April 13, 1926. 1,580,433

F. D. HOLDSWORTH

COMPRESSOR CONTROLLING MECHANISM

Original Filed Sept. 18, 1916

Fig. 1.

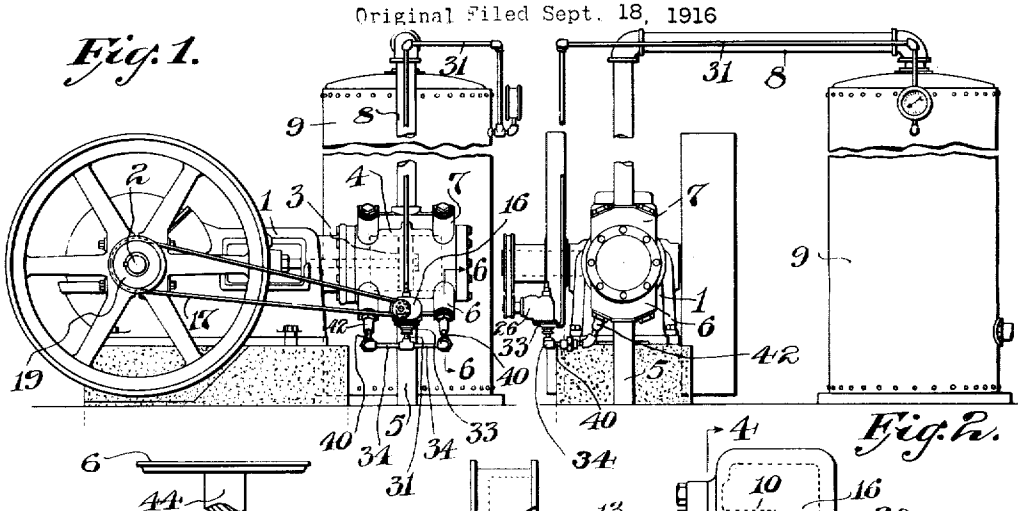


Fig. 2.

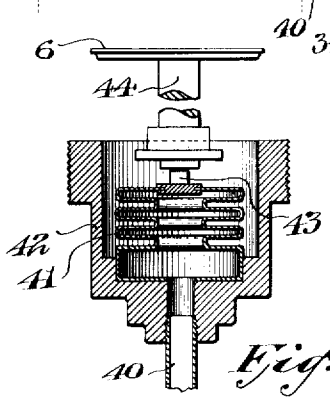


Fig. 6.

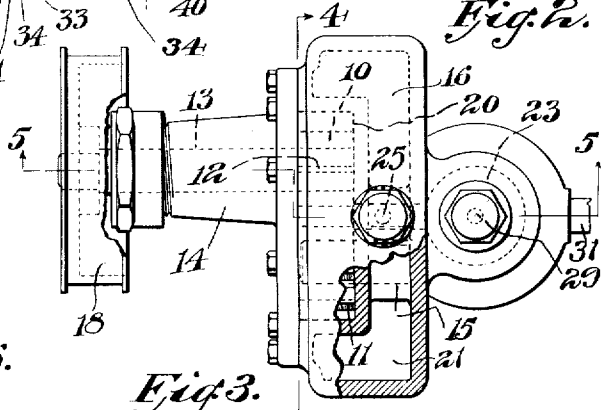


Fig. 3.

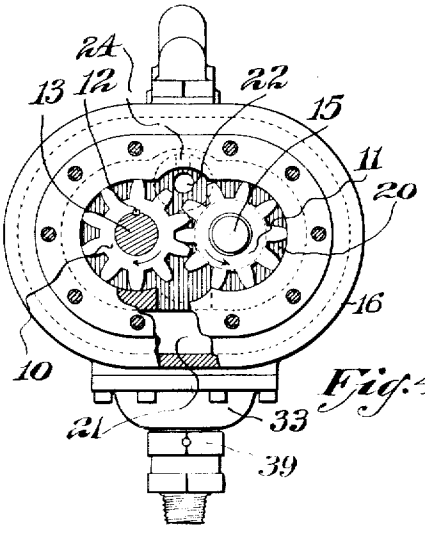


Fig. 4.

