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Hunt

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[54] **DISTRIBUTOR ADJUSTING MECHANISM**

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[52] **U.S. Cl.** ..... **123/117 R,** 123/146.5 A

[51] **Int. Cl.** **F02p 5/06**

[58] **Field of Search** ..... 123/117 R, 146.5 A, 123/149 D; 200/30 A, 30 AA, 31 R, 31 A

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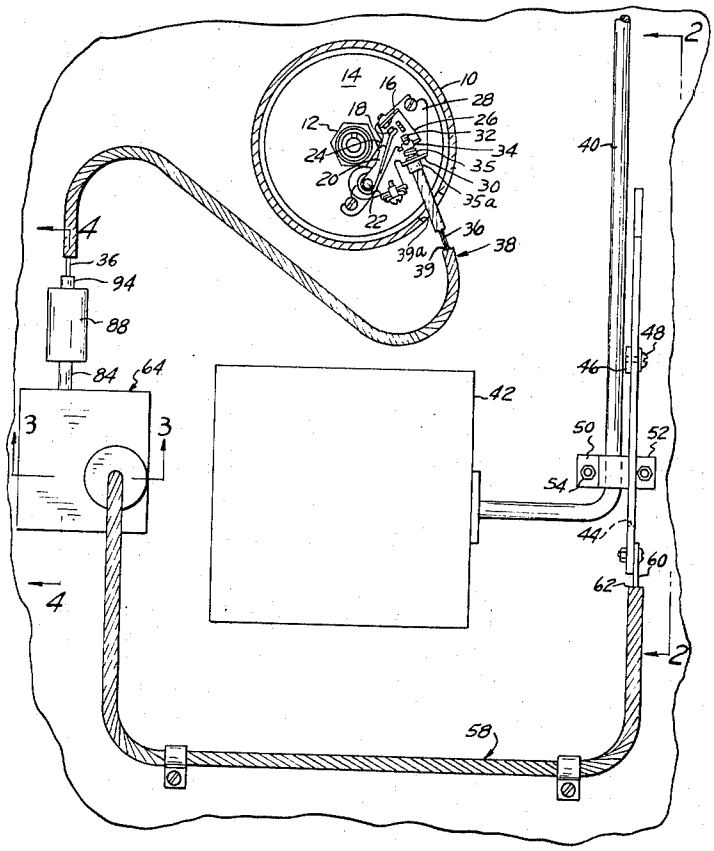
[57] **ABSTRACT**

Mechanism for adjusting the location of the stationary contact of the breaker points of a distributor in accordance with engine speed during operation of the engine, either automatically in response to speed or throttle opening, or manually by a remote operation from the driver's seat in an automobile.

