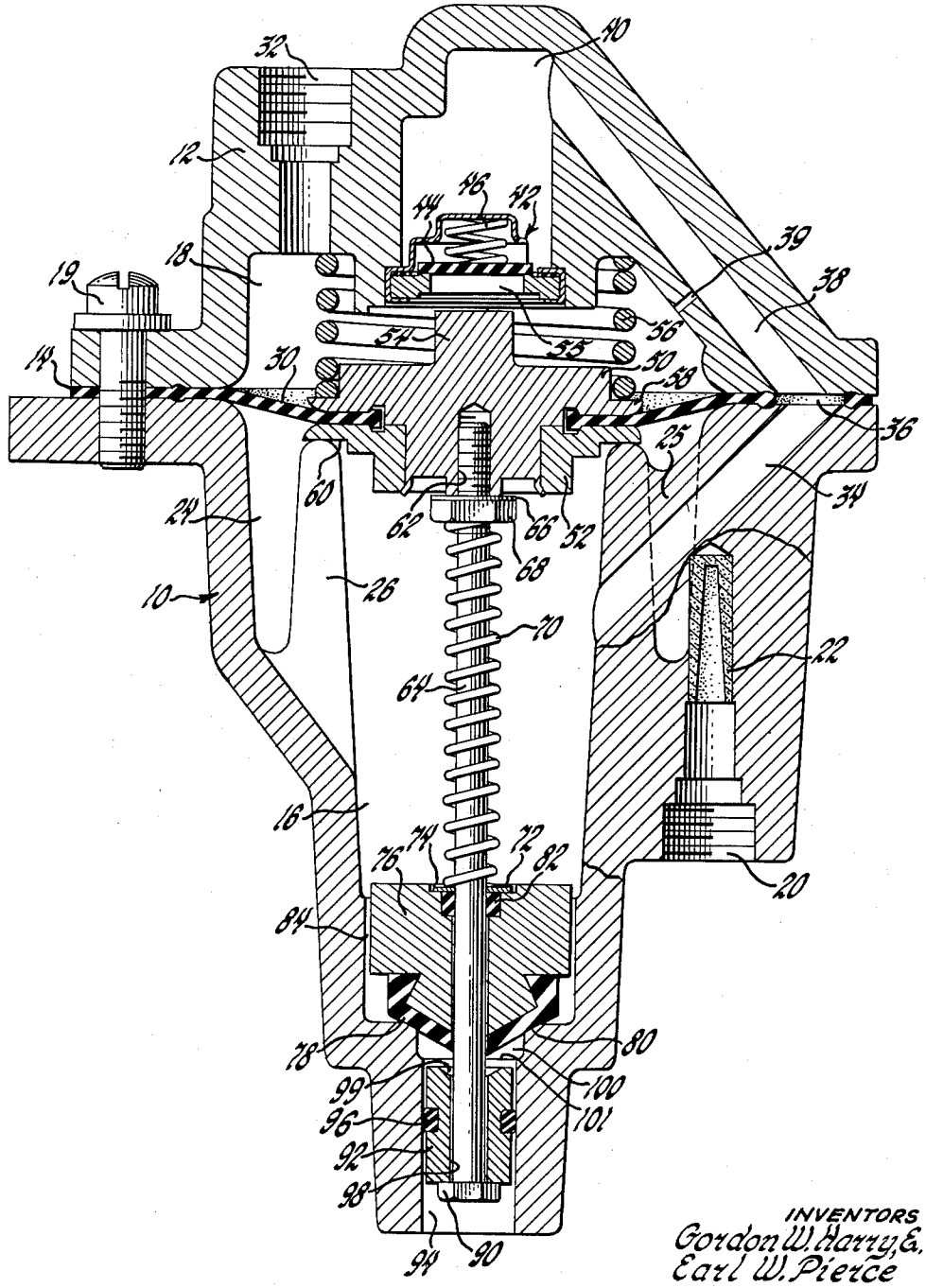
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MOISTURE BLOW-OFF VALVE

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INVENTORS
Gordon W. Harry, &
Earl W. Pierce

BY George E. Johnson

ATTORNEY

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MOISTURE BLOW-OFF VALVE

Gordon W. Harry, Flushing, and Earl W. Pierce, Flint, Mich., assignors to General Motors Corporation, Detroit, Mich., a corporation of Delaware

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This invention relates to valves for removing impurities from air lines of pneumatic systems and more particularly to valves for removing moisture from compressed air systems supplying compressed air to pneumatic apparatus such as vehicle air suspension systems or pneumatic tools.

In the operation of pneumatic apparatus such as vehicle suspension systems using compressed air, difficulties have been experienced because of the entrainment of moisture which causes malfunctioning of the valves and other parts of the systems. Difficulties have become particularly apparent during cold weather. It is obvious that a simple and compact device for removing any entrained moisture from pneumatic systems is essential and that such a device should be rugged in construction and reliable in its use.

