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COMPRESSOR UNLOADING DEVICE

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Fig. 1.

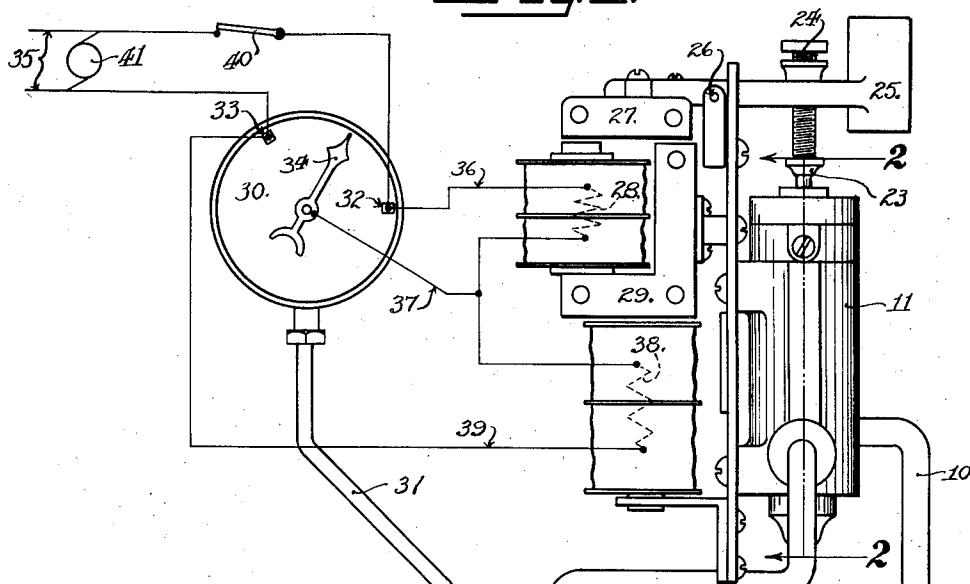
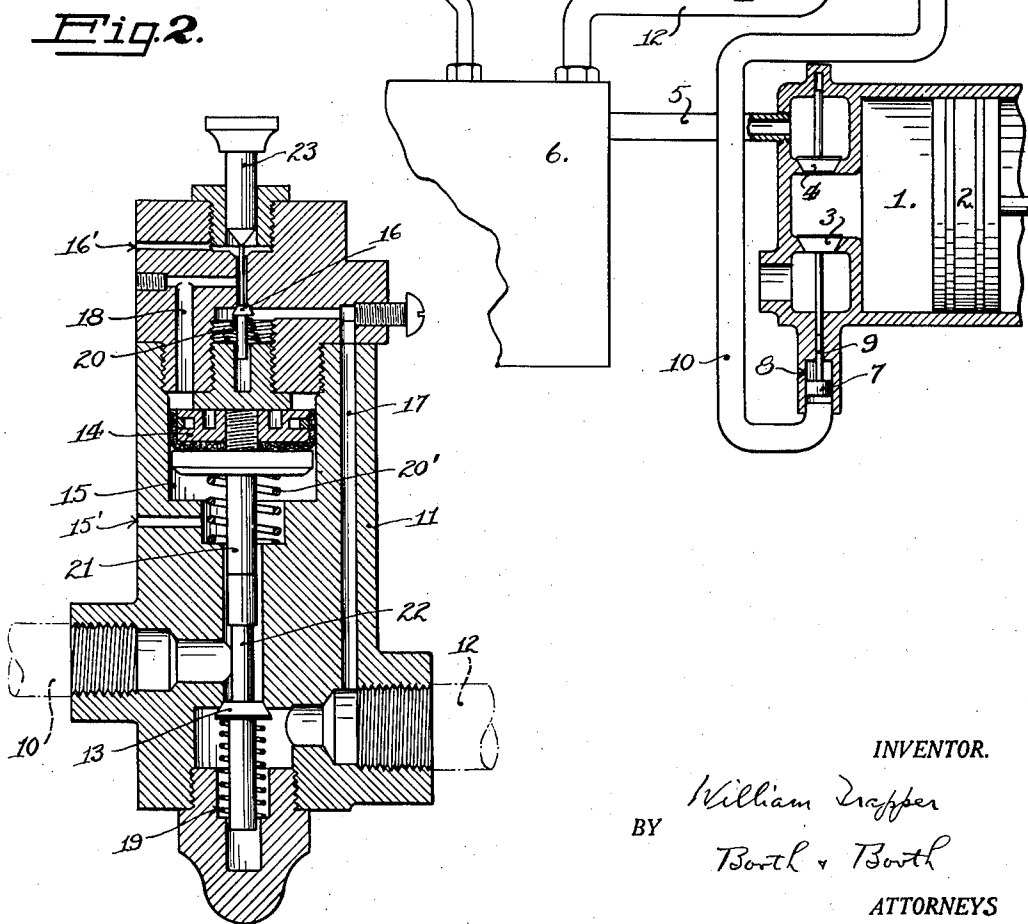


Fig. 2.



