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MULTIPRESSURE SUPPLY SYSTEM

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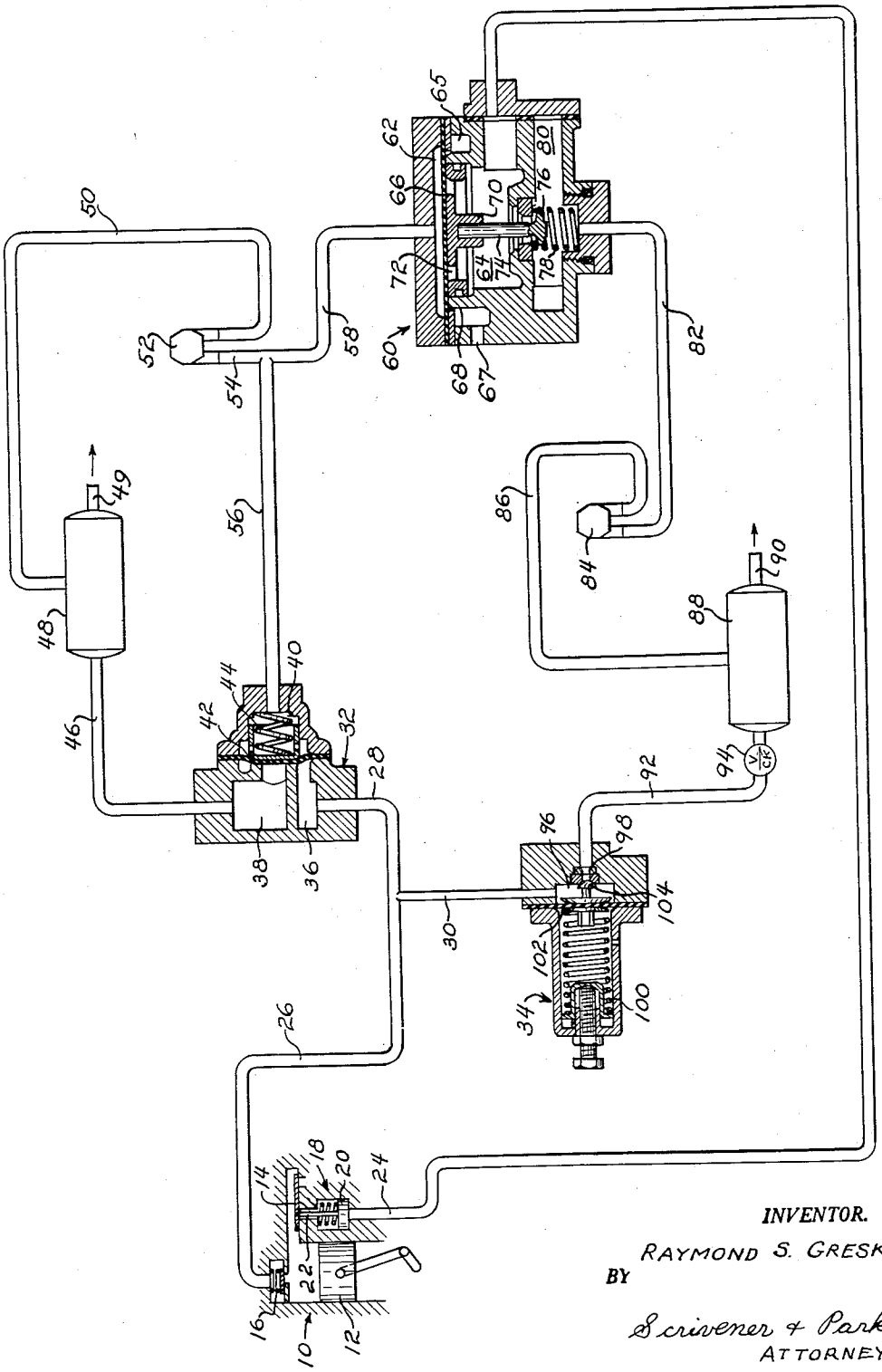

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MULTIPRESSURE SUPPLY SYSTEM

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This invention relates to fluid pressure supply systems and more particularly to an improved supply system for delivering supply pressure from a single source to different reservoirs at different pressures.

Different air pressure operated devices, for example, air brakes and an air starter for an automotive vehicle, require different pressures for their proper operation. The compressed air must be stored for its respective uses in separate reservoirs and it is desirable from an economy point of view that the air pressure be supplied to the separate reservoirs by a single compressor being loaded when either one of the reservoirs falls below its respective predetermined minimum pressure. Obviously, these minimum pressures will differ from each other in the same proportions as the normal pressures in each of the separate reservoirs and to load the compressor and deliver pressure only to the reservoir calling for pressure but not to the other presents particular problems.

