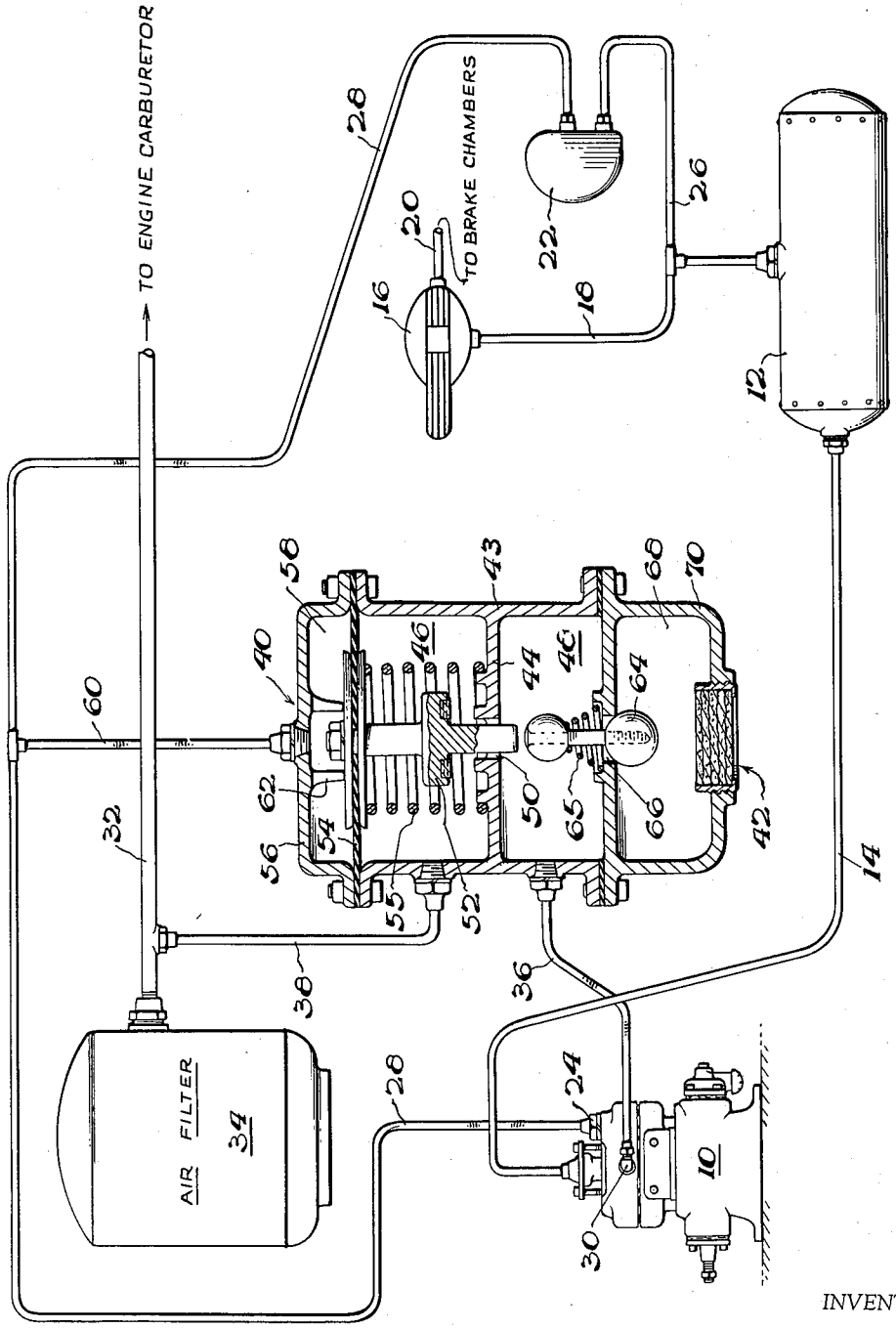
Dec. 27, 1955 J. F. SHUMAKER 2,728,517

COMPRESSOR INLET CONTROL SYSTEM

Filed April 28, 1950



INVENTOR

John F. Shumaker.

