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[54] THERMOSTATICALLY MODULATED VACUUM CONTROL VALVE
10 Claims, 2 Drawing Figs.

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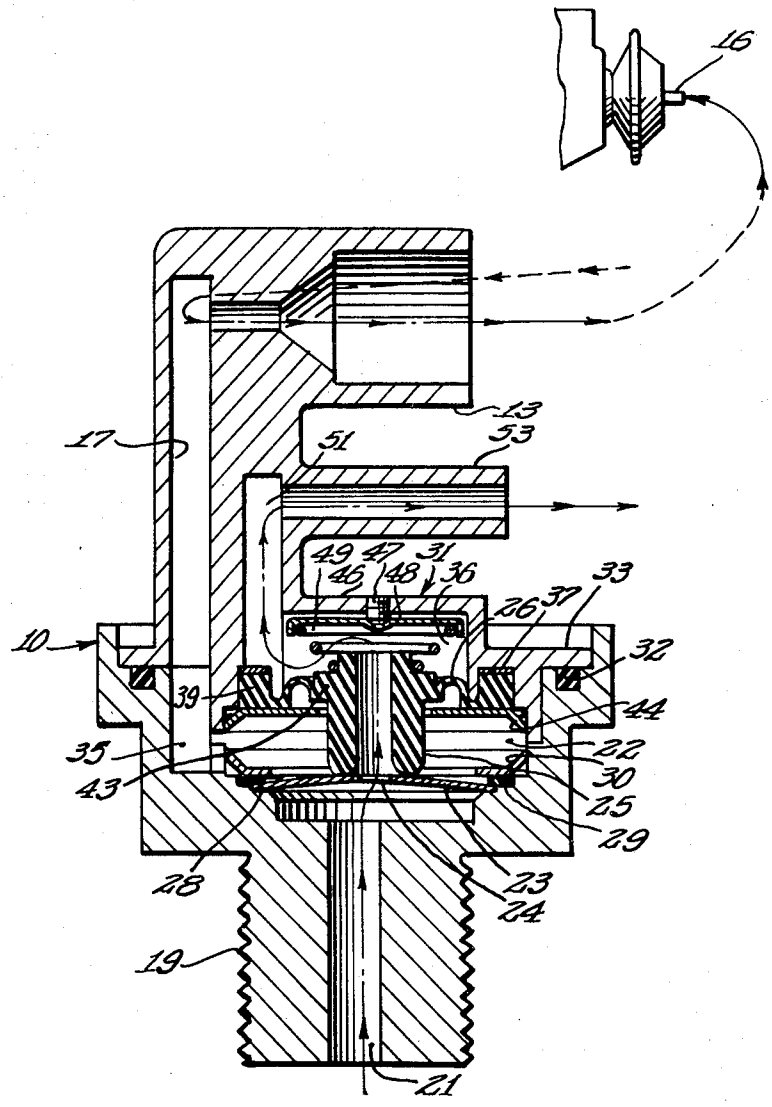
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ABSTRACT: Thermostatically modulated vacuum control valve for controlling the distributor vacuum motor advancing the spark of an internal combustion engine. The valve housing has a vacuum input leading from the housing and a vacuum output leading into the housing and having communication with the vacuum input. The vacuum input is connected with a source of vacuum such as the carburetor of an internal combustion engine. The housing has a second vacuum input connected with the intake manifold of the engine. A diaphragm valve is sealed to a valve chamber in the housing and is seated on a bimetal disk extending across the chamber and having a central opening leading therethrough. The diaphragm valve is biased into engagement with the seat by a spring and is moved out of engagement with the seat by vacuum to control vacuum from the intake manifold. During normal driving speeds, vacuum is obtained directly from the carburetor through the first vacuum input. When the engine is idling and is below a preselected temperature, the vacuum control valve is closed. As the engine temperature increases above this predetermined temperature range, the bimetallic seat will move away from the valve and a connection is made between the intake manifold and the distributor motor. Upon deceleration of the engine, vacuum from the intake manifold will effect opening of the valve and the supply of intake manifold vacuum to the motor.



