

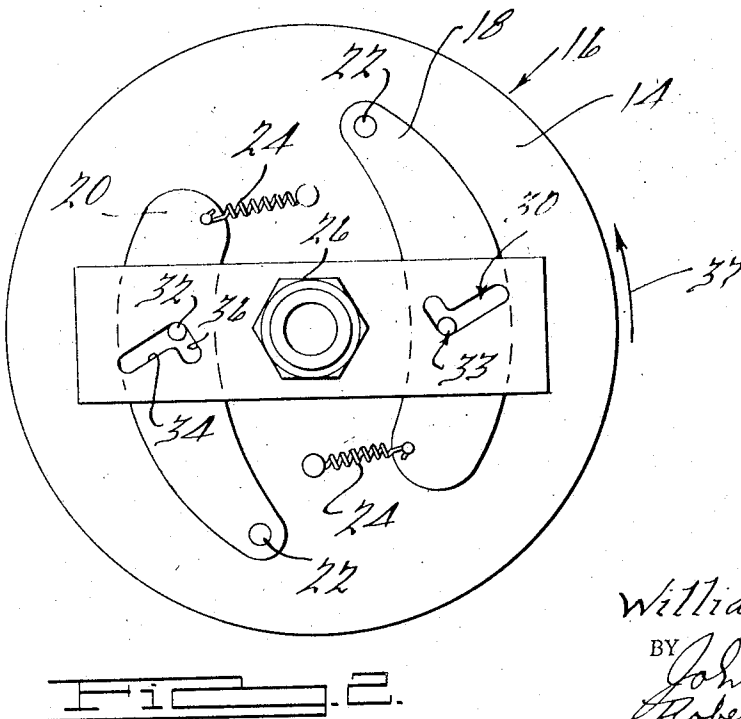
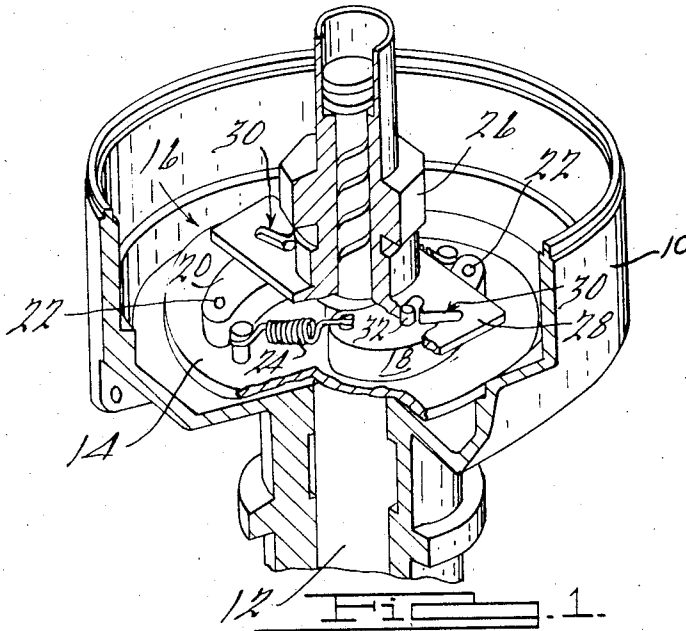
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DISTRIBUTOR SPARK ADVANCE MECHANISM

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DISTRIBUTOR SPARK ADVANCE MECHANISM
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ABSTRACT OF THE DISCLOSURE

A motor vehicle ignition distributor having a centrifugal spark advance timing mechanism including an advance cam follower slot that rotates the breaker point cam relative to the drive shaft to cause the spark timing to be advanced both when the engine speed drops below or increases above the normal idle speed setting; to thereby minimize idle speed droop caused by the intermittent operation of engine driven accessories.

This invention relates, in general, to an ignition distributor for a motor vehicle. More particularly, it relates to a centrifugal advance mechanism for advancing the spark when the engine is operating at conditions other than idle speed.

Centrifugal advance mechanisms for automatically advancing the spark with changes in engine speed are known. However, in general, these latter mechanisms are designed with a straight single slot in the distributor cam plate, one end serving as the minimum or zero advance position corresponding to engine idling speed, the opposite end providing maximum spark advance. Therefore, spark advance in these cases is provided only above the idling speed engine operation.

