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(54) **Vacuum control system.**

(57) A retard delay control valve 60 has a housing 62 defining a chamber 72 therein which has a check valve 68 in communication with the outlet 64 that is in communication with a ported vacuum source 12. The end of the chamber 72 has an inlet 66 in communication with the vacuum reservoir 54 which is in communication with the control section 56 of bypass valve 58. The chamber 72 has a scintered metal plug 76 in communication with and unchecked to the exterior of the chamber 72 for continuously bleeding in ambient air directly into the chamber at a sufficiently small rate such that when a vacuum is supplied to outlet 64, the chamber 72 is evacuated to maintain the bypass valve in a closed position. When the vacuum is not applied to outlet 64, the check valve 68 is closed to allow continuous bleeding through the scintered metal plugs 76 to slowly dissipate the vacuum in the chamber 72 such that after a predetermined amount of time the bypass valve 58 is opened.

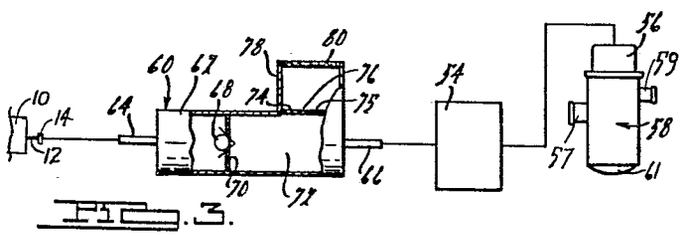

Fig. 3.

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DESCRIPTION.

VACUUM CONTROL SYSTEM.

This invention relates to vacuum control systems.

In some motor vehicles, air is introduced into the exhaust system to effect combustion of unburned hydrocarbons and to effect catalytic convertion of the exhaust gases. By-pass valves are provided to prevent overheating of the exhaust system which would otherwise occur during periods of sustained idling or deceleration. A vacuum control is usually incorporated in such systems so that the by-pass valve is actuated only after a predetermined period following commencement of the idling or deceleration. Typically, such control systems comprise an assembly of parts which are expensive to produce and difficult to assemble.

According to the present invention, there is provided a control system for a vacuum-operated valve comprising a vacuum line adapted at one end for connection to a vacuum source and at the other end for connection to the vacuum operated valve, the said valve being movable between open and closed positions in response to changes in pressure levels in the vacuum line, a check valve in the vacuum line for permitting flow of fluid in one direction along the vacuum line towards the vacuum source, characterised by a bleed passage effecring communication between a fluid pressure source and the vacuum line between the check valve and the said other end of the vacuum line.

In accordance with a preferred embodiment of the invention, a thermactor delay control has a housing defining a chamber with a check valve normally biased to a closed position operably positioned between the chamber and a ported vacuum source such that when the vacuum source applies a low pressure to the check valve, the check valve opens. The housing chamber also has a restricted orifice which is in fluid communication to the exterior of the chamber. The chamber also has an inlet which communicates with a vacuum reservoir which in turns communicates with a vacuum control portion of a bypass valve.

Further, according to the invention, the restricted orifice is preferably formed from a sintered metal plug. The sintered metal plug allows continuous bleeding of air into the chamber. The bleeding of air is sufficiently slow to normally allow the vacuum source to create sufficiently low pressure in the chamber and vacuum reservoir to control the bypass valve and maintain it in a normally closed position such that air flow is directed through the bypass valve into the thermactor system. When the vacuum source has a sufficiently high pressure during idle and deceleration modes, the check valve closes and the continuous bleeding of air slowly fills the chamber and vacuum reservoir. The vacuum control portion maintains the vacuum bypass valve in its closed position for a predetermined amount of time until sufficient amount of air bleeds through the sintered metal plug such that the pressure is sufficiently increased so that the bypass valve is biased to its open position to divert air from entering the exhaust system.

In broader terms, the delay control has a calibrated orifice for allowing a continuous bleeding of air into the line which is operably connected to the vacuum control of a bypass valve.

