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CONTROL FOR COMPRESSORS

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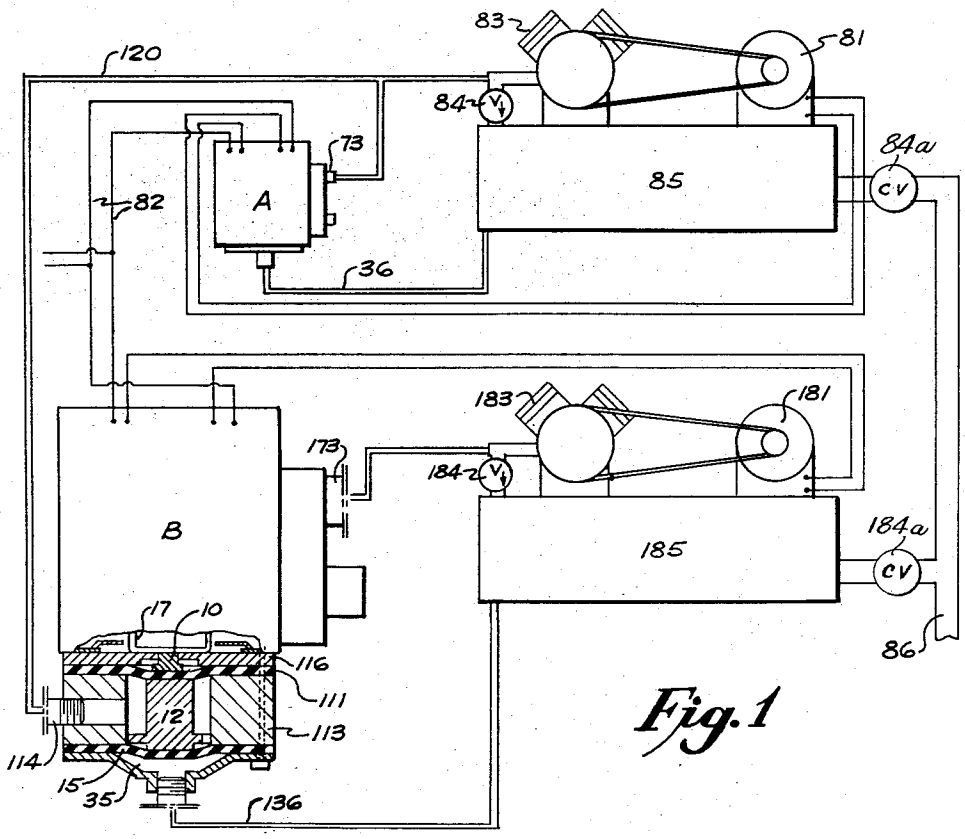
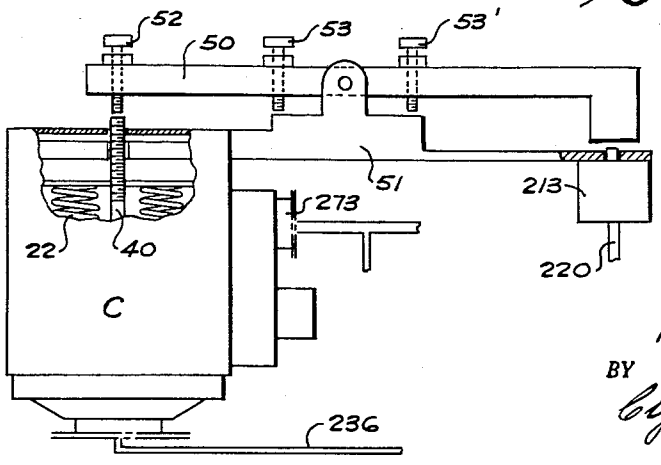


Fig. 1

Fig. 2



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CONTROL FOR COMPRESSORS

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2 Claims. (Cl. 230—2)

The present invention relates to a control mechanism for air compressors, and in particular to a control mechanism for a plurality of air compressors wherein each compressor starts immediately after the starting of the compressor before it so that the starting load on power lines is maintained at a minimum, and also wherein each compressor shuts off immediately after the compressor before it.