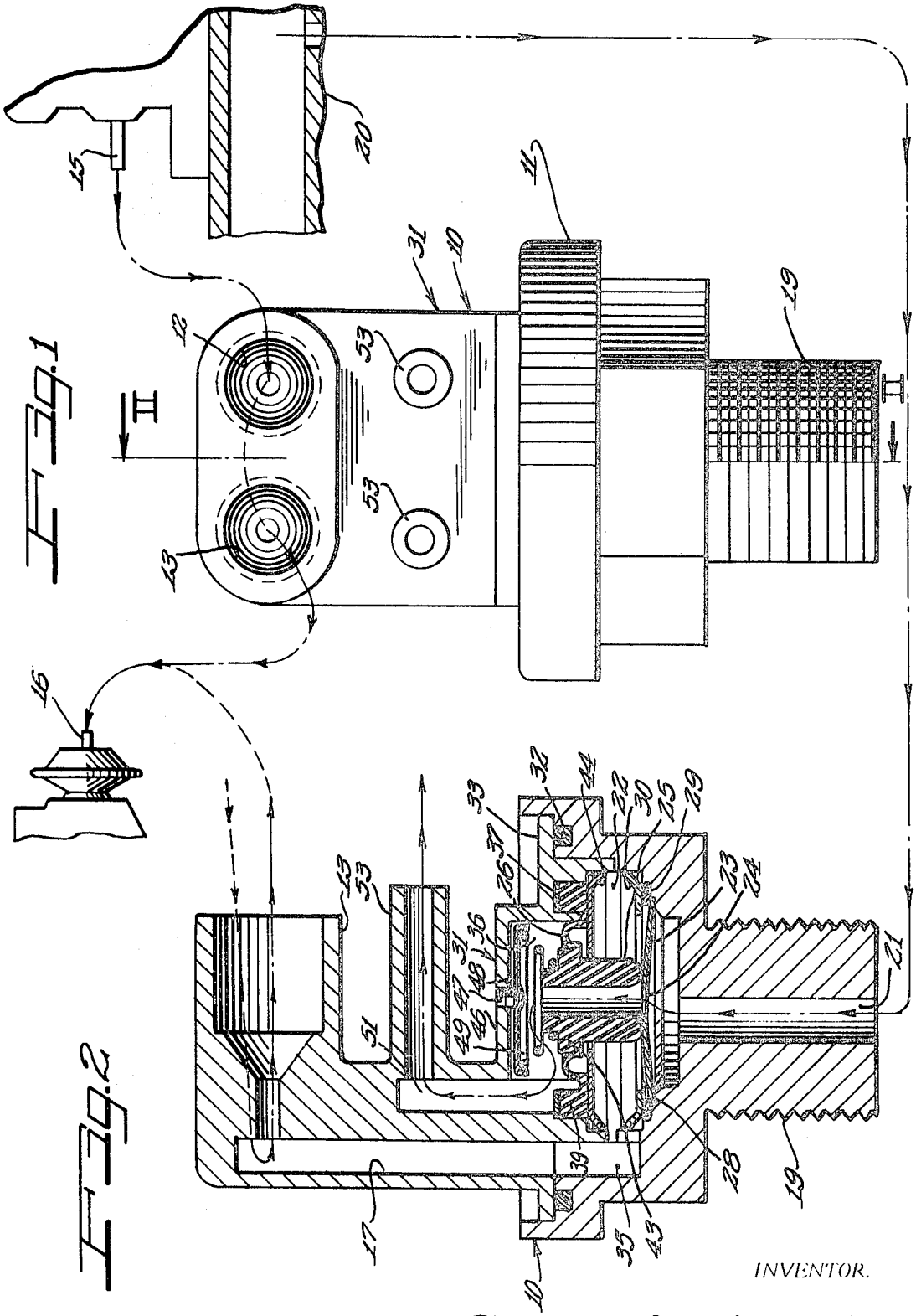


Fig. 1

Fig. 2

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THERMOSTATICALLY MODULATED VACUUM CONTROL VALVE

SUMMARY AND OBJECTS OF INVENTION

A principal object of the present invention is to provide a novel form of vacuum control valve opening at a preselected vacuum, in which opening of the valve is modulated by a thermally responsive valve seat.