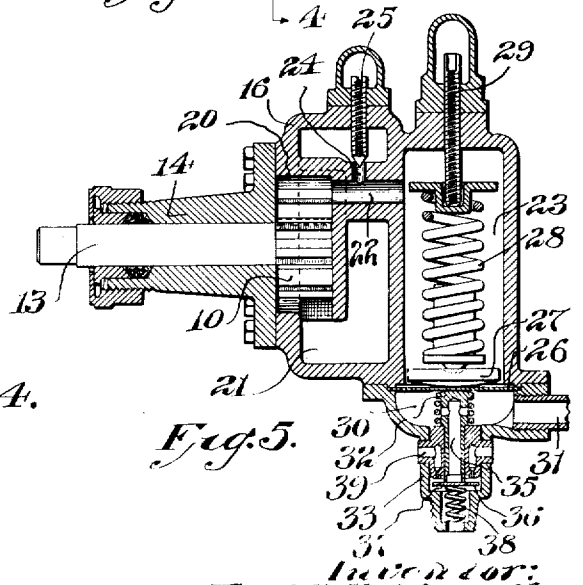


Fig. 5.

Inventor:
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Patented Apr. 13, 1926. 1,580,433

UNITED STATES PATENT OFFICE.

FRED D. HOLDSWORTH, OF CLAREMONT, NEW HAMPSHIRE, ASSIGNOR TO SULLIVAN MACHINERY COMPANY, A CORPORATION OF MASSACHUSETTS.

COMPRESSOR-CONTROLLING MECHANISM.

Application filed September 18, 1916, Serial No. 120,779. Renewed June 15, 1923.

To all whom it may concern:

Be it known that I, FRED D. HOLDSWORTH, a citizen of the United States, residing at Claremont, in the county of Sullivan and State of New Hampshire, have invented certain new and useful Improvements in Compressor-Controlling Mechanism, of which the following is a full, clear, and exact specification.

My invention relates to compressor controlling mechanism.

It has for its object to provide an improved means for loading and unloading a compressor, whereby when the compressor has been brought up to speed by its driving means, the compressor is automatically loaded, and whereby when the speed of the compressor drops below a predetermined limit, the compressor is automatically unloaded. A more specific object of my invention is to provide improved means for operating the inlet valves of a compressor adapted to perform the functions indicated.

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

In these drawings,—

Figure 1 is a side elevation of a compressor equipped with my improved controlling mechanism.

Figure 2 is an end elevation of the same.

Figure 3 is a plan view of the pump, a part of the casing being broken away to facilitate illustration.

Figure 4 is a sectional view taken on line 4—4 of Figure 3, the casing herein also being shown as broken away.

Figure 5 is a sectional view taken on line 5—5 of Figure 3, the driving pulley being omitted.

Figure 6 is a sectional detail taken on line 6—6 of Figure 1 and with parts omitted.

In the illustrative construction shown, a compressor 1, which may be of any suitable design, is driven by a driving shaft 2, herein the compressor crank shaft, adapted to be rotated by any suitable source of power, as, for instance, a motor, in such a manner as to cause the reciprocation of the compressor piston 3 in its cylinder 4 and thereby cause air to be sucked in from the compressor inlet 5 through the usual inlet valves 6 and discharged through the usual discharge valves 7 to a pipe 8 leading to the receiver 9.

