

Nov. 22, 1927.

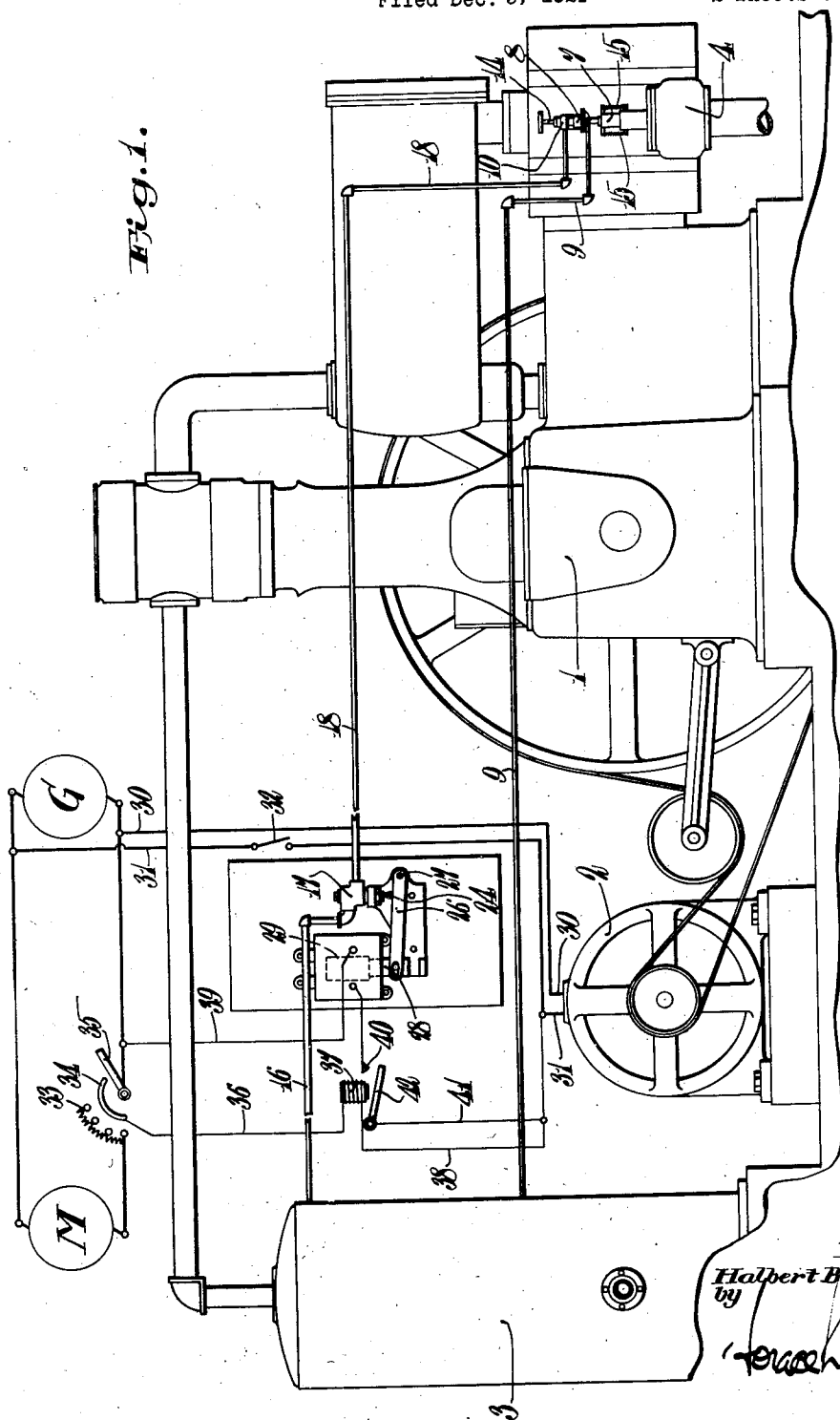
1,649,898

H. B. HALVORSEN
PLANT CONTROLLING SYSTEM

Filed Dec. 3, 1921

2 Sheets-Sheet 1

Fig. 1.



