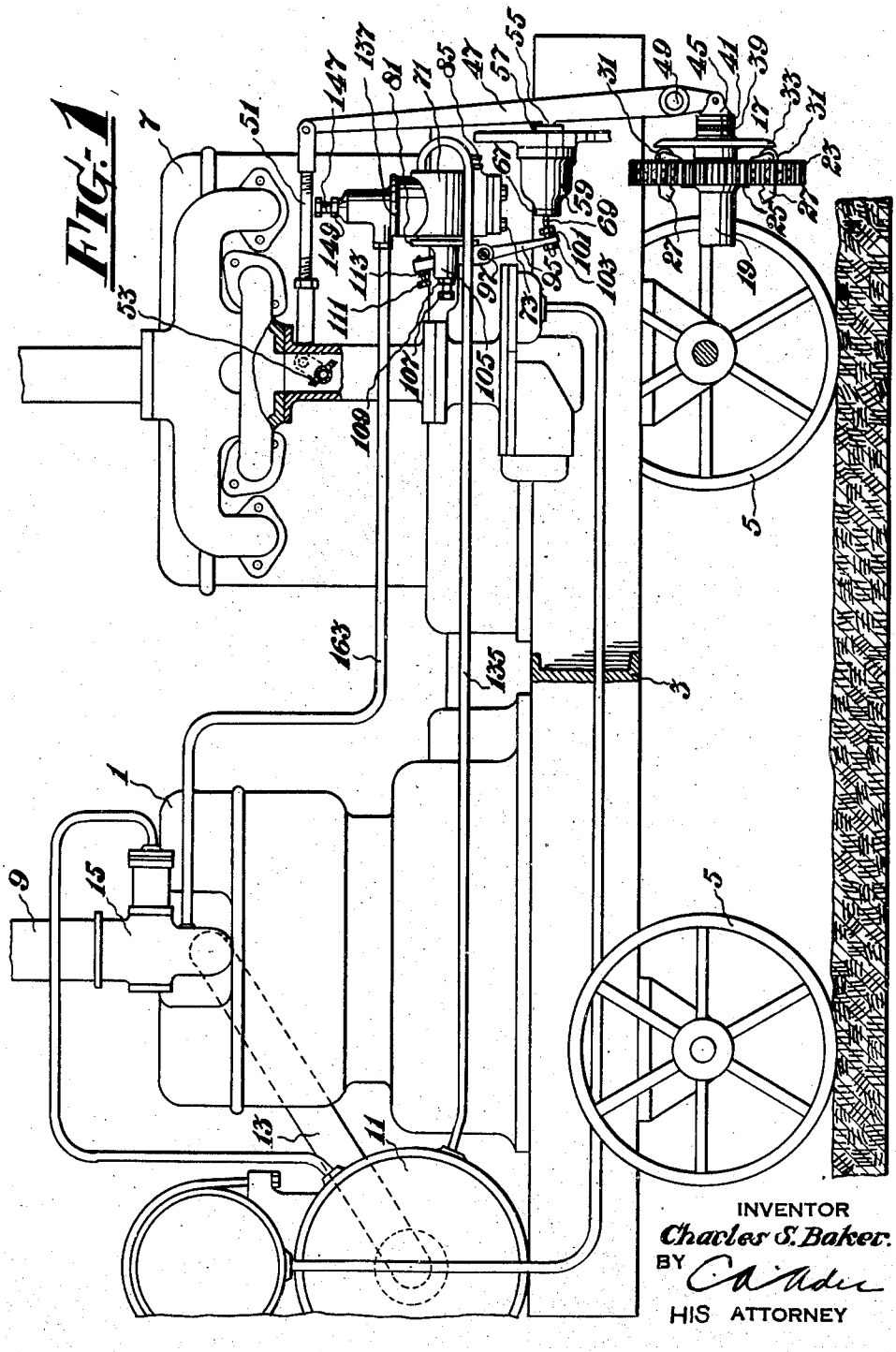
July 18, 1939. C. S. BAKER 2,166,789

COMPRESSOR REGULATOR

Filed May 12, 1938 2 Sheets-Sheet 1

FIG. 1




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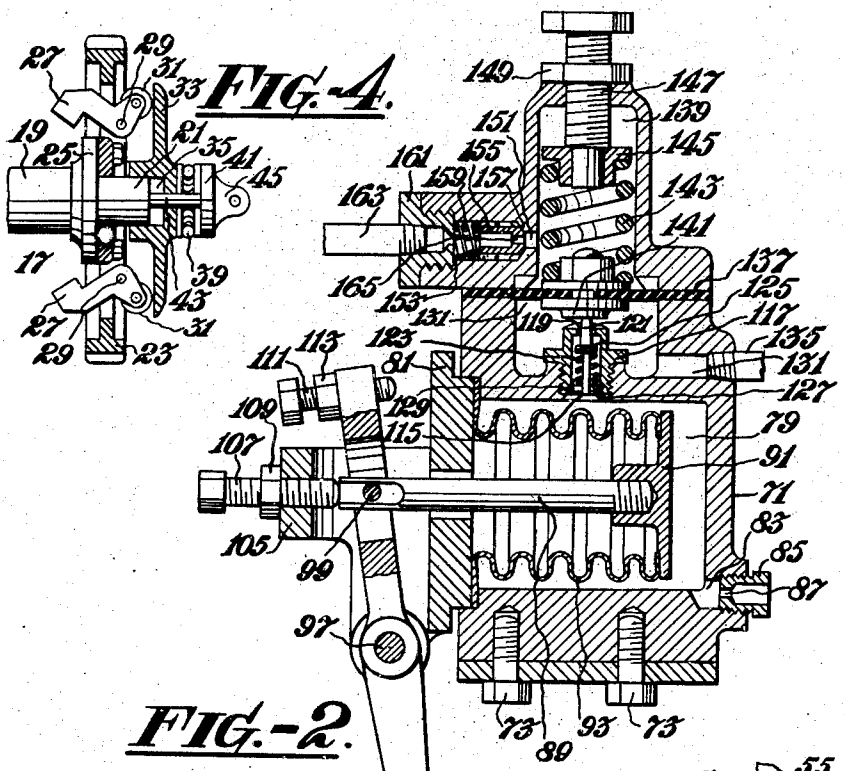


FIG.-2.

