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METHOD OF CALIBRATING VACUUM ADVANCE MECHANISMS
FOR IGNITION DISTRIBUTORS

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FIG.1

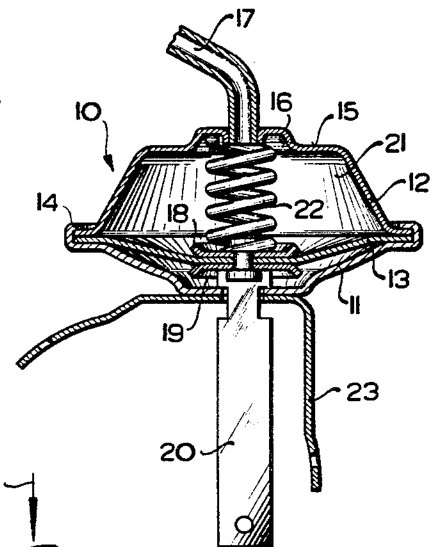
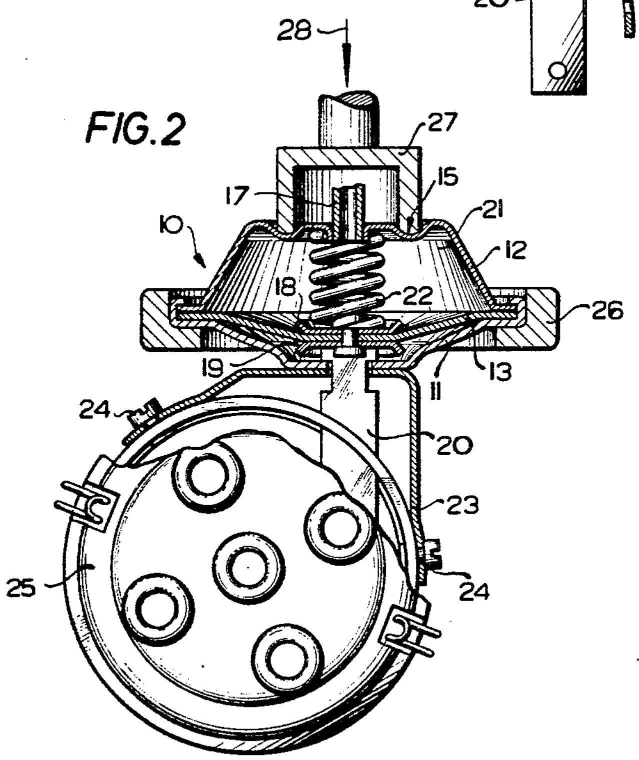


FIG.2



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1

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METHOD OF CALIBRATING VACUUM ADVANCE MECHANISMS FOR IGNITION DISTRIBUTORS

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6 Claims. (Cl. 29—173)

ABSTRACT OF THE DISCLOSURE

A method of adjusting the bias of a return spring in the chamber of a vacuum advance mechanism for ignition distributors, wherein the spring is first placed in the vacuum chamber so that opposite ends of the spring engage respectively a housing and a diaphragm defining the chamber, whereafter the housing is deformed to stress the spring in axial direction to thereby adjust the spring bias.

The present invention relates to internal combustion engines in general, and more particularly to ignition distributors for internal combustion engines. Still more particularly, the invention relates to a method of calibrating the vacuum advance mechanism for an ignition distributor.

The housing of the vacuum advance mechanism is usually mounted on or close to the ignition distributor. The vacuum advance mechanism normally comprises a vacuum diaphragm which is coupled to the breaker plate of the ignition distributor to change the angular position of the breaker plate in response to a change in pressure differential at the opposite sides of the diaphragm. The latter forms a seal at one side of a vacuum chamber which is in communication with the intake manifold of the internal combustion engine, and the vacuum chamber accommodates a return spring which opposes the pressure of ambient air against the exposed side of the diaphragm. When the suction in the manifold increases, the pressure of ambient air flexes the diaphragm against the bias of the return spring whereby the diaphragm transmits motion to the breaker plate which is turned ahead so that the contacts of the ignition distributor are opened and closed earlier in the ignition cycle. Such operation of the vacuum advance mechanism is well known in the art of internal combustion engines for automotive vehicles. The return spring is maintained under slight compression and, by changing its bias, one can adjust the action of the vacuum advance mechanism.