A further object of the invention is to provide an improved form of vacuum control valve in which the valve is in the form of a diaphragm and a bimetal disk provides a double-functioning valve seat subject to either vacuum or a preselected temperature range.

Another object of the invention is to provide a simplified form of temperature- and vacuum-sensing control valve particularly adapted for controlling the distributor spark advance motor of an internal combustion engine in which the valve supplies carburetor vacuum to the spark-advancing motor during acceleration of the engine and supplies intake manifold vacuum to the motor when carburetor vacuum is at zero.

A still further object of the invention is to provide a new and improved form of temperature-responsive vacuum control valve in which a valve in the form of an annular diaphragm having a passageway leading through the center thereof, seats against a seat in the form of a bimetal disk having a central passageway in communication with the passageway leading through the diaphragm valve, whereby the valve may be opened at preselected vacuums, and opening of the valve is modulated by the bimetal valve seat.

Other objects, features and advantages of the invention will be readily apparent from the following description of a preferred embodiment thereof, taken in conjunction with the accompanying drawings, although variations and modifications may be effected without departing from the spirit and scope of the novel concepts of the disclosure.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is an end view of a thermostatically modulated vacuum control valve constructed in accordance with the principles of the present invention and diagrammatically illustrating the carburetor vacuum output and the intake manifold, and illustrating the vacuum connections from the carburetor and intake manifold to the distributor vacuum motor controlling the advance of the spark of an internal combustion engine.

FIG. 2 is a cross-sectional view of the valve shown in FIG. 1 taken substantially along line II—II of FIG. 1 and diagrammatically illustrating the vacuum passageway from the intake manifold to the manifold input fitting of the valve and the passage of vacuum through the valve.

DESCRIPTION OF PREFERRED EMBODIMENT OF INVENTION

In the embodiment of the invention illustrated in the drawings, I have shown in front elevation a thermostatically modulated vacuum control valve **10** having a valve housing **11**, a vacuum input **12** and a vacuum output **13**, and have shown by dot-dash lines a vacuum connection from a carburetor vacuum fitting **15** to the vacuum input **12**. I have also shown a vacuum connection from the vacuum output **13** to a distributor vacuum motor **16** for operating said motor by vacuum, to advance the spark. The carburetor, the distributor vacuum motor and spark advance may be of various conventional forms and form no part of the present invention so need not herein be shown or described further.

The vacuum input **12** has communication with a vacuum chamber **17** in the valve housing **11** and also has communication with the vacuum output **13** through said vacuum chamber **17**, to effect the supply of carburetor vacuum to the distributor motor **16**, as long as carburetor vacuum is above zero. The valve body **11** also has a threaded boss **19**, which may be threaded in an intake manifold **20** or a suitable support and fitting (not shown), having fluid connection with the intake

manifold **20**. The boss **19** has a central passageway **21** extending therealong and having communication with a valve chamber **22** having a valve seat **23** extending along the lower end portion thereof. The valve seat **23** may be a bimetal disk having a central opening **24** leading therethrough and closed by an annular resilient diaphragm valve **25** extending downwardly of a diaphragm **26**, and formed integrally therewith.

As shown in FIG. **2**, the bimetal disk **23** is seated on an annular shouldered portion **28** of the cavity in the valve housing forming the valve chamber **22** and is sealed to said shouldered portion by an annular seal **29**. The seal **29** is retained in sealing engagement with a top peripheral portion of the bimetal disk as by a retainer **30** suitable mounted in the cavity forming the valve chamber **22**.

The valve housing **11** has an upper housing part **31** recessed therein and sealed thereto by an annular seal **32** engaging the undersurface of a flanged portion **33** of said upper housing part. The upper housing part **31** also has the vacuum chamber **17** formed therein, and communicating with the valve chamber **22**, as by a passageway **35**. The upper housing part **31** also has the vacuum input fitting **12** leading therefrom and the vacuum output fitting **13** leading thereinto. Said fittings may be threaded to receive compression fittings connected with a vacuum motor **16** and the carburetor **15**.