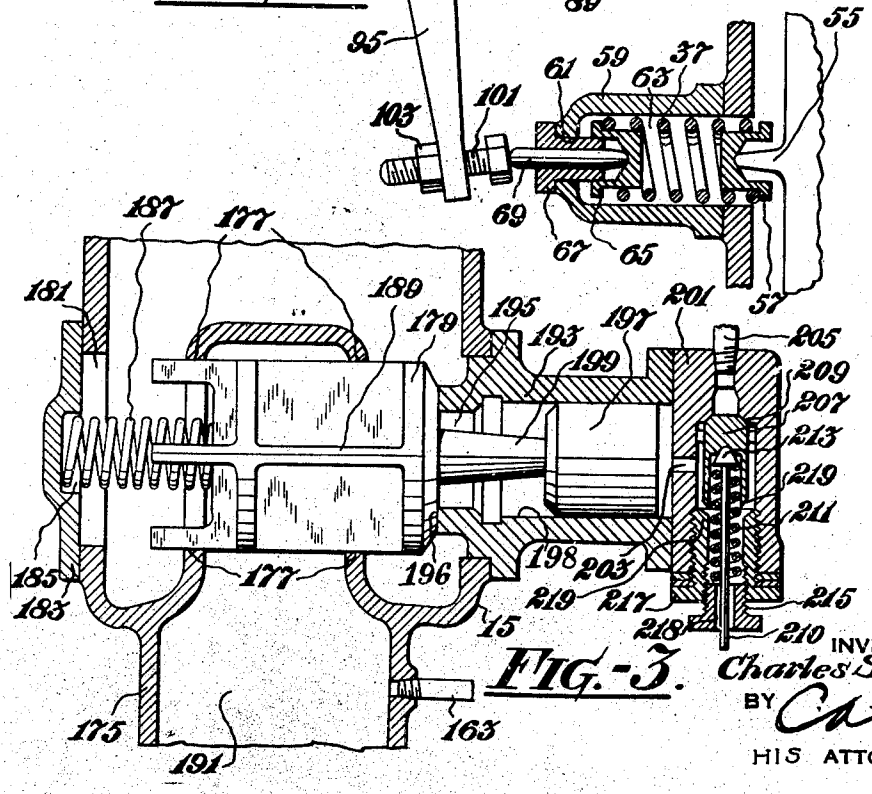


FIG.-3.



FIG.-4.

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# UNITED STATES PATENT OFFICE

2,166,789

## COMPRESSOR REGULATOR

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Application May 12, 1938, Serial No. 207,438

20 Claims. (Cl. 230—29)

This invention relates to motor driven fluid compressor units and more particularly to apparatus to control the speed of the motor in accordance with changes in the discharge pressure of the compressor and to maintain the motor at a minimum speed for a predetermined time after the compressor has been fully loaded and the output of the compressor requires the maximum speed of the motor.

An ordinary portable motor driven fluid compressor unit comprises a motor or engine such as internal combustion motor or steam engine directly connected to drive a fluid compressor which delivers fluid to a receiver tank wherein it is stored until needed. Such compressor units are commonly provided with regulator means to prevent overloading of the receiver tank when the pressure of the fluid in the receiver tank reaches a predetermined value. Upon reaching this predetermined pressure, the regulator operates to prevent a further discharge of fluid to the receiver from the compressor (commonly termed "unloading") and at the same time reduces the speed of the motor to a minimum or idling speed. Thereafter the compressor unit idles until the pressure in the receiver tank decreases to a predetermined minimum pressure whereupon the regulator again operates to permit the compressor to discharge fluid to the receiver tank (commonly termed "reloading") and to accelerate the motor to its maximum operating speed.

The chief disadvantage attending the use of such regulating means is that pressure in the receiver tank drops to predetermined minimum pressure, the compressor reloads and simultaneously therewith the motor speeds up to its maximum speed regardless of how great the demand upon the compressor may be. The speeding up of the motor to its maximum speed not only causes a great wear and tear on the motor but in many instances is entirely superfluous because an intermediate speed would be sufficient to supply the compressed fluid required by the load under which the compressor is operating. Naturally, the result is very uneconomical operation.

It is accordingly an object of the present invention to provide a compressor unit with means whereby the compressor may reload when the load is light without simultaneously accelerating the motor to the maximum speed.

Another object of the invention is to provide means whereby a motor driven fluid compressor unit may operate at its minimum speed without reloading.

A still further object is to provide means whereby the compressor unit may accelerate to and run at speed between minimum and maximum in order to maintain corresponding rates of discharge of fluid into the receiver.

A further object is to provide means in a compressor unit whereby the motor speed may be held at a minimum speed during unloading and reloading of the compressor.

It is a further object to provide means in a compressor unit whereby, under ordinary unloading and reloading, the motor is not permitted to accelerate toward the maximum speed for a predetermined time after predetermined minimum pressure occurs in the receiver.

Still another object is to provide a device which will delay acceleration of the driving motor after reloading to accommodate a light load at low motor speed and somewhat later to permit acceleration of the motor when reloading occurs under a heavy load.

These and other objects will be readily apparent from the following description of which the drawings form a part. In the drawings in which similar reference numerals refer to similar parts,

Figure 1 is a view partially in elevation and partially in section illustrating the application of the present invention to a compressor unit and in which the governor is increased in size in order that the details may be brought out more clearly.

Figure 2 is a view in sectional elevation of the governor regulating portion of the regulator constructed in accordance with the principles of the present invention and shown in Fig. 1.

Figure 3 is a sectional view of the unloading device illustrated in Fig. 1.

Figure 4 shows a sectional view of the governor illustrated in Fig. 1.

A portable motor driven fluid compressor unit is shown in Fig. 1 and comprises a fluid compressor 1, mounted on a frame 3, supported by wheels 5, driven by a motor 7, and supplied with the fluid to be compressed through the inlet pipe 9. The compressor delivers the compressed fluid to the receiver tank 11 through a conduit 13. Interposed between the inlet conduit 9 and the compressor 1 is the unloading and reloading device 15 shown in detail in Fig. 3 which will be described hereinafter.

Speed regulation of the motor 7, is accomplished by the governor generally indicated at 17. The governor, illustrated in detail in Fig. 4, consists of a shaft 19, directly connected to the cam shaft of the motor (not shown), having an extension 21. A gear 23, having weights 27 fulcrumed

at 29 thereon, is bolted to the flange 25 formed on the shaft 19.