A broad object of the present invention is to provide a system which overcomes the problems mentioned in the foregoing paragraph.

More particularly it is an object of the invention to provide a multipressure system wherein separate reservoirs are supplied with different pressures from a single source with the source delivering pressure to one reservoir to the exclusion of another upon demand by the first reservoir.

Another object of the invention is to provide a multipressure system wherein the compressor pumps only against the pressure head of the depleted reservoir.

Still another object of the invention is to provide a system as set forth in the foregoing paragraph wherein the source is an unloader-controlled compressor which operates in unloaded condition when the pressures in the reservoirs are between normal levels but is loaded by decrease below normal of the pressure in any of the reservoirs with the compressor in loaded condition delivering pressure only to that reservoir which is below normal pressure.

Other objects and their attendant advantages will become apparent as the following detailed description is read in conjunction with the accompanying drawing which discloses a schematic system constructed in accordance with the present invention.

In the drawing the numeral **10** designates a conventional compressor having a piston **12**, an inlet valve **14**, an outlet valve **16** and an unloader **18** of the usual type comprising a small piston **20** having a plunger **22** which engages the compressor inlet valve to retain this off its seat when governor-controlled air is admitted to the unloader piston by way of an unloader conduit **24** as hereinafter described in detail. Connected to the outlet of the compressor is a conduit **26** leading to branch conduits **28, 30** respectively connected to a cut-off valve **32** and a pressure protection valve **34**.

The valve **32** is of known construction and comprises a body which is divided into inlet, delivery and control cavities **36, 38, 40**, with communication between the inlet and delivery cavities being controlled by a pressure responsive diaphragm **42** urged by a spring **44** to cut-off position but being moved to open position by inlet pressure until such time as control pressure is admitted to the control cavity by means later described. Upon this latter occurrence the diaphragm **42** is moved to cut-off

position against inlet and delivery pressures because of spring force and the greater motive area of the right side than of the left side of the diaphragm.

Connected to the delivery cavity **38** of the cut-off valve is a conduit **46** leading to a low pressure reservoir **48** having an outlet **49** leading to a pressure actuated device (not shown) which may be an air brake system. Connected also to the reservoir **48** is a governor conduit **50** leading to one side of a conventional fluid pressure governor **52** whose other side is connected to a control conduit **54** having one branch **56** leading to the control cavity **40** of the cut-off valve **32** and a second branch **58** leading to the control cavity of a conventional relay valve **60** hereinafter described in detail. The governor **52** is responsive to a predetermined high pressure in reservoir **48** to connect conduits **50** and **54** to admit control pressure to the cut-off valve **32** and the relay valve **60** and is responsive to a predetermined low pressure to disconnect the conduit **50** from conduit **54** while simultaneously connecting the latter to atmosphere to exhaust control pressure from both the cut-off valve **32** and the relay valve **60**.

The relay valve **60** is of conventional construction and has a control cavity **62** which is connected to conduit **58** and is separated from a delivery cavity **64** and an exhaust cavity **65** in the valve body by a diaphragm **66**. The exhaust cavity is connected to atmosphere by a port **67** and the delivery cavity is connected to the unloader line **24**, with the exhaust cavity being separated from the delivery cavity by an annular wall **68** whose upper surface is sealed by the diaphragm when pressure is in the control cavity, the inner annular surface of the wall affording a cylinder for a piston member **70** having a plurality of exhaust ports **72** therethrough and a stem **74** which carries an inlet valve member **76** urged by a spring **78** to a position closing off a port affording a connection between the delivery cavity **64** and an inlet cavity **80**. The inlet cavity is connected to a conduit **82** leading to one side of second governor **84** whose other side is connected to a control conduit **86** leading to a high pressure reservoir **88**. The governor **84** serves to connect the conduits **86, 82** when a predetermined high pressure is reached in the reservoir **88** and to disconnect conduit **86** from conduit **82** and connect the latter to atmosphere when a predetermined low pressure is reached in the reservoir **88**.

The reservoir **88** has an outlet **90** connected to a device (not shown), such as an air starting motor, responsive to high pressure with the reservoir being supplied with pressure by way of a delivery conduit **92** containing a check valve **94**. The conduit **92** is connected to the aforementioned pressure protection valve **34** which is of conventional construction having an inlet cavity **96** which is connected to the branch conduit **30** and a delivery cavity **98** connected to the conduit **92**. The valve **34** includes an adjustable spring **100** which bears on a diaphragm **102** carrying a valve **104** which normally closes a connection between the inlet and delivery cavities **96, 98**, the arrangement being such that the spring retains the valve **104** in closed position until a predetermined minimum pressure exists in the compressor outlet conduit **26** whereupon the diaphragm is moved by the force of this minimum pressure to open the valve **104**. The purpose of the pressure protection valve **34** is to insure that a minimum pressure exists in the low pressure reservoir before air is delivered to the high pressure reservoir. Thus if the low pressure reservoir supplies a brake system, braking pressure will be assured without the low pressure air being shuttled to the high pressure reservoir which would occur if the pressure protection valve were not in the system.