The valve housing **31** has a vacuum chamber **36** therein having an annular downwardly opening sealing groove **37** extending thereabout and forming a sealing groove for a rectangular bead or rib **39** of a diaphragm **26**. The sealing bead **39** terminates along its inner margin into a thinned convoluted portion of the diaphragm, leading to a central annular boss **43**, having the valve **25** formed integrally therewith, and depending therefrom through an annular retainer **44**, seated in a downwardly opening shouldered portion of the upper valve housing part **31**. The vacuum chamber **36** has a top wall **46** having a calibration screw **47** threaded therein and leading thereinto and forming an abutment for a disk **48**, having a depending marginal rim forming a seat for a spring **49**. The spring **49** is herein shown as being a conical spring with its large diameter end seated on the plate or disk **48** and its small diameter end seated on the thickened central portion **43** of the diaphragm **26**, to bias the valve **25** into engagement with the bimetal seal **23**, to thereby block the flow of vacuum from the second vacuum input **19** through the valve seat **23**, from the valve chamber **22**, the passageway **36**, and the vacuum chamber **17**.

A passageway **51** leads upwardly along the valve housing **31** generally parallel to the chamber **17** and has communication at its lower end with the vacuum chamber **36** and at its upper end with spaced vacuum outputs **53,53**, which may be connected with auxiliary vacuum motors for opening certain selected parts of the automotive vehicle by vacuum.

Assuming the valve just described has connection with the distributor vacuum motor for advancing the spark, during normal driving conditions, the distributor vacuum motor **16** will be connected with the carburetor vacuum intake **15** through the vacuum input fitting **12** and the vacuum output fitting **13**, and through the vacuum chamber **17** connecting said fittings in flow communication with each other. During these driving conditions, the valve **25** will be closed, and intake manifold vacuum will only be supplied to the auxiliary fittings **53,53** through the central passageway or port **24** in the valve seat **23** and the central passageway leading through the valve **25**.

Upon sudden deceleration of the engine, it is desirable that the distributor vacuum motor and spark be moved to its fully advanced position, to allow the engine to continue to operate smoothly, even though the amount of fuel/air mixture entering the combustion chamber has been radically reduced because of the throttle plate (not shown) closing off in the carburetor. With throttle plate closed, the normal source of vacuum used to advance the distributor has dropped to zero and is, therefore, not available. Under these conditions, manifold vacuum is supplied to the distributor motor through the passageway

21, leading along the boss 19, the opening 24 in the valve seat 23 and past the valve 25, upon opening of said valve, through the passageway 35 and along the vacuum chamber 17. Manifold vacuum will also be in the chamber 36 and act on the diaphragm 26 to lift the valve 25 off of its seat.

The valve 25 may be so calibrated that with zero vacuum in the chambers 22 and 17, a vacuum of, for example, 23 inches of mercury in the chamber 36 acting on the diaphragm 26 will lift the valve 25 off of its seat. This will provide sufficient vacuum to the vacuum motor 16 to advance the spark to its full advance position. When the car is again accelerated to a normal driving speed, vacuum manifold will drop below 23 inches mercury and accommodate the spring 49 to close the valve and seal the chamber 17 and vacuum output 13 from manifold vacuum. Carburetor vacuum will then be restored and become the primary source of vacuum to the distributor vacuum motor.

When the engine is idle and the temperature of the engine is below 180° F., the carburetor throttle plate will be closed and the vacuum at the vacuum input 12 will be zero. Because of low engine speed, the manifold vacuum will be at a value below 23 inches of mercury, which will be insufficient to open the valve 25. Such operating conditions are desirable because they result in a slow, more complete burning of the fuel/air mixture in the combustion chambers of the automotive vehicle and result in low exhaust emissions, but cause the engine to overheat for prolonged intervals of idle time.

As the engine temperature at the intake manifold rises above 180° F. when the engine is idling, it is necessary to advance the spark in order to make the engine start running cooler by increasing the speed of the engine, with a resultant increase in airflow over the engine from the fan and an increase in the circulation of coolant through the engine. In order to attain this, the bimetal disk will sense intake manifold temperature and when the temperature reaches a preselected range as, for example, 180° F., said disk will move away from the valve 25 and connect the distributor vacuum motor 16 to manifold vacuum to again advance the spark until the manifold temperature drops below 180° F., at which time the bimetal disk will again flex toward the valve 25 and seal said valve.