In my improved construction, a pump is connected to the compressor and acts as the means for controlling the loading and unloading of the same. As shown, this pump includes meshing pinions 10 and 11, one of which is fixed, as by a spline 12, on a shaft 13 mounted in a suitable bearing 14, while the remaining pinion is rotatable on a stud 15 carried on the pump casing 16. While any suitable means for driving these elements may be employed, a belt 17 is herein shown to be extended around a pulley 18 fixed to the shaft 13, and a pulley 19 fixed to a driving shaft, herein the compressor shaft 2, so that as the shaft 2 is rotated, the shaft 13 will be rotated to rotate the pinions 10 and 11. As shown, these pinions are housed in a chamber 20 in the casing 16, and this chamber 20 communicates at its bottom with an oil or other fluid reservoir 21, and at its top with a passage 22 extending into a rearwardly disposed chamber 23 and also communicating with the reservoir 21 through a port 24 controlled by a suitable adjustable controlling valve 25 operable from the exterior of the casing. In the chamber 23 is, in turn, located a diaphragm 26 held normally under pressure by a disc 27 and a coiled spring 28 acting on the disc and having its tension adjustable by a usual bolt and nut connection 29 operable from the exterior of the casing in a well known manner. Obviously, due to this construction, as the motor or other compressor driving element is brought up to speed and the speed of the compressor is correspondingly increased, the pinions 10 and 11 will be constantly rotated and thereby caused to pump the oil or other fluid out of the reservoir 21 through the passage 22 into the chamber 23 in such a manner as to assist the spring 28 and depress the diaphragm 26. As shown, on the opposite side of this diaphragm is provided a chamber 30 connected through a pipe 31 with the receiver 9 and carrying within the same a spring pressed plunger 32 of any well known construction of pilot valve 33, adapted to control the connection between the receiver 9 and pipes 34 which lead beneath the inlet valves 6 of the compressor. As shown herein, this plunger is provided with a branched passage

35 through which the pressure from the receiver may act on a disc 36 in turn having apertures 37 therein and normally held elevated by a spring 38 in such a manner that the passage 35 is closed and that the apertures 37 and the annular space around the disc 36 form communicating elements between passages 39, leading to the atmosphere, and the pipes 34, leading to the inlet valves. As illustrated herein, these pipes 34, however, are not themselves directly connected to these valves but are instead connected to cooperating pipes 40 which in turn deliver into upstanding, corrugated, longitudinally expansible, diaphragm members 41 (Fig. 6) enclosed in suitable protecting casings 42 and adapted when the receiver pressure is admitted into the pipes 34, 40, to expand and carry upward suitable plungers 43 attached thereto, to raise the suction valve stems 44.

In the operation of my improved construction, it will be apparent that as the speed of the motor or other compressor driving element is increased toward the desired limit, the speed of rotation of the pinions 10 and 11 will be proportionately increased. Thus, through the action of the pump the pressure of the oil or other fluid within the chamber 23 will cooperate with the spring pressure normally acting upon the upper surface of the diaphragm 26 and will cause that diaphragm to be depressed and thereby depress the pilot valve plunger 32 in such a manner as to shut off communication between the receiver and the pipes 34, 40, and cause the pilot valve to exhaust the pressure in those pipes in a well known manner. Thereupon, the inlet valves 6 will seat, and the compressor will be loaded. Conversely, when the speed of the motor or other driving element decreases, the pressure upon the upper surface of the diaphragm 26 will be decreased to such an amount that it is insufficient to overcome the receiver pressure acting on the opposite side of the diaphragm, whereupon the pilot valve will be opened to permit the receiver pressure to pass again to the valves 6 and open the same to unload the compressor. Obviously, by the provision of the adjustable valve 25, the pressure exerted on the diaphragm 26 by the constantly operating pump, may be regulated as desired, the valve being adjustable to divert back to the reservoir any desired proportion of the flow necessary or desirable to maintain a predetermined pressure on the diaphragm.

While I have in this application specifically described one embodiment which my invention may assume in practice, it is to be understood that the form shown herein is used only for purposes of illustration and that the invention may be modified to assume various forms without departing from its spirit, it being my intention to include all such modifications within the scope of the appended claims.

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

1. In combination, a positively operated liquid circulating system, a fluid pressure operated unloading means, and a controlling valve for said means controlled by the liquid pressure in said system.

2. In combination, a compressor driving shaft, a pump driven thereby, a liquid circulating system operated by said pump, a fluid pressure operated unloading means, and a controlling valve for said means controlled by the liquid pressure in said system.

