly to a control system responsive to the pressure of the fluid compressed by the compressor for loading and unloading the compressor and for also controlling the compressor driving means.

It is customary in many fluid compressor installations to control the compressor driving means in response to variations in the pressure of the fluid compressed by the compressor so as to effect operation of the compressor when this pressure falls below a predetermined value and to continue operation of the compressor until the pressure of the fluid compressed by the compressor increases to a higher predetermined value.

In the control systems now in use it is customary, on an increase in the pressure of the fluid compressed to the predetermined value, to actuate the means for controlling the compressor driving means, either before the compressor is unloaded, or simultaneously with operation of the compressor unloading means, with the result that this control of the driving means is effected while the driving means is under substantially its maximum load.

In many installations the driving means is an electric motor and the control system includes a switch which opens and closes the circuit to this driving motor. If this switch is opened while the driving motor is under maximum load the switch will be required to interrupt a heavy current and considerable arcing and burning of the switch contacts will result. If the circuit to the compressor driving motor is not interrupted until after the compressor is unloaded, which results in a substantial reduction in the load on the driving motor and a corresponding reduction in the current taken by the motor, the strength of the circuit to be interrupted by the control switch will be greatly reduced and the arcing and burning of the switch contacts will be reduced to a minimum.

It is one object of this invention to provide a compressor control system for controlling the operation of a compressor and of an electric driving motor therefor, and which operates to unload the compressor and thereby reduce the load on the compressor driving motor before the circuit to the driving motor is interrupted so that the strength of the circuit which must be interrupted will be at a minimum at the time the switch is opened.

A further object of the invention is to provide a control system for a fluid compressor

which is responsive to the pressure of the fluid compressed by the compressor and which regulates the pressure of the fluid compressed by the compressor without the use of toggle lever and spring combinations or without the use of valves operating against pressures higher than atmospheric pressure.

Another object of the invention is to provide a compressor control system of the type described and having means to adjustably vary the fluid pressures which the system is adapted to maintain without affecting in a substantial manner the forces available for actuating portions of the control mechanism.

A further object of the invention is to provide a compressor control system of the type described and which is adapted for use in connection with a compressor driven by either an electric motor or by an internal combustion engine.

Another object of the invention is to provide a compressor control system for use in controlling a compressor driven by an electric motor, the control system including a switch for controlling the circuit to the driving motor and having improved means to produce a blast of air across the switch contacts when the contacts are opened in order to quickly extinguish the arc which is formed between these contacts.

A further object of the invention is to provide an improved compressor control system.

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 diagrammatic view of a fluid compressor driven by an electric motor and equipped with one embodiment of the control system provided by this invention;

Fig. 2 is a diagrammatic view of a fluid compressor driven by an internal combustion engine and equipped with another embodiment of the control system provided by this invention;

Fig. 3 is an enlarged fragmentary view, largely in section, of a portion of the apparatus employed in the control system shown in Fig. 2 of the drawings;

Fig. 4 is an enlarged sectional view of the control apparatus employed in connection with the compressor shown in Fig. 1 of the drawings;

Fig. 5 is a sectional view taken substantially along the line 5-5 of Fig. 4;

Fig. 6 is a view similar to Fig. 4 and showing the control apparatus in the position to unload the compressor and to interrupt the circuit to the compressor driving motor;

Fig. 7 is an enlarged sectional view of a modified form of compressor control apparatus embodying this invention;

Fig. 8 is an enlarged sectional view of the control apparatus employed in connection with the compressor shown in Fig. 2 of the drawings; and

Fig. 9 is a sectional view taken substantially along the line 9-9 of Fig. 8.

Referring to Fig. 1 of the drawings there is illustrated therein a fluid compressor 1, which may be of any suitable well known construction, and which compresses fluid into a reservoir 2 by way of a pipe 4. The compressor 1 is driven by means of an electric driving motor 6, while a control device, indicated generally by the reference numeral 8, is provided to control the loading and unloading of the compressor and to also control the supply of current to the driving motor 6.

The construction of the control device 8 is best shown in Figs. 4, 5 and 6 of the drawings, and as therein illustrated comprises a hollow casing 10 having a passage extending therethrough in which is interposed air straining material, such as curled hair indicated at 12, which is confined between perforated plates 14 and 16. One end of the passage through the casing 10 opens on a mounting face formed on the casing and adapted to be secured against a similar mounting face formed on the compressor surrounding the intake passage 18 leading to the inlet valve of the compressor.

The other end of the passage through the casing 10 terminates in a substantially circular opening in the face of the casing 10 which is surrounded by an annular sealing gasket 20, which may be formed of any suitable material such as rubber.

The control device 8 has associated therewith valve means adapted to control the flow of fluid to the passage through the casing 10, and this valve means comprises a valve disc 22 which is pivotally supported by means of a pin 28 on an arm 24 of a member 26.

The member 26 is pivotally supported from a casing section 30 by means of a pin 32 and is yieldingly urged in a counterclockwise direction, as viewed in Fig. 4 of the drawings, by means of a coil spring 34 which has one end connected to the pin 28 and has its other end connected to a threaded eye 36 which extends through an opening in the casing section 30 and has secured thereon a knurled nut 38.

The member 26 has an arm 40 formed integral therewith and this arm carries at the end thereof a roller 42 which is engaged by a member 44 which is pivotally secured by means of a pin 46 to a portion of the casing section 30. The member 44 is yieldingly urged into engagement with the roller 42 by means of a spring 48 which has one end secured to a portion of the casing section 30 and has its other end secured to a threaded eye 50 which extends through an opening in the member 44 and has secured thereon a knurled nut 52.

The member 44 has a recess 54 formed in the face thereof, and in one position of the arm 40 of the member 26 the roller 42 extends into the recess 54.

The member 26 has an arm 56 formed integral therewith and this arm has a round portion 58 formed on the end thereof which extends into a hollow plunger 60 which is mounted in a bore in the casing section 30. The plunger 60 is provided with an enlarged head which engages one

face of a diaphragm 62 which is subject on the other side to the pressure of the fluid in a chamber 64 which is connected by way of a pipe 66 with the reservoir 2 into which the compressor compresses fluid.

The rounded portion 58 of the arm 56 of the member 26 is engaged by means of a spring seat 70 which is slidably mounted in a bore in the plunger 60. A coil spring 72 extends between the spring seat 70 and a latch piece 74 which is slidably mounted in a bore in the plunger 60, and which is provided with an annular recess into which extends a pin 76 which projects into the bore in the plunger 60. The latch piece 74 is provided with an extension 78 of reduced diameter.

The casing section 30 is, in addition, provided with a bore in which is mounted a piston 80 which is prevented from rotating in the bore by means of a pin 82 which extends into a groove 84 in the face of the wall of the piston 80. The piston 80 also has formed thereon at a point substantially diametrically opposite the groove 84 a groove 86, and, as will hereinafter more fully appear, the projection 78 on the latch piece 74 is adapted at certain times to extend into this groove to hold the piston 80 in one of its positions.