Inventor:
Halbert B. Halvorsen.
by *[Signature]*
att'y.

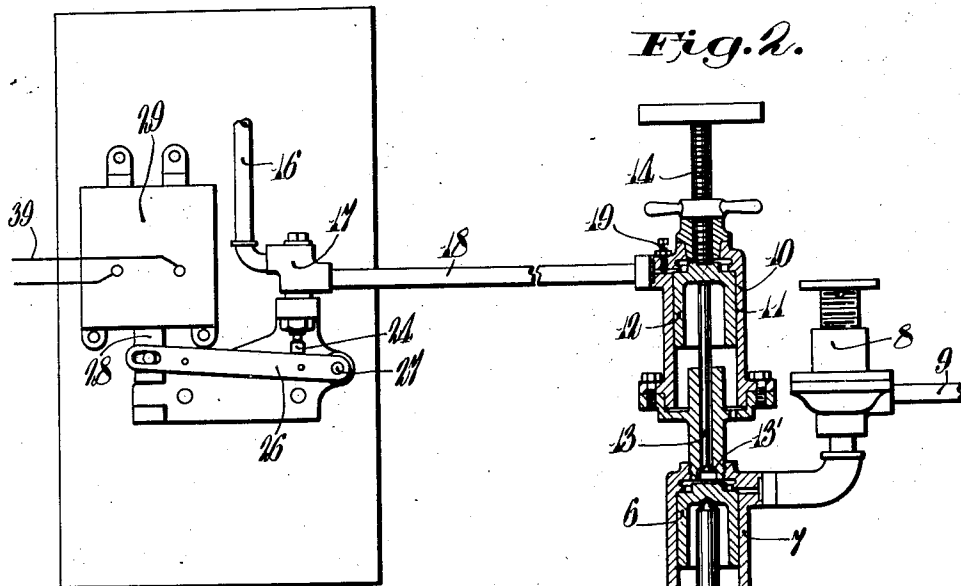
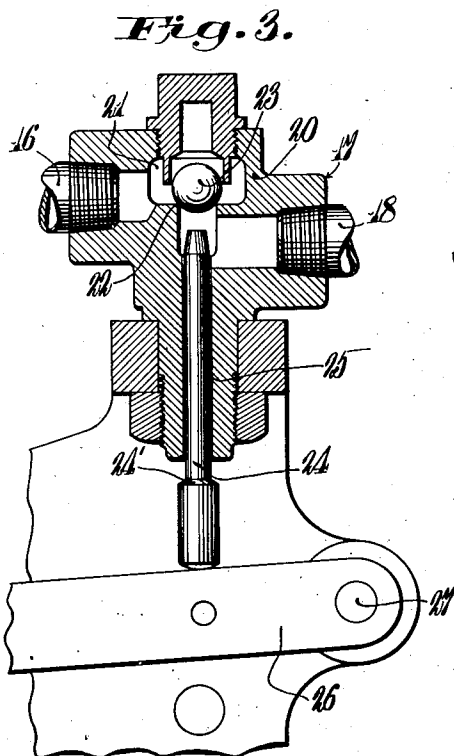
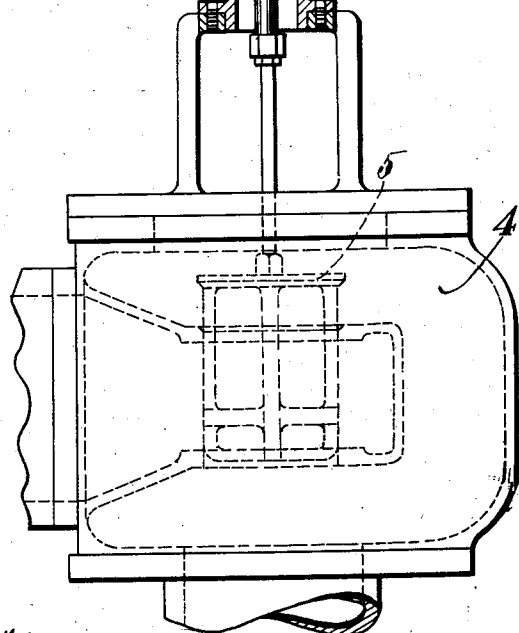
Nov. 22, 1927.