3. In combination, a compressor, a driving shaft, a pump driven thereby, and air actuated means controlled by said pump whereby said compressor is adapted to be loaded when the latter is driven at a predetermined speed.

4. In combination, a compressor, a driving shaft, a pump driven thereby, and air actuated means controlled by said pump whereby said compressor is adapted to be unloaded when the speed of the latter is reduced to a predetermined point.

5. In combination, a compressor having a driving shaft, a pump driven thereby, and means operative to effect unloading of said compressor independently of said pump, said means being controlled by said pump for causing loading of said compressor when it approaches full speed and for effecting unloading thereof when the speed falls substantially below the speed at which loading occurs.

6. In combination, a driving shaft, a compressor cylinder, a compressor piston driven by said shaft, an inlet valve for said cylinder, a pump driven by said shaft, and means controlled by said pump for causing said inlet valve to be held open when said shaft is rotating below a given speed and for permitting said inlet valve to function when said speed exceeds a predetermined rate and also operative to permit said valve to be inoperative at speeds greater than said given speed independently of said pump.

7. In combination, a driving shaft, a compressor connected thereto, a pump driven by said shaft, a fluid pressure unloading means for said compressor, said means including a pressure actuated member controlling the loading of said compressor and means for varying the pressure developed by said pump.

8. In combination, a driving shaft, a compressor connected thereto, a pump adapted to be driven at constant speed by said shaft, means including a pressure actuated diaphragm controlling the loading of said compressor, and means for maintaining a constant pressure on said diaphragm during

said constant speed operation of the pump and during unloading of said compressor.

9. In combination, a driving shaft, a compressor connected thereto, a pump adapted to be driven at constant speed by said shaft, unloading mechanism for said compressor including a diaphragm controlled by said pump, means whereby said pump pressure is adapted to be opposed by another fluid pressure, and means for maintaining a constant circulation through said pump and a constant pressure on said diaphragm during said constant speed operation of the pump.

10. In combination, a compressor, an inlet valve therefor, a receiver connected to said compressor and said inlet valve, a pump, and means operable when said pump is operated at a predetermined speed and controlled thereby controlling the connection between said receiver and said inlet valve.

11. In combination, a compressor, an inlet valve therefor, a longitudinally expansible member engageable with said valve, a receiver connected to said compressor and said member, a positively acting liquid pressure generating means, and an automatically acting means controlled by said liquid pressure for controlling the flow of pressure fluid from said receiver to said valve engaging member.

12. In combination, a compressor, an inlet valve therefor, a longitudinally expansible diaphragm member engageable with said valve, a receiver connected to said compressor and said member, and means controlling the flow of pressure fluid from said receiver into said valve engaging member responsive to variations in speed of said compressor.

13. In combination, a compressor, an inlet valve therefor, a plurality of cooperating rotating pump elements, a casing enclosing the latter, and means responsive to the pressure developed in said casing by said pump elements for controlling said inlet valve when said elements are driven at a predetermined speed.

14. In combination, a compressor, an inlet valve therefor, a plurality of cooperating rotating pump elements, a casing enclosing the latter, means in said casing responsive to the pressure developed therein by said pump elements for loading said compressor when said pump elements are driven at a predetermined speed, and means for thereafter maintaining constant the pressure developed by said elements while the latter are driven at said speed.

15. In combination, a compressor, an inlet valve therefor, a plurality of meshing piston gears, a casing enclosing said gears having a reservoir disposed adjacent said gears and a communicating chamber, means in said chamber for actuating said inlet valve when said gears are rotated at a predetermined speed, and an adjustable valve controlling the connection between said reservoir and said chamber.

16. In combination, a compressor, an inlet valve therefor, a plurality of meshing piston gears, a driving connection between one of said gears and said compressor, a casing enclosing said gears having a chamber communicating with the space around said gears, a receiver, a connection between the same and said inlet valve, a diaphragm controlled valve in said chamber controlling said connection, and means for controlling the pressure developed in said chamber by said gears.