The piston 80 has secured on the face thereof a movable contact 88 having spherical end portions which are adapted to engage stationary contacts 90 and 92. The movable contact 88 is secured to the piston 80 by means of a screw 94 and is insulated from the piston by means of insulating members 96 and 98.

The stationary contact 90 is connected by way of a wire 91 with one terminal of the driving motor 6, while the stationary contact 92 is connected by way of a wire 93 with one terminal of the source of current supply. The other terminal of the source of current supply and the other terminal of the driving motor are connected to ground.

The stationary contacts 90 and 92 are secured on a member 100 which is formed of suitable insulating material and is mounted in a recess in the member 30 so as to form a chamber 102 enclosing the stationary and movable contacts.

The stationary contacts 90 and 92 have restricted openings 104 and 106 extending therethrough and opening on the faces of the contacts which are adapted to be engaged by the movable contact 88.

The piston 80 has at one side thereof a chamber 108 which is constantly connected by way of a passage 110 with the passage through the casing section 10 and thereby with the intake passage 18 of the compressor 1.

The piston 80 has an opening 114 extending therethrough and communicating with the chamber 108 and with the chamber 102. The flow capacity of the passage 114 is less than the combined flow capacities of the passages 104 and 106 through the stationary contacts 90 and 92 respectively.

The piston 80 is urged by means of a spring 115 to a position to press the movable contact 88 against the stationary contacts 90 and 92 and complete the circuit between these contacts.

The control device 8 is shown in Fig. 4 of the drawings in the position to complete the circuit to the compressor driving motor, to effect loading of the compressor, and with the pressure of the fluid compressed by the compressor below the value to which the control device is adapted to

respond to unload the compressor and to interrupt the circuit to the driving motor.

On an increase in the pressure of the fluid compressed by the compressor 1 there will be a similar increase in the pressure of the fluid in the chamber 64 as this chamber communicates with the reservoir 2 by way of the pipe 66. When the pressure of fluid in chamber 64 has been increased to a predetermined degree sufficient to overcome the opposing pressure of the spring 34 which acts through the arms 24 and 56 and the plunger 60 to oppose movement of the diaphragm, said diaphragm will be moved upwardly, so as to cause the member 26 to be moved in a clockwise direction about the pin 32.

On this movement of the member 26 the arm 24 is moved and it will move the valve disc 22 closer to the sealing gasket 20.

In addition, on this movement of the lever 26 the arm 40 thereof will be moved and the roller 42 will move across the face of the member 44 towards the depression 54. The face of the member 44 is arranged so as to offer substantially no opposition to movement of the roller towards the depression 54.

On this movement of the plunger 60 the latch piece 74 will be moved towards the piston 80, and after a predetermined amount of movement of the plunger 60 upwardly the projecting portion 78 on the latch piece 74 will engage the face of the piston 80 so that on further upward movement of the plunger 60 the plunger will move relative to the latch piece 74 and will compress the spring 72.

After a predetermined amount of movement of the plunger 60 the member 26 will be moved an amount sufficient to move the valve disc 22 very close to the sealing gasket 20 so as to substantially restrict the rate at which air may flow from the atmosphere to the passage through the casing section 10 leading to the inlet passage of the compressor.

As the valve disc 22 approaches the sealing gasket 20, the flow of atmospheric fluid to the inlet passage of the compressor is substantially restricted, so that the atmospheric pressure acting on the outer face of the disc 22 against the partial vacuum created by the suction of the compressor at the opposite side of the disc by the movement of the disc toward its seat will cause the rapid movement of the disc to its closed position.

On movement of the valve disc 22 to the seated position the member 26 is moved in a clockwise direction, thereby moving the arm 40 across the face of the member 54 so that the roller 42 is in alignment with the recess 54, whereupon the spring 48 causes the member 44 to move about the pin 46 so that the recessed portion 54 engages the roller 42.

On movement of the valve disc 22 to the seated position, because of the force exerted on the valve disc as a result of the partial vacuum in the compressor inlet passage there will be a reduction in the force exerted by the spring 34 on the plunger 60 and the plunger 60 will be moved upwardly by the fluid under pressure in the chamber 64 acting on the diaphragm 62 into engagement with the shoulder 120 on the casing section 30, thereby increasing the amount of compression of the spring 72 and more firmly pressing the latch piece 74 against the piston 80.

On a reduction in the pressure of the fluid in the compressor intake passage 18 there will be a similar reduction in the pressure of the fluid

in the chamber 108 as this chamber communicates with the compressor intake passage by way of the passage 110. Fluid flows from chamber 102 at one side of piston 80 through the restricted port 114 in the piston to chamber 108, but since the fluid pressure in chamber 108 is reduced at a greater rate than fluid can flow through said port, the piston 80 will be moved to the right, against the resistance of the spring 115 by the higher atmospheric pressure in chamber 102.

On this movement of the piston 80 the bridging contact 88 is moved away from the stationary contacts 90 and 92. When the bridging contact 88 is moved away from the stationary contacts 90 and 92 arcs may be formed between the stationary contacts and the bridging contact, but as the compressor has already been unloaded before the bridging contact is moved away from the stationary contacts the load on the driving motor of the compressor is reduced to a minimum, and the current required by the motor is also reduced to a minimum so that the size of the arcs which are formed on interruption of the circuit to the driving motor is at a minimum.

On movement of the piston 80 to the right, as viewed in Fig. 4 of the drawings, there will be an increase in the volume of the chamber 102 and a corresponding reduction in the pressure of the fluid in this chamber. As a result of the reduction in the pressure of the fluid in the chamber 102 from this cause, as well as from the flow of fluid therefrom through the passage 114 to the chamber 108 and thence to the compressor intake passage, the pressure of the fluid in the chamber 102 will be substantially below that of the atmosphere and air will flow through the passages 104 and 106 to the chamber 102 and is discharged substantially in the zone of the arcs which form between the stationary contacts and the bridging contact 88 and serves to cool and extinguish these arcs.

As long as the compressor continues to operate there will be a high degree of vacuum in the compressor intake passage and fluid will continue to flow thereto from the chamber 102 through the passage 114, the chamber 108 and the passage 110. As a result air will continue to flow through the passages 104 and 106 to the chamber 102 to extinguish the arcs formed on the interruption of the circuit to the compressor driving motor and to cool the switch contacts as long as the compressor continues to operate.

When the piston 80 has moved substantially to the end of the bore in which it is located the projecting portion 78 of the latch piece 74 is forced into the groove 86 in the piston 80 by the spring 72 and extends beyond the shoulder at the end of the groove 86 so as to prevent return movement of the piston 80 by the spring 115.

