Dec. 1, 1931. A. W. PHILLIPS 1,834,591

CONTROLLING MECHANISM

Filed Feb. 25, 1928

Fig. 1.

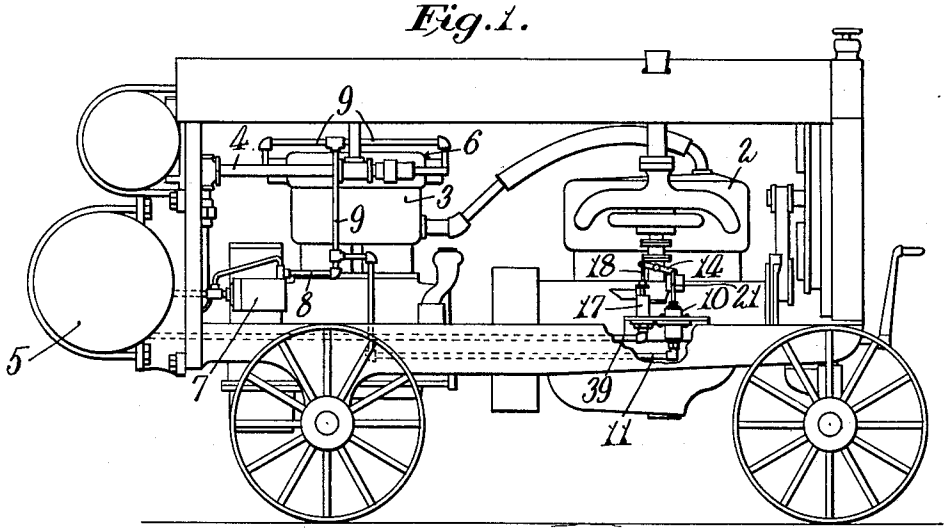
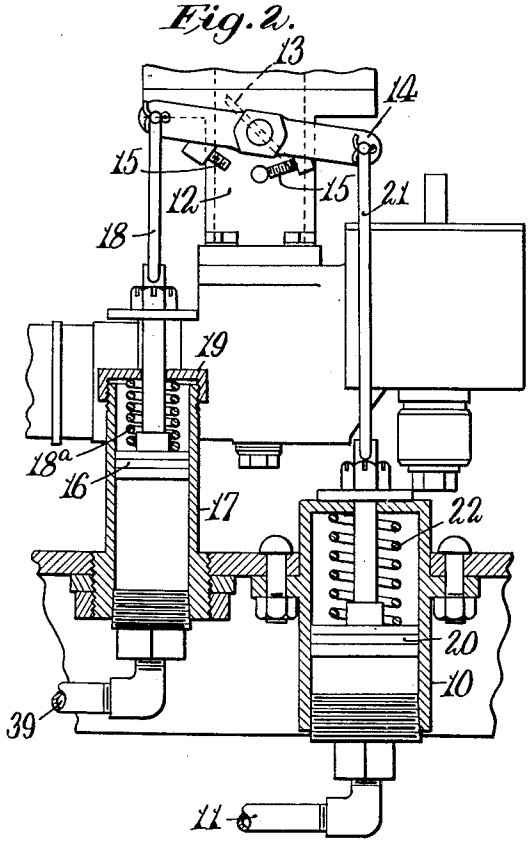


Fig. 2.



Inventor:
Arthur W. Phillips.
by Louis A. Maxson.
Atty.

Patented Dec. 1, 1931

1,834,591

UNITED STATES PATENT OFFICE

ARTHUR W. PHILLIPS, OF CLAREMONT, NEW HAMPSHIRE, ASSIGNOR TO SULLIVAN MACHINERY COMPANY, A CORPORATION OF MASSACHUSETTS

CONTROLLING MECHANISM

Application filed February 25, 1928. Serial No. 257,022.

This invention relates to controlling mechanisms, and more particularly to controlling mechanisms for internal combustion engines employed in the driving of air compressors or other pumping devices. It provides means whereby the engine throttle is operated to adjust properly the supply of fuel to the engine as the load of the engine increases and further to adjust the supply of fuel in accordance with the unloading and loading of the compressor.