BY Scrivener & Parker

ATTORNEYS

United States Patent Office 2,728,517 Patented Dec. 27, 1955

2,728,517

COMPRESSOR INLET CONTROL SYSTEM

John F. Shumaker, Elyria, Ohio, assignor to Bendix-Westinghouse Automotive Air Brake Company, Elyria, Ohio, a corporation of Delaware

Application April 28, 1950, Serial No. 158,782

15 Claims. (Cl. 230—46)

This invention relates to fluid pressure systems and more particularly to a novel arrangement for controlling the application of fluid to a compressor inlet.

At the present time, it is quite common to utilize on various types of motor vehicles, an engine driven compressor for the purpose of providing a source of compressed air for the operation of brakes, clutches, transmissions and/or various of the other vehicle controls or accessories. In such installations, it is also usual to provide some type of filtering device for the inlet of the compressor in order to eliminate the entrance of dirt, grit, etc., into the compressor cylinder. In order to simplify such engine-driven compressor installations it has been proposed that the engine air cleaner or filter be used to not only filter the air conducted to the engine carburetor, but to also filter the air fed to the compressor intake connection. Thus the compressor intake would be connected to the conduit or connection leading from the engine air filter to the carburetor. While such an arrangement avoids the necessity of utilizing a separate air filter for the compressor, it has the disadvantage of subjecting the compressor to a source of subatmospheric pressure when the compressor is unloaded, due to the engine suction created in the connection between the filter and engine carburetor. It has been found that in such installations, the subatmospheric pressure or suction which is present in the compressor cylinder during periods of operation of the compressor in an unloaded condition, cause an excessive amount of oil to be passed by the piston rings, thereby resulting in depletion of the oil supply, the creation of carbon, and the occurence of all the other undesirable features which accompanying excessive oil-passing in a compressor.

It is accordingly one of the objects of the present invention to provide a compressor inlet control system which is so constituted as to avoid the above mentioned disadvantages and objections.

Another object is to provide a compressor installation wherein the compressor inlet is connected with the air inlet of the engine and wherein the effects of engine suction in the compressor cylinder when the compressor is unloaded are completely avoided.

A further object is to provide a novel compressor control system of the above character wherein the compressor intake is connected directly with the atmosphere during all periods of operation of the compressor in an unloaded condition, such a system thereby avoiding the objections which result from connecting the compressor cylinder of an unloaded compressor to the engine intake.

Still another object comprehends in a system of the foregoing type, a novel control for automatically switching the compressor intake from the engine intake connection directly to atmosphere when the compressor is unloaded.

A still further object is to provide a novel fluid pressure system which includes a compressor, a reservoir and a governor, the compressor intake being normally connected with the engine intake, and the governor functioning in accordance with a predetermined rise in pressure in the reservoir to automatically disconnect the compressor intake from the engine intake and to automatically connect the said compressor intake directly with the atmosphere.

Other objects and novel features of the invention will appear more fully hereinafter from a consideration of the following detailed description when taken in connection with the accompanying drawing which illustrates one form of the invention. It is to be expressly understood however, that the drawing is utilized for purposes of illustration only and is not to be taken as a definition of the limits of the invention, reference being had for this purpose to the appended claims.

In the drawing, wherein the invention is diagrammatically illustrated, certain parts being shown in section, an engine driven compressor 10 is adapted to supply air under pressure to a reservoir 12 through a conduit 14, such pressure being shown as being available for the application of vehicle brakes. For this purpose, a brake valve 16, of any suitable construction such as for example that shown in the patent to W. J. Andres et al. No. 2,133,275, dated October 18, 1938, is connected with the reservoir 12 by a conduit 18 and is adapted to control the supply of compressed air through a connection 20 leading to the various brake chambers, not shown. Loading and unloading of the compressor 10 may be effected in any suitable manner, such as by the use of a governor 22 which may be constructed as shown in the patent to B. S. Aikman, No. 1,754,218, dated April 15, 1930, such governor being respectively connected with the reservoir 12 and with an unloading mechanism 24 associated with the compressor, as by means of a conduit 26 and an unloader conduit 28.