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COMPRESSOR UNLOADING DEVICE

Application filed May 14, 1928. Serial No. 277,541.

My invention relates to electrically controlled devices for actuating the unloader valves of air compressors and the like.

The objects of the invention are to provide pressure responsive means for actuating the unloader valves of one or more compressors, in order to maintain the pressure within certain limits; to provide means whereby all the unloaders of one or more compressors can be simultaneously operated manually; and to provide means for automatically unloading an electrically driven compressor in the event of interruption of the electric power.

Although my invention is applicable to any fluid pump or compressor, it is of especial advantage in connection with large compressor installations using a plurality of unloader valves. In such installations, the use of my device automatically maintains the pressure within certain limits, and permits the attendant, by the operation of a single switch, to control all the unloaders simultaneously.

In the case of an electrically driven compressor, interruption of the electric power while the machine is under load, results in sudden stalling, and throws excessive strain on the shaft or other drive connections between the motor and the compressor. This stalling and excessive strain is prevented by my device, which automatically unloads the compressor when the power is interrupted, allowing the compressor to idle freely until it comes to a stop. It also enables the operator to shut down the machine by the simple operation of cutting off the electric power, without first operating the unloader.

The above and other objects and advantages of the invention will be more fully brought out in the following specification, which should be read with the understanding that the form, construction and arrangement of the several parts may be varied, within the limits of the appended claims, without departing from the spirit of the invention as set forth in said claims.

A preferred embodiment of my invention will now be described with reference to the accompanying drawings, wherein:—

Fig. 1 is a part sectional and partly dia-

grammatic view of my device as applied to an air compressor.

Fig. 2 is a longitudinal section, enlarged, of the actuating valve.

In the drawings, the reference numeral 1 designates the cylinder of a compressor; 2 is its piston, 3 is its inlet valve, 4 is its discharge valve; and 5 is a pipe leading to a receiver 6. All these parts are illustrated conventionally, their construction forming no part of the present invention. The inlet valve 3 is provided with a suitable device for holding it open, to unload the compressor, indicated by a piston 7 operable in a cylinder 8 and provided with a stem 9 adapted to contact with the stem of said valve 3 and hold it open when air is admitted to said cylinder 8 through a pipe 10.

The numeral 11 designates generally a pressure actuating device for the unloader. Its construction is shown in detail in Fig. 2. 12 is a pipe leading from the receiver 6. A valve 13 opens and closes communication between said pipe 12 and the pipe 10 leading to the unloading cylinder 8. Therefore, when the valve 13 is open, the air pressure, passing through the pipes 12 and 10 and acting on the piston 7, holds the compressor inlet valve 3 open.

The valve 13 is opened by a piston 14, Fig. 2, working in a cylinder 15, to which air pressure is admitted through a pilot valve 16 and passages 17 and 18. The piston 14 is of greater diameter than the valve 13, so that, when the pressure is admitted to said cylinder 15, it opens said valve. Springs 19 and 20 are respectively provided for returning and holding the main valve 13 and the pilot valve 16 to their seats, and a spring 20' returns the piston 14 to its upper position. The piston 14 is provided with a suitable guide stem 21, which bears upon the top of the stem 22 of the valve 13, as shown. The lower end of the cylinder 15 is vented, as shown at 15', and its upper end has a restricted vent 16', enabling the pressure to leak out when the pilot valve 16 is closed, so that the springs may close the main valve 13.

The pilot valve 16 is opened by a plunger 23 which extends through the top of the hous-

ing 11, and is pressed downwardly by an adjustable stud 24, Fig. 1, secured to a weighted arm 25. The latter is pivoted at 26 and carries on its other end an armature 27 adapted to be attracted by an electro-magnet comprising a coil 28 wound upon a suitable core 29. When said magnet is energized, the weighted arm 25 is lifted and the pilot valve 16 is closed by its spring 20, and when said magnet is de-energized, the weighted arm 25 descends and opens said pilot valve, causing the unloader to function.