17. In combination, a compressor, inlet valves therefor, fluid pressure operated means cooperating with said valves in effecting loading and unloading of the compressor, a diaphragm controlled valve for controlling the fluid pressure means, a liquid circulating system for controlling the diaphragm operated valve, and means for varying said last named controlling means.

18. In combination, a compressor, inlet valves therefor, fluid pressure operated means cooperating with said valves in effecting loading and unloading of the compressor, a diaphragm controlled valve for controlling the fluid pressure means, a liquid circulating system for controlling the diaphragm operated valve, means for varying said last named controlling means, and a separate means for controlling the diaphragm operated valve.

19. In combination, a compressor, inlet valves therefor, fluid pressure operated means cooperating with said valves in effecting loading and unloading of the compressor, a diaphragm controlled valve for controlling the fluid pressure means, a liquid circulating system for controlling the diaphragm operated valve, means for varying said last named controlling means and a resilient means for controlling the diaphragm operated valve.

20. The combination with a fluid compressing means and driving means therefor, of means having a plurality of fluid actuating surfaces operative to effect loading of said fluid compressing means when subjected to a fluid pressure variation of a predetermined intensity, and means driven by one of said two first mentioned means for producing the requisite fluid pressure variation at a time when the driving speed of said fluid compressing means reaches a predetermined desired rate.

21. The combination with a fluid compressing means and driving means therefor, of means operative to effect loading of said fluid compressing means when subjected to a fluid pressure variation of a predetermined intensity, means driven by one of said two first mentioned means for producing the requisite fluid pressure variation when the

speed of said fluid compressing means attains a predetermined rate, and means for varying the responsiveness of said third mentioned means to fluid pressure variations whereby a pressure variation of a different predetermined intensity may effect loading of the fluid compressing means at a different driving speed.

22. The combination with a fluid compressing means and driving means therefor, of fluid pressure means for controlling said compressor means, means operative to control said fluid pressure means to effect loading of said fluid compressing means when subjected to a fluid pressure variation of a predetermined intensity, means driven by one of said two first mentioned means for producing the requisite fluid pressure variation at a time when the speed of said fluid compressing means reaches a predetermined desired amount, and means governing said pressure variation producing means whereby the requisite fluid pressure variation may be produced at a different driving speed of said fluid compressing means.

23. The combination with a compressor having suction operated inlet valves and fluid operated unloading mechanism cooperating with said valves whereby they may be held open, of means for controlling said unloading mechanism including a pump driven during running of said compressor.

24. In combination, a compressor having suction operated inlet valves, a driving shaft, a pump driven by said driving shaft, and means controlled by said pump for effecting loading of said compressor when the latter is driven at a predetermined speed, said latter means also being operable independently of said pump.

25. In combination, a compressor having suction operated inlet valves, a driving shaft, a pump driven thereby, and means having a plurality of fluid pressure actuating surfaces controlled by said pump for unloading said compressor when the speed of the latter is reduced to a predetermined point.

26. In combination, a power driven compressor, a fluid pump driven with said compressor, a fluid container fed by said pump, means for permitting the escape of fluid so that the pressure of the fluid is dependent upon the speed of the pump, and means adapted to be movable against fluid pressure during initial actuation thereof dependent upon fluid pressure for controlling the loading of said compressor.

27. In combination, a compressor, a fluid pump connected to said compressor, a chamber having a wall movable simultaneously with and against fluid pressure, means whereby the movements of said wall control the loading of said compressor, a passageway connecting the pump and chamber, and a leakage port for said passageway of constant area.

28. In combination, a compressor, unloading means for said compressor, and means actuated jointly by the pressure of the air delivered by the compressor and the speed of the compressor and including a pump driven when the compressor is running for actuating the compressor unloading means.

29. In combination, a member adapted to constitute a load, said means including an element actuated by fluid pressure acting on opposite sides thereof for a driving motor, pressure generating means driven with said load constituting means, and means whereby the pressure generated by said pressure generating means causes the application of the load.