From the above construction, it will be understood that the compressor 10 operates to furnish compressed air to the reservoir 12 for the operation of the vehicle brakes and any of the other accessories or controls of the vehicle. Also, until the pressure in the reservoir 12 attains a predetermined value, the unloader conduit 28 will be open to atmosphere at the governor 22, the compressor under these conditions operating in a loaded condition. As soon however, as the reservoir pressure reaches the cutout value for which the governor 22 is set, the latter operates to connect conduits 26 and 28 in order to supply full reservoir pressure to the unloading mechanism 24. When this occurs, the latter mechanism operates to either maintain the inlet valves of the compressor open, or to establish communication between the cylinders of the compressor, or to otherwise render the compressor inoperative to furnish the resevoir 12 with compressed air. Under these conditions, the compressor 10 is unloaded, and this action will continue until the reservoir pressure drops to the cut-in pressure for which the governor 22 is set. As soon as this occurs, the governor 22 will operate to exhaust the conduit 28 and the unloading mechanism 24 will return to its former position in order to load the compressor and enable it to again furnish compressed air to the reservoir 12.

One of the important features of the invention resides in the control of the air conducted to the compressor intake 30 so that the intake air will be filtered through the air filter of the vehicle engine. Such filters are highly efficient and of generous capacity and hence effectively prevent the entrance of dirt and other foreign matter into the compressor. Since however, the engine air filter is constantly subjected to the suction action of the engine, the compressor cylinders will be likewise subjected to this suction action. When the compressor is loaded, the suction conditions do not adversely affect the operation. The suction action, under unloading conditions however, reduces the pressure in the compressor cylin-

ders and results in undesirable oil-passing. In order to overcome this undesirable result, the invention provides an automatically operable mechanism whereby the compressor intake 30 is provided with a direct atmospheric connection when the compressor is unloaded. This mechanism is moreover arranged as to automatically reconnect the compressor intake with the engine filter as soon as the compressor is again loaded.

In order to effect the foregoing, the vehicle engine is provided with the usual air passage 32 which conducts atmospheric air to the engine carburetor through a filter 34, and the compressor intake 30 is connected to the passage 32 through conduits 36 and 38 whenever the compressor is loaded. On the other hand, when the compressor is unloaded, the invention provides a valve device 40 which operates automatically to switch the intake 30 from the conduit 38 to an atmospheric connection 42, thereby avoiding the creation of a low pressure condition in the compressor cylinders during periods of operation in an unloaded condition. Such device also operates automatically to re-establish the communication between the intake 30 and the passage 32 as soon as the compressor is loaded.

More particularly, and as shown, the valve device 40 comprises a central casing portion 43 provided with a partition 44 forming upper and lower chambers 46 and 48 which are respectively connected with the conduits 38 and 36. An opening 50 in the partition 44 normally serves to connect the chambers 46 and 48 when the compressor 10 is loaded so that under these conditions, the air intake 30 is connected with the engine air passage 32. A pressure responsive valve is provided for controlling the opening 50, and as shown, includes a valve element 52 carried by a diaphragm 54, the latter forming with a top casing portion 56, a control chamber 58 which is connected at all times with the unloader conduit 28 through a connection 60. As is illustrated, the diaphragm 54 is normally urged as by a spring 55, against a stop 62, carried by the casing portion 56, so as to maintain the valve 52 in open position. However, as will be readily understood, as soon as the governor 22 cuts out and the unloading conduit 28 is charged with reservoir pressure, such pressure will be conducted to the control chamber 58, as well as to the unloading mechanism 24, in order to close the valve 52 and interrupt communication between the compressor intake 30 and the air passage 32. When this occurs, the lower end of the valve 52 engages the upper portion of a valve 64 and moves the latter against the tension of a spring 65 to open position, whereby the chamber 48 is connected through opening 66 to a chamber 68 formed by a lower casing portion 70. Since the chamber 68 is open to atmosphere through the atmospheric connection 42, it will be readily understood that when the compressor is unloaded, the intake 30 is switched from the suction passage 32 to the atmospheric connection 42. It will likewise be seen that when the compressor is again loaded and the chamber 58 is exhausted to atmosphere through the governor 22, the valve 52 will return to the position illustrated, through the action of the spring 55, while the valve 64 will be closed by the spring 65. Thus, the compressor intake 30 will be switched to the suction passage 32 and will remain connected thereto until the governor 22 again operates to charge the control chamber 58 and engage the unloader device 24 upon a predetermined rise in reservoir pressure.