The present invention is particularly useful in small factories and shops where one or two small air compressors are used and as the shop increases another air compressor is added. The invention is also useful in places where it is more desirable to have several small compressors than one large compressor. For example if a single large compressor breaks down there is no compressed air, whereas if one of several compressors breaks down, it can be removed from the bank and the remaining compressors continue to supply needed air. Although the term air is used herein, it is understood that other gases or fluids are included. With the present invention any number of air compressors may be added to the bank with each air compressor maintaining its individuality so that it could be used separate from the others if necessary.

In the past each air compressor has been individually controlled so that the compressor started when the air in the tank reached a certain minimum pressure and stopped pumping air into the tank when the air in the tank reached a certain maximum pressure. If all of the tanks of the compressors were connected to a common line and all of the controls were set to turn the compressors on at the same minimum pressure a heavy starting drag was placed on an electrical supply line to the motors. The starting of several small motors at timed intervals does not require as large a surge of power as the starting of one large motor. Therefore many shops prefer several small compressors to a single large compressor. Even though this heavy drag only lasted for possibly a half minute the requirements were such that heavy transformers and electrical equipment were needed. Also the cost of starting the units was increased because the electric power companies had to be able to supply the surge of power when it was needed.

Attempts were made to eliminate a heavy starting load and the need for a surge of power, or the starting of all of the compressors simultaneously, by adjusting the control for each compressor so that one compressor would start at one minimum pressure and another compressor would start at another minimum pressure. This effectively decreased the starting surge of power needed, however, it caused one compressor to operate far more than any of the other compressors. Because of this, each compressor in the system had a different duty cycle. The compressor which started at the highest minimum pressure in the bank had the highest duty cycle and would wear out or need repairs much faster than any of the other compressors.

The present invention contemplates a control system

which will control a plurality of air compressors so that the duty cycle remains substantially constant on all of the compressors.

In accordance with the present invention, each air compressor has its own compressor motor and tank and a control for that motor, the control being responsive to the pressure in the tank. Each compressor also has its own unloading valve for unloading the compressor when it is not running. It is undesirable to keep the compressor delivery under pressure after the compressor stops. Hence, in most control systems, a bleed to atmosphere is provided to release such pressure after the compressor is shut off. Such valves are referred to as "unloading valves." The control unit consists of a switch operated by the pressure from the tank in such manner that the switch closes when the pressure in the tank reaches a minimum and opens when the pressure in the tank reaches a maximum.

In the present invention a pressure actuated device on the control unit of a second air compressor and in operative association with the pressure device which closes the switch is directly connected to the discharge side or line of a first air compressor. In actual operation the pressure built up in the delivery line of the first compressor, when that compressor starts running, effects changes in the control unit for the second compressor, whereby the switch for the second compressor is closed immediately after the switch for the first compressor is closed even though the pressure in the tank for the second compressor has not reached its minimum pressure setting.

The present invention also contemplates a control for a plurality of air compressors wherein each air compressor is started when the pressure in its respective tank reaches a minimum and is shut off when the pressure in its respective tank reaches a maximum and also wherein the starting of one compressor affects the starting of another compressor as well as wherein the stopping of that one compressor affects the stopping of said another compressor.

One of the objects of the invention is to provide a control system for a plurality of air compressors.

Another object of the invention is to provide a mechanism attachable to the control system for an air compressor and which may be operatively associated with the control system of another air compressor to affect a coordination of the control of the different compressors.

Another object of the invention is to provide an improved electric switch mechanism for air compressors which is simple and compact in construction and which is also highly efficient in operation to control the operation of the plurality of air compressors.

Another object of the present invention is to combine the unloading assemblage of one air compressor pump with the control switch unit on another air compressor so that the control switch on the other air compressor responds to a combination of its own tank pressure and the unloading pressure of the first air compressor pump.

Other objects and a fuller understanding of the invention will become apparent from the following description and claims when taken in conjunction with the accompanying drawings in which:

Figure 1 is a view partly in section and partly in diagrammatic representation illustrating the invention; and

Figure 2 is a fragmentary view partly in section illustrating a modification of the invention.