The control device 3 is now substantially in the position in which it is shown in Fig. 6 of the drawings. As the bridging contact 88 has been moved away from the stationary contacts 90 and 92 the circuit to the compressor driving motor is interrupted and this motor ceases to operate. The compressor, therefore, will not be driven and the partial vacuum in the compressor intake passage 18 will be gradually dissipated by the flow of air thereto from the atmosphere through the passages 104 and 106 through the stationary contacts 90 and 92, the chamber 102, the passage 114 through the piston 80, the chamber 108 and thence by way of the passage 110. The piston 80 will be urged to the left, as viewed in Figs. 4 and

6 of the drawings, by the spring 115 but its movement will be prevented by the projecting portion 78 on the latch piece 74.

As the pressure in the compressor intake passage increases to atmospheric pressure the force exerted on the valve disc 22 and tending to maintain it in engagement with the sealing gasket 20 is reduced, but this valve is held in the seated position by the fluid under pressure in the chamber 64 acting through the diaphragm 62 and plunger 60, and by the spring 48 acting through the member 44 and pressing upon the roller 42 carried by the arm 40 of the member 26 on which the valve disc 22 is mounted. Because of the shape of the depression 54 in the member 44 movement of the roller 42 out of the depression is prevented until the force tending to move the roller in the opposite direction is reduced to a value substantially below that initially required to effect movement of the roller 42 into the depression 54.

When the pressure of fluid in the reservoir 2 and in chamber 64 is reduced sufficiently, the force of the spring 34 will act against the reduced pressure in chamber 64 and any resistance to movement offered by the spring 48, to move the member 26 in a counter-clockwise direction, so that the disc 22 is moved away from its seat to thereby open the compressor intake passage to the atmosphere.

On this movement of the member 26 the roller 42, which is carried by the arm 40 of the member 26, moves out of the depression 54 in the member 44, and in moving out of the depression 54 the roller 42 moves the member 44 in a clockwise direction about the pin 46, thereby increasing the tension on the spring 48. After the initial movement of the roller 42 out of the depression 54 it engages the flat face on the member 44 so that further movement of the roller 42 does not effect a further increase in the tension on the spring 48.

On movement of the member 26 by the spring 34 the round end 58 of the arm 56 engages the plunger 60 and moves the plunger downwardly, as viewed in Figs. 4 and 6 of the drawings, and on this movement of the plunger 60 the pin 76 engages a shoulder on the latch piece 74 and retracts this latch piece so that the projecting portion 78 on the latch piece 74 is moved out of the groove 86 in the piston 80, thereby releasing the piston 80.

On the release of the latch piece 74 the piston 80 is moved by the spring 115 to the left, as viewed in Figs. 4 and 6 of the drawings, thereby moving the bridging contact 88 into engagement with the stationary contacts 90 and 92, thus completing the circuit to the driving motor 6 for the compressor so that the motor is started and operates the compressor to compress fluid into the reservoir 2.

When the pressure of fluid in the reservoir is again increased to the predetermined value at which the control device 8 operates to cut the compressor out of operation, the operation of said device as hereinbefore described is repeated.

The control device provided by this invention incorporates means by which the pressure at which the control device will operate to unload the compressor and to interrupt the circuit to the driving motor may be adjustably varied. This is accomplished by turning the knurled nut 38 which varies the tension on the spring 34. If the tension on this spring is increased the pressure to which the fluid in the reservoir 2 and in the chamber 64 must build up before the valve

disc 22 will be moved against the spring 34 to unload the compressor will be increased.

Similarly, if the tension on the spring 34 is decreased the pressure to which the fluid in the reservoir 2 and in the chamber 64 must build up before the valve disc 22 will be moved against the spring 34 to unload the compressor will be decreased.

As the means determining the difference in the pressure at which the control device operates to interrupt the circuit to the driving motor and the pressure at which it operates to complete the circuit to the driving motor is not affected by this change in the adjustment of the spring 34 any change in the adjustment of the spring 34 to vary the pressure at which the control device operates to interrupt operation of the compressor will produce a similar change in the pressure at which the control device operates to initiate operation of the compressor.

The control device provided by this invention also incorporates means by which the difference in the pressure at which the operation of the compressor is interrupted and the pressure at which the operation of the compressor is initiated may be adjustably varied. This is accomplished by turning the knurled nut 52 and thereby varying the tension on the spring 48. If the tension on this spring is increased the force exerted by the spring and opposing movement of the roller 42 out of the depression 54 after movement of the roller into this depression will be increased, and hence the pressure of the fluid in the chamber 64 must decrease to a greater degree before the force exerted by this fluid on the diaphragm 62 and through the plunger 60 on the member 26 will be enough less than the force exerted on the member 26 by the spring member 34 that the member 26 will be actuated to move the roller 42 out of the depression 54 and to move the latch piece 74 to release the piston 80.

Similarly, if the tension on the spring 48 is decreased, the force exerted by this spring and opposing movement of the roller 42 out of the depression 54 after movement of the roller into this depression will be decreased, and hence the pressure of the fluid in the chamber 64 must only decrease to a somewhat lesser degree before the force exerted by this fluid on the diaphragm 62 and through the plunger 60 on the member 26 will be enough less than the force exerted on the member 26 by the spring 34 so that the member 26 will be actuated to move the roller 42 out of the depression 54 and to move the latch piece 74 to release the piston 80.

It will be seen that the control device provided by this invention incorporates means responsive to the pressure of the fluid compressed by the compressor for unloading the compressor and for interrupting the circuit to the driving motor of the compressor, and that it operates so as to unload the compressor and reduce the load on the driving motor before the circuit to the driving motor is interrupted with the result that the strength of the current to be interrupted is at a minimum.

It will be seen also that the control device provided by this invention incorporates means to create a blast of air between the contacts at the time they are separated so as to cool and extinguish the arcs which are formed at this time, and that the means for creating this blast of air is responsive to operation of the compressor so that the air blast continues as long as the compressor continues to run.

It will be seen, in addition, that the control device provided by this invention is not dependent upon toggle lever and spring arrangements and does not employ valves operating against pressures above atmospheric pressure.

In addition it will be seen that the control device provided by this invention incorporates means to adjustably vary the pressure to which the device is adapted to respond to interrupt operation of the compressor, and also includes means to adjustably vary the differential between the pressures at which operation of the compressor is interrupted and at which operation of the compressor is initiated.

In Fig. 7 of the drawings I have illustrated another form of control device embodying this invention and adapted for use in connection with a fluid compressor driven by an electric motor.

The control device illustrated in Fig. 7 of the drawings comprises a body indicated at 130 having a chamber therein in which is positioned suitable air straining material, such as curled hair indicated at 132, and which is confined by means of perforated plates 134 and 136.

