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F1B
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(71) Applicants
University College
London,
Gower Street, London
WC1E 6BT
(72) Inventor
Christopher John Edwin
Nightingale
(74) Agents
Elkington and Fife,
High Holborn House,
52/54 High Holborn,
London WC1V 6SH

(54) **Controlling a motor vehicle engine compartment cooling air intake**

(57) A diaphragm (5) movable in response to a pressure difference across it created by intake manifold vacuum, and also movable in response to movement of a member (12) responsive to the temperature in the engine compartment is transmitted by a lever arrangement (9) to a control lever (10) which controls the position of slats which in turn control the flow of air into the engine compartment. An electric fan control may be linked to the slat control.

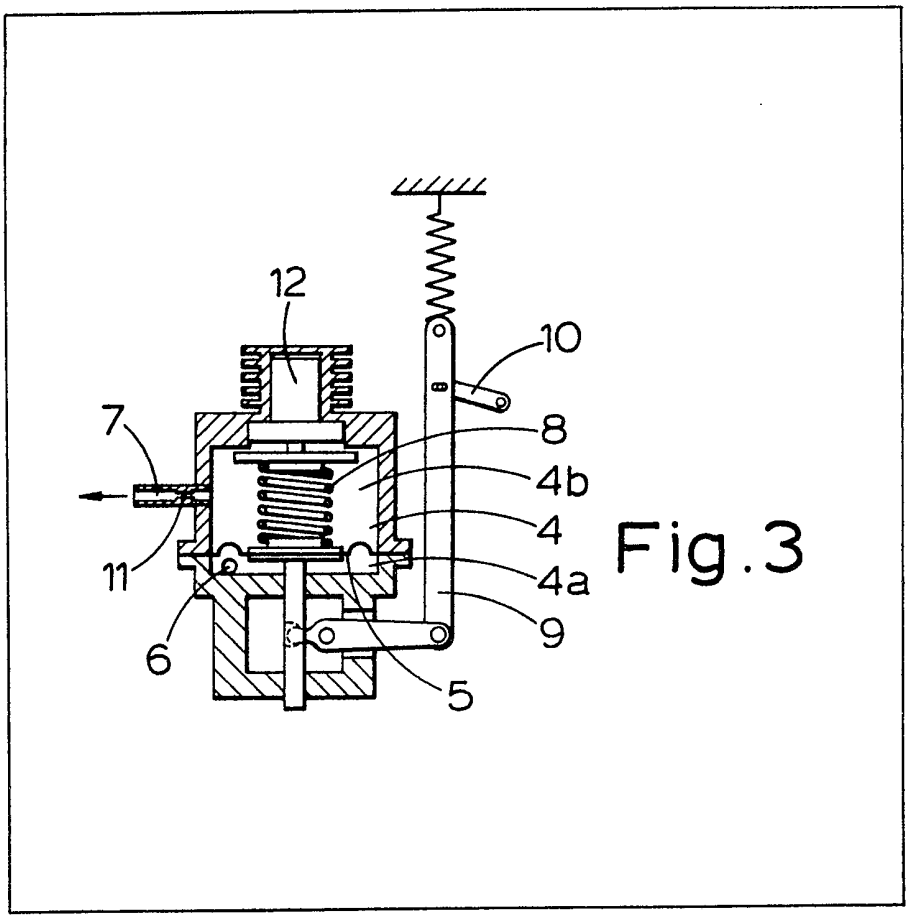

Fig.3

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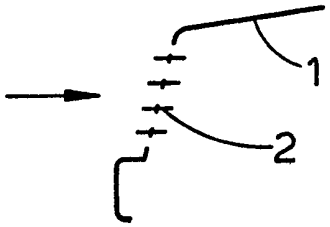