In the representation of Figure 1 a control unit A is illustrated for controlling an electric motor **81** adapted to drive an air compressor **83** which discharges its air through a one way valve **84** into a compressor tank or storage tank **85**. The control unit A controls the electrical power used by the motor **81** from a suitable power supply source **82**. This figure also illustrates a control unit B

on a second compressor motor **181** which drives a second compressor **183** for discharging air under pressure through a one way valve **184** into a suitable tank **185**. The tanks **85** and **185** may be connected together into a common supply line **86**. Check valves **84***a* and **184***a* prevent the reverse travel from line **86** to the tanks **85** and **185**.

The control unit A may be of the type illustrated in a Patent No. 2,193,126, issued to W. C. Furans, on March 12, 1940, or it may be of any other similar control unit commonly known to industry. The present disclosure uses the Furnas control unit by way of example and does not intend to limit the scope of the invention to that particular unit. However, because this unit is being used as an example the numbers on the first compressor are being aligned with the numbers on the corresponding parts of that patent. When the control unit A is a unit as illustrated in the Furnas patent the compressor **83** and tank **85** cooperate therewith in the same manner as described in the aforementioned patent. It is understood the control unit B may control the motor **181** also in the same manner as illustrated and described in the aforementioned patent.

As described in the aforementioned patent a control conduit **136** from the tank **185** to the chamber **35** applies the pressure of the tank **185** on the diaphragm **15**. As illustrated in the unit B of Figure 1 this pressure operates through suitable mechanism to exert force on the motion transmitting pointed member **17** which directly controls the opening or closing of the switch as described in the aforementioned patent.

In the present embodiment of the control unit B, direct operative connection between the member **17** and the diaphragm **15** may be obtained by means of button **10**, diaphragm **111** and member **12**. Pressure exerted on diaphragm **15** will push the member **12** against diaphragm **111** and button **10** to push the member **17** upwardly to open the switch as described in the aforementioned patent. The member **12** is contained in a cylinder **113** mounted between the diaphragm **15** and the diaphragm **111** and having a tube fitting **114** in the wall thereof. I have provided a spacer plate **116** between the diaphragm **111** and the bottom of the unit B to accommodate the button **10** and provide a support for holding it in the center of, or in alignment with, the member **12** and the pointed member **17**. The fitting **114** is connected by a suitable conduit **120** to the connection **73** on the unloading port of the unit A.

The member **12** has an end surface engaging diaphragm **15** and an end surface engaging diaphragm **111**. The effective area of diaphragm **111** is smaller than the effective unsupported area of diaphragm **15** adjacent chamber **35**. Therefore, pressure from air delivered into cylinder **113** through tap **114** from the delivery line of a prior compressor in the system creates an unbalanced force toward chamber **35** which tends to move diaphragm **15** towards chamber **35**, thereby allowing the control unit B to start the motor **181** even though the pressure in tank **185** is greater than the minimum pressure at which unit B is set to operate if no pressure appears in cylinder **113**.

The system operates as follows: It is preferable to set the control unit B to operate at a minimum pressure slightly less than that at which control unit A operates. When the pressure in tank **85** reaches minimum the pressure is transmitted through tube **36** to control unit A, which electrically connects the motor **81** to the power line **82**. The motor **81** drives compressor **83**, which is connected to the unloading device of control unit A at tap **73**. As the pressure builds up in the compressor **83** air compressed therein is driven through the one way valve **84** into the tank **85**. However simultaneously the air pressure being built up in the tap **73** is transmitted through the tube **120**, fitting **114** and into the chamber within the cylinder **113**. This pressure exerted in the chamber of cylinder **113** and against diaphragm **15** operatively associates itself with the pressure in chamber **35** and against diaphragm **15** to affect a closing of the switch in unit B. The combination of the pressure in cylinder **113** forces diaphragm **15** towards chamber **35** and against the pressure in chamber **35**; permitting member **12**, diaphragm **111**, button **10**, and member **17** to follow diaphragm **15**. This results from the pressure area on diaphragm **111** being less than the pressure area on diaphragm **15**. When the member **17** moves towards chamber **35** the switch of unit B closes in the manner as described in the aforementioned Furnas patent to start compressor motor **181**.