30. In combination, driven means adapted to constitute a load for a driving motor, said driven means being operable in loaded or unloaded condition, a pressure generating system driven with said driven means, and means whereby the pressure generated may cause the loading of said driven means upon the elapse of a predetermined interval after the starting thereof, said means also actuatable by another fluid pressure for unloading said compressor.

31. The combination comprising a compressor having unloading mechanism, a pilot valve therefor, and means for controlling said valve by liquid pressure.

32. The combination of a compressor having fluid operated unloading mechanism, a receiver, means for controlling the unloading of said compressor directly by receiver pressure fluid, and hydraulic actuated means for controlling said latter means.

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FRED D. HOLDSWORTH.

speed of said fluid compressing means attains a predetermined rate, and means for varying the responsiveness of said third mentioned means to fluid pressure variations whereby a pressure variation of a different predetermined intensity may effect loading of the fluid compressing means at a different driving speed.

22. The combination with a fluid compressing means and driving means therefor, of fluid pressure means for controlling said compressor means, means operative to control said fluid pressure means to effect loading of said fluid compressing means when subjected to a fluid pressure variation of a predetermined intensity, means driven by one of said two first mentioned means for producing the requisite fluid pressure variation at a time when the speed of said fluid compressing means reaches a predetermined desired amount, and means governing said pressure variation producing means whereby the requisite fluid pressure variation may be produced at a different driving speed of said fluid compressing means.

23. The combination with a compressor having suction operated inlet valves and fluid operated unloading mechanism cooperating with said valves whereby they may be held open, of means for controlling said unloading mechanism including a pump driven during running of said compressor.

24. In combination, a compressor having suction operated inlet valves, a driving shaft, a pump driven by said driving shaft, and means controlled by said pump for effecting loading of said compressor when the latter is driven at a predetermined speed, said latter means also being operable independently of said pump.

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27. In combination, a compressor, a fluid pump connected to said compressor, a chamber having a wall movable simultaneously with and against fluid pressure, means whereby the movements of said wall control the loading of said compressor, a passageway connecting the pump and chamber, and a leakage port for said passageway of constant area.

28. In combination, a compressor, unloading means for said compressor, and means actuated jointly by the pressure of the air delivered by the compressor and the speed of the compressor and including a pump driven when the compressor is running for actuating the compressor unloading means.

29. In combination, a member adapted to constitute a load, said means including an element actuated by fluid pressure acting on opposite sides thereof for a driving motor, pressure generating means driven with said load constituting means, and means whereby the pressure generated by said pressure generating means causes the application of the load.

30. In combination, driven means adapted to constitute a load for a driving motor, said driven means being operable in loaded or unloaded condition, a pressure generating system driven with said driven means, and means whereby the pressure generated may cause the loading of said driven means upon the elapse of a predetermined interval after the starting thereof, said means also actuatable by another fluid pressure for unloading said compressor.

31. The combination comprising a compressor having unloading mechanism, a pilot valve therefor, and means for controlling said valve by liquid pressure.

32. The combination of a compressor having fluid operated unloading mechanism, a receiver, means for controlling the unloading of said compressor directly by receiver pressure fluid, and hydraulic actuated means for controlling said latter means.

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Certificate of Correction.

It is hereby certified that in Letters Patent No. 1,580,433, granted April 13, 1926, upon the application of Fred D. Holdsworth, of Claremont, New Hampshire, for an improvement in "Compressor-Controlling Mechanism," errors appear in the printed specification requiring correction as follows: Page 3, line 108, claim 19, after the word "means" insert a comma; page 4, lines 75 to 77, claim 29, strike out the comma and words ", said means including an element actuated by fluid pressure acting on opposite sides thereof" and insert the same to follow after the word "load" and before the period in line 82 of the same claim; and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 25th day of May, A. D. 1926.

[SEAL.]

WM. A. KINNAN,
Acting Commissioner of Patents.

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