An object of the present invention is to provide an improved valve by means of which moisture may be removed from a compressed air system with a minimum of compressed air leakage.

To this end, a feature of the present invention is a valve with a pressure actuated portion of a diaphragm operated by differential air pressure forceably to eject moisture from a compressed air stream by-passing the actuated portion.

The above and other important features of the invention will now be described in detail in the specification and then pointed out more particularly in the appended claims.

In the drawing is depicted a cross-sectional view of a moisture blow-off valve constituting an embodiment of the present invention.

The valve comprises a main body **10**, a cover member **12** with a diaphragm **14** interposed between the two members and cooperating with the latter in defining an air inlet chamber **16** and an air outlet chamber **18**. Bolts such as the bolt **19** are utilized to hold the valve together. A threaded air inlet port **20** is formed in the main body member **10** and this port leads to a sintered metal filter element **22** tightly fixed within the body member **10** for separating dirt particles which may be directed through the port **20** with the air supply. The upper interior portion of the main body member **10** is enlarged to enclose an annular chamber **24** herein considered as a portion of the air inlet chamber **16** as it is separated from the main portion of the air chamber **16** only by means of two semi-circular deflectors or ridges. Only one ridge **26** is shown in the drawing but it will be appreciated that diametrically opposed passages are formed between the ridges to provide a full and open communication between the annular chamber portion **24** and the main portion of the chamber **16**. A small part of the chamber portion **24** is traversed by a web **25** for a purpose to be described hereinafter.

The diaphragm **14** is so placed that its periphery or circular margin forms a seal between the main body member **10** and the cap member **12**. The intermediate portion of the diaphragm may be flexed and constitutes a pressure actuated diaphragm portion **30** separating the air inlet chamber **16** and its annular portion **24** from the air outlet chamber **18**.

A passage **34** is formed in the main body member **10** and through the web **25** in such a way as to communicate with the main portion of the air inlet chamber **16** and by-pass the annular chamber portion **24**. The upper end of the passage **34** is arranged to communicate with an

opening **36** formed in the margin of the diaphragm **14** and also with a passage **38** formed in the cover member **12**. The other end of the passage **38** communicates with a chamber **40** in the cap member **12** which encloses a normally closed spring and pressure actuated valve generally indicated at **42**. The latter functions as a main air valve and is supported in such position that it faces the plane of the diaphragm **14** with a valve disc **44** urged downwardly into closed position by means of a spring **46**. Details regarding this main air valve are not specifically given herein, but it will be understood that it is the type of one-way valve commonly used in diaphragm fuel pumps and other devices of like nature. The central portion of the diaphragm **14** is apertured to accommodate two clamping members **50** and **52**. These two members are rigidly fixed together to clamp the inner margin of the diaphragm **14**. The clamping member **50** has a central and upwardly projecting protuberance **54** which faces the underside of the valve disc **44** and is spaced from the latter when no air is passing through the blow-off valve. The opening **55** in the valve **42** is larger in diameter than the protuberance **54**.

The drawing shows the blow-off valve in its inoperative position (that is, when no compressed air is being used by the system) and a coil spring **56** is installed within the air outlet chamber **18** and bears downwardly against a shoulder **58** formed on the member **50** to hold a shoulder **60** of the clamping member **52** down against the upper rim of the semi-circular ridges or portions in the air inlet chamber. The valve **42** is then in its normally closed position.

The underside of the clamping member **50** is bored and threaded as at **62** tightly to receive the upper end of a rod **64**. A washer **66** and a nut **68** are provided to make this attachment secure. The rod **64** is surrounded by a coil spring **70**, the upper end of which bears against the underside of the nut **68** and the lower end of which bears against a washer **72** resting in a recess **74** formed on the top of a poppet-type valve **76**. The latter is adapted to slide upon the rod **64** and is provided with a conical rubber seat **78** which faces downwardly to contact an annular seat **80** formed on the body member **10**. The washer **72** serves to confine a sealing washer **82** within the valve **76** so that air is at all times prevented from escaping along the rod and through the valve **76**.

A clearance **84** is provided between the periphery of the valve **76** and the wall of a lower reduced portion **16**. The lower end of the rod **64** is provided with an octagonal head **90** and the rod is surrounded by a piston-like valve **92** located within a blow-off port **94** leading from the bottom of the air inlet chamber **16**. An O-ring **96** is held within a groove formed in the valve continuously to prevent air leakage between the coaxial walls of the port **94** and the valve **92**. A clearance **98**, however, is provided between the cylindrical walls of the bolt **64** and the bore leading through the valve **92**.

The two independently movable valves **76** and **92** normally cooperate with the main body member **10** and the rod **64** in defining a closed annular blow-off zone **100** extending around the rod.