In order that the invention may be better understood, a typical known system, and a preferred embodiment of the invention will now be described, by way of example only, with reference to the drawings, in which:-

Reference now will be made to the accompanying drawings in which:-

Figure 1 is a schematic view of a prior art system used to retard the opening of the bypass valve.

Figure 2 is a schematic diagram of the system shown in Figure 1.

Figure 3 is a partially schematic and segmented view of an embodiment of a thermactor delay control system according to the invention.

Figure 4 is a schematic diagram of the thermactor delay control system shown in Figure 3.

Figure 5 shows a second embodiment of a thermactor delay control according to the invention.

Referring first to Figures 1 and 2 a typical vacuum control system is illustrated. This system controls a bypass valve 58 by sensing the ported vacuum in a carburetor 10 above the throttle. The carburetor 10 has a ported vacuum outlet 12 connected to a temperature vacuum switch 14. A tube 16 connects the switch 14 to a T junction 18. Tube 20 extends from T junction 18 to a check valve 22. Tube 24 is connected to control inlet 26 of a vacuum vent valve 28. Vacuum vent valve 28 includes a diaphragm 30 which is responsive to the vacuum in inlet 26 such that a predetermined low pressure therein moves diaphragm 30 to the left in Figure 1. The diaphragm 30 is integral with a valve member 32 which closes vacuum vent valve 28. Upon an increase in pressure occuring in tube 24 (i.e., a decrease in vacuum), the diaphragm 30 moves valve member 32 to the right to open the valve 28 to let air flow through a restricting orifice 34 in outlet 36.

Check valve 22 has an outlet connected to a tube 38. The outlet 36 is connected to tube 40. Tubes 38 and 40 are connected to a T junction 42 which also is connected to tube 44 leading to a retard delay valve 46 which includes a check valve 48 and a restricted orifice 50 formed by a sintered metal plug. The retard delay valve 46 is also in communication with a vacuum reservoir 54 which leads to the vacuum control 56 of bypass valve 58. The bypass valve 58 is constructed such that when a low pressure below a predetermined value is applied to the vacuum control 56, the bypass valve 58 is actuated to a position that allows air to pass from inlet 57 connected to a thermactor pump (not shown) to outlet 59 connected to the exhaust manifold (not shown) and seals off vent port 61 (hereinafter referred to as the bypass valve's closed position). When the pressure in vacuum control 45 is above the predetermined value, the bypass valve 58 is biased to move to a position that allows air to pass from inlet 57 to vent port 61 and to close off outlet 59 (hereinafter referred to as the bypass valve's open position).

The operation of the device in Figure 1 is described with reference to Figure 2. When a low pressure is applied to the ported vacuum vent 12, the vent valve 28 is moved to its closed position and check valve 22 and check valve 48 are opened so a low pressure is applied to the inlet side of the retard delay valve 46 and on the control portion 56 of the bypass valve 58 to maintain the bypass valve 58 in its closed position such that air passes from inlet 57 through outlet 59 and to the exhaust system (not shown). When the pressure in tube 16 increases due to a deceleration mode or idle mode, check valves 22 and 48 close, and the vent valve 28 opens. Air passes through tubes 40 and 44 and bleeds through orifice 50 to tube 52 which leads to vacuum reservoir 54 such that in an appropriate amount of time, the vacuum control 56 allows the bypass valve 58 to open and cause air from the thermactor pump to be dumped through vent 61 and bypass the exhaust system.

Referring now to Figure 3, a thermactor delay control 60 is operably connected to a ported vacuum source

12, a vacuum reservoir 54, and control portion 56 of a thermactor bypass valve 58. The thermactor delay control 60 includes a generally cylindrically shaped housing 62 with an outlet 64 at one end and an inlet 66 at an opposing end thereof.