The chamber 138 at one side of the air straining means 132 communicates with an opening in a mounting face on the body 130 which is adapted to be secured to a similar mounting face on a compressor so that the chamber 138 is in communication with the intake passage of the compressor.

The chamber 140 on the other side of the air straining means 132 is open to one face of a diaphragm 142, which is subject on the other side to the pressure of the fluid in a chamber 144, which is connected by way of a pipe 146 with the reservoir into which the compressor to be controlled compresses fluid.

One face of the diaphragm 142 is engaged by a plunger 148 which is mounted in the chamber 140 and which carries a valve 150 which is adapted to engage a seat rib 152 to control communication between the chamber 140 and the atmosphere.

An end of the plunger 148 engages an arm 154 of a bell crank 156 which is pivotally supported on a pin 158. The arm 154 of the bell crank 156 is yieldingly urged in a counterclockwise direction, as viewed in Fig. 7 of the drawings, into engagement with a stop 165 by means of a coil spring 160 which is secured to an eye 162 which extends through an opening in the arm 154, and which has mounted on the end thereof a nut 164 by means of which the tension on the spring 160 may be adjustably varied.

The bell crank 156 is also provided with an arm 166 through which extends a plunger 168 which is slidably mounted in a bore in the casing section 130. A spring 170 is mounted on the plunger 168 and extends between a flange 172 on the plunger 168 and a face of the arm 166 of the bell crank 156.

The plunger 168 also has secured thereon a washer 174 which is held by means of a cotter pin 176 and which limits movement of the plunger 168 by the spring 170.

The spring 170 is under initial compression and holds the washer 174 in engagement with rounded projections 178 on the lower face of the arm 166 of the bell crank 156, and the various parts of the apparatus are arranged and proportioned so that when the washer 174 is in engagement with the projection 178, and when the arm 154 is in engagement with the stop 165, the end of the plunger 168 will not extend into the bore

in the casing section 130 in which is mounted a piston 180.

The piston 180, which is mounted in a bore in the casing section 130, is provided with a groove 182 into which extends a pin 184 to prevent rotation of the piston in this bore.

The piston 180 has formed on the opposite side from the groove 182 another groove 186 into which is adapted to extend, as will hereinafter more fully appear, the end of the plunger 168.

The piston 180 is yieldingly urged to the left, as viewed in Fig. 7 of the drawings, by means of a coil spring 188 which is mounted in a chamber 190, which is connected by way of a passage 192 to the chamber 138, and thereby to the compressor intake passage. Communication between the chamber 190 and the chamber 138 through the passage 192 is controlled by means of a valve 194.

The piston 180 has secured thereto, but insulated therefrom, a bridging contact 196 which is adapted to engage stationary contacts 198 and 200 which extend through an insulating member 202. The contact 198 has secured thereto a wire 204, which is secured to one terminal of the driving motor for the compressor to be controlled, while the contact 200 has secured thereto a wire 206 which is connected to one terminal of a source of electric current.

The member 202 forms one wall of a chamber 208 enclosing the stationary and the bridging contacts controlling the circuit to the driving motor. The contact 198 has a passage 210 extending therethrough and opening on the face of the contact which is engaged by the bridging contact 196, while the contact 200 has a passage 212 extending therethrough and opening on the face of this contact which is engaged by the bridging contact 196. The piston 180 has a restricted passage 214 extending therethrough and communicating with the chamber 190 on the spring side of the piston and with the chamber 208.

This control device is shown in the drawings in the position to effect loading of the compressor, to complete the circuit to the compressor driving motor, and with the pressure of the fluid compressed by the compressor below the value to which the device is adjusted to respond to unload the compressor and to interrupt the circuit to the compressor driving motor. The compressor, therefore, will be operated by the driving motor and will compress fluid under pressure into the reservoir associated with the compressor.

On an increase in the pressure of the fluid in the reservoir associated with the compressor there will be a similar increase in the pressure of the fluid in the chamber 144 on the face of the diaphragm 142, and a corresponding increase in the force exerted on the diaphragm 142 in opposition to the spring 160, which operates through the arm 154 of the bell crank 156 and the plunger 148.

As the pressure of the fluid in the chamber 144 increases the diaphragm 142 will be moved to the left, as viewed in Fig. 7 of the drawings, thereby moving the plunger 148, and its movement will be transmitted to the arm 154 of the bell crank 156, causing the bell crank to be moved in a clockwise direction about the pin 158. On this movement of the arm 154 the tension on the spring 160 is increased, while the arm 166 presses against the spring 170 and moves the plunger 168 upwardly.

After a slight initial upward movement of the plunger 168 it engages the face of the piston 180 so that on further upward movement of the arm

166 of the bell crank 156 the spring 170 is compressed, and during this period the spring 170 opposes movement of the bell crank 156 by the fluid under pressure in the chamber 144.

5 When the pressure of the fluid compressed by the compressor is increased to a predetermined value the force exerted by the fluid under pressure in the chamber 144 is sufficient to move the diaphragm 142 against the combined opposition
10 of the springs 160 and 170 and the valve 150 will be moved adjacent the seat rib 152. As the compressor is being operated at this time air is continually drawn into the chamber 140 past the seat rib 152, and when the valve 150 is moved adjacent to the seat rib 152 so as to substantially restrict the rate of flow of fluid past the seat rib 152
15 a relatively high vacuum will be created in the chamber 140.

On this reduction in the pressure of the fluid
20 in the chamber 140 the effective pressure of the fluid in the chamber 144 on the opposite side of the diaphragm 142 will be increased, and there will be a corresponding increase in the force exerted by the fluid in the chamber 144 on the diaphragm 142 and tending to move the plunger
25 148 against the combined opposition of the springs 160 and 170.

As a result of this increase in the force exerted by the fluid under pressure in the chamber 144
30 the plunger 148 will be rapidly moved against the springs 160 and 170 and will move the valve 150 into engagement with the seat rib 152 so as to prevent the supply of fluid under pressure from the atmosphere to the chamber 140 and thence
35 to the compressor intake passage.

As a result of this movement of the plunger 148 the bell crank 156 will be moved in a clockwise direction and the compression of the spring 170
40 will be increased, thereby pressing the plunger 168 more firmly against the face of the piston 180.

On the establishment of a relatively high degree of vacuum in the compressor intake passage fluid flows thereto from the chamber 190 on the spring side of the piston 180 through the passage 192, assuming that the valve 194 is in the open
45 position, thereby reducing the pressure in the chamber 190. On a reduction in the pressure of the fluid in the chamber 190 fluid flows thereto from the chamber 208 through the passage 214, thus reducing the pressure of fluid in the chamber
50 208. The rate of flow of fluid from the chamber 208 through the passage 214 is substantially less rapid than the rate of flow of fluid from the chamber 190 through the passage 192 to the chamber 138, and hence the pressure of the fluid
55 in the chamber 190 will be reduced substantially below that in the chamber 208.