It may be seen from the foregoing that the valve of the present invention is a temperature- and vacuum-sensing control for the distributor vacuum motor and provides a seat which reacts to either vacuum or temperature, and thereby modulates the valve seat with temperature and provides a double-functioning valve seat subject to either a given vacuum or a preselected temperature range.

It should be understood that the opening point of the valve can be set at various preselected vacuums, by adjustment of the calibrating screw 47, and that the temperature at which the bimetal seat opens the valve can be varied, and is dependent upon the type of bimetal material used, and the thickness of the material.

The temperature and vacuum values, therefore, are illustrative only, and may be varied in accordance with engine operating and spark advance requirements.

I claim as my invention:

1. A temperature-modulated vacuum control valve comprising:
- a valve housing having,
- a vacuum input,
- a vacuum output, and
- a communicating vacuum chamber between said vacuum input and said vacuum output,
- a second vacuum input communicating with said housing,
- a valve chamber in said housing having communication with said second vacuum input and with said communicating vacuum chamber,
- a valve in said chamber having an annular valve element,
- a second vacuum chamber in said housing on the opposite side of said valve from said communicating vacuum chamber,
- a thermally responsive valve seat in said chamber movable axially along said chamber upon changes in temperature and forming a seat for said valve, and having a central passageway leading therethrough encircled by said annular valve element,
- said valve being opened by vacuum passing through said central passageway and annular valve element to supply vacuum to said communicating vacuum chamber, and
- said axially movable thermally responsive valve seat modulating opening of said valve.

2. The temperature-modulated vacuum control valve of claim 1,
- wherein the valve includes a diaphragm sealed to said valve chamber, and
- wherein the thermally responsive valve seat is a bimetal disk sealed to said chamber.

3. The temperature-modulated vacuum control valve of claim 2,
- wherein spring means bias said valve toward said seat, and
- wherein the thermally responsive valve seat is a bimetal disk.

4. The temperature-modulated vacuum control valve of claim 3, including means calibrating said spring means and preselecting the vacuum for opening said valve.

5. In a temperature-modulated deceleration valve and in combination with the vacuum motor particularly adapted to control the advance of the spark of an automobile vehicle,
- a valve housing,
- a vacuum intake leading from said valve housing and connected with a first source of vacuum,
- a vacuum output leading into said valve housing and connected with said vacuum motor,
- a vacuum chamber in said housing connecting said vacuum output with said vacuum input,
- a valve chamber in said valve housing having communication with said vacuum output,
- a second vacuum input leading from said valve chamber,
- vacuum-operated valve means in said valve chamber, opening by vacuum in said second vacuum input, and including a thermally responsive valve seat and a resilient valve engageable with said seat and opening in accordance with a predetermined vacuum in said second vacuum input, and in accordance with preselected engine temperatures when the automotive vehicle is idling.

6. The temperature-modulated deceleration valve in accordance with claim 5,
- wherein the valve seat has a central passageway leading therethrough, and
- wherein the valve means includes an annular valve member engaging said valve seat along the outside of said central passageway and affording a passageway through said annular valve member to supply vacuum to effect opening of said valve.

7. The temperature-modulated deceleration valve in accordance with claim 6,
- wherein at least one other vacuum output is in communication with said second vacuum input through the registering passageways leading through said valve seat and valve.

8. The temperature-modulated vacuum control valve of claim 5,
- wherein the valve means includes a diaphragm and a central resilient valve extending therefrom engageable with said seat and having a central passageway leading therethrough, and
- wherein the thermally responsive valve seat is a bimetal disk having a port leading therethrough and registering with and encircled by said central passageway leading through resilient valve.

9. The temperature-modulated deceleration valve of claim 8,
- wherein spring means bias said valve into engagement with said valve seat to block the output vacuum to said vacuum motor through said second vacuum intake.

10. The temperature-modulated deceleration valve of claim 9,

wherein said spring is a frustoconical spring,

wherein a disk forms a seat for the large diameter end of said spring and the small diameter end of said spring is seated on said valve, and

wherein calibrating means is provided to vary the position of said disk and the rate of said spring, to vary the vacuum required to open said valve.