In accordance with heretofore known methods, the return spring of a mass-produced vacuum advance mechanism is calibrated after the mechanism is mounted on the ignition distributor. Such calibration is necessary to compensate for inaccuracies in manufacture of the vacuum advance mechanism and/or ignition distributor, and also to insure that the adjustment carried out by the mechanism in actual operation will invariably result in turning of the breaker plate through a desired angle, i.e., that the vacuum advance mechanism can actually fulfill its intended purpose of advancing the spark as a function of the vacuum prevailing in the intake manifold. In calibrating the return spring, manufacturers of vacuum advance mechanisms resort to adjusting screws, bolts and similar rotary elements which can change the bias of the spring in the vacuum chamber and which must be fixed in final position of adjustment to prevent uncontrolled changes in the spring bias. Such calibrating operation is time-consuming and requires much skill as well as precision-finished tools and other accessories.

Accordingly, it is an important object to provide a novel and improved method of calibrating the return spring of

2

a vacuum advance mechanism according to which the calibrating operation may be performed by resorting to a very simple apparatus, without necessitating the provision of screws, bolts and similar parts which are likely to change their position when the vacuum advance mechanism is in actual use, and according to which the calibrating operation may be carried out with the same degree of accuracy in each of a series of mass-produced vacuum advance mechanisms.

Another object of the invention is to provide a method of the just outlined characteristics according to which the calibrating operation requires less skill than all such heretofore known calibrating operations which are known to me at this time.

A further object of the invention is to provide a method of calibrating the return spring of a vacuum advance mechanism in such a way that the bias of the spring thereupon remains unchanged for any desired length of time.

A concomitant object of the invention is to provide a method of calibrating the return spring of a vacuum advance mechanism in such a way that, in order to change its bias, the spring need not be accessible at all.

Still another object of the invention is to provide a method of the above outlined characteristics which may be resorted to in connection with all such types of vacuum advance mechanisms wherein the pressure of atmospheric air against a deformable portion of the housing for a vacuum chamber is opposed by a prestressed spring.

Briefly stated, one feature of my present invention resides in the provision of a method of adjusting the bias of a return spring in the chamber of a vacuum advance mechanism for ignition distributors of internal combustion engines wherein the chamber is defined by a vacuum diaphragm and a housing and wherein the spring opposes the pressure of ambient air against the exposed side of the diaphragm. In its elementary form, the method comprises a first step of introducing into the vacuum chamber a spring whose bias is less than necessary to offer satisfactory resistance to the pressure of ambient air, and a second step of thereupon changing the configuration of the chamber to thereby store energy in the spring until the latter offers a requisite resistance to the pressure of ambient air.

In accordance with a more specific feature of my invention, the change in the configuration of the vacuum chamber is brought about by deforming the housing of the vacuum advance mechanism with a view to reduce the volume of the vacuum chamber and to thereby compress the spring between the housing and the diaphragm. The spring is preferably a helical spring one end convolution of which bears against the central zone of a substantially disk shaped diaphragm and the other end convolution of which bears against the bottom portion of a cup-shaped housing whose open end is sealed by the diaphragm. By deforming the bottom portion of the cup-shaped housing while the pressure differential at the opposite sides of the diaphragm remains unchanged, one can compress the spring axially to such an extent that the spring stores some energy and is capable of effectively resisting the pressure of atmospheric air to thereby maintain the breaker plate of the ignition distributor in optimum position regardless of whether the spring alone resists the pressure of ambient or whether the bias of the spring is assisted by a rise in pressure which prevails in the vacuum chamber.

The novel features which are considered as characteristic of the invention are set forth in particular in the appended claims. The improved method itself, however, together with additional features and advantages thereof, will be best understood upon perusal of the following detailed description of the accompanying drawings, in which:

FIG. 1 is an axial section through a vacuum advance mechanism whose return spring is about to be calibrated in accordance with my method; and

FIG. 2 is a similar axial section through the vacuum advance mechanism, further showing the calibrating apparatus and a portion of the ignition distributor whose breaker plate is controlled by the diaphragm of the vacuum advance mechanism, the return spring being shown in calibrated condition.