Present day passenger vehicles are frequently equipped with many intermittently operated engine driven accessories, such as, for example, air conditioning units, power steering, power brakes, etc. If the engine is idling, and the air conditioner, for example, is switched on, the sudden additional load may cause a decrease in the distributor shaft speed sufficient to stall the engine.

All engines develop maximum torque at a certain ignition spark setting. Theoretically, the spark should ignite the fuel-air mixture when the piston is at the top dead center position during the compression stroke. However, for various reasons, such as the different characteristics of different engines, maximum torque often is obtained by providing spark ignition, say, 2° to 12°, for example, ahead of the piston top dead center position. Also, when the individual requirements of the vehicle and/or the use of substandard fuels dictate, the initial timing often is retarded from the maximum torque setting to eliminate detonation or spark knock, for example.

The present invention minimizes the above idle speed droop due to the activation of accessories by providing a distributor centrifugal advance mechanism that advances the spark timing when the distributor or engine shaft speeds drop below a preselected idling speed. Since, as stated above, the initial spark timing setting may be retarded from the normal optimum spark timing setting, at idling, the initial torque provided will be less than the maximum torque available. Accordingly, advancing the spark timing at below idle speeds moves the spark timing back towards the normal or optimum setting, thereby increasing the torque available and increasing the speed of the distributor shaft so as to compensate for the idle speed droop due to the accessory load.

The above is accomplished by the use of a centrifugal advance slot that has two intersecting spark advance por-

tions, with the point of interconnection or knee of the slot constituting the normal idle speed position, or position of zero advance of the distributor cam. This latter position would also correspond to the initial retard timing setting chosen for the particular engine.

Therefore, it is an object of the invention to provide a motor vehicle distributor centrifugal advance mechanism that aids in alleviating the idle speed instability problem by providing spark advance at below idling speed operation when a load is suddenly placed on the distributor drive shaft.

It is a further object of the invention to provide a motor vehicle distributor that provides a stable idle speed operation, regardless of the sudden change in load placed on the distributor drive shaft.

It is also an object of the invention to provide a distributor centrifugal advance mechanism that is simple in construction and economical to manufacture, and yet provides stable idle speed operation of the vehicle regardless of the change in load on the distributor drive shaft.

Other objects, features and advantages of the invention will become apparent upon reference to the succeeding detailed description thereof, and to the drawings illustrating the preferred embodiment thereof, wherein:

FIGURE 1 is a perspective view, with parts broken away and in section, of a portion of a motor vehicle distributor embodying the invention; and

FIGURE 2 is a plan view of the centrifugal advance mechanism of the distributor illustrated in FIGURE 1.

FIGURE 1 shows a lower portion of a motor vehicle distributor that, for the most part, is conventional. It has a stationary outer housing 10 in which is rotatably mounted a drive shaft 12. The drive shaft would be connected in any suitable manner, not shown, to the engine crankshaft to rotate at, say, one-half engine speed. Drive shaft 12 is rigidly attached to a circular base plate 14 constituting one part of a centrifugal spark advance mechanism 16.

As best seen in FIGURE 2, a pair of arcuate weight members 18 and 20 of suitable preselected mass are pivotally connected by pins 22 to base plate 14 so as to swing arcuately in a plane essentially at right angles to the axis of drive shaft 12. An idle speed spring 24 of preselected force is secured between base plate 14 and the end of each weight, and biases the weight inwardly to the idle speed position shown. The balance between the centrifugal forces acting on weights 18 and 20 and the forces of springs 24 will maintain the weights in the position shown for a predetermined rotation of the drive shaft. Increases or decreases in the speed correspondingly change the centrifugal forces on weights 18 and 20 to swing them outwardly or inwardly as the case may be to advance the spark timing, in a manner to be described.

The distributor illustrated also, of course, would contain a conventional breaker plate assembly, not shown, containing at least one pair of breaker points that are opened and closed intermittently by a breaker cam 26. The cam is essentially in the shape of a polygonal nut having as many apices or points (eight in this case) as there are engine cylinders. Cam 26 is drivingly connected to distributor drive shaft 12 by a stop plate 28 and the centrifugal advance mechanism 16.