As the speed of the motor increases, the centrifugal force moves the weights 27 toward their outermost position and in so doing the rollers 31, mounted on the lever supporting the weight 27, bear against the plate 33. Recess 35 provided on plate 33 surrounds the shaft extension 21 and guides the plate as it slides on the extension 21. The motion of the plate 33 is transmitted through the anti-friction bearing 39 to a plate 41 formed integrally with the pin 43 slidably mounted in the shaft extension 21 and co-axial therewith.

The clevis 45 mounted on the plate 41 is pinned to the lever 47 (shown in Fig. 1) fulcrumed on the frame of the motor at 49. At the end of the lever 47 opposite to the clevis 45, is a tie-rod 51 to control the butterfly valve 53 in the intake of the motor and since outward movement of the weights 27 tends to pivot the lever 47 about its fulcrum 49 to move the tie-rod to the left, the consequent movement of the butterfly valve 53 will throttle the fuel supply to the motor and decelerate the motor.

Conversely, when the motor speed is to be increased, the weights 27 will move toward their innermost position and the lever 47 and tie-rod 51 will then move the butterfly valve 53 to its open position and thereby increase the fuel supply to the motor to accelerate the motor.

As is customary in centrifugal governors, the weights 27 are resiliently maintained in their retracted position and for this purpose a spring 37 is provided. The compressive force of the spring 37 is transmitted to the weights 27 through the lever 47 by the member 57 bearing against one end of the spring 37 and the projection 55 formed on the lever 47 between the tie-rod end and the fulcrum 49.

In order to inclose the spring 37, a casing 59 having a bore 61 extending therethrough and communicating at one end with the recess 63 is secured to the frame of the motor 7. As was pointed out, one end of the spring 37 bears against the member 57, and the opposite end bears against a similar member 65. The degree of compression of the spring is, of course, controlled by the position of the members 57 and 65 and since the member 57 bears against projection 55, regulation of the compression of the spring 37 can be accomplished by the movement of the member 65. For this purpose, a guide member 67 extends through the bore 61, into the recess 63, and into a recess formed in the member 65. A plunger pin 69 is guided by the guide member 67 and bears directly against the member 65. When the spring 37 is compressed by movement of the plunger pin 69 against the member 65, it is obvious that the centrifugal force set up by the weights 27 required to move the lever 47 against the compression of the spring 37 is much greater than when the spring 37 is in its released or uncompressed position. It is also apparent that the degree of compression on the spring by which the speed setting of the governor is determined may be controlled by regulating the position of the plunger pin 69 and for this purpose the regulating mechanism shown in Fig. 2 is employed.

This regulator consists of a casing 71, suitably secured to the motor frame by bolts 73, provided with a bellows chamber 79, closed by a head 81 secured to the casing. The interior of the bellows chamber communicates directly with the atmosphere through the opening 83 in which is threadedly secured a bushing 85 having an orifice 87 to restrict the flow of fluid passing through the bushing.

Extending through a suitable opening in the head 81, into the bellows chamber 79, and secured within the chamber to a piston 91 is a plunger rod 89. Bellows member 93 hermetically sealed to the piston 91 at one end between the casing 71 and the head 81 at the other end controls movement of the plunger rod 89. With this arrangement the passage of fluid from the bellows chamber 79 to the interior of the bellows 93 is impossible, but communication with atmosphere is provided by the opening surrounding the plunger 89 in the head 81. For the purpose of transmitting movement between the bellows 93 and the plunger pin 69, a lever 95 is pivotally connected to the plunger rod 89 by a pin 99. Since it is often desirable to regulate the degree of compression of the governor spring 37 which the bellows 93 can affect, a bolt 101 threadedly engages the end of the lever 95 and bears against the plunger pin 69. A nut 103 serves to lock the bolt 101 in position.

Similarly, it is often advantageous to control the degree of compression of the bellows 93 and consequently the movement of the plunger 89. To this end the head 81 carries a bracket 105 through which is threaded a bolt 107 suitably locked in position by the lock nut 109. The limit of expansion of the bellows 93 may be adjusted by the position of the bolt 111 secured on the opposite end of the lever 95 and locked in position by the lock nut 113. By this present arrangement, it is therefore possible to regulate the compression limits of the governor spring 37 by adjustment of any one of the three bolts 101, 107, and 111 under certain conditions, or by adjustment of all of the bolts under other conditions.

In the upper part of the casing 71 is an opening 115 in which rests a valve bushing 117. This valve bushing 117 has an orifice 119 into which extends a needle valve 121. The needle valve 121 is normally pushed into the orifice 119 by a spring 123, bearing at one end againt a flange 125 on the needle valve 121 and at the other end against a washer 127 held in the valve bushing 117 by the ring 129. The valve bushing extends into a recess 131 formed in the upper part of the casing 71 and permits communication between this recess and the chamber 79 when the needle valve is not maintained at its seating position. Pressure fluid from the receiver tank is supplied to the recess 131 through the opening 133 by the conduit 135 leading directly to the receiver tank.

In order to form a closed chamber of the recess 131, a diaphragm 137 is interposed between the walls of the casing 79. This diaphragm 137 also serves to define one end of a second chamber 139. Centrally located in the diaphragm is a contact member 141 which bears against the end of the needle valve 121. It is desirable for the operation of this apparatus that the contact member normally be brought to bear on the end of the needle valve and for this reason the spring 143 is placed in the chamber 139. The regulation of the degree of spring compression is accomplished by the bushing member 145 longitudinally movable by the stem 147 and maintained in position by the nut 149.

By the means of this arrangement of parts, when the fluid pressure in the receiver tank is sufficiently great to move the diaphragm 137 against the force of spring 143, the contact member 141 will move upwardly thus permitting the spring 133 to move the needle valve 121 into its

seating position to close the orifice 119 and thus prevent entrance of fluid from the receiver tank to the bellows chamber 79. Conversely, when the receiver tank pressure falls to a pressure which is insufficient to permit the diaphragm 137 to overcome the compression of the spring 143, the contact member 141 will move the needle valve 121 from its seating position, by overcoming the resistance of the spring 123, and thus permitting fluid to enter the bellows chamber 79. When fluid enters the bellows chamber 79, if its pressure is sufficient, it will tend to move the bellows 93 toward the left; otherwise the pressure of the fluid within the bellows 93, the escape of fluid through orifice 87, and the compressive force of the governor spring 37 are all factors tending to maintain the bellows 93 stationary.

