W. H. WINEMAN.

COMPRESSOR CONTROLLING MECHANISM.

APPLICATION FILED DEC. 22, 1917.

1,398,913.

Patented Nov. 29, 1921

2 SHEETS—SHEET 1.

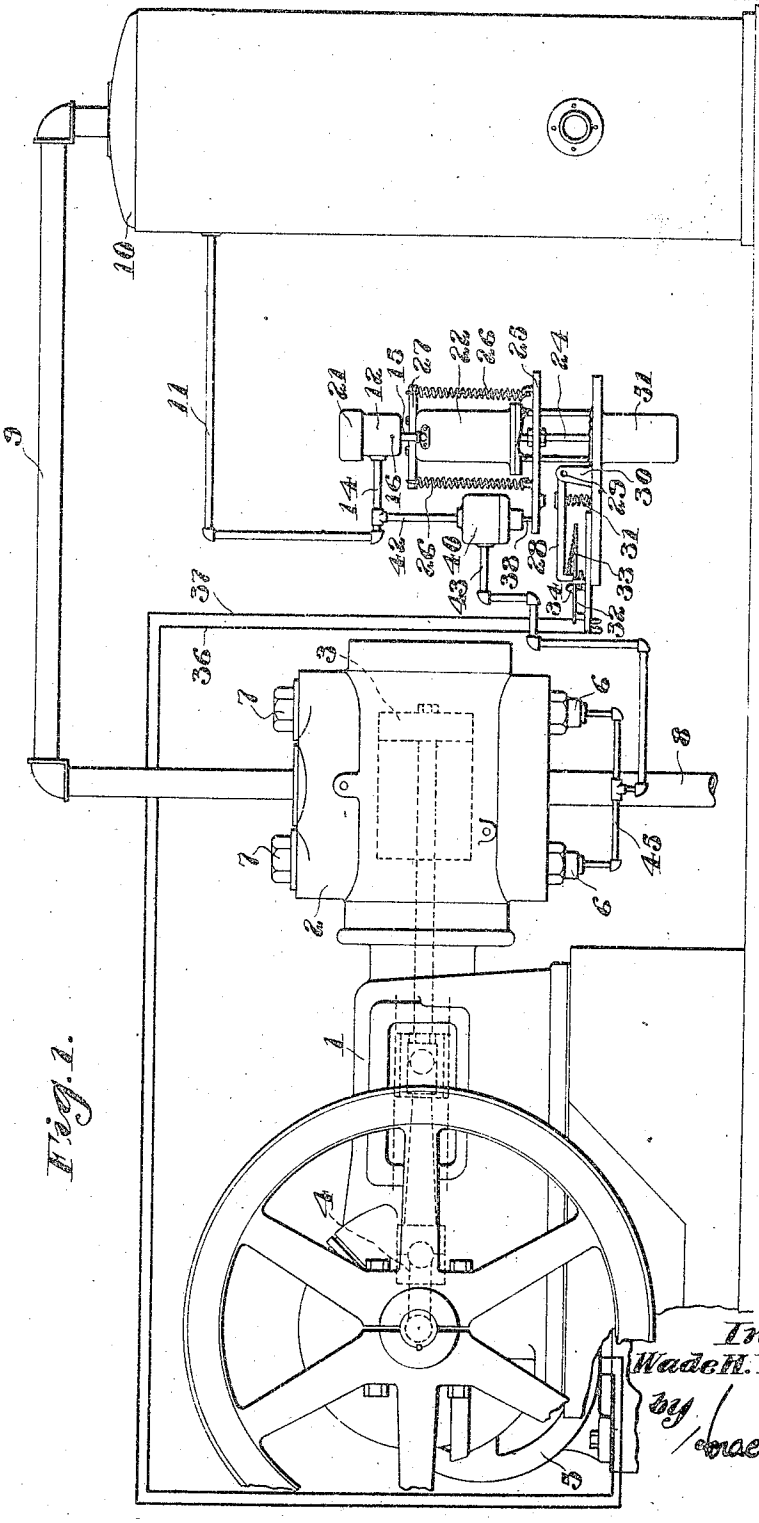


Fig. 1.