In operation and assuming a no-air condition, the governors **52** and **84** are in positions disconnecting the respec-

tive reservoirs from the relay valve 60. The control chamber of the cut-off valve 32 is connected to atmosphere through governor 52 and the unloader is also connected to atmosphere through the delivery cavity 64, exhaust ports 72 and exhaust chamber 65 of the relay valve 60.

When the compressor 10 commences operation compressed air is delivered by way of conduits 26, 28 and chambers 36, 38 of the cut-off valve 32 to the low pressure reservoir 48. Air pressure is also delivered by way of conduit 30 to protection valve 34 but can proceed no further until such time as the pressure in the low pressure reservoir 48 reaches a predetermined minimum level determined by the setting of the adjustment spring 100 of the protection valve. When this minimum level is reached the protection valve moves to open position and air pressure thereafter is delivered equally to the high and low pressure reservoirs exactly as if the protection valve were not in the system.

When the pressure in the low pressure reservoir 48 has reached a predetermined high level determined by the setting of governor 52, the latter is energized to connect the reservoir 48 with the cut-off valve 32 and with the control chamber 62 of the relay valve 60. Upon this occurrence the cut-off valve diaphragm 42 is moved to cut off the connection between the compressor and the low pressure reservoir and the diaphragm 66 of the relay valve 60 is forced downwardly to disconnect the exhaust chamber 65 from the delivery chamber 64 while simultaneously moving the valve 76 to open position so that conduit 82, connected to governor 84, is in free communication with the conduit 24 leading to the unloader but because there is as yet only atmospheric pressure in conduit 82, no effect is had on the unloader by the opening of the valve 76, and the compressor continues to deliver pressure but only to the high pressure reservoir.

It is desired to point out here that the unloader 18 will function to unload the compressor when supplied with fluid pressure of a value similar to that supplied to cavity 62 by operation of the low pressure governor 52.

Assume now that the high pressure governor 84 cuts-out, charging the cavities 80 and 64 with pressure in excess of the pressure in low pressure cavity 62. This excess pressure immediately causes the inlet valve 76 to come to closed position and the exhaust valve 68 to lap-off to trap the pressure in the cavity 64 approximately equal to the pressure in the low pressure governor cavity 62 while the high pressure governor cut-out pressure is trapped in the cavity 80. The compressor now is in the unloaded position due to pressure in the conduit 24 and remains so until either the high pressure governor 84, or the low pressure governor 52 cuts-in.

Assuming that the pressure in the low pressure reservoir 48 is the first to fall, the governor 52 is operated to disconnect conduit 50 from conduits 56 and 58 while connecting the latter, and hence the control chambers of the cut-off and relay valves 32, 60, to atmosphere. When the control chamber 62 of the relay valve is connected to atmosphere, the pressure in the delivery chamber 64 and hence in the unloader conduit 24 is connected to atmosphere through the ports 72 in the relay valve piston 70, the pressure on the lower side of the diaphragm 66 moving the latter upwardly clear of the upper edge of wall 68 so that the pressure in the delivery cavity 64 can escape freely to atmosphere. When this occurs, the unloader moves automatically to loading position so that the compressor 10 again delivers air pressure to conduit 26. The pressure flows through conduit 26, conduit 28, the cut-off valve 32 and conduit 46 to the reservoir 48 where the pressure builds up to the high setting of the governor 52 so that air pressure is again admitted to the control chambers of the cut-off valve and the relay valve to close the former and open the valve 76 to again connect the unloader to the high pressure air from reservoir 88 to unload the compressor. As pressure is delivered to the low pressure reservoir no additional pressure is delivered to the high pressure reservoir because the back pressure on the check valve 94 prevents this from being unseated by the relatively much lower pressure being delivered to the low pressure reservoir.

Assume now, that the high pressure reservoir 88 falls to its predetermined low setting before the low pressure reservoir. Upon this occurrence, the governor 84 operates to disconnect the conduit 86 from conduit 82 and to connect the latter to atmosphere which also serves to connect the unloader conduit 24 to atmosphere inasmuch as the valve 76 in the relay valve 60 is maintained in open position by the low pressure air operating on the upper side of the diaphragm 66 to urge the latter downwardly. When the unloader moves to loading position, the compressor delivers air to conduits 26, 30 through protection valve 34, conduits 92 and check valve 94 to the high pressure reservoir. No pressure is delivered to the low pressure reservoir 48 because the diaphragm of the cut-off valve is retained in closed position by pressure from governor 52. If during the process of charging the high pressure reservoir a depletion of the low pressure reservoir results, to the point where it is below its predetermined low pressure, the system functions to divert the charging pressure to the low pressure reservoir. Thus it can be seen that the system functions to favor, at all times, the low pressure reservoir.