A dividing wall 70 partitions off a chamber 72 within housing 62. A check valve 68 is mounted in the dividing wall 70 in communication with outlet 64 and chamber 72. The outlet 64 is operably connected to the ported vacuum source 12. The check valve 68 is normally biased to a closed position and is mounted such that when a low pressure is applied to outlet 64 the check valve 68 opens.

Sidewall 74 of chamber 72 has an orifice 75 fitted with a scintered metal plug 76. The scintered metal plug 76 includes a multitude of metallic fibers secured together to provide flow spaces therebetween. It is sealingly fitted in the orifice 75 to restrict and calibrate the amount of flow of air flowing therethrough and into the chamber 72.

A projecting section 78 of housing 62 is capped with an air filter 80 which covers the scintered metal plug 76 to protect it from particulates that can clog the plug 76.

The inlet 66 is in fluid communication with the vacuum reservoir 54 which in turn is connected to the control section 56 of bypass valve 58.

The specific shape of the control 60 can have many variations. Figure 4 shows more clearly, in schematic form, the functional structure of the control 60. The outlet line 64 is in communication with check valve 68 biased to a closed position and operable upon a vacuum in outlet line 64. Orifice 75 is upstream from check valve 68 and has one end in fluid communication with

inlet line 66 and check valve 68. The other end of orifice is unchecked and provides continuous bleeding into the vacuum lines.

The operation of the thermactor control system can be described with reference to Figures 3 and 4. A low pressure is normally applied to outlet 64 which opens check valve 68 and introduces a low pressure to chamber 72 and inlet 66. The orifice 75 with the scintered metal plug 76 sufficiently restricts the flow into the chamber 72 such that the vacuum source 12 connected to outlet 64 easily overcomes the continuous bleeding through the orifice 74 to maintain the low pressure within the chamber 72, line 66, vacuum reservoir 54, and the control section 56 of the bypass valve 58. The pressure applied to control section 56 sufficiently low to maintain the bypass valve in a normally closed position against its bias to open such that air passes from inlet 57 to outlet 59 and to the exhaust manifold (not shown).

When the carburetor 10 is put in the idle mode or deceleration mode, and the ported vacuum source 12 no longer provides a sufficiently low pressure, the check valve 68 is biased to its closed position to prevent backup of vapors through the thermactor delay control 60, and to close off vacuum reservoir 54. Air slowly bleeds through orifice 75 which allows continuous bleeding of air therethrough into the chamber 72 and through the inlet 66 to the vacuum reservoir 54. The calibrated bleeding of air is sufficiently slow to maintain a low pressure within reservoir 54 for controlling the bypass valve 58 for a predetermined amount of time after which the pressure is sufficiently increased to allow the bypass valve to bias to its open position. Air which passes through inlet 57 is then dumped through vent port 61. Most commonly, the scintered metal plug 76 is formed to allow for an

approximately 50 second delay after an idle or deceleration modes commences after which the bypass valve 58 is then opened. As a consequence of the delay control, if the carburetor 10 has its idle mode or deceleration mode for less than a 50 second continuous span, the bypass valve 58 remains closed during the span and the thermactor system remains actuated with air being pumped into the exhaust manifold.

A second embodiment of a thermactor control according to the invention is illustrated in Figure 5. In the second embodiment, the thermactor delay control 60 includes a substantially cylindrical housing 80 with an annular end plate 82 having a central outlet 84 extending therefrom. An annular end plate 86 is spaced from the end plate 82 with an inlet tube 88 extending therefrom. A scintered metal plug 96 is mounted within an aperture 98 in the annular plate 86.

A dividing plate 90 is positioned within housing 80 between the two end plates 82 and 86. The dividing plate 90 has a check valve 92 mounted therethrough which is normally biased to a closed position and openable upon a vacuum present in inlet 84. The dividing plate 90, end plate 86, and housing sidewall 80 define a chamber 94 in communication with the inlet 88.