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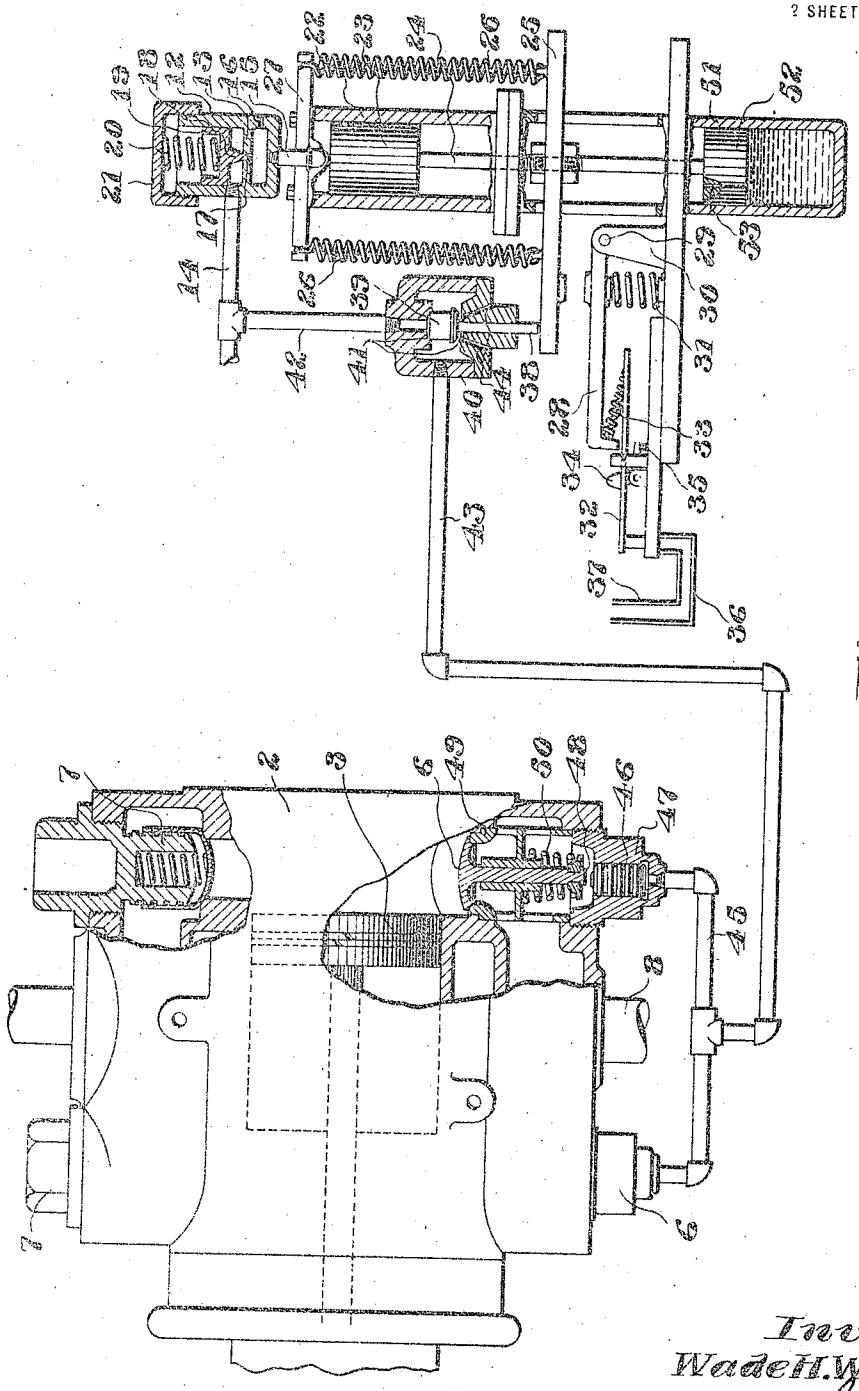


Fig. 2.