As a result of the reduction in the pressure of the fluid in the chamber 190 the piston 180 will
60 be moved by the fluid in the chamber 208 against the spring 188.

On this movement of the piston 180 the bridging contact 196 is moved away from the contacting faces of the stationary contacts 198 and 200,
65 thereby interrupting the circuit to the compressor driving motor. On movement of the bridging contact 196 away from the contacts 198 and 200 arcs form between the bridging contact 196 and the stationary contacts.

On movement of the piston 180 against the spring 188 the volume of the chamber 208 is increased, thereby further reducing the pressure of the fluid in this chamber. As a result of the reduction in the pressure of the fluid in the chamber
70 208 air from the atmosphere flows through

the passages 210 and 212 against the bridging contact 196 and cools and thereby helps to interrupt the arcs which form between the bridging contact and the stationary contacts.

Fluid will continue to flow from the chamber
5 208 through the passage 214 to the chamber 190 on the spring side of the piston 180, and therefrom through the passage 192 to the chamber 138 leading to the compressor intake passage, as long as the compressor continues to operate. As a result
10 of the flow of fluid from the chamber 208 air will continue to flow from the atmosphere through the passages 210 and 212 so that the air blast which serves to extinguish the arcs formed on the interruption of the circuit to the driving motor
15 and to cool the contacts continues to flow as long as the compressor continues to operate.

On movement of the piston 180 against the spring 188 substantially to the end of the bore in which the piston 180 is mounted, the piston
20 moves to a position in which the groove 186 is in alignment with the end of the stem 168 so that the stem 168 is forced into the groove 186 by the spring 170. This serves to lock the piston 180 and to prevent its return by the spring 188
25 when the compressor ceases to operate and the pressure of the fluid in the compressor inlet passage is restored to atmospheric pressure by the flow of air thereto through the passage 214 and the passage 192, or by other means.

On movement of the plunger 168 into the groove 186 the spring 170 expands somewhat, thereby reducing the force exerted by this spring
30 on the arm 166 of the bell crank 156, and reducing the force tending to move the plunger 148 against the opposing force of the fluid under pressure in the chamber 144.

After the compressor ceases to be driven by the driving motor air from the atmosphere flows to the chamber 208 and therefrom by way of the
35 passage 214, the chamber 190, and the passage 192 to the chamber 138 which communicates with the compressor intake passage. The pressure of the fluid in the chamber 138, therefore, and also in the chamber 140, will be gradually restored to
45 atmospheric pressure.

On an increase in the pressure of the fluid in the chamber 140 to atmospheric pressure, there is an increase in the force exerted by this fluid on the diaphragm 142 in opposition to the force
50 exerted by the fluid in the chamber 144 and tending to maintain the control device in the condition to interrupt the circuit to the compressor driving motor.

The various parts of the control device are arranged and proportioned, however, so that the increase in force resulting from this increase in
55 the pressure of the fluid in the chamber 140 and opposing the force exerted by the fluid in the chamber 144, is of lesser magnitude than the reduction in force opposing the force exerted by the fluid under pressure in the chamber 144 which occurs as a result of the expansion of the spring 170 when the plunger 168 is pressed into the groove 186 in the piston 180.
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As a result of these changes in the various forces operative in the control device, there is an increase in the force effective to maintain the control device in the condition to interrupt operation of the driving motor for the compressor.
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On a reduction in the pressure of the fluid in the reservoir associated with the compressor controlled by this control device there will be a corresponding reduction in the pressure of the fluid in the chamber 144, and a similar reduction
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will result in the force exerted by this fluid on the diaphragm 142 and on the plunger 148 in opposition to the springs 160 and 170.

However, because of the reduction in the degree of compression of the spring 170 as a result of movement of the plunger 168 into the groove 186 in the piston 180, the springs 170 and 160 will not exert enough force on the plunger 148 to move it against the opposing force of the fluid under pressure in the chamber 144 until a predetermined reduction in the pressure of the fluid in the chamber 144 has taken place.

On this predetermined reduction in the pressure of the fluid in the chamber 144 the springs 160 and 170 operating through the bell crank 156 will move the plunger 148 and the diaphragm 142 against the opposing force of the fluid under pressure in the chamber 144.

On this movement of the plunger 148 the valve 150 is moved away from the seat rib 152, thereby again establishing communication from the atmosphere to the chamber 140, from which fluid flows to the compressor intake passage.

After a certain amount of movement of the arm 166 of the bell crank 156 the projection 172 engages the washer 174 so that on further movement of the bell crank 156 the plunger 168 is moved away from the piston 180.

When the spring 170 has expanded to a degree sufficient to press the projections 172 against the washer 174, this spring thereafter does not exert any force on the bell crank 156, and tending to move it against the opposing force of the fluid under pressure in the chamber 144 on the face of the diaphragm 142.

The bell crank 156, therefore, will be urged in the direction to move the plunger 168 away from the piston 180 only by the spring 160 and the force exerted by this spring will gradually decrease as the arm 154 is moved towards the stop 165 and the tension on the spring 160 is reduced.

Because of this gradual decrease in the force exerted by the spring 160 the fluid in the chamber 144 must reduce to a somewhat lower value before the bell crank 156 is moved to the position to move the plunger 168 to unlock the piston 180 than was required to move the plunger 148 against the spring 160 to the position in which the valve restricted the flow of air past the seat rib 152 to a substantial extent. This is true as the parts of the control device are arranged so that the plunger 168 does not release the piston 180 until the bell crank 156 is moved substantially into engagement with the stop 165, while the valve 150 does not greatly restrict the flow of fluid past the seat rib 152 until it has been moved towards the seat rib an amount sufficient to cause the arm 154 of the bell crank 156 to be moved a substantial distance away from the stop 165.

When the pressure of the fluid in the chamber 144 has reduced to a predetermined value the bell crank 156 is moved into engagement with the stop 165, while the plunger 168 is moved out of the path of movement of the piston 180, thereby releasing the piston, with the result that the spring 188 moves the piston to the left, as viewed in Fig. 7, in the bore in the casing 130.

On this movement of the piston 180 the bridging contact 196 moves into engagement with the stationary contacts 198 and 200, thereby completing the circuit between these contacts and establishing a circuit to the driving motor of the compressor.

On the completion of the circuit to the compressor driving motor the motor operates to drive the compressor and causes it to compress fluid into the reservoir associated therewith. The compressor continues to operate until the pressure of the fluid in this reservoir has increased to the value which is effective to cause the control device to again operate as described in detail above to unload the compressor and to interrupt the circuit to the driving motor.

This control device incorporates means to condition it to permit continuous operation of the compressor driving motor if desired, and to effect only unloading of the compressor on an increase to a predetermined value in the pressure of the fluid compressed by the compressor and to maintain the compressor unloaded until the pressure of the fluid compressed by the compressor has decreased to a lower predetermined value.