The numeral 30 in Fig. 1 designates a suitable pressure-responsive electric control switch. For purposes of illustration I have shown this as comprising an ordinary pressure gauge, connected by a pipe 31 with the receiver 6, and provided with two spaced contacts 32 and 33, which are insulated from each other and from the frame of the gauge, and adapted for contact with the hand or pointer 34 of said gauge. Suitable means, not shown, may be provided for adjustably positioning said contacts in the path of travel of the pointer 34.

The electrical connections are also shown in Fig. 1, and comprise line wires 35 by which the current is supplied, and which are connected respectively with the stationary gauge contacts 32 and 33. A wire 36 connects the contact 32 with one terminal of the magnet coil 28. The other terminal of said magnet coil is connected directly with the gauge pointer or movable contact 34 by a wire 37, and with the gauge contact 33 through a series resistance 38 and a wire 39.

When the pressure rises to the desired maximum, the gauge pointer 34 makes contact with the stationary contact 32, thereby short-circuiting and de-energizing the magnet 28. The weighted arm 25 thereupon descends, opening the pilot valve 16, which in turn causes the main valve 13 to open and the unloader to function. The compressor then runs idle until the pressure drops to the desired minimum, when the gauge pointer 34 makes contact with the stationary contact 33. This short-circuits the resistance 38, thereby energizing the magnet 28, which attracts its armature and lifts the weighted arm 25.

The pilot valve 16 and main valve 13 are closed by their respective springs, and the compressor inlet valve 3 is released to function normally. When the gauge pointer 34 is between the two contacts 32 and 33, the resistance 38 is in series with the magnet 28, and cuts down its force so that it will hold the armature 27 if the latter is in contact with the magnet core 29, but will not attract it if it is not in contact. The weighted arm 25 and the unloader control and actuating valves therefore remain in whichever position they may be in while the gauge pointer is traveling between said contacts 32 and 33.

In addition to the above described pressure

regulating function, my device may be used as a safety or emergency control, by inserting a switch in the line 35, as indicated at 40. Opening this switch de-energizes the magnet 28, thereby unloading the compressor. In large installations, where multicylinder compressors, or a plurality of compressors, are employed, a single electrical control device and actuating valve can be used to control all the unloaders, merely by running branch pipes (not shown) from the pipe 10 to each unloader. In such an installation, all unloaders operate simultaneously, and the entire plant can be unloaded instantly merely by opening the switch 40.

In the case of electrically driven compressors, my device also furnishes an automatic safety control for unloading in case the power fails, thus preventing excessive strains on the shafts or driving connections of the compressors resulting from stalling or stopping under load. This is accomplished by the simple expedient of taking the control current and the compressor driving current from the same source, so that, if the driving current fails, the control current is also interrupted, and the magnet 28 is de-energized. I have illustrated this in Fig. 1 by indicating conventionally a motor 41 connected with the line 35, said motor being understood to be suitably connected with the compressor for driving its piston 2.

I claim:—

1. An apparatus for controlling fluid operated compressor unloaders comprising a valve for controlling the admission of fluid to said unloader; and electrical means for controlling said valve comprising an electro-magnet, a resistance in series therewith, a source of electric current connected normally with said magnet and said resistance, a switch for short-circuiting either said magnet or said resistance, and pressure actuated means for operating said switch.

2. An apparatus for controlling fluid operated compressor unloaders comprising a valve for controlling the admission of fluid to said unloader; a weighted movable arm for operating said valve; an electro-magnet for moving said arm; and pressure actuated means for varying the strength of the field of said magnet.

3. An apparatus for controlling unloaders of electrically driven compressors comprising an electro-magnet normally connected with the compressor driving current, a resistance in series therewith, a switch for short-circuiting either said magnet or said resistance, pressure actuated means for operating said switch, and means actuated by said magnet for controlling the unloader.

4. A fluid controlling device comprising a body having an inlet and an outlet, a valve controlling communication between said inlet and outlet, means actuated by the pressure

at said inlet for operating said valve, a second
valve for controlling said pressure actuated
means, a weighted arm for operating the last
mentioned valve, an electro magnet for actu-
ating said arm, a resistance in series with said
5 magnet, a switch for short circuiting either
said magnet or said resistance, and pressure
actuated means for operating said switch.

10 In testimony whereof I have signed my
name to this specification.

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