Needle valve 121 is tapered so that its position with respect to its seat 119 determines the amount of fluid admitted from chamber 131 to chamber 79. Inasmuch as orifice 87 provides a fixed resistance to escape of fluid from chamber 79, valve 121 meters the flow of fluid to and pressure in chamber 79 in accordance with receiver pressures at 11 but in greatly exaggerated degree. Accordingly, the pressure exerted by bellows 91 upon governor spring 37 varies with such receiver pressure. Thus, when the compressor unit is started, the pressure of the fluid in the receiver is insufficient to move the diaphragm 137 and, consequently, the spring 143 maintains the needle valve 121 open thereby admitting fluid from the receiver tank to the bellows chamber. The pressure of the fluid in the bellows chamber 79 will be relieved through the orifice 87 under ordinary conditions but as soon as the pressure begins to increase to the point where the orifice 87 is insufficient in size to relieve the pressure of the fluid entering the chamber 79 pressure will act to compress the bellows. As the bellows is compressed, the governor spring 37 will also be compressed as was previously explained. When a pressure sufficient to compress the bellows 93 and hold the plunger rod 89 against the stop 107 is reached, the governor spring will be compressed to its utmost limit and, consequently, the motor will operate at its maximum speed. As the pressure in the receiver tank 11 increases during the operation of the motor at maximum speed, the pressure acting on the diaphragm 137 will likewise be increased and tend to move the diaphragm 137 to close the needle valve 121 and further restrict the flow of fluid to the bellows chamber. With the needle valve closed, the pressure remaining in the bellows chamber 79, will escape through the orifice 87 and the bellows 93 will expand under the influence of the governor spring 37. Under such conditions the governor spring 37, being fully expanded, permits the motor to operate at its minimum speed.

If the load on the compressor should increase to decrease the receiver pressure, the needle valve 121 will again be opened and the same cycle of operation will occur to bring the motor speed to the maximum speed. After such a load change it is desirable to operate the motor at its minimum speed for a predetermined time without increasing the speed of the motor to its maximum speed. Therefore, in order to provide a suitable time delay the casing 71 is provided with an opening 151 in the wall of the chamber 139, which opens into the recess 153. A check valve 155 is placed in the recess 153 and covers the opening 151 when it is seated. The check valve is normally maintained on its seat 157 by a spring 159 which is maintained in the recess 153 by the plug 161. The plug 161 is threaded to receive the conduit 163 communicating directly with the compressor inlet manifold. In this manner the recess 153 is maintained at the same pressure as the compressor inlet manifold and since the check valve is provided with an orifice 165 communicating with the opening 151 the chamber 139 is also subjected to the same pressure.

To ensure economical operation of the above described regulating apparatus, it is important that some means of unloading and reloading the compressor be supplied and for that reason the unloader shown in Fig. 3 will now be described. This unloader, generally indicated at 15, consists of a casing 175 placed at the inlet of the compressor 1 and connected with the inlet conduit 9. A portion of the casing 175 extends within the outer walls thereof to form valve guides 177 for the balanced unloading valve 179 reciprocal within the casing. To one side of the casing is an opening 181 closed by a plate 183 provided with a recess 185 in which one end of the spring 187 rests. The opposite end of the spring 187 bears against the valve 179 to maintain this valve normally in its open position as indicated in Fig. 3. With the valve in this position fluid may enter from the conduit 9, pass around the valve 179 into the passage 191 leading directly to the compressor. As long as valve 179 is open, passage 191 is subjected to atmospheric pressure but upon closing the valve the pressure is reduced to a vacuum.

Opposite the opening 181 is another opening 195 in the casing wall in which is secured a piston chamber 193 having a surface 196 which serves as a stop for the valve 179 when it is in its open position. For the purpose of moving the valve the piston 197, in slidable engagement with the cylindrical wall 198 of the piston chamber, is provided and is adapted to transmit its motion to the valve 179 by bearing against the shaft 199 which is formed as an integral part of the valve. Since the unloading and reloading of the compressor depends on the pressure in the receiver tank, the piston is arranged to be actuated by the pressure of the fluid in the receiver tank.

Means for regulating the admission of fluid from the receiver tank to the piston chamber is provided and to that end an auxiliary valve is formed as a part of the unloading device. This auxiliary valve consists of an auxiliary valve body 201 closing the open end of the piston chamber 198 and communicating with the interior of the chamber through the passage 203. The conduit 205 supplies fluid from the receiver tank to the interior of the auxiliary valve body. Within the casing 201 is a reciprocatory auxiliary valve proper 207 normally maintained on an upper seat 209 by the spring 211 to prevent the entrance of fluid from conduit 205 to the piston chamber 198. Member 210 provided with a head 213 interposed between one end of the spring 211 and a recess formed in the valve proper 207 forms a guide for the spring and manual means for opening the valve. The bushing 215 forms the other limiting abutment for the spring 211 and is secured in a second bushing 217 threadedly engaging the auxiliary valve chamber 201. This second bushing 217 provides an adjustable seat 219 against which the valve 207 bears when the pressure in the receiver tank is sufficient to move the valve against pressure of the spring 211. The pressure of the spring 211 is regulated by threaded bushing 215 and de-

termines the receiver pressure at which the valve is to open.

A vent 218 is formed by the member 210 and the bushing 215 and serves to relieve the pressure in the auxiliary valve chamber and the piston chamber when the auxiliary valve proper 207 is seated on its seat 209. If, while the compressor is operating, the fluid pressure in the receiver tank 11 increases sufficiently to move the auxiliary valve proper 207 from its seat 209 and to maintain it on the adjustable seat 219, the fluid pressure will pass through the passage 203 into the piston chamber and cause the piston 197 to move the cylindrical valve 179 to its closed position thus preventing further ingress of air to the compressor and creating a vacuum in inlet manifold 191. In the event that the pressure in the receiver tank should drop sufficiently to enable the auxiliary valve proper 207 to seek its seat 209, the spring 187 will force the cylindrical valve 179 to its right hand position and any air existing in the piston chamber will escape through the passage 203 and the vent 218 to the atmosphere. In such an event the compressor will be fully loaded since the entrance of air is not prevented by the valve 179 and the inlet manifold 191 will again be subjected to atmospheric pressure.