Fig.1a

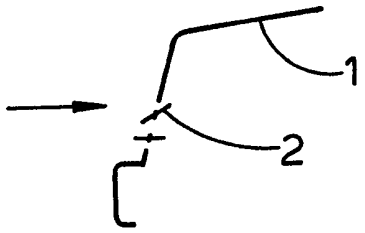

Fig.1b

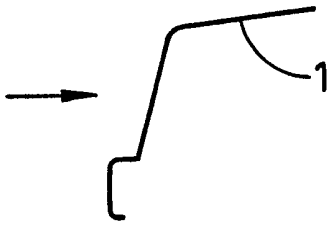

Fig.1c

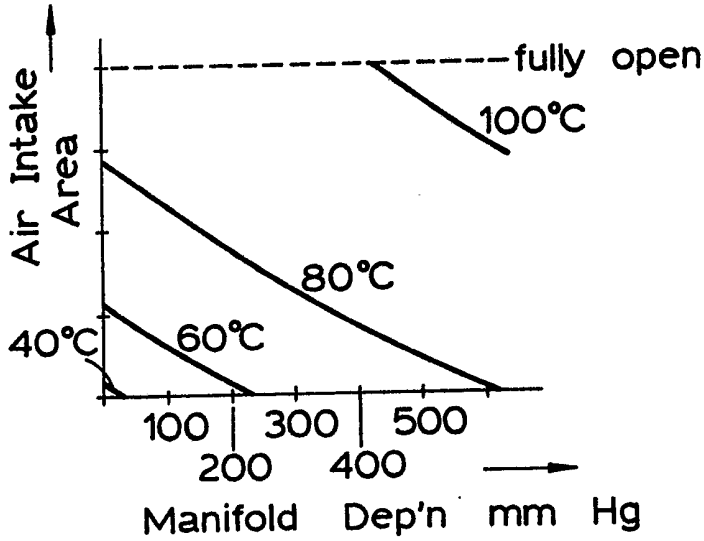

Fig.2

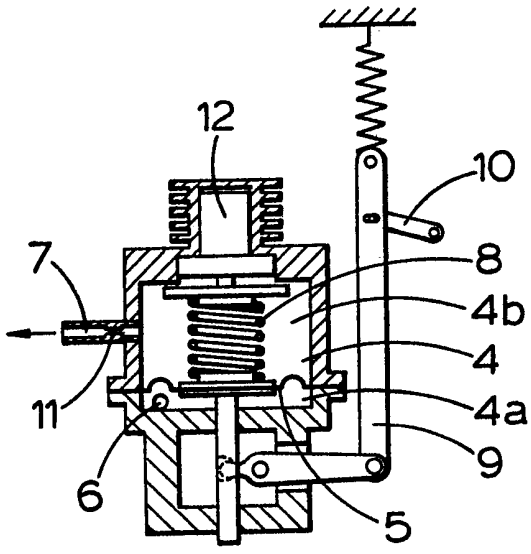

Fig.3

SPECIFICATION

Arrangement for controlling the air-intake of a vehicle

This invention relates to an arrangement for controlling the air-intake of a vehicle having an internal combustion engine.

According to the present invention there is provided an arrangement for controlling the air-intake of a vehicle having an internal combustion engine mounted in an engine housing, the arrangement comprising a sensor responsive to the temperature of a location in the engine housing and also responsive to the pressure level in an intake manifold of the engine, and an air-intake control arranged to control the flow of air into the engine housing in response to the sensor.

In the accompanying drawings:

Figures 1*a*, 1*b* and 1*c* show the foward end of a vehicle with the air-intake control respectively in a fully open, part open and fully closed position;

Figure 2 represents graphically the characteristics of an arrangement according to the present invention; and

Figure 3 is a schematic drawing of one form of sensor which may be used in the present invention.

As shown in Figure 1*a*, the intake of air into the engine housing 1 is controlled by a plurality of slats 2 which extend horizontally and which are pivotal about their horizontal axis. When the vehicle is stationary and the engine is off, the slats 2 are in the free open position of Figure 1*a*, but when the engine is started with consequent creation of a reduced pressure in the air-intake manifold, the slats 2 begin to close sequentially, as indicated in Figure 1*b*. Under certain conditions of temperature and pressure, which are discussed below, the slats will all be fully closed, as indicated in Figure 1*c*.