1,649,898

H. B. HALVORSEN
PLANT CONTROLLING SYSTEM

Filed Dec. 3, 1921

2 Sheets-Sheet 2



Inventor:
Halbert B. Halvorsen.
by

Ernest L. Locks

Att'y.

Patented Nov. 22, 1927.

1,649,898

UNITED STATES PATENT OFFICE.

HALBERT B. HALVORSEN, OF CHICAGO, ILLINOIS, ASSIGNOR TO SULLIVAN MACHIN-
ERY COMPANY, A CORPORATION OF MASSACHUSETTS.

PLANT-CONTROLLING SYSTEM.

Application filed December 3, 1921. Serial No. 519,861.

My invention relates to plant controlling systems and more particularly to compressor controlling systems and especially to systems including compressors as an adjunct to a plant in which other prime movers make intermittent relatively large demands upon the source of power.

An object of my invention is to provide an improved system of control for plants including continuously and intermittently operating units. Another object of my invention is to provide an improved compressor controlling mechanism adapted to unload a compressor at such times as other power consuming devices drawing their power medium from the same source as the compressor driving motor are in operation. A further object of my invention is to provide an improved compressor controlling mechanism adapted to unload the compressor at such times as other power consuming devices drawing their power medium from the same lines as the compressor driving motor are in operation and automatically operating to reload the compressor as soon as the demand for current by such other devices ceases. Other objects of my invention will hereinafter more fully appear.

In the accompanying drawings I have shown for purposes of illustration one form which my invention may assume in practice.

In these drawings,—

Fig. 1 is a side elevation of a compressor including system operating in accordance with my invention, certain parts being shown diagrammatically.

Fig. 2 is a detail on an enlarged scale with parts shown in central vertical section to illustrate structural features.

Fig. 3 is another detail in central vertical section on a still larger scale and of a different part from that shown in section in Fig. 2.

In the illustrative embodiment of my invention I have shown the same employed in connection with a power plant in which there is comprised a compressor 1 driven by an electric motor 2 and discharging to a receiver 3. The intake of the compressor is provided with an intake unloading valve mechanism 4 of a well known form, this mechanism comprising a valve proper 5 which is adapted to be closed by a piston 6 reciprocating in a cylinder 7 when receiver pressure rises above a predetermined desired maximum, the receiver pressure under those

conditions being sufficient to open a pilot valve 8 of the well known Judson type, (see the patent to Osborne, 1,141,975) and accordingly supply fluid through a pipe connection 9 to act upon the piston 6. When the receiver pressure falls to a predetermined desired minimum, the pilot valve will interrupt the supply of air to act upon the piston 6 and will open a suitable vent in a well known manner. Arranged in alinement with the cylinder 7 is a supplemental cylinder 10 having a bore 11 in which a piston 12 is reciprocable, this piston being adapted to exert a pressure upon a rod 13 whose lower end may engage the upper surface of the piston 6 and force it downward under conditions hereinafter described. As the rod 13 has a loose sliding fit in its guide, air from the lower cylinder 7 might escape through the lower end of cylinder 10. To prevent this the lower end of rod 13 is formed into a valve head 13' and closes communication between cylinders 7 and 10 when in uppermost position. A suitable adjustable stop 14 serves to limit the possible upward movement of the piston 12 in its cylinder. It will be noted from Fig. 1 that springs 15 automatically raise the piston 6 and accordingly the piston 12 as soon as the pressure acting to hold either of these pistons in depressed position is relieved. For the purpose of conducting operating fluid to the cylinder 11, a connection 16 leads from the receiver to a second pilot valve 17 and thence by way of a line 18 to the top of the cylinder 11, a suitable adjustable needle valve 19 controlling the rate of flow to the latter.