The operation of the invention as described above is as follows:

During the period when the compressor unit is being brought into operation obviously no change is desired and accordingly the regulating apparatus above referred to functions only when the compressor unit is operating under normal load conditions. Accordingly, while the compressor unit is operating under load and the pressure in the receiver tank 11 is low, the diaphragm 137 holds valve 125 open permitting fluid under pressure to enter bellows chamber 79 and to compress bellows 93. The compression of the bellows 93 is transmitted to the governor spring 37 as was previously described and the speed of the motor is, therefore, dependent on the degree of compression of the bellows 93. With valve 125 in its openmost position the pressure in bellows chamber 79 will be sufficient to cause bellows 93 to hold governor spring 37 fully compressed and allow the motor to operate at its maximum allowable speed. So long as the pressure in the receiver tank 11 does not rise, the motor will function at its maximum speed thus automatically providing the correct motor speed for a heavy load.

With a rise in pressure in the receiver tank 11, however, the diaphragm 137, being subject to receive pressure, will move upwardly in direct accordance with the degree of pressure. Upward movement of the diaphragm 37 permits the tapered needle valve 125 to move upwardly a corresponding amount and begin metering or restricting the fluid entering bellows chamber 79. Inasmuch as the diaphragm 137 controls the needle valve 125, the degree of metering is dependent on the pressure in the receiver tank 11. The effect of metering the fluid entering the chamber 79 is to reduce the amount of fluid entering that chamber and since the orifice 87 continually vents the chamber, the pressure acting on bellows 93 varies inversely with the pressure of the fluid in the receiver tank 11 but in a greater degree. Consequently, as the receiver pressure increases, the bellows 93 will re-expand under the influence of governor spring 37. As the compressive force on the governor spring 37 is reduced the motor is decelerated. Full expansion of governor spring 37 and bellows 93 permitting deceleration of the motor speed to the minimum speed occurs only when the pressure in the receiver tank has reached a high pressure of predetermined value. In accordance with this invention, so long as the compressor unit remains loaded, the motor speed is arranged to fluctuate in accordance with fluctuations in the load on the unit as evidenced by the compressor discharge pressure or pressure in the receiver tank 11.

The receiver pressure at which the motor speed is reduced to a minimum is determined by the method in which it is desired to operate the unit. If the motor is to operate at minimum speed only when the compressor is completely unloaded, the compression of spring 143 is so regulated that the diaphragm 137 is unable to permit needle valve 125 to assume the metering position corresponding to the minimum speed of the motor until the maximum receiver pressure is reached. However, at the maximum pressure the diaphragm 137 is not moved to its minimum speed position by the pressure of the fluid supplied by conduit 131. Instead, this movement is brought about in the following manner:

Upon the occurrence of the maximum permissible pressure in the receive tank 11 the device 15 unloads the compressor 1 and induces a vacuum in the compressor inlet manifold 191, as was pointed out hereinbefore. At the same time, the vacuum is set up in conduit 163 which moves check valve 155 against spring 159 to open port 151 wide and quickly subject recess 139 to the vacuum. The effect of the vacuum is to almost instantaneously snap the diaphragm 137 to its uppermost position thereby closing needle valve 125 and, as above described, causing the motor 7 to operate at its idling speed. The vacuum serves also to lock the diaphragm in its uppermost position and to provide a time delay as will be explained.

In some instances it may be preferable to operate the motor at its minimum speed at pressures below the maximum allowable discharge pressure in order that the compressor need not necessarily be unloaded before the motor may decelerate to its idling speed. To achieve this purpose the spring 143 is adjusted to allow a predetermined high discharge pressure acting on diaphragm 137 to move the diaphragm and the needle valve 125 to positions where bellows 93 will expand and allow the governor spring 37 to assume its minimum motor speed position. The device 15, however, is still adjusted to unload the compressor 1 when the maximum allowable discharge or receiver pressure is attained.

The effect of such an adjustment is to cause the motor speed to reduce to the minimum speed when a predetermined high discharge pressure is reached. Variation of the discharge pressure above the predetermined high pressure without reaching the predetermined maximum pressure does not affect the minimum speed setting of the governor but, if the pressure fluctuates below the predetermined high discharge pressure, the speed of the motor will vary since that variations in receiver pressure affect diaphragm 137 and consequently needle valve 125 controlling the flow of fluid to bellows chamber 79. Such variations will cease as soon as the receiver pressure rises to the maximum permissible discharge pressure since the device 15 then acts to unload the compressor 1 and induce a vacuum in chamber 139.

Again the diaphragm 137 will snap to its uppermost position and remain locked there to prevent further variation of the motor speed from the minimum.

Regardless of which of these methods of operating the unit is used, whenever the maximum discharge pressure is reached the motor is maintained at its minimum speed. Thereafter, upon a drop in pressure from the predetermined maximum pressure the compressor 1 remains unloaded and the motor speed at a minimum until a predetermined minimum pressure occurs in the receiver tank. With proper adjustment of spring 211, in the auxiliary valve body 201, the valve 207 will close and permit the cylindrical valve 179 to open and reload the compressor 1 when this predetermined minimum pressure occurs. Were it not for the check valve 155 and its restricting orifice 165 which causes a time delay, the motor speed, under control of the governor regulating apparatus, would almost immediately jump to a maximum.

As the compressor 1 is reloaded by the opening of the valve 179 the compressor manifold 191 is subjected to atmospheric pressure. The conduit 163 conveys fluid at this pressure to the check valve 155 which, under the combined force of spring 159 and atmospheric pressure, returns to its seat 157. While the check valve 155 is so maintained on its seat, fluid at atmospheric pressure can enter chamber 139 only through the orifice 165. The pressure in chamber 139 accordingly will gradually approach atmospheric pressure after the compressor 1 has been reloaded but, naturally, there will be a certain time delay before the chamber will be at atmospheric pressure and the diaphragm 137 free to move under the influence of the pressure in the receiver tank 11. The duration of the delay is predetermined by the size of the orifice 165 and, by variation of the size, any desired delay may be secured.

Thereafter the apparatus functions as though no time delay had occurred and the motor varies its speed as required to conform with the load on the compressor.

