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COMPRESSOR UNLOADER MECHANISM

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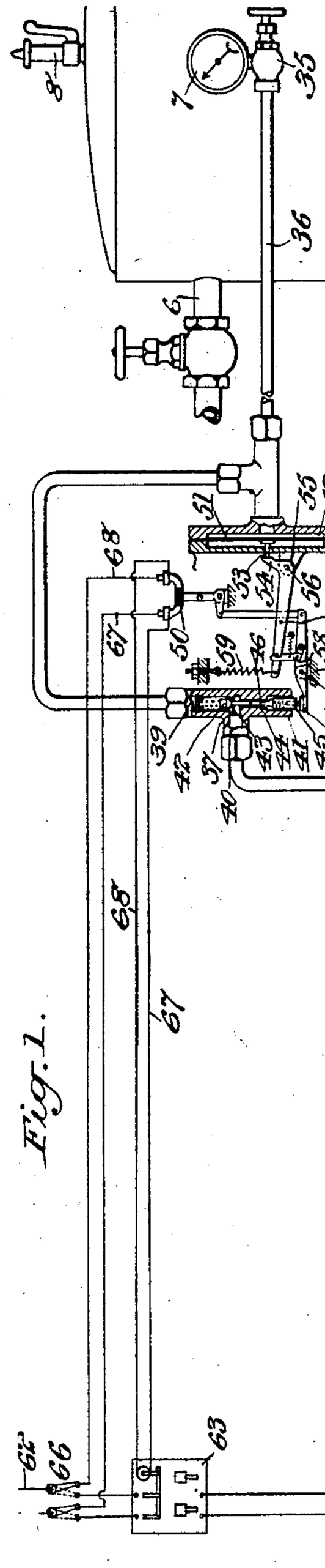


Fig. 1.

Fig. 2.

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FREDERICK A. MULLER, OF RICHMOND HILL, AND LORENTZ L. BASBERG, OF BROOKLYN, NEW YORK, ASSIGNORS TO JANET E. CLEARY, TRADING UNDER NAME OF AMERICAN AIR COMPRESSOR WORKS, OF BROOKLYN, NEW YORK.

COMPRESSOR UNLOADER MECHANISM.

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This invention relates to compressors and more particularly to electric compressor unloader mechanisms adapted to be automatically controlled by the air pressure in the receiver.

One object of our invention is to provide a combination of mechanisms which will simultaneously control and relieve the load on electric motor driven compressors more particularly at the period of starting and stopping operations.

Another object is to provide mechanisms which coact with the motor driven compressor to assure the unloading of the compressor during the period of acceleration.

A practical embodiment of our invention is represented in the accompanying drawing, in which

Fig. 1 illustrates the relation of certain of the parts diagrammatically and other of the mechanisms partly in side elevation and partly in cross section, and

Fig. 2 represents a vertical section, on an enlarged scale, of the device for controlling the compressed air from the receiver.

The compressor is denoted by 1 and may be of any well known or approved type having an air inlet pipe 2 and an outlet pipe 3. The air receiver 4, also of the usual well known construction, has an inlet pipe 5, a valved outlet pipe 6, a pressure gauge 7, and a safety valve 8. Interposed between the outlet pipe 3 of the compressor and the inlet pipe 5 of the receiver we located a check valve which comprises a body member 10 having an inlet 11, which connects with the outlet pipe 3, and a cover 12 provided with an outlet 13 which is coupled with the inlet pipe 5 of the receiver 4.

A stop cock 10* is disposed in the body member 10, to open communication with the external atmosphere at the will of the operator.

The body member 10 is provided with a valve seat 14 having passages 15, therethrough. A plate valve 17 is arranged to be moved away from its seat 14 by the pressure of the air through the compressor outlet pipe 3, and moved toward its seat by the air pressure in the pipe 5 of the receiver 4.