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UNITED STATES PATENT OFFICE.

WADE H. WINEMAN, OF CHICAGO, ILLINOIS, ASSIGNOR TO SULLIVAN MACHINERY COMPANY, A CORPORATION OF MASSACHUSETTS.

COMPRESSOR-CONTROLLING MECHANISM.

1,398,913. Specification of Letters Patent. Patented Nov. 29, 1921.

Application filed December 22, 1917. Serial No. 208,433.

To all whom it may concern:

Be it known that I, WADE H. WINEMAN, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Compressor-Controlling Mechanisms, of which the following is a full, clear, and exact specification.

My invention relates to compressor controlling mechanisms.

It has for its object to provide an improved controlling mechanism for a compressor, especially adapted to use in connection with motor driven compressors. A further object of my invention is to provide means of an improved and simplified construction whereby the motor driving the compressor may be brought up to speed prior to the loading of the compressor and the latter thereafter automatically loaded and unloaded in accordance with variations in terminal pressure. A still further object of my invention is to provide an improved mechanism adapted to attain the above mentioned ends and to use in connection with a compressor of the type wherein suction inlet valves are employed. These and other objects and advantages of my improved construction will, however, hereinafter more fully appear.

In the accompanying drawings, I have shown one embodiment which my invention may assume in practice, illustrating the same as applied to a standard type of compressor.

In these drawings,—

Figure 1 is a diagrammatic side elevation of a compressor equipped with my improvement.

Fig. 2 is an enlarged detail view partially in section and with parts broken away showing the controlling mechanism disposed in diagrammatic form.

In this illustrative construction, I have shown a compressor comprising the usual frame 1 having a cylinder 2 thereon in which a piston 3 is movable back and forth and connected in the usual manner to a crank shaft 4 adapted to be propelled through suitable driving connections from a motor 5. As shown, this cylinder 2 is provided with suction inlet valves 6 and discharge valves 7, the former controlling the communication between the cylinder and the intake 8, and the latter controlling the communication between the cylinder and a pipe 9 leading to the receiver 10.

In my present invention, which constitutes a development of my invention described and claimed in my co-pending application Serial No. 208,432, filed December 22, 1917, I have provided improved means whereby the controlling mechanism described in that application is adapted to use in connection with a compressor employing suction valves, means being provided herein whereby the controlling mechanism in question may cause those valves to be operative or inoperative at different times in the operation of the machine as the terminal pressure varies, in such a manner as to load or unload the compressor in a predetermined sequence relative to the making or breaking of the circuit of the compressor driving motor. More specifically, it will be observed that the receiver 10 is connected, as through a pipe connection 11, with a suitable pilot valve responsive to variations in terminal pressure. This valve may, obviously, be of any desired type. In the form of my invention illustrated herein, however, it will be observed that this valve is shown as a simplified form of pilot valve including a valve casing 12 having therein a suitable septum 13 spaced apart from its bottom and communicating on its opposite sides with a pipe 14 communicating with the pipe 11 and with a pipe 15 hereinafter described, an outlet or vent 16 being preferably provided beneath the septum, and a port 17 being provided in the septum and controlled by a valve member 18 on a piston 19 movable in the valve casing and normally depressed by a spring 20 the tension of which is adjustable by means of an adjustable cap 21. Thus, it will be observed that the variations in pressure in the receiver 10 act to control the valve 18 and thereby control the supply of fluid from the receiver to the pipe 15. This pipe, as shown, is in turn connected to the upper end of a cylinder 22 having therein a piston 23 which carries on its lower end a rod 24, herein adapted to control the motor circuit and also to control the inlet valves 6 through the control of the connection between the receiver and these valves. As shown, this rod 24 is provided with a transversely disposed arm or cross arm 25 resili-