As an illustration of the manner in which the compressor unit will function when the minimum speed and unloading pressure are reached at the same instant, let it be assumed that the compressor motor 7 is to operate at maximum speed when the pressure in the receiver tank reaches 80 pounds per square inch and at a minimum speed when the pressure is at 105 pounds per square inch. Furthermore, that the compressor is to be unloaded at a pressure of 105 pounds per square inch and is to be reloaded at 80 pounds per square inch. Upon operation of the compressor, as the pressure gradually increases from 80 pounds per square inch toward, but does not reach, 105 pounds per square inch, the motor speed gradually decelerates from the maximum toward the minimum motor speed. If, then, the pressure remains constant or decreases gradually, the motor will respectively either remain at constant speed or accelerate gradually in order that the motor speed will be just sufficient to carry the load on the compressor. Should the pressure in the receiver tank reach 105 pounds per square inch, the loading device 15 will function and unload the compressor and, at the same time, the motor will assume its idling speed.

Leakage or the load on the receiver will reduce the pressure in the receiver tank 11 and when it reaches 80 pounds per square inch, the compressor is reloaded by the loading device 15. During this time the compressor motor is operating at its idling speed. Upon reloading, after a predetermined time delay as explained hereinbefore, the motor is permitted to accelerate rather slowly toward its maximum speed. The cycle of operation will thereafter repeat itself.

Under the alternate method of operation above referred to, the only difference is that the motor is adjusted to operate at minimum speed when the discharge pressure is at 100 pounds per square inch for instance, whereas, the unloading pressure of the compressor is at 105 pounds per square inch. A pressure of 100 pounds will therefore cause the motor to assume its minimum speed but so long as the pressure does not reach 100 pounds per square inch the speed of the motor may vary with the receiver pressure increasing or decreasing between maximum and minimum speeds and in the range between 100 and 105 pounds the motor speed stays at a minimum. If the pressure becomes 105 pounds per square inch, the compressor will unload and, as was previously explained, lock the motor speed at the idling speed. In other respects the function of the compressor unit, under this method, is identical with the first method disclosed.

It is to be understood that the construction above described is a preferred embodiment of the invention and that many changes which do not depart from the scope and spirit of the invention will occur to those skilled in the art.

I claim:

1. In a motor driven fluid compressor unit having a motor speed governor, a pressure responsive device to control and vary the speed setting of the governor upon variation of the discharge pressure of the compressor while the compressor is loaded, means to unload the compressor at a predetermined pressure and to reload the compressor at a predetermined minimum discharge pressure, means to lock said pressure responsive device at said predetermined discharge pressure of the compressor until said predetermined minimum discharge pressure is reached, and means to prevent variation of the governor speed setting by the pressure responsive device for a predetermined time after the discharge pressure reaches said predetermined minimum discharge pressure and the compressor has been reloaded.

2. In a motor driven fluid compressor unit having a motor speed governor, a pressure responsive device to control and vary the speed setting of the governor upon variation of the discharge pressure of the compressor while the compressor is loaded having a maximum speed setting position when the discharge pressure is at and below a predetermined minimum discharge pressure and a minimum speed setting position when the discharge pressure is at and above a predetermined high discharge pressure, means to unload the compressor at a second predetermined high discharge pressure and to reload the compressor at said predetermined minimum discharge pressure of the compressor, means to lock said pressure responsive device at the minimum speed position, means to maintain the pressure responsive device at the minimum speed setting position for a predetermined time after the discharge pressure reaches said minimum discharge pressure and the compressor has been reloaded.

3. In a motor driven fluid compressor unit having a motor speed governor, a pressure responsive device to control and vary the speed setting of the governor upon variation of the discharge

pressure of the compressor while the compressor is loaded having a maximum speed setting position when the discharge pressure is at a predetermined minimum discharge pressure and a minimum speed setting position at a predetermined higher discharge pressure, means to unload the compressor at a predetermined pressure at least as great as said predetermined higher discharge pressure and to reload the compressor at said predetermined minimum discharge pressure of the compressor, means to predetermine said pressures, means to render the pressure responsive device inoperative to vary the speed setting of the governor at said predetermined higher discharge pressure of the compressor until a predetermined minimum discharge pressure is reached, and means to prevent variation of the governor speed setting by the pressure responsive device for a predetermined time after the discharge pressure reaches said predetermined minimum discharge pressure and the compressor has been reloaded.

4. In a motor driven fluid compressor unit having a motor speed governor, a pressure responsive device to control and vary the speed setting of the governor upon variation of the discharge pressure of the compressor while the compressor is loaded having a maximum speed setting position at a predetermined minimum discharge pressure and a minimum speed setting position at a predetermined high discharge pressure, means to unload the compressor at a predetermined maximum discharge pressure and to reload the compressor at said predetermined minimum discharge pressure, means to predetermine said maximum discharge pressure with respect to the last said means, and means to prevent variation of the governor speed setting by the pressure responsive device for a predetermined time after the discharge pressure reaches said predetermined minimum discharge pressure and the compressor has been reloaded.

5. In a motor driven fluid compressor unit having a motor speed governor, a pressure responsive device to control and vary the speed setting of the governor upon variation of the discharge pressure of the compressor while the compressor is loaded having a maximum speed setting position at a predetermined minimum discharge pressure and a minimum speed setting position at a predetermined high discharge pressure, means to predetermine said high discharge pressure, means to unload the compressor at a predetermined maximum discharge pressure and to reload the compressor at said predetermined minimum discharge pressure, and means to prevent variation of the governor speed setting by the pressure responsive device for a predetermined time after the discharge pressure reaches said predetermined minimum discharge pressure and the compressor has been reloaded.

6. In a motor driven fluid compressor unit having a motor speed governor, a pressure responsive device to control and vary the speed setting of the governor upon variation of the discharge pressure of the compressor while the compressor is loaded having a maximum speed setting position at a predetermined minimum discharge pressure and a minimum speed setting position at a predetermined high discharge pressure comprising a chambered casing, pressure responsive means in a chamber of the casing, a shaft coacting with the pressure responsive means, means to connect the shaft with the governor, means to unload the compressor at a predetermined pressure at least as great as said predetermined high discharge pressure and to reload the compressor at said predetermined minimum discharge pressure of the compressor, means to prevent variation of the governor speed setting by the pressure responsive device for a predetermined time after the discharge pressure reaches said predetermined minimum discharge pressure and the compressor has been reloaded comprising a valve in a second chamber of said chambered casing to control communication between said chambers, a conduit to admit pressure discharge fluid to the second casing, a diaphragm in the second chamber bearing on the valve and forming a third chamber, a spring to hold the diaphragm against the valve in the third chamber, a second conduit to admit fluid to and from the compressor intake from and to said third chamber, means to adjust the tension of the spring, and check venting means in the second conduit whereby the flow of the fluid admitted to the third chamber is restricted to provide said time delay.