After the pressure in the tank **85** builds up to the maximum or desired pressure at which control unit A is set, control unit A will open the switch therein to shut off the motor **81**. This eliminates the pressure in the line **120** and in cylinder **113**. Thus control unit B is now responsive directly to the pressure in the tank **185**, the pressure in cylinder **113** having been eliminated. Since the pressure in the tank **185**, and thus in the chamber **35**, is at or above the pressure at which the control unit B is set to start the compressor motor **181**, the control unit B shuts off the motor **181**.

It is understood that any number of these units may be connected in series by connecting a tube from the delivery line such as at tap **173** of control unit B to a cylinder corresponding to the cylinder **113** on the next switch or control unit on the next succeeding air compressor. It is also understood that suitable valves may be used in lines **120** whereby the line **120** may be operatively connected to more than one or a desired one of the control units of several compressors.

A modification of the invention is illustrated in Figure 2. Control unit C, may also be of the Furnas type as illustrated or of such other style as may be desired.

In this instance control unit C has springs **22** and a spring pressure adjustment screw **40** which operate basically in accordance with similar parts in the aforementioned patent. The screw **40** is carried by springs **22** and is abuttable against one end of a pivot bar **50**, pivotally mounted on a support **51** and adapted to be actuated by an air cylinder, **213**. Suitable adjusting screws **52**, **53** and **53'** may be provided in the bar **50** to control the amount of movement thereof and to adjust the minimum pressure setting of the control unit C.

The modified unit may be connected in the same bank as the units of Fig. 1 and in series therewith or as a substitute for unit B in Fig. 1. In substituting unit C for unit B in Fig. 1 the line **236** is connected in place of line **136**, line **220** is connected in place of line **120** and tap **273** is connected in place of tap **173**.

When pressure appears in cylinder **213** a force is exerted on springs **22** causing unit C to respond the same as if screw **40** had been adjusted to cause the unit to start the motor at a different minimum pressure, thus each compressor motor is responsive to its own tank pressure and the discharge pressure of another compressor.

It is understood that other modifications and arrangements of parts may be had without departing from the spirit and scope of the present invention and that the present description has been by way of example and not of limitation. The limits and scope of the invention are set forth in the following claims.

What is claimed is:

1. A compressor system comprising in combination, a series of at least a first and second compressor, a first storage tank for said first compressor, a delivery line from said first compressor to said first storage tank, a check valve in said delivery line, a second storage tank for said second compressor, a delivery line from said second compressor to said second storage tank, a check valve in said delivery line, a common delivery line from said first and second storage tanks to service, a discharge check valve between each storage tank and the common delivery line,

a first motor in driving relationship with said first compressor, a second motor in driving relationship with said second compressor, a first control device in operative electrical control of said first motor, said first control device connected to respond to pressure in said first tank, a second control device in control of said second motor connected to the delivery line from said first compressor ahead of the check valve therein and responsive to pressure in said delivery line, said second control device operative to activate said second motor upon an increase in pressure in said delivery line of the first compressor and to deactivate said motor upon a decrease in such pressure, and a bleed valve in said delivery line from the first compressor ahead of the check valve operated by said first control to release the pressure from said delivery line upon the deactivation of said motor of the first compressor.

2. A compressor system comprising, in combination, a master compressor, at least one slave compressor, each compressor having a storage tank, a delivery line from said master compressor to its storage tank, a check valve in said delivery line, an electrical motor for each compressor, a first pressure responsive device in electrical control of the motor of the master compressor, said first control mounted to respond to pressure in said storage tank of the master compressor, said control means activating said master compressor upon a drop in pressure to a predetermined low in the storage tank and deactivating

the compressor upon an increase of pressure in the storage tank to a predetermined high, a pressure release valve in said delivery line, means to open said pressure release valve upon cessation of operation of the master compressor, and a slave pressure responsive electrical control device connected to the master compressor delivery line between the master compressor and the said check valve, said slave control adapted to activate the slave compressor upon an increase of pressure and deactivate the slave compressor upon a decrease in pressure, whereby said slave compressor will be activated only after said master compressor has operated long enough to restore pressure in the delivery line therefrom to its storage tank.

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