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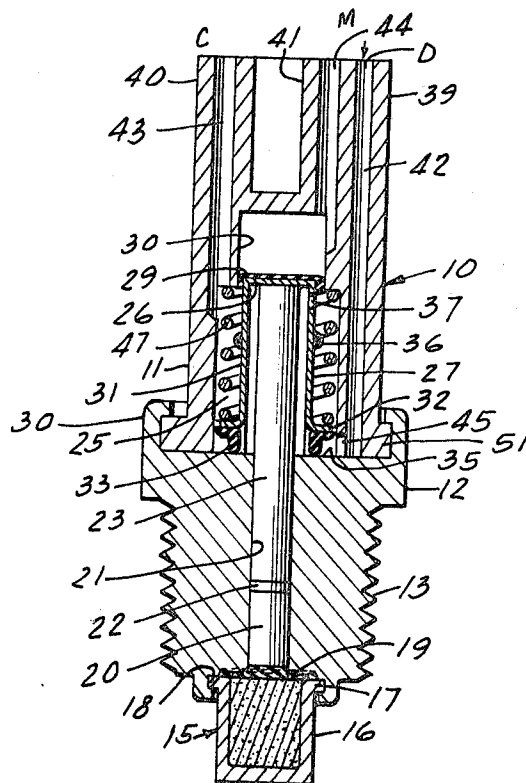
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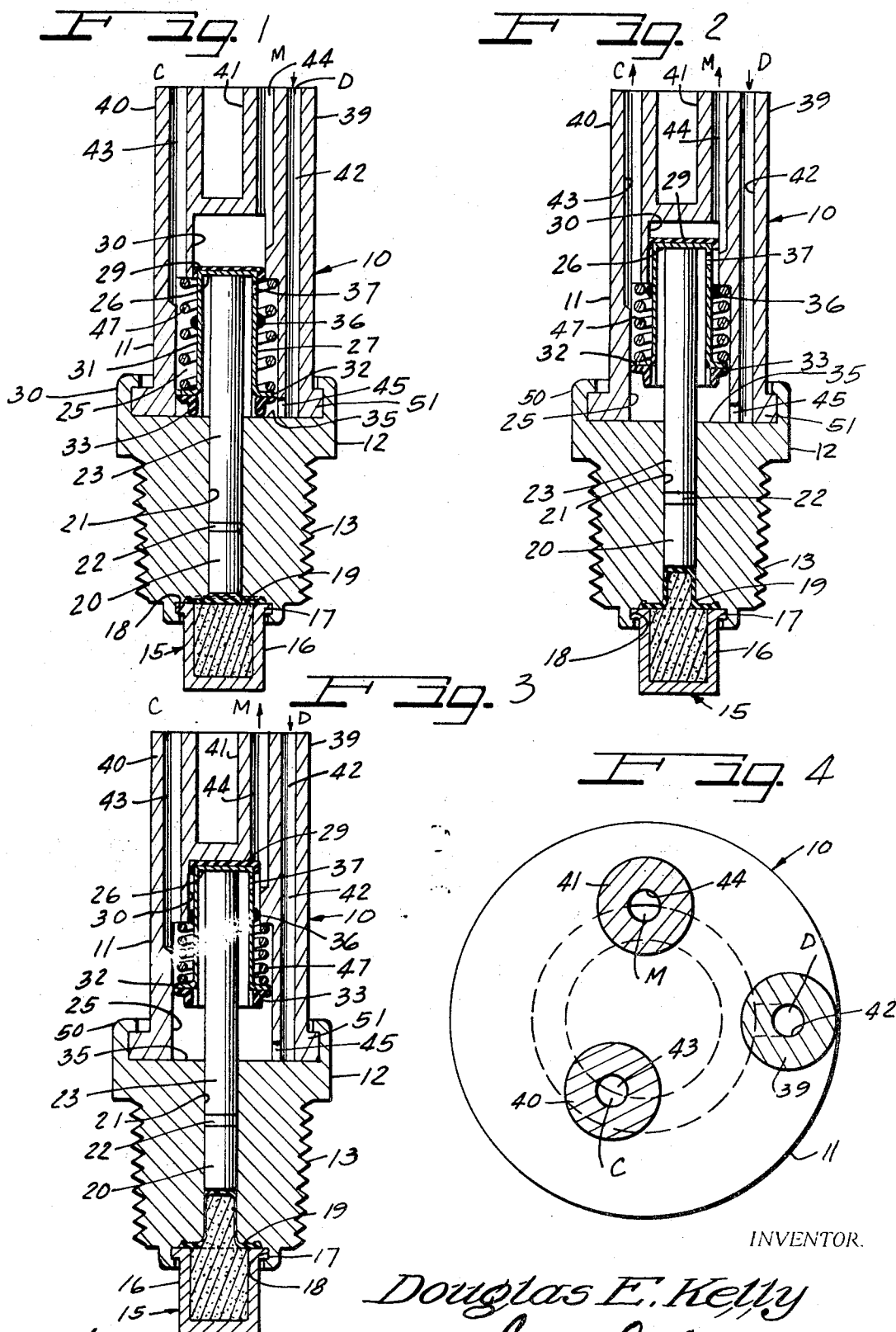
[54] **MULTITEMPERATURE VACUUM CONTROL VALVE**
7 Claims, 4 Drawing Figs.