The body member 10 of the check valve is provided between the inlet 11 and the valve seat 14 with an outlet pipe 18 which connects with an atmospheric valve casing 19 having a plunger valve 20 arranged to close upon a seat 21 in the casing. The plunger valve is provided with an upwardly extending stem 22 arranged to receive a spring 23, which is interposed between an adjusting screw 24, threaded in the casing 19, and the plunger valve 20. A lock nut 25 serves to secure the adjusting screw 24 against unintentional displacement. The plunger valve 20 is also provided with a downwardly extending stem 26 which passes through a tubular passage 27 in the casing 19, and its lower end is attached to a diaphragm 28. The peripheral edge of this diaphragm is secured between a member 29 and its cover 30, which member and cover are constructed with a timing chamber 31 below the diaphragm and a smaller chamber 32 above the diaphragm. The member and its cover are held in position on the casing 19 by the cover 30 having a screw threaded engagement with a threaded nipple 33 extending downwardly from the casing 19. The outlet pipe 18 is arranged to communicate with the external atmosphere through a passage 34 in the casing 19, which passage is opened and closed by the plunger valve 20.

The air in the receiver is allowed to pass through a valve 35 to a pipe 36 of relatively small diameter to a control device 37, thence through a pipe 38 of similar diameter connected with the timing chamber 31 of the member 29.

The control device 37 is provided with an inlet port 39, a discharge port 40 and an exhaust port 41, of which the inlet and exhaust ports are disposed in vertical alinement, while the discharge port 40 is located substantially at right angles to the inlet and exhaust ports and midway therebetween.

A spring actuated valve 42 having a depending stem is arranged to open and close a passage 43 interposed between the inlet and discharge ports. A passage 44 is located between the discharge and exhaust ports and is opened and closed by means of a needle valve 45, which is arranged to extend a distance below, and be reciprocated in the exhaust port 41 the purpose of which will be hereinafter referred to. The needle valve 45 is provided with a stem 46 which extends upwardly through the passage 44

into position to engage the depending stem of the valve 42 and a spring pressed plunger 46* which is disposed in position to be actuated by a pressure snap switch of any well known or approved construction. In the present form of switch mechanism we have shown a rocking lever 47 pivoted at 48 to a housing 49, one end of which lever 47 engages the plunger 46* while the other end controls the movement of a contact switch 50. A diaphragm 51 is mounted in a chamber 52 of the housing 49, and has a pin 53 extending through the housing in position to engage one arm 54 of a bell crank lever 55 pivoted at 56 on the housing 49. The other arm 57, of the bell crank lever 55, is connected to the lever 47, by a vibrating link 58. The diaphragm 51 is held in its normal position and against the pressure of air in the receiver 4, by means of a spring 59, one end of which is connected to the arm 57, while the other end is adjustably attached to the housing 49. The tension of the spring 59 is adjusted to regulate the movement of the diaphragm 51 through its pin 53 and bell crank lever 55. A motor 60 drives the compressor through the usual pulley and belt connections, and receives its electric power from main electric power lines 61—62.

An automatic starter 63 is connected with the motor 60 by wires 64—65 and may be thrown into and out of direct connection with the main lines 61—62 by means of a double pole switch 66. Wires 67—68 are also connected with the double pole switch 66 and the toggle switch 50, which wires lead from the switch 50 to the automatic starter 63.

In operation:—Assuming that the pressure of air in the reservoir has reached the point above which the tension spring 59 is set, the diaphragm 51 will be pressed to the left thereby causing the pin 53 to actuate the bell crank lever 55, which in turn transmits its motion to the rocking lever 47 through the vibrating link 58. The rocking of the lever 47 moves the toggle of the switch 50 and breaks the electrical contact of the wires 67—68 with the main line wires 61—62 thereby stopping the motor 60. Simultaneously with the movement of the switch 50, the lever 47 actuates the needle valve 45, which raises the valve 42 from its seat, against the air pressure and the tension of its spring, by means of the stem 46 and permits the air in the pipe 36 to pass through the passage 43 to the discharge port 40, thence through the pipe 38 to the timing chamber 31. As the valve 42 is raised from its seat the needle valve 45 will be brought to its seat and close the passage 46. Any further movement of the lever 47 will be absorbed by the spring actuated plunger 46* housed in the body of the needle valve 45. When the compressed air enters the chamber 31 it will lift the diaphragm 28, which in turn raises the plunger valve 20 from its seat 21, against the tension of its spring 23, and allows the entrapped air between the check valve 10 and the compressor to pass through the passage 34 to external atmosphere, thus releasing the pressure in the compressor.

When the pressure of the air in the receiver has reached the point equal to or below the tension of the spring 59 the air pressure in contact with the diaphragm 51 will also be reduced, and the spring 59 will cause the bell crank lever 55 to resume its normal position. As the bell crank lever 55 returns to its normal position it rocks the lever 47, which moves the contact switch 50 to close the circuit of the main lines 61—62 and wires 67—68, so that the automatic starter 63 will be actuated and the motor 60 and compressor again set in motion.