In operation, the parts will occupy the positions illustrated in the drawing until the pressure in the reservoir 12 attains the cut-out pressure for which the governor 22 is set. Under these conditions, the compressor 10 functions in a loaded condition and the compressor intake 30 draws its air supply from the suction passage 32 by way of conduit 38, chamber 46, port 50, chamber 48 and conduit 36. Thus the intake air lead to the compressor is subjected to the filtering action of the engine

filter 34 and all danger of the entrance of dirt and other foreign matter into the compressor cylinders will be avoided. As well understood in the art, the supply of fluid pressure in the reservoir 12 is available for the operation of the vehicle brakes through manipulation of the brake valve 16, and is likewise available for the operation of any of the other vehicle controls or accessories by providing suitable connections to the conduit 18, not shown.

As soon as the reservoir pressure attains the cut-out value of the governor 22, the latter operates to disconnect the conduit 28 from the atmosphere and to connect the conduit 26 with the conduit 28. Full reservoir pressure will then be conducted to the unloader mechanism 24 in order to unload the compressor. Simultaneously therewith, the chamber 58 of the valve device 40 is charged with reservoir pressure through the conduit 60, this action causing the diaphragm 54 and the valve 52 to be moved downwardly against the tension of the spring 55 in order to close the port 50 and interrupt communication between the engine intake 30 and the suction passage 32. As the valve 52 moves to its closed position, the valve 64 will be opened in order to switch the intake connection 30 to the atmospheric opening 42. Thus during unloading of the compressor, the compressor cylinders will not be subjected to the engine suction and all danger of oil-passing in the compressor will be avoided.

As soon as the reservoir pressure drops to the cut-in pressure of the governor 22, the latter will function to connect the unloader conduit 28 to the atmosphere. When this occurs, the unloader mechanism 24 functions to load the compressor and the parts of the valve device 40 will return to the positions illustrated. Thereupon, the atmospheric connection 42 will be closed by the valve 64 and the compressor intake 30 will be reconnected to the suction passage 32. Thereafter, during operation of the compressor in its loaded condition, the intake air for the compressor will be drawn through the engine filter 34.

While one embodiment of the invention has been illustrated and described herein with considerable particularity, it will be understood by those skilled in the art that various modifications may be resorted to without departing from the spirit of the invention. Reference will therefore be had to the appended claims for a definition of the limits of the invention.

What is claimed is:

1. A compressed air system comprising a compressor having an inlet and an outlet, a reservoir for the storage of air compressed by said compressor, conduit means constantly connecting said outlet and reservoir at all times, means including a normally open valve for connecting the inlet with a source of subatmospheric pressure, means for connecting said inlet with the atmosphere, a normally closed valve in said last named means, unloading mechanism for said compressor, a conduit connecting said unloading mechanism with said reservoir, a governor in said conduit operable to conduct compressed air from the reservoir to the unloading mechanism to unload the compressor when the pressure in said reservoir rises to a predetermined value and pressure responsive means for closing the first valve and for opening the second valve to transfer the inlet from the source of subatmospheric pressure to the atmosphere when the compressor is unloaded.