ently connected through springs 26 disposed in opposite sides of the cylinder 22, with an upper cross arm 27 carried by the cylinder casing, in such a manner that the springs normally tend to resist downward movement of the arm 25 and tend to draw the same upward. Coöperating with this arm 25, is a suitable switch, which may be of any desired type, preferably adapted to make or break the circuit with a quick snap action under the control of the arm 25. As herein shown, this switch is of a well known Cutler-Hammer type and includes an operating member 28 pivoted at 29 on a suitable support 30 preferably connected to the cylinder, the member 28 being normally held in elevated position by means of a spring 31 and adapted to control the movement of a contact carrying member 32 resiliently connected thereto through a spring 33, through the operation of a latch 34 normally held in elevated position by means of a spring 35, the construction and arrangement of the parts being such that when the arm 25 is moved downward by an increase in pressure in the receiver, the contact carrying member 32 is actuated in such a manner as to interrupt the flow of current in the conductors 36 and 37 leading to the compressor driving motor, and thereby bring the motor to rest. As above indicated, a moving part of the mechanism responsive to variations in receiver pressure also acts to control the flow of pressure fluid from the receiver to the inlet valves 6. Herein, it will be noted that the arm 25 is also utilized as the controlling element, the same being adapted to engage at a point adjacent one of its ends with a valve stem 38 of a suitable trigger valve 39 controlling these valves. As shown, this valve 39 is carried in a suitable valve casing 40 and adapted to seat at will in suitable seats 41 and thus control the communication between a pipe 42 and a pipe 43, the former communicating with the pipe 11 and the latter leading to a point beneath the inlet valves 6. As shown, the valve casing 40 is also provided with suitable vents 44, preferably located in its lower seat 41, so that when the valve 39 is elevated by the cross arm 25, the air trapped in the valve casing and in the pipe 43 may find an outlet to the atmosphere through these vents and thus relieve the pressure beneath the inlet valves 6. As shown, it will be noted that when the valve 39 is in its lower position, the receiver pressure passing into the pipe 43 is enabled to operate upon the valves 6 in a well known manner to render the same inoperative, the same passing through suitable lateral pipe connections 45 communicating with the pipe 43, and acting upon pistons or plungers 46 movable in suitable cylinders 47 in such a manner as to cause them to engage the lower ends of the valve stems 48 and thereby lift the valves 6 from their seats 49 against the pressure of their springs 50; while when the valve 39 is in its upper position, the air beneath those pistons is exhausted to the atmosphere through the vents 44 in such a manner as to cause the pistons to drop down and thus permit the valve 6 to seat in their operative or loaded positions under the influence of their springs 50. It will also be observed that in my improved construction I have provided improved means adapted to coöperate with the springs 26 in retarding the movement of the cross arm 25. These means may, obviously, assume various forms, but it will be noted that in the present embodiment of my invention the same are illustrated in the form of a dash pot including a dash pot casing 51 adapted to receive a suitable retarding fluid, such as air or oil, and housing therein a dash pot piston 52 carried on the lower end of the rod 24 and adapted to move slowly back and forth in the cylinder 51 as the fluid therein passes through a longitudinally disposed port 53 in the piston.

In the operation of my improved mechanism, it will be evident that during the normal running operation of the compressor the motor circuit will be closed and the inlet valves 6 thereof will occupy their operative or loaded position shown in Fig. 2, wherein they are freely movable up and down in response to the back and forth movement of the piston 3, as is usual with ordinary suction valves. However, when the terminal pressure, *i. e.*, the pressure in the receiver 10, exceeds a predetermined limit determined by the position of the cap 21, the pressure in the same will then act to elevate the piston 19 of the pilot valve and thereby raise the valve 18 in such a manner as to permit the receiver pressure to pass through the opening 17 and the pipe 15 into the top of the cylinder 22 and thereby depress the piston 23. As a result the cross arm 25 will be moved downward against the tension of the springs 26 and be brought into engagement with the member 28 of the switch mechanism, which in turn releases the latch 34 and thereby breaks the motor circuit. It will also be noted that as the member 25 thus moves downward, it will permit the valve 39 to drop in such a manner as to open communication between the receiver and the pipe 43 through the pipe connections 11, 42, and 43, and thus enable the receiver pressure to act upon the pistons in the cylinders 47 and cause those pistons to rise and lift the valves 49 from their seats, thus rendering the compressor inoperative, or unloaded. This condition will, obviously obtain so long as the pressure in the receiver 10 is above a predetermined limit. When, however, the pressure in the receiver drops below a predetermined mini-