Referring to the drawings in detail, FIG. 1 shows a vacuum advance mechanism **10** which comprises a cupped housing **12** having a bottom portion **15** provided with an annular depression **16** which accommodates one end convolution of a helical return spring **22**. The open end of the housing **12** is sealed by a flexible disk-shaped vacuum diaphragm **13** whose marginal portion is sealingly clamped to the housing by upsetting an annular flange **14** on the periphery of a cover or lid **11**. The central portion of the diaphragm **13** is disposed between two stiffening washers **18**, **19** and is connected to a link **20** serving to transmit motion to the breaker plate of an ignition distributor **25** shown in FIG. 2. The housing **12** and the diaphragm **13** define between themselves a vacuum chamber **21** which accommodates the return spring **22**, and the lower end convolution of this spring bears against the central portion of the diaphragm, i.e., against the washer **18**. The latter is provided with an annular peripheral flange to serve as a retainer for the spring **22** whereby the latter is properly located between the bottom portion **15** and the diaphragm **13**. A conduit **17** connects the housing **12** with the intake manifold of an internal combustion engine, not shown, so that the conduit **17** can admit vacuum manifold to the chamber **21**. The underside of the diaphragm **13** is subjected to the pressure of ambient air so that the spring **22** opposes such pressure by tending to prevent flexing of the diaphragm toward the bottom portion **15** of the housing **12**. It will be noted that the end of the conduit **17** communicates with the central zone of the depression **16** in the bottom portion **15**.

The cover **11** is welded or otherwise secured to a mounting bracket **23** which is attached to the ignition distributor **25** by screws **24** shown in FIG. 2. When the vacuum advance mechanism **10** is tested with a view to adjust the bias of the return spring **22**, the open end of the housing **12** is propped by a matrix **26** and the bottom portion **15** of the housing **12** is deformed by a ram **27** which is moved in the direction indicated in FIG. 2 by an arrow **28**. The deformation of an annular part of the bottom portion **15** which surrounds the depression **16** results in a change in the configuration and volume of the vacuum chamber **21** by simultaneous compression of the spring **22**. During such deformation of the housing **12**, the pressure differential at the opposite sides of the diaphragm **13** remains unchanged. Thus, the spring **22** is inserted into the chamber **21** while the volume and configuration of the chamber are such that the spring is subjected to less than requisite compression, and the deformation of the housing **12** and resultant reduction in the volume of the chamber **21** are terminated when the spring **22** has stored sufficient energy to insure that the vacuum advance mechanism **10** can regulate the position of the breaker plate as a function of manifold vacuum. It is clear that the function of the matrix **26** and ram **27** can be reversed, i.e., that the ram can remain stationary and the matrix can move in a direction counter to that indicated by the arrow **28**. Also, each of the parts **26**, **27** can be moved in a sense to deform the housing **12** and to reduce the axial length of the return spring **22**.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can, by applying current knowledge, readily adapt it for various applications without omitting features which fairly constitute essential characteristics of the generic and specific aspects of my contribution to the art and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the following claims.

What is claimed as new and desired to be protected by Letters Patent is:

1. A method for adjusting the bias of an elongated return spring in the chamber of a vacuum advance mechanism for ignition distributors wherein the chamber is defined by a vacuum diaphragm and a housing, and wherein the spring opposes the pressure of ambient air against one side of the diaphragm, said method comprising a first step of introducing into said chamber an elongated spring with only its opposite ends engaging said housing and said diaphragm, respectively, and whose bias is different from that necessary to offer a predetermined resistance to the pressure of ambient air on said diaphragm; and a second step of deforming said housing substantially in direction of elongation of the spring to change the position of said opposite spring ends relative to each other to thereby change the spring bias until the spring offers a requisite resistance to the pressure of ambient air on said diaphragm.

2. A method as set forth in claim **1**, wherein said spring is inserted in said housing with the bias less than necessary to offer said predetermined resistance against pressure of ambient air on said diaphragm, and wherein said housing is inwardly deformed to stress the spring to an increasing extent to thereby increase the spring bias.

3. A method as set forth in claim **1** wherein the return spring is a helical spring whose end convolutions respectively bear against the diaphragm and against the housing, and wherein said second step comprises deforming the housing in a direction to reduce the axial length of the spring.

4. A method as set forth in claim **3**, wherein the housing resembles an open-ended cup having a bottom portion, wherein the diaphragm extends across the open end of the cup, and wherein the return spring is inserted between the bottom portion of the housing and a central portion of the diaphragm, said deforming step comprising propping the open end of the cup and deforming the bottom portion in a direction toward the diaphragm.

5. A method as set forth in claim **1** wherein said second step is carried out while the pressure at the opposite sides of the diaphragm remains unchanged.

6. A method as set forth in claim **5**, wherein said second step comprises deforming the housing in a single direction so as to reduce the volume of the chamber.

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