Referring to Fig. 3, it will be noted that the pilot valve 17 comprises a housing 20 having therein a ball valve receiving chamber 21. Within the chamber 21 there is arranged a valve seat 22 upon which a ball valve 23 may seat. The pipe 16 communicates with the chamber 21 above the seat 22 and pipe 18 with said chamber below the ball valve 23. Accordingly, it will be evident that the ball valve must be unseated in order that fluid pressure may flow to the auxiliary unloading mechanism 10. For the purpose of unseating the valve 23, a plunger 24 is arranged in alinement therewith, there being a sufficient clearance between the periphery of the plunger 24 and the wall of the guiding passage 25 formed in the housing 20 in which it is reciprocable

to permit, after seating of the valve 23, the leaking away of the pressure from above the piston 12. This plunger is provided at its lower end with a head 24' adapted to close the passage 25 when the ball 23 is unseated. A lever 26 is pivoted upon the stationary pivot 27 to one side of the lower end of the plunger 24 and this lever is adapted to raise the plunger and open the valve under certain conditions hereinafter described, the free end of the lever being loosely connected to the core or armature 28 of a solenoid 29 in order that the supply of current to the solenoid may cause raising of the lever 26 and opening of the ball valve.

It will be noted that the motor 2 receives current by way of wires 30 and 31 from a generator G, the wire 31 being controlled by a suitable switch herein shown simply as a knife switch 32. It will be obvious, however, that both wires 30 and 31 may be controlled by a double blade switch, or any different type of switch used in the wire 31 if desired, a regular starting box being preferred in practice. Also adapted to be operated by current supply from the generator G is a motor M which may be any other electrically operated prime mover of such size as to draw heavily upon the mains connected with the generator G, for example, a hoist operating motor. The control of current supply to the motor M is controlled by the starting box 33, and cooperating with the controller lever 35 thereof is a sector made of conducting material 34 which is adapted to be contacted by the lever 35 before the first point in the controller 33 is reached. The contact member 34 is connected by a wire 36 with the time relay 37 which is likewise connected by a wire 38 with the line 31. The function of the time relay is to prevent rapid unloading and re-loading of the compressor in case the motor M is an elevator or hoist motor and the control circuit is opened and closed rapidly as might be the case on making an even stop at a floor. It will further be noted that one of the mains from the generator G, herein the one to which the wire 30 is connected is likewise tapped by a wire 39 which connects to the magnet 29 and then to a stationary contact 40. A wire 41 leads from the wire 31 to a member 42 which is adapted when current is supplied to the magnet 37 to close a circuit through magnet 29 by contact with the contact member 40. If a time relay were not needed the parts 37 and 42, 40 could be omitted and the circuit changed by connecting 31 to the left hand connection on 29 and the wire 39 to the sector 34.

The mode of operation of this illustrative mechanism will be readily apparent. Assume that the switch 32 is closed and that the motor 2 is driving the compressor which is loaded at the time. It will be evident

that in a large size compressor a considerable quantity of current may be drawn from the power mains by the motor 2. Assume then that it is desired to start the motor M and that this motor also will draw heavily upon the mains and in fact so heavily that for any one of numerous reasons it is desirable not to have the combined full load current consumption of the motors M and 2 simultaneously drawn from the mains. When the controlling lever 35 is moved around to start up the motor M, it will first close the circuit through the contact 34, wire 36, magnet 37, wire 38, and wire 31 and so energize the magnet 37. This will at once raise the member 42 and close the circuit through the magnet 29 by way of wire 39, contact 40, contact lever 42, wire 41 and wire 31. The energization of the magnet 29 will cause the lifting of the plunger 28 and the swinging of the lever 26 about its pivot 27 with the resultant lifting of the plunger 24 and opening of the valve 23. Air will promptly be supplied from the receiver through pipes 16 and 18 to act upon the upper piston 12 and, by closure of the intake controlling valve 5, unload the compressor. Any suitable means, as for example, a dash pot, may be provided to retard the movement of the controller handle 35 sufficiently to permit the unloading of the compressor before the motor M is started. It will be evident, however, that the motor M and the motor 2 will not draw simultaneously upon the lines for more than an instant at full load capacity in any event. When the compressor has been unloaded, the current consumption of the motor 2 will drop to a very small percent of its full load demand and accordingly the current consumed in the plant will be largely reduced. It will be evident that when the motor 2 is not in operation the various control mechanisms will be inoperable and so no current will be wasted.