Simultaneously with the movement of the switch 50 the lever 47 released its pressure on the needle valve 45 so that the valve moved away from its seat on the passage 44 and allowed the spring actuated valve 42 to close the passage 43. As the passage 43 is closed the passage 44 will be opened by the needle valve 45 and the air in the timing chamber 31 and pipe 38 permitted to slowly pass through the exhaust port 41 to atmosphere, thereby allowing the diaphragm 28 to assume its normal position by the action of the spring 23 on the plunger valve 20 which is brought to its seat 21 to close the passage 34.

While the air is being exhausted from the timing chamber 31 the compressor is being brought to its maximum speed and is building up air pressure in the pipe 3 and check valve so that as soon as the chamber 31 is exhausted the plunger valve 20 will close on its seat 21, aided by the spring 23 and the compressed air which is being passed from the compressor to the pipe 3 and check valve. After the plunger valve 20 is closed air will then be forced through the passages 15 past the plate valve 17 of the check valve to the receiver 4.

Thus it will be seen that the compressor is free to be brought to its maximum speed without a load, by the closing of the valve 20 upon its seat 21, which closing is so timed that the compressor will discharge air through the passage 34 to external atmosphere until the air is exhausted from the chamber 31 and the diaphragm 28 free to allow the valve 20 to close the passage 34.

If desired, the compressor 1 may be driven uninterruptedly and the air pressure in the receiver 4 relieved in the manner above described, except that the double pole switch 66 is moved to the position shown in dotted outline in Fig. 1, in which position the elec-

tric power from the main lines 61—62 is passed to the wires 64—65 directly through the automatic starter 63 to the motor 60, and breaking the contact of the wires 67—68 of the contact switch 50.

The timing of the atmospheric valve is dependent upon the amount of pressure applied to the spring 23 by the adjusting screw 24 and the area of the timing chamber 31, together with the volume of air leakage through the exhaust port 41 during the period in which the compressor is being brought to its maximum speed.

To relieve the compressor at the initial starting the stop cock 10* is manipulated to open the check valve to atmosphere, and closed when the compressor reaches its maximum speed.

It will be understood that various changes may be resorted to in the form, construction and arrangement of the several parts without departing from the spirit and scope of our invention; and hence, we do not intend to be limited to the details herein shown and described, except as they may be included in the claims.

What we claim is:—

1. In a system of air compressor control, a compressor, an air receiver, an air line leading from the compressor to said receiver, a check valve in said line, an outlet to external atmosphere leading from the control side of said check valve, a normally closed atmospheric valve in said outlet, a relatively small air line leading exteriorly from said receiver to said last named valve for opening the same to unload the compressor when the pressure in the receiver reaches a predetermined high point, and a motor switch controlled by variations in pressure in said relatively small air line to stop and start the motor.

2. In a system of air compressor control, an air receiver, an air line leading from the compressor to said receiver, a check valve in said line, an outlet to external atmosphere leading from the control side of said check valve, a normally closed atmospheric valve in said outlet, a relatively small air line leading from said receiver to said last named valve for opening the same to unload the compressor when the pressure in the receiver reaches a predetermined high point, a motor switch controlled by variations in pressure in said relatively small air line to stop and start the motor, and an exhaust valve in the relatively small air line actuated by the movement of said switch.

3. In a system of air compressor control, a compressor, an air receiver, an air line leading from the compressor to said receiver, a check valve in said line, an outlet to external atmosphere leading from the control side of said check valve, a normally closed atmospheric valve in said outlet, a relatively small air line leading from said receiver to said last named valve for opening the same to unload the compressor when the pressure in the receiver reaches a predetermined high point, a motor switch controlled by variations in pressure in said relatively small air line to stop and start the motor, and an exhaust valve in the relatively small air line actuated by the movement of said switch, said exhaust valve arranged to be actuated in one direction to open communication with the atmospheric valve and in the other direction to connect the atmospheric valve with the external atmosphere.