Among the objects of the present invention is the provision of an improved controlling mechanism for a prime mover which drives a compressor. Another object of the invention is to provide improved controlling means for a fluid pumping system which includes an internal combustion engine. A further object of the invention is to provide an automatic control to increase the supply of fuel to the engine as the load on the engine increases and to vary the supply of fuel to the engine in accordance with the loading and unloading of the compressor. Other objects and advantages of the invention will be apparent from the following description and more particularly pointed out in the claims.

In the accompanying drawings in which for purposes of illustration one embodiment of the invention is shown,

Fig. 1 is a side elevation of a compressor mechanism in which an illustrative form of the invention has been incorporated.

Fig. 2 is a fragmentary view in side elevation of the intake connections for an internal combustion engine, showing one illustrative form of controlling mechanism with parts in central vertical sections.

In the drawings a portable compressor outfit is shown as including a motor 2, an air compressor 3 and a receiver 5 connected to the compressor by a pressure discharge line 4. The compressor is provided with appropriate unloading mechanism 6 of that type in which fluid supply thereto effects unloading. A pilot valve 7 controls the flow of fluid from the receiver 5 or pressure discharge line 4 into the line 8, and functions in a well known manner to permit such flow when a predetermined maximum pressure has been reached in the receiver 5 or pressure discharge line 4. Upon the lowering to a predetermined minimum of the receiver or discharge line pressure, the pilot valve vents the line 8 to atmosphere. Connections 9 lead from the line 8 to the unloading mechanism 6. A throttle controlling cylinder 10 is connected by piping 11 to the connections 9 and operates in a manner later more fully brought out.

The intake manifold 12 of the compressor driving engine 2 is provided with a butterfly valve 13 which is operated by a lever 14. As seen in Fig. 2, the limiting positions (maximum open, and closed) of the butterfly valve are determined by set screws 15. Supported on the frame of the outfit, herein in vertical position beneath one arm of the lever 14, is a throttle controlling cylinder 17 which is connected by a line 39 to the receiver. The piston 16 in cylinder 17 is connected by a link 18 to the left end of the lever 14 which controls the butterfly valve 13. A strong spring 18^a surrounds the piston rod and presses against the top of the piston 16 and also against the upper end of the cylinder. A spring of such strength as is required by the pressure conditions in the receiver and the piston area is selected and adjustment is made practicable by providing an adjustable cap 19 to adjust the spring tension and thus change the relation of receiver pressure to fuel supply. It should be noted that cap 19 is not a tight fit for the piston rod, and therefore no pressure above atmospheric opposes upward movement of the piston 16.

Parallel to cylinder 17 and beneath the other arm of lever 14 lies cylinder 10, also supported on the frame of the outfit. Cylinder 10 is provided with a cooperating piston 20 which is connected by a link 21 with the other end of the butterfly valve lever 14. A light spring 22 is employed to return the piston 20 toward the lower end of the cylinder 10.

The manner in which the illustrative embodiment of the invention operates is easily understood from the above description. The portable compressor is generally started with the receiver tank 5 vented to atmosphere.

Upon starting, the receiver vent is closed and pressure gradually builds up in the receiver 5. There is, of course, a corresponding building up of pressure within the cylinder 17 under the piston 16. In its bottom position the throttle is nearly closed so that the engine will not race when running nearly unloaded. The piston 16 is gradually forced up against the action of the strong spring 18ª as receiver pressure builds up. Accordingly, the fuel supply is increased as the pressure in the receiver tank increases, thereby preventing stalling and maintaining speed.

If the compressor were started under load, the controlling mechanism would also operate effectively. In such case the piston 16 would cause the butterfly valve 13 to supply an increased amount of fuel to the motor 2 so as to operate the pump or compressor against the pressure in the receiver tank 5.

At any time that the pressure in the receiver tank 5 is high enough to cause unloading of the compressor, fluid will be supplied to the line 8 and the mechanism 6 will unload the compressor. Fluid is concurrently supplied to the cylinder 10 which is of considerably larger diameter than the cylinder 17. Accordingly, the larger piston 20 overcomes the force of the smaller piston 16 and the butterfly valve 13 is moved towards closed position to slow down the engine to an idling speed. It is therefore evident that should the compressor start with sufficient fluid pressure in the receiver tank 5 to unload the compressor, the butterfly valve 13 will be held at low speed position by the piston 20. If during the operation of the compressor, the compressor is unloaded, the butterfly valve 13 is immediately turned to reduced speed position.