It must be understood that this system of control could be employed equally well with a steam driven plant, or in fact, practically any plant wherein the available motive power is limited, and might even be used where a compressor and some other load were arranged to be driven by a single prime mover, e. g. whereby the compressor might be still turned over unloaded while the other load was on the prime mover. Again, for example, assuming a steam plant with limited boiler capacity, steam driven compressors and steam driven hoist, it will be evident that the opening of the throttle in the main steam line to the hoist engine would be caused to admit steam directly to the piston 12 and so unload the compressor driving engine. Then, the latter being provided with a control mechanism of the well known Conrader or Wineman types would at once have its steam consumption reduced

to a minimum, until the compressor was reloaded when it would again resume full operation.

While I have in this application specifically described one embodiment which my invention may assume in practice, it will be understood that this form of the same has been 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 power system, a plurality of prime movers, a source of power medium ample for the simultaneous full load operation of all of said prime movers, means for connecting said prime movers with said source capable of transmitting such medium thereto in quantity adequate for simultaneous full loaded operation thereof, and means automatically operative to effect a substantial reduction in the consumption of power medium by one of said prime movers when another is started.

2. In a power system, a source of power medium, a plurality of prime movers arranged to be driven thereby and having separate loads, and means automatically operative to throw off the load of one of said prime movers when the other is started.

3. In a power system, a compressor, unloading means therefor, another load, means for driving said compressor and load, and means for automatically causing said unloading means to unload the compressor throughout any rate of driving of the other load whereby to preclude the compressor load and the other load being carried at the same time by the power system.

4. In a power system, a compressor, unloading means therefor, another load, means for driving said compressor and load, means for initiating the driving of said load independently of the driving of said compressor and means controlled by said last mentioned means to unload the compressor.

5. In an electrically driven power system, a generator, a plurality of motors both of which receive their operating current from said generator and one of which is intermittently operable, a compressor driven by another of said motors, and means for unloading said compressor when said first mentioned motor is started.

6. In an electrically driven power system, a generator, a plurality of motors both of which receive their operating current from said generator and one of which is intermittently operated, a variable load driven by another of said motors, and means for reducing said load to a minimum when said first mentioned motor is started, said means comprising a control circuit which is opened

when said second mentioned motor is stopped.

7. In a power system, a source of power medium, a plurality of prime movers arranged to be driven thereby, and means automatically operative to effect a reduction in power medium consumption by one of said prime movers whenever the other is started including a control system controlled by the state, as to operation, of both prime movers.

8. In a power system, a source of power medium, a plurality of prime movers arranged to be driven thereby, controlling means for each of the same, and means automatically operative to effect a reduction in power medium consumption by one of said prime movers when the other is started including a control system controlled by the controlling means for each of said prime movers.

9. In an electrically driven power system, a generator, a plurality of motors both of which receive their operating current from said generator and one of which is intermittently operable, a compressor driven by another of said motors, and means for unloading said compressor when said first mentioned motor is started, said means comprising a control circuit which is opened when said compressor driving motor is stopped.

10. In a power system, a source of power medium, a plurality of prime movers operable thereby, a compressor driven by one of said prime movers, another of said prime movers being intermittently operable, a receiver, receiver pressure controlled means for loading and unloading said compressor, and means for unloading said compressor operative upon starting of said second mentioned prime mover.

11. In a power system, a source of power medium, a plurality of prime movers operable thereby, a compressor driven by one of said prime movers, another of said prime movers being intermittently operable, a receiver, receiver pressure controlled means for loading and unloading said compressor, and means for unloading said compressor operative upon starting of said second mentioned prime mover, said means being operative to maintain said compressor unloaded until said second mentioned prime mover is stopped.