4. In a system of air compressor control, a compressor, an air receiver, an air line leading from the compressor to said receiver, a check valve in said line, an outlet to external atmosphere leading from the control side of said check valve, a normally closed diaphragm operated valve in said outlet, a relatively small air line leading exteriorly from said receiver to said last named valve for opening the same to unload the compressor when the pressure in the receiver reaches a predetermined high point, and a motor switch controlled by variations in pressure in said relatively small air line to stop and start the motor.

5. In a system of air compressor control, a compressor, an air receiver, an air line leading from the compressor to said receiver, a check valve in said line, an outlet to external atmosphere leading from the control side of said check valve, a normally closed diaphragm operated valve in said outlet, a relatively small air line leading from said receiver to said last named valve for opening the same to unload the compressor when the pressure in the receiver reaches a predetermined high point, a motor switch controlled by variations in pressure in said relatively small air line to stop and start the motor, and an exhaust valve in the relatively small air line actuated by the movement of said switch.

6. In a system of air compressor control, a compressor, an air receiver, an air line leading from the compressor to said receiver, a check valve in said line, an outlet to external atmosphere leading from the control side of said check valve, a normally closed diaphragm operated valve in said outlet, a relatively small air line leading from said receiver to said last named valve for opening the same to unload the compressor when the pressure in the receiver reaches a predetermined high point, a motor switch controlled by variations in pressure in said relatively small air line to stop and start the motor, and an exhaust valve in the relatively small air line actuated by the movement of said switch, said exhaust valve arranged to be actuated in one direction to open communication with the diaphragm operated

valve and in the other direction to connect the diaphragm operated valve with the external atmosphere.

7. In a system of air compressor control, a compressor, an air receiver, an air line leading from the compressor to said receiver, a check valve in said line, an outlet to external atmosphere leading from the control side of said check valve, an adjustable normally closed diaphragm operated valve in said outlet, a relatively small air line leading exteriorly from said receiver to said last named valve for opening the same to unload the compressor when the pressure in the receiver reaches a predetermined high point, and a motor switch controlled by variations in pressure in said relatively small air line to stop and start the motor.

8. In a system of air compressor control, a compressor, an air receiver, an air line leading from the compressor to said receiver, a check valve in said line, an outlet to external atmosphere leading from the control side of said check valve, an adjustable normally closed diaphragm operated valve in said outlet, a relatively small air line leading from said receiver to said last named valve for opening the same to unload the compressor when the pressure in the receiver reaches a predetermined high point, a motor switch controlled by variations in pressure in said relatively small air line to stop and start the motor, and an exhaust valve in the relatively small air line actuated by the movement of said switch.

9. In a system of air compressor control, a compressor, an air receiver, an air line leading from the compressor to said receiver, a check valve in said line, an outlet to external atmosphere leading from the control side of said check valve, an adjustable normally closed diaphragm operated valve in said outlet, a relatively small air line leading from said receiver to said last named valve for opening the same to unload the compressor when the pressure in the receiver reaches a predetermined high point, a motor switch controlled by variations in pressure in said relatively small air line to stop and start the motor, and an exhaust valve in the relatively small air line actuated by the movement of said switch, said exhaust valve arranged to be actuated in one direction to open communication with the diaphragm operated valve and in the other direction to connect the diaphragm operated valve with the external atmosphere.

10. In a system of air compressor control, a compressor, an air receiver, an air line leading from the compressor to said receiver, a check valve in said line, an outlet to external atmosphere leading from the control side of said check valve, a normally closed atmospheric valve in said outlet, a relatively small air line leading from said receiver to said last named valve for opening the same to unload the compressor when the pressure in the receiver reaches a predetermined high point, a motor switch controlled by variations in pressure in said relatively small air line to stop and start the motor, and a needle valve in the relatively small air line actuated by the movement of said switch.

11. In a system of air compressor control, a compressor, an air receiver, an air line leading from the compressor to said receiver, a check valve in said line, an outlet to external atmosphere leading from the control side of said check valve, a normally closed atmospheric valve in said outlet, a relatively small air line leading from said receiver to said last named valve for opening the same to unload the compressor when the pressure in the receiver reaches a predetermined high point, a motor switch controlled by variations in pressure in said relatively small air line to stop and start the motor, and a needle valve in the relatively small air line actuated by the movement of said switch, said needle valve arranged to be actuated in one direction to open communication with the atmospheric valve and in the other direction to connect the atmospheric valve with the external atmosphere.

In testimony, that we claim the foregoing as our joint invention, we have signed our names this 22nd day of June, 1927.

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