In operating the valve and remembering that the purpose of the valve is to remove impurities and particularly moisture from an air line system, air is admitted under pressure and from the air supply by way of the port **20** with the removal of solid impurities by the filter **22** and the removal of moisture in the air chamber **16**. The removal of the moisture is by virtue of the deflecting action of the ridges **26** which serve as baffles and also by virtue of the capacity of the chamber **16** which promotes the dropping out of the moisture. The latter tends to gather at the lower end of the air inlet chamber **16** around the poppet type valve **76**. This presupposes that air is passing

through the blow-off valve and to the system by way of the outlet port **32**. If no air is called for by the suspension system or by any pneumatic tool served by the system in which the blow-off valve is installed, no air passes from the chamber **18** by way of the port **32** even though communication between the chamber **16** and the chamber **40** is had by way of the passages **34** and **38**. This is because the valve **42** is held in its closed position by means of the spring **46**. As soon as air is called for, however, the suspension system or pneumatic tool will demand air from the air outlet chamber **18**. This will give rise to a reduction in pressure in that chamber with a consequent lifting of the diaphragm **30** and the displacement of the valve disc **44** by the protuberance **54**. As a consequence, air will pass through the port **55** of the valve **42** and through the outlet chamber **18** and the port **32** to the point of use. When the demand for compressed air ceases, the pressure in the chamber **18** will rise—i.e., the differential pressure affecting the diaphragm **14** will cease to exist and the spring **56** will cause the parts to assume the positions shown in the drawing. Valve **42** will become closed.

When air is called for and the diaphragm **14** rises against the spring **56**, the rod **64** rises with the diaphragm with the head **90** of the rod closing the clearance space or moisture discharge passage **98**. The rod also carries the valve **92** upwardly until it seats at **99** against the lower end of the valve **76** after which both valves **92** and **76** continue to rise. As a consequence, the valve **76** is lifted from its seat **80** and any moisture which may previously have settled at the lower end of the chamber **16** will run into the blow-off zone **100** and be temporarily retained therein. The design is such that the O-ring seal **96** never rises beyond a shoulder **101** formed on the main body. This is to prevent wear and abrasion of the seal.

When the demand for compressed air ceases and the diaphragm **14** lowers and simultaneously lowers the rod **64**, the spring **70** will again cause the valve **76** to seat and sufficient air pressure will be retained within the zone **100** to expel any moisture therein to atmosphere through the discharge passage **98** and the port **94**. It will be noted that at no time during the complete cycle of the valve is there a free passage for the escape of compressed air from the air inlet chamber **16** to atmosphere by way of the port **94**. Such a passage is blocked either at **80** or **99** and, because of this feature, no compressed air is wasted despite the moisture ejection.

The bleed **39** is preferably utilized to insure blow-off of moisture by the valve despite possible limited use or prolonged non-use of compressed air by the system served. It is obvious that if the water ejection was not sufficiently or periodically engaged in, the first demand on the system for compressed air may well find operation difficult. By means of the vent **39** the blow-off valve maintains the system clear of moisture at all times. After

the valve **44** is closed upon an initial downward movement of the rod **64**, it is possible that unequal air pressures will be exerted on opposite sides of the diaphragm **14** so that the latter and the valve **92** will not lower to discharge moisture. This difficulty would be due to a build-up of a pressure pocket in chamber **16**. This being the case, a moisture blow-off passage would not be opened before air would again be required from the system. The vent **39**, however, provides a means whereby the air pressures on opposite sides of the diaphragm **14** are slowly equalized during a period of non-use for the system with the result that the spring **56** is enabled to effect complete downward rod movement and moisture is discharged.

We claim:

A moisture blow-off valve comprising a main body member, a cover member, a diaphragm between said members and cooperating with the latter in defining an air inlet chamber in said body member and an air outlet chamber in said cover member, a port leading from each of said chambers, a pressure actuated portion of said diaphragm having a rod fixed thereto and depending therefrom, spring means in said outlet chamber urging said pressure actuated portion downwardly, a passage in said valve extending around said pressure actuated portion and connecting said chambers, a main air valve controlling said passage, a moisture blow-off port leading from said air inlet chamber, two valves slidable on said rod and movable upwardly by the latter when a differential pressure exists between said inlet and outlet chambers, one of said two valves being a spring-loaded poppet type valve adapted to seat on said body member to close the port leading from the air inlet chamber when said differential pressure is non-existent and said spring means is effective, the other of said valves cooperating with said rod in defining a moisture discharge passage within said blow-off port and being arranged to seat on said one valve to close said discharge passage when said differential pressure exists, said two valves and said main body defining a blow-off zone around said rod in communication with said discharge passage, and the arrangement being such that either one of said two valves is in closed position when the other of said two valves is in open position whereby no free communication is had at any time between said inlet chamber and said blow-off port.

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