12. In a power system, a source of power medium, a plurality of prime movers operable thereby, a compressor driven by one of said prime movers, another of said prime movers being intermittently operable, a receiver, receiver pressure controlled means for loading and unloading said compressor, and means for unloading said compressor operative upon starting of said second mentioned prime mover, said means being operative to maintain said compressor unloaded

until said second mentioned prime mover is stopped and comprising a member cooperating with said unloading means.

13. In an unloading mechanism for compressors, a compressor intake controlling valve, and a plurality of automatically operable means for actuating the same.

14. In combination, a plurality of power means, a compressor driven by one of said means, and a compressor controlling mechanism comprising an intake controlling valve, receiver pressure responsive means for controlling the same, and means for controlling the same operated upon starting one of said means.

15. In combination, a plurality of power means, a compressor driven by one of said means, and a compressor controlling mechanism comprising an intake controlling valve, receiver pressure responsive means for controlling the same, and means for controlling the same operated upon starting of the other of said power means.

16. In a compressor controlling mechanism, an intake controlling valve, a plurality of cylinders in axial alinement therewith, a plurality of alined pistons in said cylinders, and means for supplying operating fluid to each of said pistons, either of said pistons being operative to control said unloading valve.

17. In a compressor controlling mechanism, an intake controlling valve, a pair of alined cylinders, pistons therein, means for supplying operating fluid to said pistons, means for transmitting movement of one of said pistons to the other thereof, and means for transmitting the movement of the latter piston to said intake controlling valve.

18. In an unloading mechanism for compressors, a compressor intake controlling valve, and a plurality of fluid pressure operated means for actuating the same.

19. In an unloading mechanism for compressors, a compressor intake controlling valve, and a plurality of fluid pressure operated means for actuating the same, one of which means is controlled by compressor discharge pressure.

20. In combination, a source of operating medium, a motor adapted to be driven thereby, means for controlling the driving of said motor by said medium, a second motor adapted to be driven by said operating medium, a compressor driven by said second motor, an intake controlling valve associated with said compressor, and a plurality of means for actuating said intake controlling valve respectively controlled by compressor discharge pressure and by said controlling means.

21. In an electrically driven power system, a generator, a plurality of motors, one of

which is intermittently operable, a compressor driven by another of said motors, and means for unloading said compressor when said first mentioned motor is started including means for preventing instantaneous reloading thereof if said first mentioned motor is immediately stopped after its starting.

22. In combination, a motor, a compressor, and means for unloading said compressor, said means being automatically electrically actuated upon starting of said motor to cause unloading of said compressor.

23. In a compressor system, a compressor, a driving motor therefor, another motor, and means whereby when said latter motor is started the output of said compressor is diminished.

24. A compressor system comprising a plurality of load carrying elements, driving means therefor capable on adequate supply of power medium of driving all of said elements simultaneously, and means automatically operative to preclude more than one of said loads being carried at a time notwithstanding an availability of operating medium for said driving means adequate to permit the latter to drive said load carrying elements simultaneously.

25. A compressor system comprising a plurality of load carrying elements, driving means therefor capable on adequate supply of operating medium of driving all of said elements simultaneously, and means automatically operative whenever one of said loads is applied to preclude the application of the other notwithstanding an availability of operating medium for said driving means adequate to permit the latter to drive said load carrying elements simultaneously.

26. A compressor system comprising a plurality of load carrying elements, driving means therefor, capable on adequate supply of operating medium of driving all of said elements simultaneously, and means for automatically relieving the load of one of said elements during continuous driving thereof whenever the other of said loads is applied, notwithstanding an availability of operating medium for said driving means adequate to permit the latter to drive said load carrying elements simultaneously.

27. A compressor system comprising a compressor having a controlling valve, a fluid pressure receiver and electrical means associated therewith, and means for actuating said valve including means associated with both the fluid pressure receiver and the electrical means and adapted to be controlled either by the pressure in said receiver or by said electrical means.

In testimony whereof I affix my signature.
HALBERT B HALVORSEN.