mum, the spring 20 will act upon the piston 19 in such a manner as to lower the same and cause its valve 18 to close the aperture 17 and thus shut off the supply of receiver pressure to the cylinder 22 and permit the pressure above the piston 23 to pass out through the vent 16 to the atmosphere. As a result, the piston 23 will then be free to move upward in the cylinder 22 due to the action of the springs 26 upon the cross arm 25, and the latter will be raised from engagement with the switch member 28 in such a manner as to enable the switch to be re-set in circuit closing position and thus start the motor in operation as the first step in the loading process. During the further upward movement of the cross arm 25 and, due to the action of the dash pot 51, 52, at an appreciable time after the motor circuit has been closed, it will be noted that the arm 25 will also engage the stem 38 of the valve 39 in such a manner as to seat the valve in its upper seat 41 and thus close communication between the receiver connections 11 and 42 and the pipe connection 43 and open communication between the pipe 43 and the vents 44 so that the air beneath the pistons 46 will be exhausted to the atmosphere. As a result, it will be observed that the pistons 46 will then drop down in their cylinders and thus permit the valve springs 50 to seat the inlet valves 6, the compressor then being loaded.

It will be noted from an inspection of the dash pot 51, 52, that downward movement of the piston will be retarded by the necessity of forcing the fluid contained in the cylinder 51 upward through the port 53 in the piston 52. It will further be noted that a very slight movement of the arm 25 will suffice to operate the valve 39 to unload the compressor, but that a materially further movement will be necessary before the switch is operated to break the circuit. It will thus be obvious that if the port 53 be made of relatively small size, a considerable interval may intervene between the unloading of the compressor and the shutting down of the motor and that by making this interval of a considerable duration, it may be possible to run the compressor when operating at near capacity without stopping the motor at all, while yet maintaining a nearly constant receiver pressure. The advantage of this will be obvious when it is considered that the stopping and starting of the motor at frequent intervals is highly disadvantageous as a relatively large starting current is required and the wear on the starting apparatus is considerable. In fact, it has been found desirable in some plants to have two separate compressor systems, one with an intake or inlet type unloader, and the other with a driving motor start and stop mechanism; the first plant to be used at times when a relatively constant large demand is maintained, the second, when but a relatively small part of the compressor's capacity is requisite to furnish the air needed. In the first case, it will be obvious that frequent but very short operations of the unloading mechanism will be needed; and in the second, that the plant may be shut down for a considerable period at a time so that the gain due to saving in current may off-set the losses due to high starting current and wear on the electric control mechanism. It will thus be seen that I have provided a mechanism which will automatically take care of a relatively constant full capacity demand without the operation of the starting mechanism at all, whereas, in case the demand is very slight or fluctuates, the plant will be shut down entirely in the intervals during which no compressing action is necessary.

As a result of my improvement, it will be observed that it is possible to control the suction valves of the compressor in such a manner as to render the same operative or inoperative in accordance with the variations in terminal pressure. It will also be observed that through the provision of my improved controlling mechanism the motor circuit is closed a sufficient time before the compreessor is loaded to permit the motor to be brought up to speed before the same is required to drive the loaded compressor. More specifically, it will be observed that due to the operation of my improved means responsive to terminal pressure, both the switch controlling the motor and the valve controlling the flow to the inlet valve operating pistons are controlled in a predetermined sequence in such a manner that the switch is operated and the inlet valves are rendered operative or inoperative automatically in accordance with the variations in terminal pressure and without placing an undue load upon the motor. At the same time, it will be observed that an exceedingly simple mechanism is produced which is adapted to be very cheaply manufactured and applied in substantially unitary form to any standard form of compressor, the entire mechanism being of such a construction that it may be very compact and adapted if desired to be carried on a bracket on the compressor frame. These and other advantages of my improved construction will, however, be clearly apparent to those skilled in the art.