[52] U.S. Cl. **123/117,**
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976; 251/11

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ABSTRACT: Temperature operated multitemperature vacuum control valve isolating the distributor advance until the coolant reaches a predetermined operating temperature, then effecting successive control of the spark advancer at preselected higher temperatures. The valve includes a valve housing having a stepped valve chamber the large diameter end of which opens to the bottom of the valve housing. The valve chamber is closed by a separate base for the housing, positioning a thermally responsive element in the water jacket of an internal combustion engine, in flow of coolant along the water jacket. The thermally responsive element has an extensible piston extending along the base into the valve chamber and carrying a generally cylindrical valve having a closed top mounted on the top of the piston. At least three vacuum passageways lead axially along the valve housing and have communication with the valve chamber at different levels. The valve has three axially spaced valve elements cooperating with the passageways to connect the automatic spark advancer to carburetor vacuum at one engine temperature, to manifold and carburetor vacuum at a higher engine temperature and to manifold vacuum alone at a still higher engine temperature.





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MULTITEMPERATURE VACUUM CONTROL VALVE

SUMMARY AND OBJECTS OF THE INVENTION

A principal object of the present invention is to provide a simple and improved form of thermally responsive valve controlling the spark advance of an internal combustion engine, and arranged to attain fast engine warmup, low exhaust emissions, and to prevent overheating of the engine.

A further object of the invention is to provide a new and improved form of temperature operated vacuum control valve, controlling the vacuum to the automatic spark advancer of an internal combustion engine, varying the vacuum to the distributor for the engine at predetermined operating temperatures of the engine, in which the valve consists essentially of a single moving part on the power element of a thermally responsive element.

Still another object of the invention is to provide a multitemperature vacuum control valve arranged with a view toward utmost simplicity and efficiency in construction and operation.

These and other objects of the invention will appear from time to time as the following specification proceeds and with reference to the accompanying drawings.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a vertical sectional view of a valve constructed in accordance with the principles of the present invention, with the valve nipples and passageways rearranged to show all of the valve nipples and passageways in a single vertical plane, and showing the valve in its closed position isolating the spark advancer from vacuum.

FIG. 2 is a vertical sectional view somewhat similar to FIG. 1, but showing the valve in position to connect the distributor to both manifold and carburetor vacuum;

FIG. 3 is a view somewhat similar to FIGS. 1 and 2 and showing the valve in its high temperature position, with carburetor, vacuum sealed off, and connecting the spark advancer of the distributor to manifold vacuum; and

FIG. 4 is a plan view of the valve housing with the base for the housing removed and showing nipples in horizontal section.

DESCRIPTION OF PREFERRED EMBODIMENT OF INVENTION

In the drawings, I have shown a multitemperature vacuum control valve 10 including a valve housing 11 mounted on and sealed to a base 12 having a threaded nipple 13 formed integrally therewith, which may be threaded in the cylinder head of an internal combustion engine and position a thermally responsive element 15 in the water jacket of the engine.

As shown in FIGS. 1, 2 and 3 of the drawings, the thermally responsive element 15 is a so-called power type of thermally responsive element, including a casing 16 having a flange 17 extending radially outwardly of its upper end portion within a cylindrical bore 18 of the base 12, and crimped thereto by crimping the wall of the bore over the flange 17.

The casing 16 may contain a fusible thermally expansible material, such as, a wax containing a powdered metal heat-conducting material and a binder, which reacts against a diaphragm 19 extending across the flange 17 within the base 12, and sealed to said flange by the operation of crimping the wall of the bore 18 over said flange.

The diaphragm 19 reacts against a plug 20 extending along a central bore or passageway 21 extending axially along said base and opening to the upper end thereof. The plug 20 abuts a disk 22 at its upper end. The disk 22 forms a seat for a piston 23 extending along the central passageway 21 into and along a valve chamber 25 extending axially along the valve housing 11. The piston 23 forms the power member for the thermally responsive element 15 and engages a top portion 26 of a vacuum control valve 27 at its upper end. A valve 29 extends across the top of said top portion 26 and radially beyond opposite sides thereof and is movable upwardly into and along a

reduced diameter portion 30 of the valve chamber upon increases in temperature.