10 Claims, 6 Drawing Figures



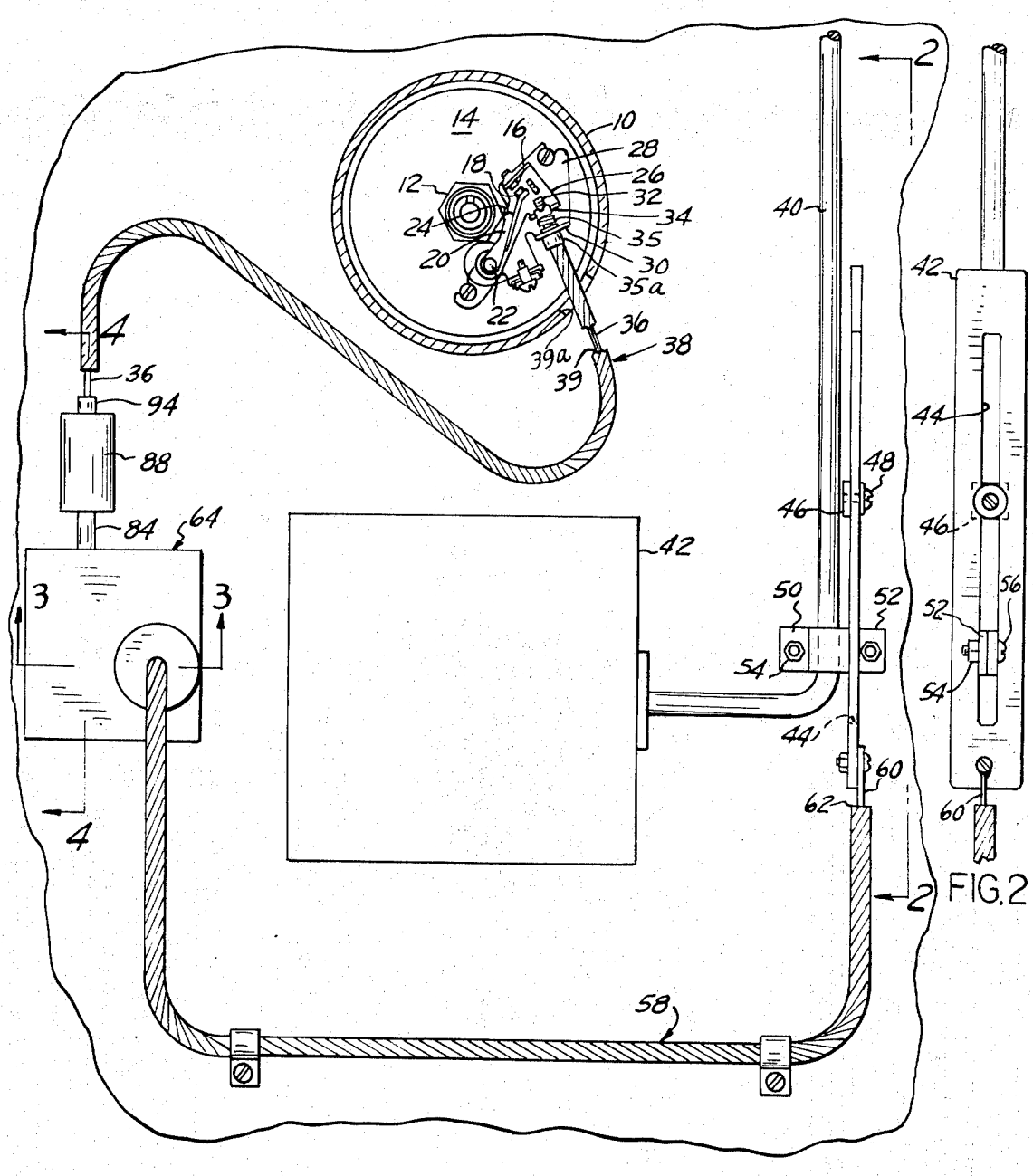

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FIG. 2

FIG. 1

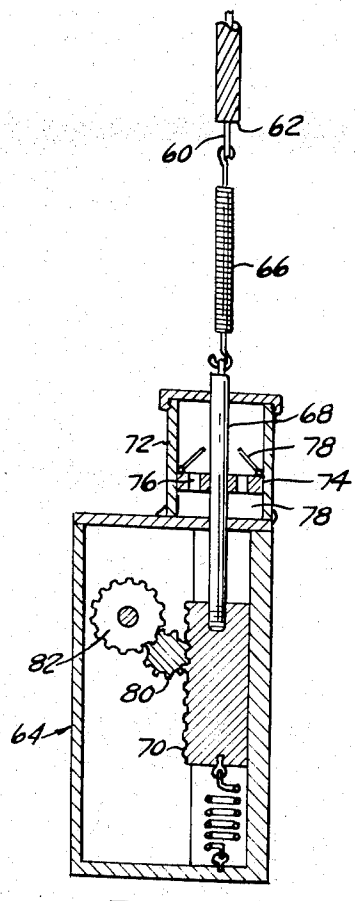

FIG. 3

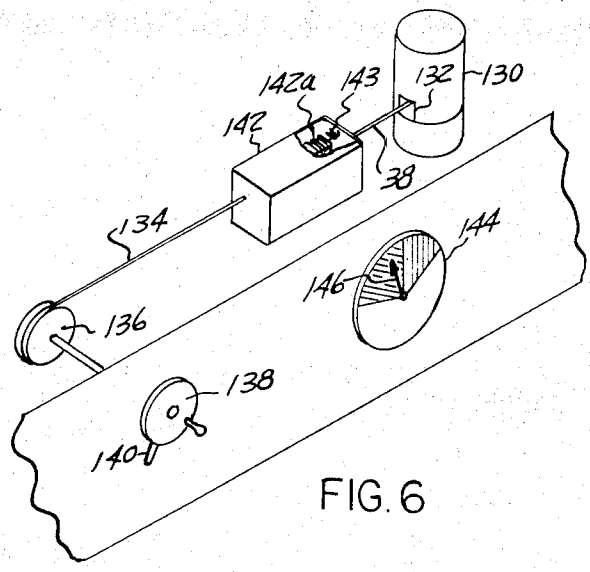

FIG. 6

FIG. 4

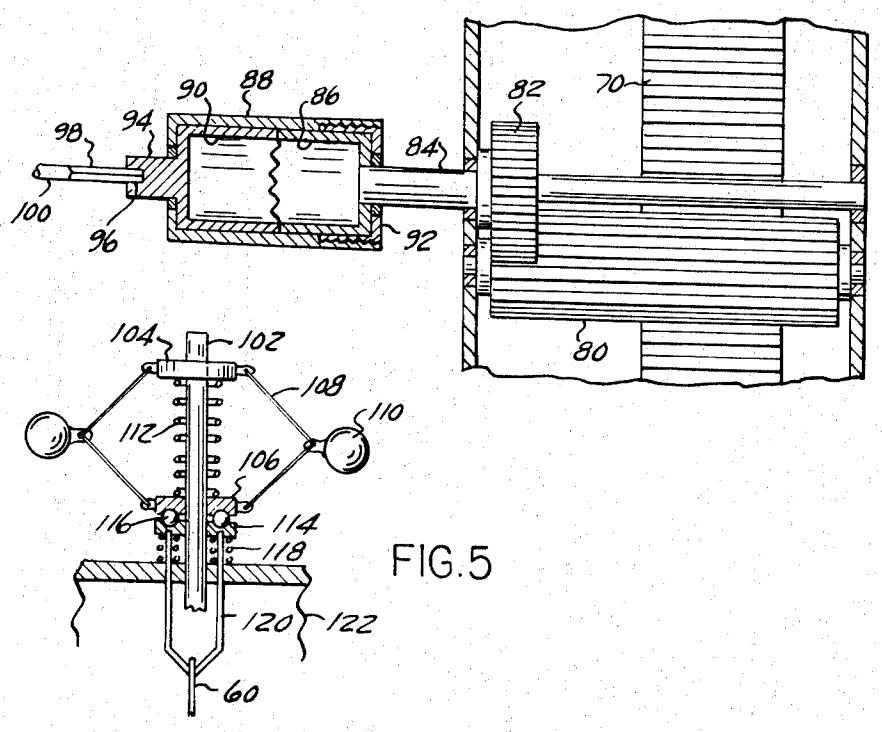

FIG. 5

DISTRIBUTOR ADJUSTING MECHANISM

BRIEF SUMMARY OF THE INVENTION

Internal combustion engines having spark ignition are provided with a distributor which includes electrical contacts opened and closed in timed relation to engine speed. The ignition system includes a transformer in which the high voltage secondary is connected to the spark plugs, and the primary of the transformer includes the breaker points. When the breaker points are closed a circuit builds up in the primary and when the breaker points open the field of the primary windings collapses, inducing a high voltage in the secondary which produces a spark at the spark plug.

In conventional distributors in use today a cam rotor is provided usually having lobes equal to the number of cylinders or a fraction of the number of cylinders. One of the breaker points is adjustably mounted on a plate which is in turn angularly about adjustable the axis of rotation of the cam, in order to effect automatic timing of the spark with reference to the position of the piston in each cylinder of the engine. A further adjustment of the so-called fixed contact is accomplished by mounting it and the movable contact carried by the movable breaker arm on a sub-plate movable generally radially of the cam. The movable breaker arm is provided with a projection which is engaged by the high points or lobes of the cam which move the breaker arm in a direction to separate the contacts or breaker points as previously mentioned. The moveable breaker arm is spring biased so that its contact normally engages the stationary contact except when moved away by operation of the cam.

From the foregoing it will be apparent that if the sub-plate carrying both breaker points is moved far engough away from the cam, the cam will not engage the projection on the movable breaker arm and the contacts will remain closed. On the other hand, if the sub-plate is adjusted too far in a direction toward the cam, the projection on the movable breaker arm will engage the cam at all times and the breaker points will never close. When the sub-plate is adjusted into an intermediate position the lobes on the cam will have the effect of opening the breaker points during each passage of a lobe past the projection on the breaker arm, and the interval during which the breaker points are separated and the interval during which the breaker points are closed is determined by the adjustment of the sub-plate.