While I have in this application specifically described one embodiment which my invention may assume in practice, it will be noted that this form of the same is used for purposes of illustration and that the invention may be modified and embodied in other forms without departing from its spirit or the scope of the appended claims.

What I claim as new and desire to secure by Letters Patent is:

1. In combination with a compressor having automatically acting inlet valves, an unloading mechanism, means for controlling said unloading mechanism comprising a pressure fluid inlet to said mechanism, means for controlling a flow of pressure fluid through said inlet, and means comprising a motor independent therefrom for controlling said flow controlling means.

2. In combination with a compressor having automatically acting inlet valves, an unloading mechanism, means for controlling said unloading mechanism and comprising a pressure fluid inlet to said mechanism, means for controlling a flow of fluid through said inlet to unload said compressor and from said mechanism to load the compressor, and means for controlling said flow controlling means comprising a motor independent therefrom and governed by compressor discharge pressure.

3. In combination with a compressor having automatically acting inlet valves, an unloading mechanism, means for controlling said unloading mechanism and comprising a pressure fluid inlet to said mechanism, means for controlling a flow of pressure fluid through said inlet, and pressure fluid actuated means for controlling said flow controlling means comprising a fluid motor independent therefrom.

4. In combination with a compressor having automatically acting inlet valves, an unloading mechanism, means for controlling said unloading mechanism and comprising a pressure fluid inlet to said mechanism, means comprising a valve for controlling a flow of fluid through said inlet to unload said compressor and from said mechanism to load the compressor, and fluid actuated means comprising a member engageable with said valve for controlling the latter and a fluid motor controlling said member.

5. In combination with a motor driven compressor having automatically acting inlet valves, an unloading mechanism, means for controlling said unloading mechanism and comprising a pressure fluid inlet to said mechanism, means for controlling a flow of pressure fluid through said inlet, means for controlling said flow controlling means, and means controlled by said last named means for controlling the compressor motor.

6. In a compressor controlling mechanism, a pilot valve, a pressure operated member controlled thereby, an unloading mechanism, means comprising a valve for controlling said unloading mechanism, and means operated by said member for controlling said last named means.

7. In a compressor controlling mechanism, the combination comprising inlet valve operating mechanism, a valve controlling the flow of pressure thereto, a controlling switch, and means responsive to terminal pressure controlling said valve and said switch.

8. In a compressor controlling mechanism, the combination comprising inlet valve operating mechanism, a valve controlling the flow of pressure thereto, a controlling switch and means responsive to terminal pressure successively actuating said valve and said switch.

9. In a compressor controlling mechanism, the combination comprising inlet valve operating mechanism, a valve controlling the flow of pressure thereto, a controlling switch, and means responsive to terminal pressure for alternately actuating said valve and said switch.

10. In a compressor controlling mechanism, the combination comprising pressure fluid actuated inlet valve operating mechanism including a fluid pressure controlling element, a motor controlling switch, and a single member movable in response to variations in terminal pressure and mechanically controlling said controlling element and said controlling switch.

11. In a compressor controlling mechanism, the combination comprising inlet valve operating mechanism, a motor controlling switch, and a resiliently mounted member movable in response to variations in terminal pressure successively controlling said elements.

12. In a compressor controlling mechanism, the combination comprising inlet valve controlling mechanism, a motor controlling switch, a member movable in response to variations in terminal pressure to control said mechanism and said switch sequentially, and means for governing the speed of movement of said member.

13. In a compressor controlling mechanism, the combination comprising inlet valve operating mechanism, a motor controlling switch, a member responsive to variations in terminal pressure successively controlling said elements, and means for retarding the movement of said member.

14. In a compressor controlling mechanism, the combination comprising inlet valve operating mechanism, a valve controlling the flow of fluid thereto, a motor circuit controlling switch, means responsive to variations in terminal pressure engageable with said valve or switch, and means resisting movement of said last mentioned means.