2. A fluid pressure system comprising a compressor having an inlet and an outlet, a reservoir, conduit means constantly connecting said outlet and reservoir at all times, means including a normally open valve for connecting the inlet with a source of subatmospheric pressure, means for connecting said inlet with the atmosphere, a normally closed valve in said last named means, and means operable upon a predetermined rise in pressure in said reservoir for closing the first valve and for

opening the second valve to transfer the inlet from the source of subatmospheric pressure to the atmosphere.

3. A fluid pressure system comprising a compressor having an inlet and an outlet, a reservoir, means constantly connecting said outlet and reservoir at all times, a conduit for conducting filtered air to the intake of an internal combustion engine, means including a normally open valve for connecting the inlet with said conduit, means for connecting said inlet with the atmosphere, a normally closed valve in said last named means, and means for closing the first valve and for opening the second valve to transfer the inlet from the conduit to the atmosphere.

4. A fluid pressure system comprising a compressor having an inlet and an outlet, a reservoir, means constantly connecting said outlet and reservoir at all times, a conduit for conducting filtered air to the intake of an internal combustion engine, means including a normally open valve for connecting the inlet with said conduit, means for connecting said inlet with the atmosphere, a normally closed valve in said last named means, and means operable upon a predetermined rise in pressure in said reservoir for closing the first valve and for opening the second valve to transfer the inlet from the conduit to the atmosphere.

5. A compressed air system comprising a compressor having an inlet and an outlet, a reservoir for the storage of air compressed by said compressor, conduit means constantly connecting said outlet and reservoir at all times, a pair of separate intake connections for conducting air to said inlet, means including a normally open valve for connecting the inlet to one of said connections, means for connecting the inlet with the other of said connections, a normally closed valve in said last named means, unloading mechanism for said compressor, a conduit connecting said unloading mechanism with said reservoir, a governor in said conduit operable to conduct compressed air from the reservoir to the unloading mechanism to unload the compressor when the pressure in said reservoir rises to a predetermined value and pressure responsive means for closing the first valve and for opening the second valve to transfer the inlet from the one connection to the other connection when the compressor is unloaded.

6. A fluid pressure system comprising a compressor having an inlet and an outlet, a reservoir, conduit means constantly connecting said outlet and reservoir at all times, a pair of separate intake connections for conducting air to said inlet, means including a normally open valve for connecting the inlet to one of said connections, means for connecting the inlet with the other of said connections, a normally closed valve in said last named means, and means operable upon a predetermined rise in pressure in said reservoir for closing the first valve and for opening the second valve to transfer the inlet from the one connection to the other connection.

7. A fluid pressure system comprising a compressor having an inlet and an outlet, a reservoir, conduit means constantly connecting said outlet and reservoir at all times, means including a normally open valve for connecting the inlet with a source of subatmospheric pressure, means for connecting said inlet with the atmosphere, a normally closed valve in said last named means, a normally inactive pressure responsive device connected with said normally open valve, and means for subjecting said pressure responsive device to reservoir pressure when the pressure in the latter reaches a predetermined value for closing the first valve and for opening the second valve to transfer the inlet from the source of subatmospheric pressure to the atmosphere.

8. A fluid pressure system comprising a compressor having an inlet and an outlet, a reservoir, means constantly connecting said outlet and reservoir at all times, a conduit for conducting filtered air to the intake of an internal combustion engine, means including a normally open valve for connecting the inlet with said conduit, means for connecting said inlet with the atmosphere, a normally closed valve in said last named means, a normally inactive pressure responsive device connected with said normally open valve, and means for subjecting said pressure responsive device to reservoir pressure when the pressure in the latter reaches a predetermined value for closing the first valve and for opening the second valve to transfer the inlet from the conduit to the atmosphere.

9. A fluid pressure system comprising a compressor having an inlet and an outlet, a reservoir, conduit means constantly connecting said outlet and reservoir at all times, a pair of separate intake connections for conducting air to said inlet, means including a normally open valve for connecting the inlet to one of said connections, means for connecting the inlet with the other of said connections, a normally closed valve in said last named means, a normally inactive pressure responsive device connected with said normally open valve, and means for subjecting said pressure responsive device to reservoir pressure when the pressure in the latter reaches a predetermined value for closing the first valve and for opening the second valve to transfer the inlet from the one connection to the other connection.