7. In a motor driven fluid compressor unit having a motor speed governor, a pressure responsive device to control and vary the speed setting of the governor upon variations of the discharge pressure of the compressor while the compressor is loaded having a maximum speed setting position at a predetermined minimum discharge pressure and a minimum speed setting position at a predetermined high discharge pressure comprising a chambered casing, pressure responsive means in a chamber of the casing, a shaft co-acting with the pressure responsive means, means to connect the shaft with the governor, and means to predetermine said high discharge pressure with respect to the pressure responsive device, means to unload the compressor at a predetermined pressure at least as great as said predetermined high pressure and to reload the compressor at said predetermined minimum discharge pressure, means to prevent variation of the governor speed setting by the pressure responsive device for a predetermined time after the discharge pressure reaches said predetermined minimum discharge pressure and the compressor has been reloaded comprising a valve in a second chamber of said chambered casing to control communication between said chambers, a conduit to admit pressure discharge fluid to the second chamber, a diaphragm in the second chamber bearing on the valve and forming a third chamber, a spring to hold the diaphragm against the valve in the third chamber, a second conduit to admit fluid to and from the compressor intake from and to said third chamber, means to adjust the tension of the spring, and check venting means in the second conduit whereby the flow of the fluid admitted to the third chamber from the compressor intake is restricted to provide said time delay.

8. In a motor driven fluid compressor unit having a motor speed governor, a pressure responsive device to control and vary the speed setting of the governor upon variation of the discharge pressure of the compressor while the compressor is loaded having a maximum speed setting position at and below a predetermined minimum discharge pressure and a minimum speed setting position at a predetermined high discharge pressure comprising a chambered casing, pressure responsive means in the chamber of the casing, a shaft co-acting with the pressure responsive means, means to connect the

shaft with the governor, means to unload the compressor at a predetermined discharge pressure at least equal to said predetermined higher discharge pressure and to reload the compressor at said predetermined minimum discharge pressure, means to predetermine said high discharge pressure, means to prevent variation of the governor speed setting by the pressure responsive device for a predetermined time after the discharge pressure reaches said predetermined minimum discharge pressure and the compressor has been reloaded comprising a valve in a second chamber of said chambered casing to control communication between said chambers, a conduit to admit pressure discharge fluid to the second casing, a diaphragm in the second chamber bearing on the valve and forming a third chamber, a spring to hold the diaphragm against the valve in the third chamber, a second conduit to admit fluid to and from the compressor intake from and to said third chamber, means to adjust the tension of the spring, and check venting means in the second conduit whereby the flow of the fluid admitted to the compressor intake from the third chamber is restricted to provide said time delay.

9. In a motor driven fluid compressor unit having a motor speed governor, a pressure responsive device to control and vary the speed setting of the governor upon variation of the discharge pressure of the compressor while the compressor is loaded having a maximum speed setting position at a predetermined minimum discharge pressure and a minimum speed setting position at a predetermined high discharge pressure comprising a chambered casing, pressure responsive means in the chamber of the casing, a shaft co-acting with the pressure responsive means, means to connect the shaft with the governor, means to predetermine said high discharge pressure, means to unload the compressor at a predetermined discharge pressure at least as great as said predetermined high discharge pressure and to reload the compressor at said predetermined minimum discharge pressure, means to predetermine said maximum discharge pressure with respect to the said varying means, means to prevent variation of the governor speed setting by the pressure responsive device for a predetermined time after the discharge pressure reaches said predetermined minimum discharge pressure and the compressor has been reloaded, comprising a valve in a second chamber of the casing to control communication between said chambers, a conduit to admit pressure discharge fluid to the second casing, a diaphragm in the second chamber bearing on the valve and forming a third chamber, a spring to hold the diaphragm against the valve in the third chamber, a second conduit to admit fluid to and from the compressor intake from and to said third chamber, means to adjust the tension of the spring, and check venting means in the second conduit whereby the flow of the fluid admitted to the third chamber from the compressor intake is restricted to provide said time delay.

10. In a motor driven fluid compressor unit having a motor speed governor, a pressure responsive device to control and vary the speed setting of the governor upon variation of the discharge pressure of the compressor while the compressor is loaded having a maximum speed setting position at a predetermined minimum discharge pressure and a minimum speed setting position at a predetermined high discharge pressure, means to unload the compressor at a predetermined discharge pressure at least as great as said predetermined high discharge pressure and to reload the compressor at said predetermined minimum discharge pressure, and means to prevent variation of the governor speed setting by the pressure responsive device for a predetermined time after the discharge pressure reaches said predetermined minimum discharge pressure and the compressor has been reloaded.

11. In a motor driven fluid compressor unit having a motor speed governor, a pressure responsive device to control and vary the speed setting of the governor upon variation of the discharge pressure of the compressor while the compressor is loaded having a maximum speed setting position at a predetermined minimum discharge pressure and a minimum speed setting position at a predetermined high discharge pressure, means to predetermine said high discharge pressure with respect to the pressure responsive device, means to unload the compressor at a predetermined discharge pressure at least as great as said predetermined high discharge pressure and to reload the compressor at said predetermined minimum discharge pressure, and means to prevent variation of the governor speed setting by the pressure responsive device for a predetermined time after the discharge pressure reaches said predetermined minimum discharge pressure and the compressor has been reloaded.

12. In a motor driven fluid compressor unit having a motor speed governor, a pressure responsive device to control and vary the speed setting of the governor upon variation of the discharge pressure of the compressor while the compressor is loaded having a maximum speed setting position at a predetermined discharge pressure and a minimum speed setting position at a predetermined high discharge pressure, means to predetermine said high pressure, means to unload the compressor at a predetermined discharge pressure at least as great as said predetermined high pressure and to reload the compressor at said predetermined minimum discharge pressure, means to predetermine said predetermined discharge pressure with respect to said unloading means, and means to prevent variation of the governor speed setting by the pressure responsive device for a predetermined time after the discharge pressure reaches said predetermined minimum discharge pressure and the compressor has been reloaded.