15. In a compressor controlling mechanism, the combination comprising inlet valve operating piston mechanism, a valve controlling the flow of fluid thereto, a motor circuit controlling switch, means responsive to variations in terminal pressure engageable with said valve or switch, and means

resisting movement of said last mentioned means in either direction.

16. In a compressor controlling mechanism, the combination comprising inlet valve operating mechanism, a controlling valve therefor movable to admit fluid thereto or exhaust fluid therefrom, means responsive to variations in terminal pressure for actuating said valve, and a motor controlling switch likewise actuated by said last mentioned means.

17. In a compressor controlling mechanism, the combination comprising inlet valve operating mechanism, a controlling valve therefor movable to admit fluid thereto or exhaust fluid therefrom, a motor controlling switch, means responsive to variations in terminal pressure for alternately actuating said valve and switch, and means resisting movement of said last mentioned means.

18. In a compressor controlling mechanism, the combination comprising inlet valve operating mechanism, a controlling valve therefor movable to admit fluid thereto or exhaust fluid therefrom, a motor controlling switch, means responsive to terminal pressure for alternately actuating said valve and switch, and resilient means resisting movement of said last mentioned means.

19. In a compressor controlling mechanism, the combination comprising inlet valve operating piston mechanism, a valve controlling the flow of fluid thereto, a motor circuit controlling switch, means responsive to variations in terminal pressure engageable with said valve or switch, means resisting movement in one direction of said last mentioned means, and means for delaying movement of the same in the opposite direction.

20. In a compressor controlling mechanism, the combination comprising inlet valve operating piston mechanism, a valve controlling the flow of fluid thereto, a motor circuit controlling switch, means responsive to variations in terminal pressure engageable with said valve or switch, means resisting movement in one direction of said last mentioned means, and means for delaying movement of the same in either direction.

21. In a compressor controlling mechanism, the combination comprising inlet valve operating mechanism, a controlling valve therefor movable to admit fluid thereto or exhaust fluid therefrom, a motor controlling switch, means responsive to terminal pressure for alternately actuating said valve and switch, resilient means resisting movement of said last mentioned means, and retarding means likewise resisting movement of said last mentioned means.

22. In a compressor controlling mechanism, the combination comprising pressure fluid actuated inlet valve operating mechanism, a motor controlling switch, a single controlling means for said mechanism and said switch, and means movable in response to variations in terminal pressure controlling said last mentioned means.

23. In a compressor controlling mechanism, the combination comprising inlet valve operating piston mechanism, a valve controlling the flow of fluid thereto, a motor circuit controlling switch, and a single member responsive to variations in terminal pressure for controlling the switch and the valve operating piston mechanism.

24. In a compressor controlling mechanism, the combination comprising a compressor unloading mechanism and a motor controlling switch, and a member for operating both said unloading mechanism and said switch, said member being effective to operate said switch only at a predetermined time after the operation of said unloading mechanism.

25. In a compressor controlling mechanism, the combination comprising compressor unloading mechanism and motor controlling mechanism, and a single member operative to operate said unloading mechanism and, after a predetermined interval, to operate said motor controlling mechanism.

26. In a compressor controlling mechanism, the combination comprising compressor unloading mechanism and a motor controlling switch, and means including a single control member responsive to terminal pressure and controlling the operation of said unloading mechanism and said switch, said member being effective to unload said compressor with a minimum of delay and being provided with means to prevent opening of the motor controlling switch except after a predetermined time interval thereafter.

27. In a motor driven compressor system comprising a driving motor, a compressor and a receiver connected to said compressor, the combination comprising a compressor unloading mechanism and motor controlling mechanism, and a member operative when receiver pressure exceeds a desired minimum by a predetermined amount to control said compressor unloading mechanism to unload the compressor, said member being also operative to control said motor controlling mechanism to stop said motor but having means associated therewith to prevent stopping of the motor unless receiver pressure remains in excess of said minimum for a predetermined time.

In testimony whereof I affix my signature.

WADE H. WINEMAN.