From the foregoing description it should be apparent that the present invention has provided a dual pressure system for delivering different pressures to different reservoirs by means of a single compressor with the compressor being loaded in response to the fall of pressure to different low levels in either of the respective reservoirs. It should be understood that if no necessity exists for quick build-up of pressure in the low pressure reservoir the pressure protection valve 34 could be omitted and if desired a second cut-off valve could be substituted therefor between the conduits 30 and 92. The system of the invention has been described as using valves of known construction. It should be expressly understood that this is for illustrative purposes only since it would be apparent to those skilled in the art that if desired a single pressure responsive element might be employed to operate both the cut-off valve and the valve 76 in the relay valve 60, with a conventional three-way valve being substituted for the supply-and-exhaust feature of the relay valve illustrated. Those and other modifications are intended to be included within the purview of the invention and within the scope and spirit of the appended claims.

What is claimed is:

1. A fluid pressure system comprising a compressor, a pair of reservoirs connected in parallel to said compressor, valve means in the connection between said compressor and one of said reservoirs, fluid pressure responsive means for controlling said valve means, an unloader for said compressor, fluid pressure conduit means connecting said second reservoir to said unloader, second valve means in said conduit means normally disconnecting said second reservoir from said unloader while connecting the latter to atmosphere, second fluid pressure responsive means operatively connected to said second valve means and movable in response to fluid pressure to connect said second reservoir to said unloader while disconnecting the latter from atmosphere, second fluid conduit means connecting said first reservoir to said first and second fluid pressure responsive means, a governor in said first conduit for controlling the flow of fluid pressure in said second reservoir to and from said second valve means in response to pressure conditions in said second reservoir, and a second governor in said second conduit for controlling the flow of fluid pressure to and from said first and second fluid pressure responsive means in response to fluid pressure conditions in said first reservoir.

2. A fluid pressure system according to claim 1 and including a normally closed pressure protection valve in the connection between said compressor and said second reservoir and means responsive to a predetermined pressure in said first reservoir for moving said protection valve to open position.

3. A fluid pressure system according to claim 1 and including a check valve in the connection between said compressor and said second reservoir.

4. A fluid pressure system comprising a compressor, a pair of reservoirs connected in parallel to said compressor, valve means in the connection between said compressor and one of said reservoirs, an unloader for said compressor, fluid pressure conduit means connecting said second reservoir to said unloader, second valve means in said conduit means normally disconnecting said second reservoir from said unloader while connecting the latter to atmosphere, fluid pressure responsive means operatively connected to said first and second valve means and movable in response to fluid pressure to disconnect said compressor and said first reservoir and connect said second reservoir to said unloader while disconnecting the latter from atmosphere, second fluid conduit means connecting said first reservoir to said fluid pressure responsive means, a governor in said first conduit for controlling the flow of fluid pressure in said second reservoir to and from said second valve means in response to pressure conditions in said second reservoir, and a second governor in said second conduit for controlling the flow of fluid pressure in said first reservoir to and from said fluid pressure responsive means in response to fluid pressure conditions in said first reservoir.

5. A fluid pressure system according to claim 4 and including a check valve in the connection between said compressor and said second reservoir.

6. A fluid pressure system according to claim 5 where-

in the governor in said first conduit is operative at a pressure higher than the governor in said second conduit.

7. In a fluid pressure system including a compressor, a pair of reservoirs connected in parallel to the compressor, and an unloader for controlling the compressor, means for maintaining different fluid pressures in said reservoirs comprising valve means in the connection between said compressor and one reservoir, fluid conduit means between said unloader and said second reservoir, second valve means in said conduit normally disconnecting said second reservoir from said unloader while connecting the latter to atmosphere, pressure responsive means for moving said first valve means to closed position and moving said second valve means so as to connect said second reservoir to said unloader while disconnecting the latter from atmosphere, second fluid conduit means connecting said first reservoir and said pressure responsive means, a fluid pressure governor in said second conduit responsive to predetermined pressures in said first reservoir for controlling the flow of pressure to and from said pressure responsive means, and a second governor in said first conduit responsive to predetermined pressures, higher than the pressures in said first reservoir, for controlling the flow of pressure to and from said second valve means.

8. In the fluid pressure system of claim 7 including a check valve in the connection between said compressor and said second reservoir.

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