The characteristics of the air-intake control are shown in Figure 2, where the air-intake area permitted by the slats is plotted as a function of the manifold pressure for various under-bonnet temperatures. The manifold pressure is expressed as the extent to which the pressure is reduced below atmospheric. It will be seen that when the temperature is below about 40°C the air-intake is completely closed. At temperatures of around 100°C the air-intake area will be at its maximum, for all normal engine operating conditions. It is to be understood that the characteristics shown in Figure 2 are by no means the only possible characteristics, and that other characteristics might be used instead, depending, for example, on the overall vehicle and engine design. If desired, an electric fan control can be linked with the variable air-intake system.

The sensor 3 shown in Figure 3, responds to temperature and manifold depression and controls movement of the slats 2 and thereby controls the air-intake area. As will be seen from Figure 3, the sensor 3 comprises a chamber 4 which is divided into two sub-chambers 4*a* and 4*b* by a diaphragm 5. One sub-chamber 4*a* is connected to atmosphere by a vent 6 and the other sub-chamber 4*b* is connected to the air-intake manifold of the engine via a duct 7. As the manifold depression increases, the reduced pressure in the sub-chamber 4*b* causes the diaphragm 5 to move upwardly (as viewed in the drawing) against the force of a spring 8. This upward movement is transmitted via a spring-biassed lever system 9 to a control lever 10 which controls the position of the slats. It should be noted that connection of the sub-chamber 4*b* to the manifold is made through a small orifice 11 in the duct 7 so as to provide some degree of damping for the system.

The sensor is responsive to temperature by means of a wax capsule 12 the size of which increases with increasing temperature. An increase in temperature thus tends to cause downward movement of the diaphragm 5. Various other temperature-sensitive elements could be used in place of the wax capsule, for example an appropriate alloy element.

The arrangement of the present invention can be used to ensure that there is only minimal air-flow to the engine housing during the period following a cold start, so that the warm-up period is shortened with consequent reduction of the need for wasteful mixture enrichment. The arrangement can also ensure that the air-intake is small under part load conditions (for example 80 km/hr motorway cruising), providing that the engine housing temperature was not too high; the aerodynamic drag of the vehicle should thereby be reduced with a corresponding benefit in fuel consumption.

Figures 1*a*, 1*b* and 1*c* show the application of the invention to a vehicle with the engine housing at the front thereof. However, it should be noted that the invention can also be applied to a vehicle where the engine housing is at the rear. In this case the function of the slats 2 could be taken over by one or more pivotal scoops set into body panels and arranged to move between an open position in which air is directed to the interior of the engine housing and a closed position in which air is prevented from entering the engine housing.

One further point which should be noted is that there is at present a trend, at least in experimental vehicles, to covering the underside of road surface vehicles by as smooth and as continuous a surface as possible in order to reduce aerodynamic drag. This means that the engine compartment becomes more of an enclosure, rather than the half-open box which is now generally used. The invention is of particular value in relation to such enclosed engine compartments where the need to prevent overheating in warm weather on the one hand, and the desirability of minimizing aerodynamic drag on the other hand, are critical.

CLAIMS

1. An arrangement for controlling the air-intake of a vehicle having an internal combustion engine mounted in an engine housing, the arrangement comprising a sensor responsive to the

temperature of a location in the engine housing and also responsive to the pressure level in an intake manifold of the engine, and an air-intake control arranged to control the flow of air into the engine housing in response to the sensor.

2. An arrangement according to claim 1, wherein the air-intake control comprises a plurality of movable slats.

3. An arrangement according to either preceding claim, wherein the sensor comprises a chamber divided into two sub-chambers by a partition, one sub-chamber being connected to the intake manifold and the other sub-chamber being connected to atmosphere, the air-intake control being arranged to respond to movement of the said partition.

4. An arrangement according to claim 3, wherein the connection between the first mentioned sub-chamber and the intake manifold is throttled to provide damping.

5. An arrangement according to claim 3 or 4, wherein movement of the partition is further influenced by movement of a temperature-sensitive member responsive to the temperature of the said location in the engine housing.

6. An arrangement according to any one of claims 3 to 5, wherein the said partition is a diaphragm.

7. An arrangement for controlling the air-intake of a vehicle, substantially as herein described with reference to the accompanying drawings.

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