The sidewall 81 of housing 88 extends axially beyond the end plate 86 to form a seat for an annular filter 98 which fits about the inlet 88 and covers the scintered metal plug 96. An annular end cap 100 is fitted within the cylindrical sidewall 81 about inlet tube 88 to cover the filter 98. The end cap 100 has radially extending slots 102 which allow air to pass therethrough and through the filter 98 and the sintered metal plug 96. As shown for the first embodiment, the inlet tube 88 is fluidly connected to the vacuum reservoir 54 and outlet 84 is similarly connected to the ported vacuum source 12.

The function of the second embodiment is identical to the first embodiment in that when a low pressure is applied to outlet 84, the check valve is opened and the vacuum source evacuates the chamber 94 and vacuum reservoir 54 and control section 56 to control bypass valve 58.

The scintered metal plug 96 allows a calibrated continuous bleed that is sufficiently slow for the vacuum source to easily overcome.

When the vacuum source has an increased pressure, the check valve 92 closes to close off chamber 94. Continuous bleeding of air through the scintered metal plug 96 into chamber 94 and through outlet 88 into vacuum reservoir 54 slowly builds up the pressure therein such that upon a predeteremined amount of time, the bypass valve 58 opens thereby dumping the thermactor air into vent port 61.

The use of an orifice that provides continuous bleeding allows for a great simplification of the thermactor delay control system. The simple one-piece control valve 60 replaces a myriad of parts; namely, T junctions 18 and 42, lines 24, 20, 38, 40 and 44, vented value 28, check valve 22, and retard valve 46 shown in Figure 1. In total, the one control 60 replaces ten separate parts and eliminates the cost of assembling these ten parts.

The use of a continuous bleeding delay valve which provides for a calibrated constant bleeding of air can directly be substituted for the previous systems. The substitution provides a great cost savings.

CLAIMS.

1. A control system for a vacuum-operated valve comprising a vacuum line adapted at one end for connection to a vacuum source and at the other end for connection to the vacuum-operated valve, the said valve being movable between open and closed positions in response to changes in pressure levels in the vacuum line, a check valve in the vacuum line for permitting flow of fluid in one direction along the vacuum line towards the vacuum source, characterised by a bleed passage effecting communication between a fluid pressure source and the vacuum line between the check valve and the said other end of the vacuum line.

2. A vacuum control system comprising:

a housing defining a chamber with an inlet, outlet and passage including an orifice;

said outlet operably connectable to a ported variable vacuum source;

a one way check valve operably positioned on the outlet side of said chamber and operable upon a sufficiently low predetermined gas pressure applied on said outlet by said ported variable vacuum source;

said orifice being in fluid communication with an exterior air source and being calibrated for continuously bleeding air into said chamber;

said inlet being operably connectable to a vacuum actuated thermactor bypass valve;

said bypasss valve being actuated to a first position when the gas pressure within said chamber is below a predetermined pressure and actuated to a second position when the gas pressure within said line is above said predetermined pressure;

said orifice calibrated for a sufficiently small continuous bleed such that said variable vacuum source provides sufficiently low gas pressure below said predetermined pressure in said chamber when said check valve is open in view of constant bleeding of air through said orifice and into said chamber, and a sufficiently slow buildup in gas pressure in said chamber connected to said inlet occurs when said check valve is closed to controllably delay the buildup of pressure to said predetermined amount whereby the actuation of said bypass valve to its second position is controllably delayed.

3. A system according to claim 1 wherein:-

said housing has a substantially cylindrical sidewall;

said housing has one end wall with said outlet therethrough;

said housing has a second endwall with said inlet and said bleed passage therethrough;

a dividing wall between said endwalls with said check valve mounted in an perture through said dividing wall;

said chamber is defined by said dividing wall, said second endwall and said cylindrical sidewall.

4. A system according to any one of claims 1 to 3 wherein said bleed passage comprises a flow restricting plug means including a multitude of members secured together in a manner providing flow spaces therebetween to provide a controlled continuous bleed to delay actuation of said bypass valve.

5. A system according to claim 4 as defined in claim 3 wherein said flow restricting plug means is a sintered metal plug.