While I have in this application specifically described one embodiment which my invention may take in practice, it will be understood that this form is shown for purposes of illustration and that the invention may be modified and embodied in various 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 a controlling mechanism for a compressor system comprising a compressor and an internal combustion driving engine therefor, in combination, a valve controlling the fuel supply to said engine, means operative on fluid supply thereto to unload a compressor and operative on release of fluid so supplied to permit reloading, pressure fluid operated means for moving said fuel supply controlling valve, means for controlling fluid supply and exhaust to said latter fluid operated means and to said means for unloading the compressor, and means responsive to the discharge pressure of the compressor for controlling said fuel supply controlling valve.

2. In a controlling mechanism for a compressor system having a driving motor, a compressor, and an unloader for the compressor, in combination, controlling means for the motor including a lever, a servo motor for actuating the same, said servo motor being supplied with pressure at compressor discharge pressure and having a spring adapted to yield in accordance with said receiver pressure, and means adapted to shift said lever to slow down said motor notwithstanding the action of the receiver pressure within said servo motor.

3. In a pumping mechanism the combination of a pump, a driving motor therefor, means adjustable to control the power of said motor, and controlling means for said last mentioned means including means responsive to the pressure against which the pump works and means exercising a superior controlling function when said pressure reaches a predetermined point.

4. In a pumping mechanism, the combination of a pump, a driving motor therefor, means adjustable to control the power of said motor, and controlling means for said last mentioned means including a plurality of controlling devices each actuated by the medium pumped, one exercising a graduated control varying with the pressure against which the pump works, another exercising its control only when a predetermined pressure is reached.

5. In a controlling mechanism for a compressor system comprising a compressor and an internal combustion driving engine therefor, in combination, a throttle controlling the fuel supply to said engine, a pressure fluid operated unloading device for said compressor, and a pair of pressure responsive devices operatively connected to said fuel supply throttle, one of said devices being subjected to compressor discharge pressure and the other being subjected to the pressure fluid supplied to said unloading device.

6. In a controlling mechanism for a compressor system comprising a compressor and an internal combustion driving engine therefor, in combination, means operative to automatically unload said compressor when the discharge pressure reaches a predetermined point, a controlling element having an area subjected to compressor discharge pressure for normally controlling movement of said element, a throttle for controlling the supply of fuel to said engine operatively connected to said element to be moved thereby, a spring cooperating with said element to oppose the action of such pressure, and superior controlling means for moving said element to close said throttle when said unloading means unloads said compressor.

7. In a controlling mechanism for a compressor system comprising a compressor and a prime mover for driving the same, in combination, means for controlling the sup-

ply of actuating medium to said prime mover, a pressure fluid operated unloading device for said compressor, and regulating means operatively connected to said actuating medium controlling means, said regulating means having a pair of surfaces, one of said surfaces being subjected to compressor discharge pressure and the other being subjected to the pressure fluid supplied to said unloading device.

8. In a controlling mechanism for a compressor system comprising a compressor and an internal combustion driving engine therefor, in combination, a throttle controlling the fuel supply to said engine, pressure fluid operated unloading means for said compressor, a pilot valve for automatically controlling the operation of said unloading means in accordance with variations in compressor discharge pressure, and regulating means operatively connected to said throttle comprising an element subjected to compressor discharge pressure, a spring cooperating with said element to oppose the action of such pressure, and means supplied with pressure fluid simultaneously with the supply of pressure fluid to said unloading means for moving said element to close said throttle.

9. In a controlling mechanism for a compressor system comprising a compressor and an internal combustion driving engine therefor, in combination, a valve controlling the fuel supply to said engine, fluid pressure operated unloading means for said compressor, a fluid pressure responsive device supplied with fluid at compressor discharge pressure for moving said valve towards open position, said device comprising a spring opposing the said opening motion, a second fluid pressure responsive device operatively connected to said valve for moving the same towards closed position, and a pilot valve for supplying pressure fluid to said second mentioned device and to said unloading means when the compressor discharge pressure reaches a predetermined point.

10. In a controlling mechanism for a compressor system comprising a compressor and a prime mover for driving the same, in combination, means for controlling the supply of actuating medium to said prime mover, regulating means operatively connected to said actuating medium controlling means and adapted to increase the supply of such medium in accordance with increase in compressor discharge pressure, a pilot valve responsive to compressor discharge pressure, and means controlled thereby for unloading said compressor and for taking control of said actuating medium control away from said regulating means.