The valve 27 has a generally cylindrical skirt or wall 31 extending downwardly of the top portion 26 thereof along the piston or power element 23. A flange 32 extends radially of the lower end of said cylindrical wall and has a valve element 33 mounted on the undersurface thereof and depending therefrom to engage a top surface 35 of the base 12 at the low temperature position of the valve, as shown in FIG. 1.

A resilient valve 36 also extends about the cylindrical wall 31 intermediate the ends of said wall. A port 37 extends through said cylindrical wall 31 between the valve elements 29 and 36.

The valve housing 11 has three parallel nipples 39, 40 and 41 leading from the top thereof and having passageways 42, 43 and 44 leading along the respective nipples and along the valve housing 11 and having communication with the valve chamber 25 at their lowest ends, at different levels.

As shown in FIGS. 1, 2 and 3, the passageway 42 leads to the bottom of the valve housing 11 and has communication with the valve chamber 25 through a transverse port 45. The passageway 43 opens to the valve chamber 25 through the sidewall thereof just beneath the reduced diameter portion 30 of said valve chamber. The passageway 44 leading along the nipple 41, opens to the reduced diameter portion 30 of the valve chamber along the wall thereof.

The nipple 39 and passageway 42 may be connected to the distributor of the engine to operate the automatic spark advancer and forms a vacuum output for the distributor. The passageway 43 extending along the nipple 40 is adapted to be connected with carburetor vacuum to advance the spark by carburetor vacuum, as the valve 33 moves off its seat at a preselected low operating temperature of the engine, which may be of the order of 160°F. In this position of the valve, air is drawn through the vacuum output nipple 39 and passageway 42 and into the valve chamber along the port 45, the inside of the cylindrical wall 30, out through the wall 31 of the valve 27, through the port 37 leading through said wall, into the valve chamber 25 and out through the passageway 43 and nipple 40.

Upon increases in temperature, as for example, in the temperature range of 220°F., the valve element 29 will move along the reduced diameter portion 30 of the valve chamber 25 above the opening of the passageway 44 into said reduced diameter portion of said valve chamber. Manifold vacuum will draw vacuum into the valve chamber through the port 45, out the port 37 and along the passageway 44 extending along the nipple 41. In the position of the valve shown in FIG. 2, the nipple 40 and passageway 43 will also draw vacuum into the valve chamber 25 through the port 45 and out through the cylindrical wall 31 through the port 37 and along the vacuum outlet passageway 43.

Upon still higher engine temperatures, to temperatures of the order of 230°F., the power member 23 of the thermally responsive element 15 will have moved the valve element 29 into engagement with the top of the reduced diameter portion 30 of the valve chamber. The valve element 36 will then have moved into the reduced diameter portion 30 of the valve chamber to close the port 37 to carburetor vacuum, and thus to isolate carburetor vacuum from the nipple 39 and spark advancer of the distributor. In this position of the valve, as shown in FIG. 3, the nipple 39 and passageway 42 leading therealong will be connected to manifold vacuum through the hollow interior portion of the cylindrical wall 31 of the valve 27 and out through the port 37 and passageway 44.

A spring 47 is seated at its upper end in a downwardly facing shouldered portion of the valve chamber 25 formed by the juncture of the increased diameter portion of said valve chamber with the reduced diameter portion thereof. The lower end of the spring 47 is seated on the top surface of the flange 32. Said spring thus serves to retractably move the valve 27 and power member 23 to move the valve element 29 to first connect the spark advancer to carburetor and manifold

vacuum as the valve element 36 moves out of the reduced diameter portion 30 of the valve chamber 25, and to then isolate the distributor from vacuum as the valve element 33 engages the top surface of the base 35.

The base 12 has an axial flange 50 extending above its top surface 35 and along and around a radial flange 51, extending radially of the bottom of the valve housing 11. The upper portion of the wall of the axial flange 50 may be crimped over the shoulder formed by the top surface of the radial flange 51, to retain the valve housing 11 to the base 12, and to seal the undersurface of the radial flange 51 to the top surface 35 of said base.

While I have herein shown and described one form in which the invention may be embodied, it should be understood that various variations and modifications in the invention may be attained without departing from the spirit and scope of the novel concepts thereof.