6. A system according to claim 4 or claim 5 wherein said plug is covered by a filter.

7. A control system according to claim 6 wherein the filter comprises an annular filter cap with apertures therethrough.

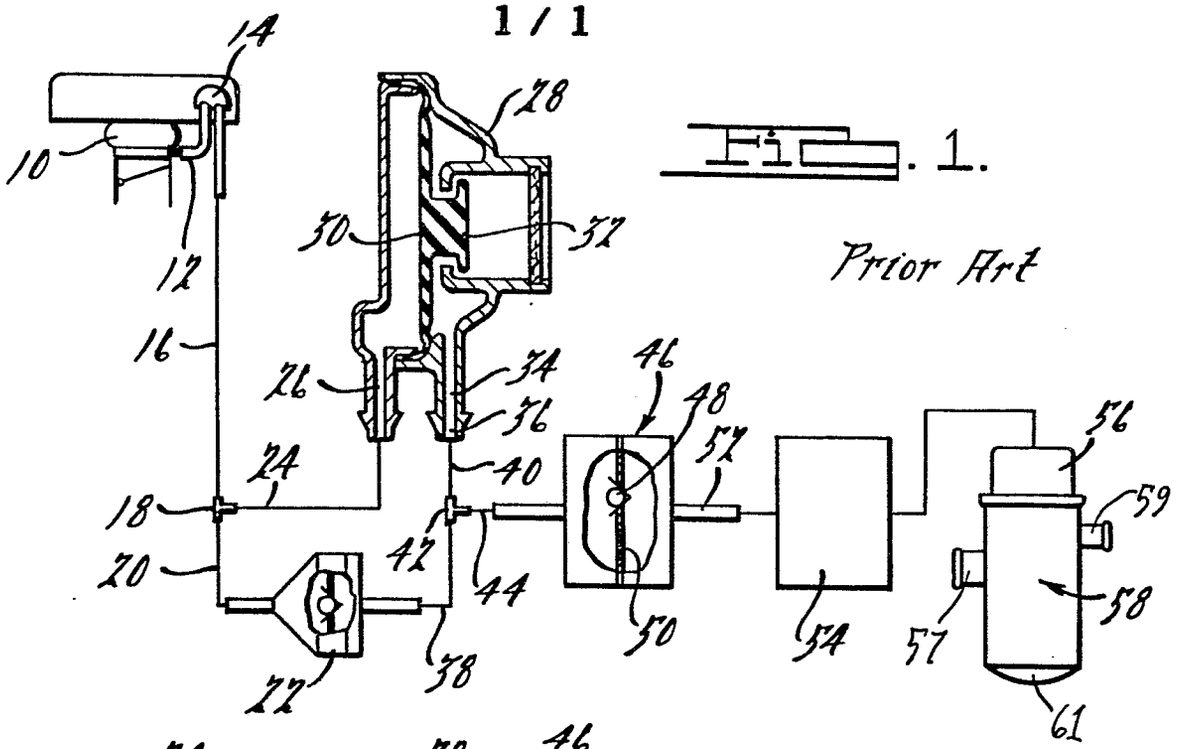
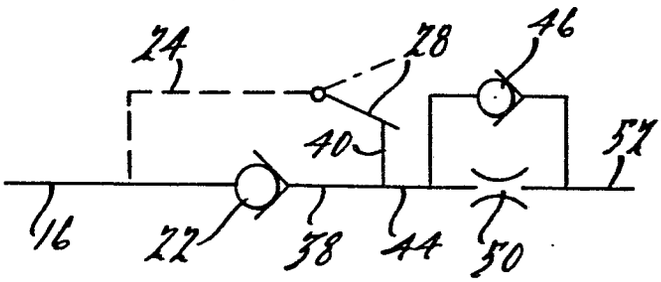


Fig. 1.

Prior Art



Prior Art

Fig. 2.