10. A fluid pressure system comprising a compressor having an inle and an outlet, a reservoir, conduit means constantly connecting said outlet and reservoir at all times, a pair of separate intake connections for conducting air to said inlet, means including separate valves for selectively connecting the inlet to one or the other of said connections, fluid pressure actuated means for controlling said valves, and means responsive to a predetermined rise in reservoir pressure to connect said fluid pressure actuated means with said reservoir.

11. A compressed air system for use on a vehicle having an internal combustion engine provided with a conduit for conducting filtered air to the engine intake, comprising a compressor having an inlet and an outlet, a reservoir, a conduit constantly connecting said outlet and reservoir at all times to deliver compressed air from the compressor outlet to the reservoir, means including a normally open valve for connecting the compressor inlet with the conduit to the engine whereby said compressor is supplied with filtered air at subatmospheric pressure during operation of the engine, means for contcting the compressor inlet with the atmosphere, a normally closed valve in said last-named means, a pressure responsive element movable to close the normally open valve and to open the normally closed valve, and means operable when the pressure of the compressed air in the reservoir reaches a predetermined high value to subject the element to reservoir pressure to move said element to close the normally open valve and to open the normally closed valve.

12. A fluid pressure system comprising a compressor having an inlet and an outlet, a reservoir, conduit means constantly connecting said outlet and reservoir at all times, means including a normally open valve for connecting the inlet with a source of subatmospheric pressure, means for connecting said inlet with the atmosphere, a normally closed valve in said last named means, and means for closing the first valve and for opening the second valve to transfer the inlet from the source of subatmospheric pressure to the atmosphere, said last named means comprising a fluid pressure actuator and a governor operable upon a predetermined rise in pressure in said reservoir for subjecting said actuator to reservoir pressure.

13. A fluid pressure system comprising a compressor having an inlet and an outlet, a reservoir means constantly connecting said outlet and reservoir at all times, a conduit for conducting filtered air to the intake of an internal combustion engine, means including a normally open valve for connecting the inlet with said conduit,

means for connecting said inlet with the atmosphere, a normally closed valve in said last named means, and means for closing the first valve and for opening the second valve to transfer the inlet from the conduit to the atmosphere, said last named means comprising a fluid pressure actuator and a governor operable upon a predetermined rise in pressure in said reservoir for subjecting said actuator to reservoir pressure.

14. A fluid pressure system comprising a compressor having an inlet and an outlet, a reservoir, conduit means constantly connecting said outlet and reservoir at all times, a pair of separate intake connections for conducting air to said inlet, means including a normally open valve for connecting the inlet to one of said connections, means for connecting the inlet with the other of said connections, a normally closed valve in said last named means, and means for closing the first valve and for opening the second valve to transfer the inlet from the one connection to the other connection, said last named means comprising a fluid pressure actuator and a governor operable upon a predetermined rise in pressure in said reservoir for subjecting said actuator to reservoir pressure.

15. A compressed air system comprising a compressor

having an inlet and an outlet, a reservoir for the storage of air compressed by said compressor, conduit means constantly connecting said outlet and reservoir at all times, an intake connection for conducting air to said inlet, a normally open valve in said connection, a fluid pressure actuated member cooperating with said valve to close the same, unloading mechanism for said compressor, a conduit connecting said unloading mechanism with said reservoir, a governor in said conduit operable to conduct compressed air from the reservoir to the unloading mechanism to unload the compressor when the pressure in said reservoir rises to a predetermined value and means for subjecting said member to rseervoir pressure to close the valve when the compressor is unloaded.

References Cited in the file of this patent

UNITED STATES PATENTS

930,989	Richards	Aug. 10, 1909
1,433,007	Harris	Oct. 24, 1922
2,275,364	Harris	Mar. 3, 1942

FOREIGN PATENTS

23,840	Great Britain	1912
415,319	Great Britain	1934