

Feb. 10, 1970

D. A. REISE

3,494,338

TEMPERATURE RESPONSIVE CONTROL OF A DISTRIBUTOR

Filed April 17, 1968

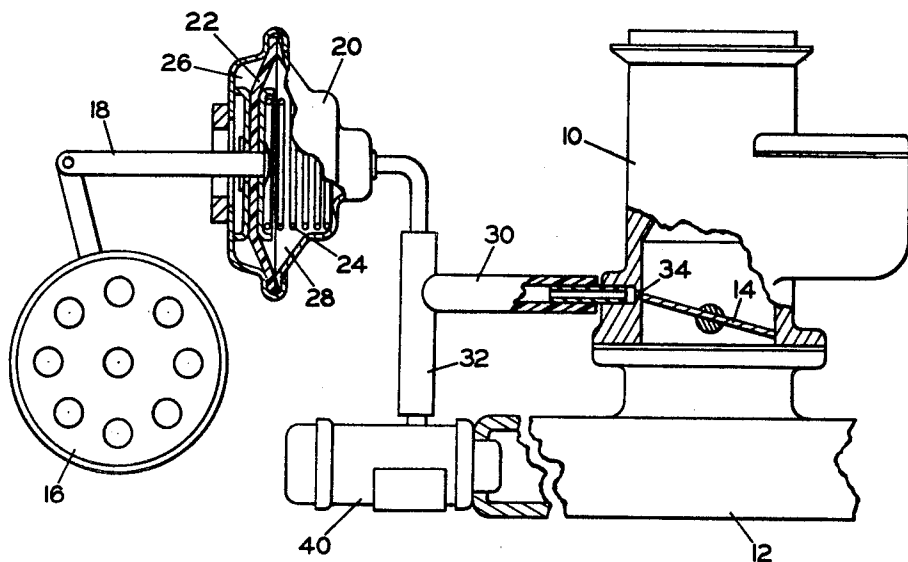


FIG. 1.

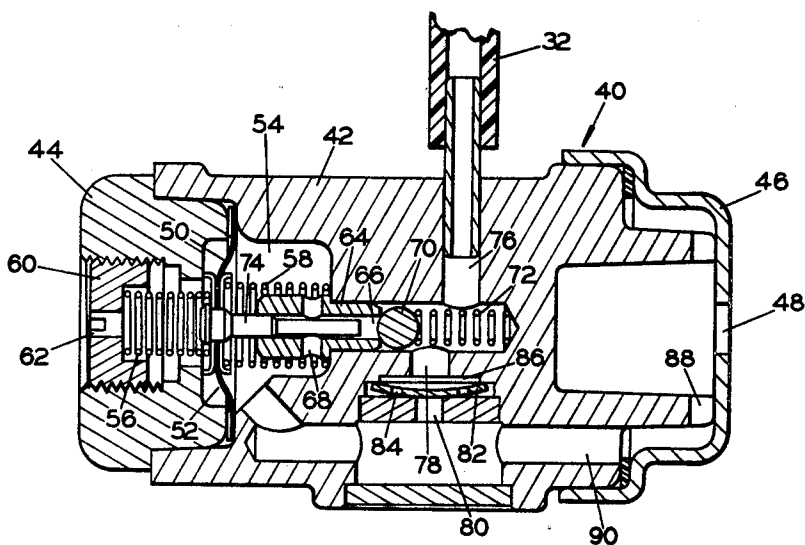


FIG. 2.

INVENTOR

DONALD A. REISE

BY *Edward H. Casey*

ATTORNEY

1

3,494,338

TEMPERATURE RESPONSIVE CONTROL  
OF A DISTRIBUTOR

Donald A. Reise, St. Louis, Mo., assignor to ACF Industries, Incorporated, New York, N.Y., a corporation of New Jersey

Filed Apr. 17, 1968, Ser. No. 722,128

Int. Cl. F02p 5/04

U.S. Cl. 123—117

4 Claims

## ABSTRACT OF THE DISCLOSURE

A distributor which is advanced in accordance with engine speed, is retarded by a vacuum motor during idling and advanced by the motor in response to a given manifold pressure drop applied via a valve which is opened by the pressure drop. According to the invention the valve includes a temperature responsive element for opening the valve at high temperatures to advance the distributor, whereby engine speed is increased.