If this method of operation is desired the valve 194 is turned to the seated position to cut off communication between the chamber 138 and the chamber 190 on the spring side of the piston 180. With the control device conditioned for this method of operation the piston 180 is maintained by the spring 188 in the position in which the contact 196 engages the stationary contacts 198 and 200 to complete the circuit to the compressor driving motor.

The compressor will be driven by the driving motor, therefore, and on an increase in the pressure of the fluid compressed by the compressor to a predetermined value the pressure of the fluid in the chamber 144 will exert a force on the diaphragm 142 sufficient to move the diaphragm 142 and the plunger 148 to the left, as viewed in Fig. 7 of the drawings, thereby moving the bell crank 156.

On initial movement of the bell crank 156 the plunger 168 is moved into engagement with the piston 180 so that on further movement of the bell crank the spring 170 is compressed, while this movement of the bell crank 156 is opposed by the spring 160.

On a predetermined increase in the pressure of the fluid in the chamber 144 the plunger 148 will be moved far enough against the springs 160 and 170 to move the valve 150 adjacent to the seat rib 152. As the compressor is being operated at this time air is drawn into the chamber 140 from the atmosphere and flows therefrom to the compressor intake passage. When the flow of fluid to the chamber 140 from the atmosphere is restricted by movement of the valve 150 adjacent to the seat rib 152 a partial vacuum will be created in the chamber 140.

This will reduce the pressure of the fluid on the face of the diaphragm 142 opposite from the chamber 144 and will increase the effective force of the fluid under pressure in the chamber 144 acting on the diaphragm 142. The diaphragm 142 will thereupon be rapidly moved to the left, as viewed in Fig. 7, and will move the stem 148 to the left, thereby moving the valve 150 into engagement with the seat rib 152 to cut off the flow of air from the atmosphere to the chamber 140 which communicates with the compressor inlet passage.

As communication between the chamber 138 and the chamber 190 on the spring side of the piston 180 through the passage 192 is cut off by the valve 194 at this time the piston 180 remains in the position to maintain the bridging contact 196 in engagement with the stationary

contacts 198 and 200 and thereby continue to cause the driving motor to drive the compressor.

As the compressor continues to be driven by the driving motor, and as the valve 150 is maintained in engagement with the seat rib 152, a relatively high degree of vacuum will be present in the chamber 140 and in the other passages associated with the compressor intake passage, and this relatively high degree of vacuum operating upon the differential areas of the diaphragm 142 and the face of the valve 150 within the seat rib 152 increases the effective force of the fluid under pressure in the chamber 144 operating on the diaphragm 142 and tending to maintain the plunger 148 in the position to unload the compressor.

On a reduction in the pressure of the fluid in the reservoir associated with the compressor controlled by this control device there will be a corresponding reduction in the pressure of the fluid in the chamber 144, and a similar reduction in the force exerted by the fluid in this chamber on the diaphragm 142 and tending to maintain the plunger 148 in the position to unload the compressor.

Because of the partial vacuum in the chamber 140 the pressure of the fluid in the chamber 144 on the face of the diaphragm 142 must reduce to a somewhat lower value than is effective to move the plunger 148 to the position to unload the compressor before the springs 160 and 170 will be able to overcome the forces tending to maintain the plunger 148 in the position to unload the compressor.

However, when this reduction in the pressure of the fluid in the chamber 144 has taken place the springs 160 and 170 operating through the bell crank 156 move the plunger 148 against the opposing force of the fluid under pressure in the chamber 144 acting on the diaphragm 142, thereby moving the valve 150 away from the seat rib 152.

On movement of the valve 150 away from the seat rib 152 air from the atmosphere flows past the seat rib 152 to the chamber 140 and increases the pressure of the fluid in this chamber. This increases the pressure on the face of the diaphragm 142 and decreases the effective force of the fluid under pressure in the chamber 144 on the opposite side of the diaphragm 142.

As a result, therefore, the springs 160 and 170 will thereupon rapidly move the plunger 148 to the right, as viewed in Fig. 7 of the drawings, until the bell crank 156 has been moved into engagement with the stop 165.

The compressor is now unloaded and as it continues to be driven by the driving motor it will compress fluid under pressure into the reservoir associated therewith, and will continue to do so until the pressure of the fluid in this reservoir has increased to a value sufficient to cause the control device to again operate as described in detail above to unload the compressor.

This control device incorporates means by which the pressure to which the device is responsive to effect unloading of the compressor may be adjustably varied if desired. This is accomplished by turning the nut 164 on the eye 162, thereby varying the tension on the spring 160. If the nut 164 is turned so as to increase the tension on the spring 160 the pressure to which the fluid is compressed by the compressor must build up before the compressor will be unloaded is increased, while if the nut turned in a direction to reduce the tension on the spring

160 the compressor will be unloaded in response to a somewhat lower pressure in the reservoir associated therewith.

In Figs. 2, 3, 8 and 9 of the drawings I have illustrated a form of control device embodying this invention and adapted for use in connection with a compressor driven by an internal combustion engine.

As shown in Fig. 2 of the drawings there is a compressor 200, which may be of any suitable well known construction and is driven by means of an internal combustion engine 201, which may also be of any suitable well known construction.

The engine 201 is provided with an intake manifold 203 having a fuel supply device in the form of a carburetor 205 associated therewith. The carburetor 205 includes a throttle valve 208, which controls the supply of fuel from the carburetor to the engine, and this throttle valve is controlled by means of a lever 210 which is connected by means of a link 212 with a piston 214 mounted in a bore of a control device 216.

The piston 214 of the control device 216 is yieldingly urged by means of a spring 218 in the direction to move the throttle valve 208 to the open or engine load position.

The compressor as shown in Fig. 2 of the drawings has a control device indicated generally by the reference numeral 220 associated therewith, and operative in response to variations in the pressure of the fluid compressed by the compressor to control the supply of fluid under pressure to and the withdrawal of fluid from the control device 216 and thereby control the position of the throttle valve 208 of the engine 201.

The construction of the control device 220 is best shown in Figs. 8 and 9 of the drawings, and as shown in Fig. 8 of the drawings, the control device 220 comprises a hollow body 222 having a passage extending therethrough in which is interposed suitable air straining material, such as curled hair indicated at 224, which is confined between perforated plates, one of which is indicated at 226.

The passage through the body 222 communicates with an opening in a mounting face on the body which is adapted to be secured against a similar mounting face on the compressor 200 surrounding the compressor intake passage 228.

The control device 220 includes, in addition, a movable abutment in the form of a diaphragm 230 which is subject on one side to the pressure of the fluid in a chamber 232 which communicates by way of a choke 234 and a pipe 236 with the reservoir 238 into which the compressor compresses fluid.