11. In a controlling mechanism for a compressor system comprising a compressor and a prime mover for driving the same, in combination, a throttle controlling the prime mover, pressure fluid operated unloading means for the compressor, and means for regulating the position of the throttle comprising opposed actuators, one of said actuators being subjected to compressor discharge pressure, and a pilot valve automatically responsive to compressor discharge pressure to supply pressure fluid to said other actuator and to said unloading means.

12. In a controlling mechanism for a fluid compressing system having a driving motor and a compressor driven thereby, in combination, a valve for controlling supply of actuating medium to said motor, and pressure responsive means constituting the sole controlling means for said valve during normal operation and controlling the same solely in accordance with the compressor discharge pressure, increasing the valve opening as the compressor discharge pressure rises.

13. In a controlling mechanism for a fluid compressing system having a driving motor and a compressor driven thereby, in combination, a throttle valve for controlling supply of actuating medium to said motor, a pressure responsive device connected to said throttle valve and adapted to increase the throttle opening as the pressure acting on said device increases, said throttle valve being solely under the control of said device during normal effective operation of the compressor, and means for continuously subjecting said device to compressor discharge pressure.

14. In a controlling mechanism for a compressor system having a driving motor, a compressor driven thereby and a receiver, in combination, means for controlling the power supply to said motor, a pressure responsive device connected to said control means, yielding means acting against said pressure responsive device tending to move said power supply control means to slow speed position, and means for subjecting said pressure responsive device to receiver pressure to act against said yielding means and increase the power input to said motor as the receiver pressure rises, said power control means being solely under the control of said device during normal operation of the compressor.

15. In a compressor controlling mechanism, the combination with a compressor, and a driving motor therefor, of controlling means for the motor including a lever, a servo motor for actuating the same, said servo motor comprising an actuating element attached to said lever, yielding means tending to hold said lever in slow speed position, and means subjected to compressor discharge pressure acting against said yielding means for moving said actuating element and motor control means away from slow speed position in accordance with the increase in compressor discharge pressure, and superior control means adapted to shift said lever to slow

speed position notwithstanding the pressure acting on said device.

16. In a controlling mechanism for a compressor system having a driving motor, a compressor driven thereby, an unloader for the compressor and a receiver, in combination, controlling means for the motor including a pair of pressure fluid motors, each of said pair of pressure fluid motors comprising a cylinder and a piston, said pair of pressure fluid motors having their pistons opposed, one of said cylinders having a connection under receiver pressure and the other cylinder having a connection with the unloader, the second mentioned cylinder being of larger cross section than the other cylinder.

17. In a controlling mechanism for a compressor system comprising a compressor, and a driving motor therefor, in combination, means adjustable to control the power of said motor, a controlling device for said last mentioned means comprising an element subjected to and actuated by compressor discharge pressure for increasing the power of said motor as the compressor discharge pressure rises, a spring opposing the action of fluid pressure on said element, and a superior controlling device for rendering said first mentioned device ineffective to increase the power of said motor.

18. In combination, in a fluid pumping system, a driving motor, a pump driven thereby, a source of power medium for the motor, a controlling device for directly controlling the power medium supplied to the motor arranged between said motor and said source and movable to different positions to permit the flow of power medium to the motor at different rates suited to different loads upon the motor, a pressure responsive device connected to said controlling device and arranged to move the latter, as the pressure on said pressure responsive device increases, progressively to positions providing for higher and higher rates of power medium flow to said motor and to maintain said controlling device continuously in each of the several positions to which it moves it, so long as the pressures to which said positions respectively correspond remain unchanged, and means for continuously subjecting said pressure responsive device to the pressure against which said pump operates, whereby it is directly responsive in its movements to the pressure against which the pump operates.

19. In a controlling mechanism for a fluid compressing system having a driving motor and a compressor driven thereby, in combination, a valve for controlling the supply of actuating medium to said motor, and means including means graduatedly responsive to a wide range of compressor discharge pressures between a comparatively low pressure substantially below the minimum desired normal discharge pressure and normal line pressure, for governing the position of said valve, causing opening of the latter progressively as compressor discharge pressure rises, the position of said valve being independent of the phases of the cycle of the driving motor.

In testimony whereof I affix my signature.

ARTHUR W. PHILLIPS.