More specifically, cam 26 is formed integrally with an essentially rectangularly shaped stop plate 28 that has a pair of essentially right-angled or elbowed cam follower slots 30 for cooperation with the centrifugal weights 18 and 20. Projecting through each of the cam follower slots 30 is a drive pin 32 that is rigidly attached to or formed integral with the respective centrifugal weight 18 or 20. The cam follower slots cam the stop plate 28 and cam 26 rotatively relative to the drive shaft

upon changes in engine speed to advance the spark timing when needed to provide efficient operation of the engine, in a known manner.

As stated previously, many engines often have a retarded initial spark setting to suit the particular operating characteristics of a particular engine. In this case, the initial retarded setting would establish idle speed operation. In FIGURE 2, idle speed position corresponds to the point where the centrifugal weight pins 32 are in the knee or point of intersection 33 between the two advance slot portions 34 and 36. It will be clear, therefore, that when the engine speed and centrifugal forces acting on weights 18 and 20 increase sufficiently above idling to overcome the forces of springs 24, the outward arcuate movement of each of the centrifugal weights 18 and 20 will move the pins 32 in the same direction and thereby along the advance slot portion 34. This will positively advance the spark timing by rotating stop plate 28 and cam 26 in a direction opposite to the direction of rotation (indicated by arrow 37) of the distributor drive shaft 12 and base plate 14.

If, for some reason, such as, for example, an air conditioning unit is suddenly placed in operation when the engine is idling and pin 32 in the position shown in FIGURE 2, the sudden increase in load will drop the speed of the distributor drive shaft 12 and cause an inward movement of weights 20 and 18 by the forces of springs 24. This inward movement will cause pin 32 to react against the walls of the centrifugal weight advance slot portion 36 to force a clockwise rotation of stop plate 28 and cam 26, and thereby again advance the spark timing. Since, as stated previously, the initial idle speed timing setting is retarded from that setting providing maximum torque, an advance of the spark timing at this time will increase the torque available and recover the engine speed.

From the above, therefore, it will be seen that the invention provides a distributor advance mechanism that provides idle speed stability by the use of a multiportion cam follower slot connection between the distributor cam and the distributor spark advance mechanism so that the timing will be advanced both as a function of increases and decreases in engine speed from the idle speed retarded initial setting. It will also be seen that the above is accomplished in a simple and economical manner to eliminate engine stalling and the normal speed droop when accessories are intermittently cut in or out with the engine operating at idle speed.

While the invention has been described and shown in its preferred embodiment, it will be clear to those skilled in the arts to which the invention pertains that many changes and modifications may be made thereto without departing from the scope of the invention.

I claim:

1. A centrifugal spark advance mechanism for a motor vehicle distributor comprising, in combination, a rotatable distributor shaft, centrifugally responsive flyweight means operatively pivotally secured adjacent one end of said shaft about an axis essentially parallel to the shaft axis

for rotation with said shaft and pivotal movement in a plane essentially at right angles to the axis of said shaft in response to centrifugal forces acting thereon upon predetermined rotation of said shaft, spring means biasing said weight means in one direction to oppose the movement of said weight means by centrifugal forces, and a distributor cam plate having a cam thereon rotatably mounted on said shaft, said plate having a cam follower slot therein, said weight means having cam means secured thereto projecting into said cam follower slot for a driving rotational connection between said shaft and distributor cam, said slot having a plurality of interconnected portions extending at angles to each other, the point of interconnection between the said portions constituting the minimum spark advance and normal idle speed position of said distributor cam.

2. A mechanism as in claim 1, said slot having essentially a right angled shape providing rotation of said distributor cam relative to said shaft to spark advance positions above the minimum upon movement of said plate cam means in said portions away from said slot minimum position.

3. A mechanism as in claim 1, said flyweight means comprising a pair of flyweights symmetrically arranged with respect to said shaft.

4. A mechanism as in claim 1, said cam follower slot portions comprising a pair of portions essentially at right angles to each other whereby the apex of said portions constitutes the minimum spark advance position.

5. A mechanism as in claim 4, said portions being of different lengths.

6. A mechanism as in claim 1, said plate cam means comprising a pin secured to said plate and projecting through a part of the slot portion so as to be moved in one direction of the other by said slot walls upon movement of said flyweight member relative to said shaft.

7. A mechanism as in claim 2, rotation of said shaft at a predetermined preselected idle speed positioning said flyweight cam means at the apex of said slot, changes in speed of said shaft below or above the preselected speed effecting movement of said flyweight means and thereby said cam means against the opposite respective side portions of said slot to cam said distributor plate and cam to various spark advance positions.

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