The diaphragm 230 has secured thereto a hollow stem 240 which is adapted to engage a stop 242 to limit movement of the diaphragm 230 and the stem 240 in one direction.

The stem 240 has an opening extending therethrough in which is mounted a valve 244 which is urged to the seated position by means of a spring 246 mounted in a bore in the stem 240 and extending between a shoulder on the stem 240 and a spring seat 248 which is secured on the valve 244.

The stem 240 has an annular recess formed therein and adapted to receive substantially round projections 250 carried by arms 252 which are pivotally supported on a pin 254 and which have their free ends joined by means of a member 256. One end of a spring 258 is connected

to the member 256 and the other end of this spring is connected to an eye 260 which extends through an opening in the body of the control device and has a knurled nut 262 secured on the end thereof.

The control device 220 has associated therewith a valve 266 having a head which is slidably mounted on the end of the stem 240, and having a tubular guide portion 268 which is slidably mounted in a bore in the body of the control device. The head of the valve 266 carries a sealing gasket 270 which is adapted to engage a seat rib 272 to cut off communication between the atmosphere and a passage 274 leading to the compressor intake passage. The passage 274 is connected by way of a pipe 276 with a chamber 278 in the control device 216.

The valve 266 is yieldingly urged away from the seat rib 272 by means of a coil spring 280, while the tubular portion 268 of the valve 266 has a restricted opening 282 therethrough so as to establish communication with the chamber 284 within the tubular portion 268 and the passage 274.

The end of the valve 244 carried by the stem 240 is provided with an enlarged head 286, which is adapted to be engaged by a portion of the head of the valve 266, as will hereinafter more fully appear.

This control device is shown in Fig. 8 of the drawings in the position to effect loading of the compressor, to condition the fuel supply device associated with the engine for driving the compressor to supply fuel to the engine at the maximum rate, and with the pressure of the fluid compressed by the compressor below the pressure to which the control device is adapted to respond to unload the compressor and to restrict the supply of fuel to the engine for driving the compressor.

On an increase in the pressure of the fluid in the reservoir 238 there will be a similar increase in the pressure of the fluid in the chamber 232 and a corresponding increase in the force exerted by this fluid on the diaphragm 230. Movement of the diaphragm 230 is opposed at this time by the spring 258 acting through the arms 252 and the projections 250 which engage the stem 240, and also by the spring 280 which opposes movement of the valve 266 to the closed position.

As the pressure of the fluid in the chamber 232 increases, however, the force exerted on the diaphragm 230 will increase, and when the pressure of the fluid in the chamber 232 has increased to a predetermined value the force exerted on the diaphragm 230 will be sufficient to overcome the opposing forces of the springs 258 and 280. The diaphragm 230 and the stem 240 will thereupon be moved and the valve 266 will be moved towards the seat rib 272.

As the compressor is being operated at this time there is a rapid flow of air from the atmosphere past the seat rib 272 to the passage 274 and thence to the intake passage 228 of the compressor. When the valve 266 is moved adjacent to the seat rib 272 so as to restrict the flow of air from the atmosphere to the passage 274 a partial vacuum will be formed in the passage 274, and the higher air pressure operating on the opposite side of the valve 266 will assist movement of the valve 266 into engagement with the seat rib 272.

The distance which the valve 266 has to be moved in moving to its seat after having been

moved closely adjacent thereto is relatively small so that the valve may move relative to the stem 240 to the seated position without the head portion of the valve 266 engaging the enlarged head 286 on the valve 244.

Because of the difference in the pressure of the fluid on opposite sides of the valve 266 a force will be exerted on this valve tending to move it to the seated position or to hold it in the seated position after movement thereto against the opposing force of the spring 280. The force exerted by the spring 280, therefore, on the stem 240 to oppose movement of this stem by the fluid under pressure in the chamber 232 acting on the diaphragm 230 is accordingly reduced. Because of this reduction in the force exerted on the stem 240 in opposition to the fluid under pressure in the chamber 232, on movement of the valve 266 to the seated position the stem 240 will thereafter be moved very rapidly by the fluid under pressure in the chamber 232 and will press against the valve 266 and hold the sealing gasket 270 in engagement with the seat rib 272.

The chamber 284 within the tubular portion of the valve 266 communicates with the passage 274 by way of the restricted passage 282, and on a reduction in the pressure of fluid in the chamber 274 fluid flows thereto from the chamber 284 through the restricted passage 282. This results in a reduction in the pressure of the fluid in the chamber 284 and increases the area of the valve 266 which is subject to the opposing pressures of the atmosphere and of the partial vacuum in the passages associated with the compressor intake passage and increases the force effective to hold the valve 266 in the seated position.

The various parts of the control device are proportioned so that when the valve 266 is moved to the seated position, and the fluid in the chamber 284 within the tubular portion 268 of the valve 266 is reduced substantially to the same pressure as the fluid in the passage 274, the force exerted by the higher atmospheric pressure on the exposed face of the valve 266 and opposing the spring 280 exceeds by a substantial amount the force exerted on the valve 266 by the spring 280.

As the compressor continues to be operated by the driving motor a relatively high degree of vacuum will be present in the compressor intake passage and also in the passages communicating therewith and air will be drawn through the pipe 276 from the chamber 278 of the control device 216.

On a reduction in the pressure of the fluid in the chamber 278 the higher atmospheric pressure on the opposite side of the piston 214 moves the piston 214 against the spring 218 and this movement of the piston 214 is transmitted through the link 212 to the lever 210 which operates the throttle valve 208.

On this movement of the piston 214 the throttle valve 208 is moved from the engine load position, in which position fuel is permitted to be supplied to the engine at substantially the maximum rate, to the engine idling position, in which the supply of fuel to the engine is substantially restricted. This results in a reduction in the speed of the engine and of the compressor, but the compressor continues to be driven at a speed high enough to cause a relatively high degree of vacuum to be maintained in the compressor intake passages and in the associated passages.

It will be seen, therefore, upon operation of

the unloading means to effect unloading of the compressor the fuel supply to the engine for driving the compressor is restricted.

As the restriction in the supply of fuel to the engine does not take place until the compressor has been unloaded there is no danger of the engine being stalled as a result of being overloaded. As the restriction in the supply of fuel to the engine takes place immediately upon operation of the unloading means there is no danger either that the engine will race or overspeed because of an excess supply of fuel thereto.

On a reduction in the pressure of the fluid in the reservoir 238 there will be a similar reduction in the pressure of the fluid in the chamber 232, and a corresponding reduction in the force exerted by this fluid on the diaphragm 230.