## Background of the invention

It is known to retard an ignition spark distributor during engine idling in order to obtain more complete fuel combustion, and to advance the spark when cruising or coasting above a given speed. The distributor may be adjusted in this manner by a vacuum motor controlled by a suitable pressure responsive valve, as shown in Patents 3,252,451 and 3,353,524. While retarding the spark during idling can reduce the emission of unburned fuel and gases, it may have disadvantages. Continued idling with a retarded spark has a tendency to produce additional heat. If an air conditioner or other load on the engine is added during the idling cycle, the engine may become overheated. According to the invention, the spark will be advanced after the engine has reached a predetermined temperature and this will cause the engine to speed up, thereby enabling it to more adequately handle the load of the air conditioner and also, as an added benefit, to cool down somewhat.

Before the time when adjustments were being made to the distributor advance for the purpose of improving the exhaust emissions, a typical engine would operate at curb idle satisfactorily on a throttle opening equivalent to passage of approximately 0.6 lb. of air per minute. This was changed to a great extent when the spark was retarded for emission purposes. At present many engines operate at curb idle with a throttle opening equivalent to approximately 1.2 lbs. of air per minute or twice that used formerly. Under these conditions the engine still runs at approximately the same r.p.m. as formerly but is handling a greater quantity of air and fuel. It therefore follows that if the spark is advanced, a considerable increase in engine r.p.m. would result. This increase in engine r.p.m. causes the fan to run at a higher rate of speed and more air is drawn across the radiator and the engine cools off.

## Summary of the invention

An automobile internal combustion engine conventionally includes a distributor having means for advancing the spark as the engine speed increases. A vacuum motor is connected to retard the distributor during engine idling, and to advance the distributor at higher engine speeds. This is accomplished by connecting one side of a diaphragm vacuum motor to the carburetor upstream of the throttle valve, and also to a point downstream of the throttle valve through a control valve which is opened by a predetermined manifold vacuum. When the engine is idling, as well as under certain deceleration conditions, the manifold vacuum is not great enough to open the con-

2

trol valve, and with the throttle closed or nearly closed and the choke open, the pressure upstream of the throttle which is applied to the vacuum motor causes it to retard the spark. When the engine runs at or near idle speed for a considerable time, especially if it is loaded, as by an air-conditioner, it may overheat. To prevent overheating the control valve is provided with a bypass closed by a thermostatic disc which pops open at a predetermined temperature, thereby applying manifold vacuum to the vacuum motor to cause it to advance the distributor. The advancement of the spark increases the speed of the engine and enables it to handle its load and to cool down. Spark advance also occurs with large decelerations.

## Brief description of the drawing

The invention will be fully understood from the following description together with the accompanying drawing wherein:

FIG. 1 is a schematic view, partly in section, of the configuration of the essential elements of the invention.

FIG. 2 is a sectional view of the valve utilized in the invention.

## Description of the preferred embodiment

Referring to FIG. 1, carburetor 10 is connected to intake manifold 12 of an internal combustion engine of an automobile. Throttle valve 14 is shown in its closed position, and it is understood that the carburetor includes a choke (not shown) above throttle 14. A distributor 16 is connected by suitable linkage 18 to a vacuum motor 20. The latter includes a diaphragm 22 connected to linkage 18 and spring 24. Chamber 26, on the left side of the diaphragm, is vented to the atmosphere, while chamber 28 is connected to conduits 30 and 32. Conduit 30 communicates with the air horn of carburetor 10 through a restricted orifice 34 located immediately above throttle 14, while conduit 32 is connected to control valve 40 mounted in manifold 12.

The details of control valve 40 are shown in FIG. 2. It comprises a body portion 42, an end cap 44, and an adapter 46 for tightly mounting the control valve in a circular opening in manifold 12. Adapter 46 has a central opening 48 through which valve 40 communicates with manifold 12. It will be obvious that the adapter may be replaced by other suitable mountings or connectors. Between body 42 and end cap 44 is fixed a flexible diaphragm 50 defining chambers 52 and 54. Coil springs 56 and 58 are applied to opposite sides of diaphragm 50. A threaded spring retainer 60 is screwed into end cap 44, and has a central opening 62 for placing chamber 52 at atmospheric pressure. A sleeve 64 is fixed in body 42 and is provided with a bore 66 and lateral ports 68. A ball 70 is pressed by spring 72 against the end of sleeve 64 to close bore 66 normally. Pin or plunger 74 is fixed to diaphragm 50 and is adapted to move therewith to push ball 70 off its seat and thereby open bore 66 to outlet 76 of the valve and conduit 32.

Valve 40 also includes a bypass round ball valve 64, 70 consisting of passages 78 and 80. Passage 80 is normally closed by arcuate bimetallic disc 82 having perforations 84. The resilience of disc 82 insures its closure of passage 80, and the normally higher pressure on the upper side of disc 82 augments its sealing. Disc 82 is constructed to reverse its curvature at a desired temperature. In view of the undercut portion 86, and the fact that passage 78 is larger than passage 80, disc 82 does not close passage 78 when its curvature is reversed.