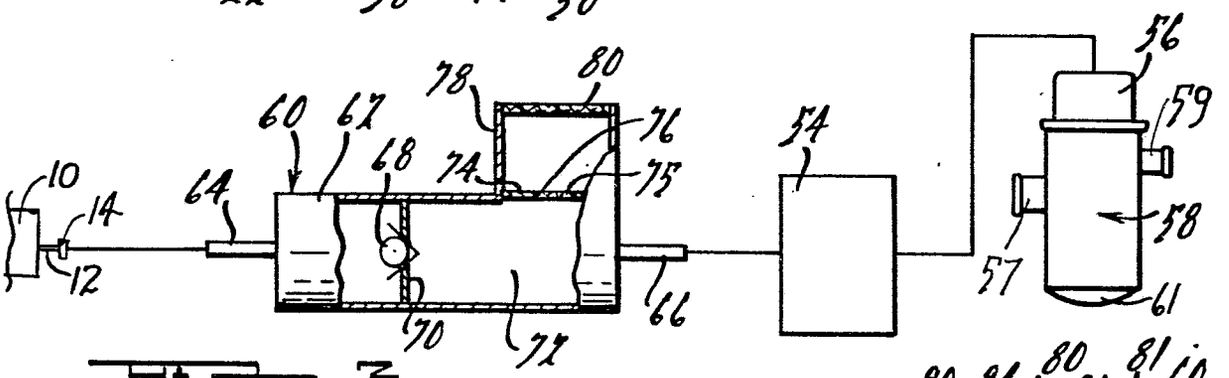


Fig. 3.

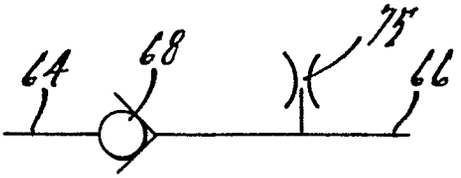


Fig. 4.

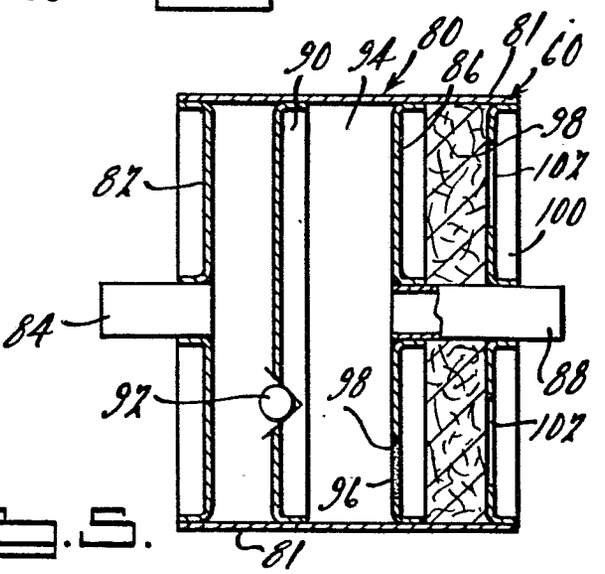


Fig. 5.

0051452

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EUROPEAN SEARCH REPORT

Application number
EP 81 30 5124

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim
X	US - A - 4 050 249 (COLLINS) * Column 1, line 32 - column 3, line 43; figures *	1-7
X	US - A - 4 174 610 (HOLLIS et al.) * Column 2, line 30 - column 6, line 22; figures 1-3 *	1-7
A	US - A - 3 992 878 (MOORMAN)	
A	US - A - 4 033 125 (INADA et al.)	

CLASSIFICATION OF THE APPLICATION (Int. Cl. 3)

F 01 N 3/22

TECHNICAL FIELDS SEARCHED (Int.Cl. 3)

F 01 N

CATEGORY OF CITED DOCUMENTS

X: particularly relevant if taken alone
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D: document cited in the application
L: document cited for other reasons

&: member of the same patent family, corresponding document

X The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	28-01-1982	BICHI