13. In a motor driven fluid compressor unit having a motor speed governor, means to control and vary the speed setting of the governor upon variation of the discharge pressure of the compressor while the compressor is loaded having a maximum speed setting position at a predetermined low discharge pressure and a minimum speed setting position at a predetermined high discharge pressure including pressure responsive means, means to conduct compressor discharge fluid to the pressure responsive means to actuate said pressure responsive means, and means to regulate the flow of discharge fluid to said pressure responsive means in accordance with variations in the pressure of the compressor discharge fluid and to prevent flow of fluid for a predetermined time after the pressure of the discharge fluid has reached said predetermined low pressure, and means to unload the compressor at a predetermined pressure at least as great as said predetermined high pressure and to reload the

compressor at said predetermined low discharge pressure.

14. In a motor driven fluid compressor unit having a motor speed governor, means to control and vary the speed setting of the governor upon variation of the discharge pressure of the compressor while the compressor is loaded having a maximum speed setting position at a predetermined minimum discharge pressure and a minimum speed setting position at a predetermined high discharge pressure including pressure responsive means, means to conduct compressor discharge fluid at the pressure responsive means to actuate said pressure responsive means, and means to regulate the flow of discharge fluid to said pressure responsive means in accordance with variations in the pressure of the compressor discharge fluid and to prevent flow of fluid for a predetermined time after the pressure of the discharge fluid has reached said predetermined minimum pressure, means to unload the compressor at a predetermined pressure at least equal to said predetermined high discharge pressure and to unload the compressor at said predetermined minimum discharge pressure, and means to predetermine the higher pressure with respect to said loading means.

15. In a motor driven fluid compressor unit having a motor speed governor, means to control and vary the speed setting of the governor upon variation of the discharge pressure of the compressor while the compressor is loaded having a maximum speed setting position at a predetermined low discharge pressure and a minimum speed setting position at a predetermined high discharge pressure including means to predetermine said high discharge pressure, means to conduct compressor discharge fluid to the pressure responsive means to actuate said pressure responsive means, and means to regulate the flow of discharge fluid to said pressure responsive means in accordance with variations in the pressure of the compressor discharge fluid and to prevent flow of fluid for a predetermined time after the pressure of the discharge fluid has reached said predetermined minimum pressure, and means to unload the compressor at a predetermined pressure at least equivalent to said high pressure and to reload the compressor at said predetermined minimum discharge pressure.

16. In a motor driven fluid compressor unit having a motor speed governor, means to control and vary the speed setting of the governor upon variation of the discharge pressure of the compressor having a maximum speed setting position at a predetermined minimum discharge pressure and a minimum speed setting position at a predetermined high discharge pressure including means to predetermine said high discharge pressure, means to conduct compressor discharge fluid to the pressure responsive means to actuate said pressure responsive means, and means to regulate the flow of discharge fluid to said pressure responsive means in accordance with variations in the pressure of the compressor discharge fluid and to prevent flow of fluid for a predetermined time after the pressure of the discharge fluid has reached said predetermined minimum pressure, means to unload the compressor at a predetermined pressure at least equal in magnitude to said predetermined high pressure and to reload the compressor at said predetermined minimum discharge pressure, and means to predetermine said higher pressure with respect to said means to unload.

17. In a motor driven fluid compressor unit having a motor speed governor, means to control and vary the speed setting of the governor in accordance with variations of the discharge pressure of the compressor while the compressor is loaded having a maximum speed setting position at a predetermined minimum pressure and a minimum speed setting position at a predetermined high discharge pressure including pressure responsive means actuated by the pressure of the compressor discharge fluid, means to control the compressor discharge fluid actuating the pressure responsive device and to prevent actuation thereof for a predetermined time when the discharge pressure reaches said predetermined minimum pressure, and means to unload the compressor at a predetermined pressure at least as great as said predetermined high pressure and to reload the compressor at said predetermined minimum pressure.

18. In a motor driven fluid compressor unit having a motor speed governor, means to control and vary the speed setting of the governor in accordance with variations of the discharge pressure of the compressor while the compressor is loaded having a maximum speed setting position at a predetermined minimum pressure and a minimum speed setting position at a predetermined high discharge pressure including pressure responsive means actuated by the pressure of the compressor discharge fluid, means to control the compressor discharge fluid actuating the pressure responsive device and to prevent actuation thereof for a predetermined time when the discharge pressure reaches said predetermined minimum pressure, means to unload the compressor at a predetermined pressure at least as great as said predetermined high pressure and to reload the compressor at said predetermined minimum pressure, and means to predetermine said predetermined pressures.

19. In a motor driven fluid compressor unit having a motor speed governor, a pressure responsive device to control and regulate the speed setting of the governor comprising a chambered casing, pressure actuated means in the casing, means to transmit movement of the pressure actuated to the governor, means to vent said chamber, a diaphragm in the casing subject to the pressure of the compressor discharge fluid and defining a second and a third chamber in the casing, said second chamber being in communication with the first said chamber, a spring pressed valve normally open to control communication between the first said chamber and said second chamber bearing against said diaphragm, a spring in the third chamber bearing against the diaphragm, means to regulate the compression of said spring, means to vent said third chamber, and an orificed check valve in the last said means to delay the entrance of fluid into the third chamber.

20. In a motor driven fluid compressor unit having a motor speed governor, a pressure responsive device to control and regulate the speed setting of the governor comprising a chambered casing, pressure actuated means in the casing, means to transmit movement of the pressure actuated to the governor, means to vent said chamber, a diaphragm in the casing subject to the pressure of the compressor discharge fluid and defining a second and a third chamber in the casing, said second chamber being in com-

munication with the first said chamber, a spring pressed valve normally open to control communication between the first said chamber and said second chamber bearing against said diaphragm, a spring in the third chamber bearing against the diaphragm, means to regulate the compression of said spring, means to vent said third chamber, an orificed check valve in the last said means to delay the entrance of fluid into the third chamber, and means to unload the compressor at a predetermined discharge pressure and to reload the compressor at a predetermined minimum discharge pressure.

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