The operation of valve 40 may be summarized as follows. Manifold vacuum is applied through opening 48 and passages 88 and 90 to passage 80 and chamber 54. If the manifold vacuum is sufficient, diaphragm 50 is

moved to the right by the pressure in chamber 52 and spring 56, whose compression has been set to a desired value by adjustable retainer 60. The movement of diaphragm 50 moves plunger 74 and forces ball 70 off its seat. The manifold vacuum is then communicated through ports 68 bore 66 and passage 76 to conduit 32. If the engine temperature rises to a predetermined level disc 82 is heated to its pop over temperature, reverses its curvature and opens passage 80 to passage 76 and conduit 32.

When the engine, is idling, or during deceleration, throttle 14 may be in the position shown in FIG. 1 and the pressure at orifice 34 will be near the atmospheric level. This pressure will be applied through conduit 30 to chamber 28, and diaphragm 22 will be urged to the position shown by spring 24, causing linkage 18 to retard distributor 16. Through proper selection of the springs 56 and 58 and by adjustment of retainer 60, biasing forces can be created on diaphragm 50 such that it will move to the right only under predetermined pressure conditions. Normal curb idle vacuum conditions in the intake manifold are of the order of 18" Hg. A vacuum of this magnitude should not move the diaphragm to the right and therefore ball valve 70 will remain seated at normal idling conditions. However, on deceleration the manifold vacuum will increase sharply and the biasing forces can be adjusted to allow the diaphragm to move to the right under any pre-selected condition. Normally this will be adjusted to a pressure of approximately 20" Hg below atmospheric. Thus, on a deceleration when manifold vacuum may rise to as high as 25 to 27" Hg diaphragm 50 of valve 40 is actuated to unseat ball 70, the manifold vacuum will then be applied through conduit 32 to chamber 28 of motor 20. This will cause diaphragm 22 to move to the right in FIG. 1 and linkage 18 will adjust distributor 16 to an advanced spark position. This advanced spark on deceleration has been found beneficial in that it reduces the quantity of unburned hydrocarbons and carbon monoxide that is discharged through the exhaust system of the vehicle. Once manifold vacuum has returned to the preset condition, diaphragm 50 will move to the left and pressure will equalize in the chamber 28 by virtue of the atmospheric pressure available at port 34. During normal running the distributor will adjust the amount of spark advance in accordance with engine speed as is well known.

If during idling, the engine temperature rises and causes disc 82 to pop over, manifold vacuum will be applied

through passages 80, 78, 76 and conduit 32 to motor 20, and diaphragm 22 will move to the right, causing linkage 18 to advance distributor 16. Assuming the engine has been adjusted to idle with a lean fuel mixture, to obtain minimum emission of unburned hydrocarbons, advancing the spark will increase the engine speed. This, of course, will increase the speed of the fan and cool the radiator and the engine. The higher engine speed will also enable it to supply its load without overheating.

What is claimed is:

1. In an automobile internal combustion engine having an ignition distributor and pressure responsive control means connected to the distributor for advancing and retarding it in accordance with engine speed and intake manifold pressure, said pressure responsive means having a connection to the intake manifold; temperature responsive valve means in said connection adapted to open in response to a pre-determined temperature for advancing the distributor; and a second valve means for connecting said pressure responsive means to the intake manifold in response to a pre-determined pressure drop in the manifold.

2. Apparatus according to claim 1, wherein said temperature responsive valve and said second valve means are connected in parallel relation with each other in said connection to the intake manifold.

3. Apparatus according to claim 2, wherein said pressure responsive control means includes a vacuum motor and a conduit connecting one side of said vacuum motor to the air horn of the carburetor through a restricted orifice located upstream of the carburetor throttle valve.

4. Apparatus according to claim 3, comprising a unitary device embodying said temperature responsive valve and said second valve means, said second valve means including a valve and a vacuum motor for actuating said last-mentioned valve in response to intake manifold pressure.

#### References Cited

##### UNITED STATES PATENTS

|           |         |               |           |
|-----------|---------|---------------|-----------|
| 2,809,619 | 10/1957 | Norris        | 123—117.1 |
| 2,809,620 | 10/1957 | Boylan        | 123—117.1 |
| 3,203,411 | 8/1965  | Seiden        | 123—117.1 |
| 3,301,242 | 1/1967  | Candelize     | 123—117.1 |
| 3,385,275 | 5/1968  | Burnia et al. | 123—117.1 |
| 3,400,698 | 9/1968  | Kelly         | 123—117.1 |

MARK M. NEWMAN, Primary Examiner