As pointed out above the spring 280 is ineffective to urge the stem 240 against the fluid in the chamber 232 at this time as the valve 266 is held in engagement with the seat rib 272 by atmospheric pressure acting on the exposed face of the valve. The stem 240, therefore, is subject to the opposing pressures of the fluid in the chamber 232 and of the spring 258, and the stem 240 will not be moved by the spring 258 until the pressure of the fluid in the chamber 232 has reduced to a value such that the force exerted by this fluid is less than the force exerted on the stem 240 by the spring 258. This pressure will be somewhat less than the pressure required to effect movement of the stem 240 to unload the compressor as this movement of the stem 240 is opposed by the spring 280 in addition to the spring 258.

When the pressure of the fluid in the chamber 232 is reduced a predetermined low value such that the force exerted on the stem 240 by the spring 258 exceeds the opposing force of the fluid under pressure acting on the diaphragm 230 and thereby on the stem 240, the stem 240 will be moved to the right, as viewed in Fig. 8 of the drawings, by the spring 258 acting through the arms 262 and projections 250.

After a predetermined amount of movement of the stem 240 the head 286 on the valve 244 engages the head of the valve 266 and on further movement of the stem 240 the valve 244 is moved away from its seat against the spring 246.

On movement of the valve 244 away from its seat the fluid under pressure present in the chamber 232 is permitted to escape therefrom at a rapid rate through the passage in the stem 240 in which the valve 244 is located to the chamber 284 within the tubular portion 268 of the valve 266. This increases the pressure of the fluid in the chamber 284 and reduces the force tending to hold the valve 266 in engagement with the seat rib 272.

On movement of the valve 244 away from its seat fluid under pressure flows from the chamber 232 to the chamber 284 at a rapid rate, while fluid is permitted to flow to the chamber 232 from the reservoir 238 by way of the pipe 236 and through the choke 234 only at a restricted rate.

There will, therefore, be a rapid reduction in the pressure of the fluid in the chamber 232 as soon as the valve 244 is opened, and on this reduction in the pressure of the fluid in the chamber 232 there will be a corresponding decrease in the force exerted on the diaphragm 230 and the spring 258 will thereupon rapidly move the stem 240 to the right until it engages the stop 242.

On the supply of fluid under pressure to the chamber 284 there is a reduction in the force

tending to maintain the valve 266 against the seat rib 272. The valve 266 may be moved away from the seat rib 272 at this time by the spring 280. If, however, the valve is not moved away from the seat rib by the spring 280, on further movement of the stem 240 to the right, as viewed in Fig. 8 of the drawings, the end of the stem 240 engages the spring seat 248, so as to move the valve 244 to the right, and on this movement of the valve 244 the head 286 presses against the head of the valve 266 and moves it away from the seat rib 272.

On movement of the valve 266 away from the seat rib 272, air from the atmosphere flows past the seat rib 272 to the passage 274, thereby increasing the pressure of the fluid in the passage 274. On this increase in the pressure of the fluid in the passage 274 there is a reduction in the forces tending to hold the valve 266 in the seated position, and the valve 266 will thereafter be moved very rapidly to the full open position by the spring 280.

On an increase in the pressure of the fluid in the chamber 274 as a result of opening of the valve 266 fluid flows therefrom by way of the pipe 276 to the chamber 278 of the control device 216, and on an increase in the pressure of the fluid in this chamber the spring 218 moves the piston 214 to the right, as viewed in Fig. 3 of the drawings, and this movement of the piston 214 is transmitted through the link 212 to the arm 210 and moves this arm so as to move the throttle valve 208 from the engine idling position to the engine load position.

The compressor is now in the loaded condition, while the engine is supplied with fuel at a rapid rate so as to drive the compressor and cause it to compress fluid into the reservoir 238. The compressor will continue to operate and to compress fluid into the reservoir 238 until the pressure of the fluid in this reservoir has increased to the value which is effective to cause the control device to again operate as described in detail above to unload the compressor and to restrict the supply of fuel to the engine for driving the compressor.

This form of compressor control device incorporates means by which the pressure to which the device responds to unload the compressor and to reduce the supply of fuel to the engine may be adjustably varied if desired. This is accomplished by turning the knurled nut 262 so as to vary the tension on the spring 258.

If the tension of the spring 258 is increased the pressure of the fluid in the reservoir 238 and in the chamber 232 must increase to a higher value before the force exerted on the diaphragm 230 exceeds the force exerted by the springs 258 and 280 and opposing movement of the stem 240 to the position to condition the control device to unload the compressor.

Similarly, if the tension on the spring 258 is decreased the force exerted by the fluid under pressure in the chamber 232 on the diaphragm 230 will exceed the opposing force of the springs 258 and 280 on an increase in the pressure of the fluid in the chamber 232 to a somewhat lower value than before.

It will be seen that this form of compressor control device incorporates means responsive to the pressure of the fluid compressed by the compressor for effecting loading and unloading of the compressor, and that it includes, in addition, means responsive to operation of the unloading

means for controlling the means for driving the compressor.

While several embodiments of the improved compressor control 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 combination, a fluid compressor having an intake passage through which fluid is supplied to the compressor, valve means controlling the supply of fluid to said intake passage, driving means for the compressor, means responsive to the pressure of the fluid in said intake passage and controlling the driving means, said means comprising a control member movable between a cut-in position in which the driving means is conditioned to drive the compressor and a cut-out position in which the driving means is conditioned not to drive the compressor, an abutment subject to and operated on a predetermined increase in the pressure of the fluid compressed by the compressor for operating the valve means to cut off the supply of fluid to the intake passage, and latch means associated with said abutment for maintaining the control member in the cut-out position.

2. In combination, a fluid compressor having an intake passage through which fluid is supplied to the compressor, valve means controlling the supply of fluid to said intake passage, driving means for the compressor, means responsive to the pressure of the fluid in said intake pas-

sage and controlling the driving means, said means comprising a control member movable between a cut-in position in which the driving means is conditioned to drive the compressor and a cut-out position in which the driving means is conditioned not to drive the compressor, an abutment subject to and operated on a predetermined increase in the pressure of the fluid compressed by the compressor for operating the valve means to cut off the supply of fluid to the intake passage, and latch means associated with said abutment and operative on movement of the abutment to condition the valve means to cut off the flow of fluid to the intake passage to permit the control member to move to the cut-out position and on movement of the control member to the cut-out position to prevent movement thereof to the cut-in position.

3. In combination, a fluid compressor having an intake passage, valve means controlling the flow of fluid to said intake passage, an electric motor for driving the compressor, a pair of relatively movable contacts controlling the supply of current to the driving motor, said contacts being mounted in a chamber having communication with the compressor intake passage, means operated on a predetermined increase in the pressure of the fluid compressed by the compressor for closing said valve means and for thereafter effecting separation of said contacts and thereby interrupting the supply of current to the driving motor, and means operative on a reduction in the pressure of the fluid in said chamber to a pressure below atmosphere for creating a flow of air in the region between said contacts.

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