I claim:

1. A multitemperature vacuum control valve comprising:
 - an elongated valve housing having a valve chamber therein and extending axially therealong;
 - said valve chamber having a reduced diameter upper end portion and an enlarged diameter lower end portion;
 - at least three vacuum passageways leading along said housing along the outer side of said valve chamber and extending parallel to the wall thereof;
 - a base for said housing and valve chamber;
 - a temperature responsive element carried by said base and including;
 - a power member extensibly movable along said base and valve chamber upon predetermined increases in temperature;
 - a generally cylindrical valve on the end of said power member and having;
 - a closed top supported on the top of said power member and a cylindrical wall extending along said power member having a valve element depending from said cylindrical wall engageable with said base;
 - two additional valve elements extending about said cylindrical wall and movable into sealing engagement with said reduced diameter upper end of said valve chamber upon increases in temperature; and
 - said vacuum passageways opening into said valve chamber at different levels and cooperating with said valve elements to vary the vacuum in the vacuum output upon predetermined increases in temperature.
2. A multitemperature vacuum control valve:
 - wherein the valve elements are resilient and the top valve element extends across the top of said valve and has sealing engagement with said reduced diameter portion of said valve chamber in the low temperature position of said valve; and
 - wherein a next lower valve element moves into said reduced diameter position of said valve chamber at an intermediate temperature position of said valve, and said valve element depending from said wall engages the top of said base and the sidewall of said enlarged diameter portion of said valve chamber in the off position of said valve.
3. A multitemperature vacuum control valve in accordance with claim 1:
 - wherein the juncture between said reduced and said enlarged diameter portions of said valve chamber forms a shoulder;
 - wherein a flange extends laterally of the lower end of said cylindrical valve; and
 - wherein a spring seated between said shoulder and said flange biases said valve into a closed position and returns said power member of said thermally responsive element upon predetermined reductions in temperature.
4. A multitemperature vacuum control valve in accordance with claim 3:
 - wherein one vacuum passageway is a vacuum output passageway and extends along the outer side of said valve

chamber parallel to the wall thereof and opens into said valve chamber along said base;

wherein a second vacuum passageway is adapted to be connected to manifold vacuum and leads along said housing parallel to said first vacuum passageway and opens into said reduced diameter portion of said valve chamber;

wherein a third of said vacuum passageways is adapted to have connection with carburetor vacuum and opens to said valve chamber adjacent the top portion of said enlarged diameter portion of said valve chamber; and

wherein a port leads through said cylindrical valve between said top and intermediate valve elements and affords communication between all of said passageways upon disengagement of said lower valve element from the top surface of said base and until movement of said intermediate valve element into and along said reduced diameter cylindrical wall portion.

5. In a vacuum control valve particularly adapted to operate the automatic spark advancer of an internal combustion engine:

- a valve housing;
- an outlet from said valve housing adapted to be connected to a source of manifold vacuum;
- a second outlet from said housing adapted to be connected to a source of carburetor vacuum;
- a vacuum output leading into said housing and adapted to be connected to the distributor of the engine to provide the vacuum for automatically advancing the spark;
- a valve chamber in said housing having communication with said outlets and said vacuum output at different levels;
- a base for said housing in axial alignment therewith and adapted to be threaded in the cylinder head of an internal combustion engine;
- a thermally responsive element carried by said base and positioned thereby in the water jacket of an internal combustion engine and having a power member guided for axial movement along said base and extending into and movable along said valve chamber upon changes in temperature;
- a single valve member in said valve chamber carried by said power member and having a plurality of axially spaced valve elements cooperating with said valve chamber; and
- spring means seated in said chamber and retractably moving said power member and said valve member into a closed position, said power member moving said valve member along said chamber in response to increases in the temperature of the coolant to first connect said vacuum output to carburetor vacuum at a low engine temperature, to then connect said vacuum output to manifold vacuum and carburetor vacuum at a higher engine temperature, and to then connect said vacuum output to manifold vacuum only at a higher temperature range of the engine.

6. The vacuum control valve of claim 5:

- wherein the valve member is a cylindrical valve member and has an elongated cylindrical wall having a top extending across said wall and a flange extending radially of the lower end portion of said cylindrical wall;
- wherein a valve element depends from said flange for engagement with the top surface of said base;
- wherein the valve chamber has a reduced diameter upper cylindrical wall portion, and an enlarged diameter lower cylindrical wall portion terminating at said base;
- wherein the valve member has two axially spaced valve elements extending radially outwardly of said cylindrical wall;
- wherein the juncture between said reduced and enlarged diameter cylindrical wall portions of said valve chamber forms a shoulder;
- wherein the spring means is seated between said shoulder and said flange to return said power element upon reductions in temperature;
- wherein one vacuum outlet leads from said reduced diameter cylindrical wall, a second vacuum outlet leads from said enlarged diameter cylindrical wall; and

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wherein the vacuum output leads to said enlarged diameter cylindrical wall along the top surface of said base.

7. A vacuum control valve in accordance with claim 6, wherein a port leads through said cylindrical wall between said two axially spaced valve elements, and affords communication between said vacuum output and said vacuum outlet connected to carburetor vacuum in the low-temperature position

of the valve, between said vacuum output and said vacuum outlets connected to carburetor vacuum and to manifold vacuum in an intermediate position of the valve, and between said vacuum output and said vacuum outlet connected to manifold vacuum in the high-temperature positions of the valve.

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