It has been found by experiment that most efficient ignition at any particular engine speed occurs when the sub-plate is adjusted to a position dependent on engine speed. In general terms, at high speed the sub-plate should be adjusted away from the cam so as to reduce the maximum space between the contacts when the breaker points are separated. However, when this adjustment is in effect engine operation is less efficient at lower speeds as for example 30–40 miles per hour. Similarly, if the stationary breaker contact is adjusted by adjustment of the sub-plate so that the optimum gap exists for low speed operation, engine operation is less efficient at high speed.

The foregoing is of particular importance since the inefficient engine operation, attributable to less than an optimum spark at the spark plug, causes faulty combustion and results in undesirable emissions in the engine exhaust.

By providing for an adjustment of the stationary breaker point with a corresponding adjustment of the relative duration of open and closed conditions of the breaker points, maximum engine efficiency and fuel combustion occurs at all speeds.

In general terms, means are provided for effecting adjustment of the sub-plate carrying the stationary contact together with the movable contact of the breaker points, either manually, from the driver's compartment while the engine is running, or automatically in direct response to engine speed, or automatically in response to throttle position, which in turn affects engine speed.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a schematic view illustrating the distributor and mechanism for adjusting the sub-plate carrying the stationary and movable breaker points.

FIG. **2** is a fragmentary elevational view looking in the direction of the arrows **2—2**, FIG. **1.**

FIG. **3** is a sectional view on the line **3—3**, FIG. **1.**

FIG. **4** is an enlarged sectional view on the line **4—4**, FIG. **1.**

FIG. **5** illustrates a centrifugal device for operating the adjustable means in accordance with engine speed.

FIG. **6** is a fragmentary perspective diagrammatic view illustrating manually controlled mechanism for effecting the adjustment.

DETAILED DESCRIPTION

Referring first to FIG. **1** there is shown a distributor **10** with the cover removed, the distributor including a rotatable cam **12** illustrated as of generally hexagonal shape and adapted to be rotated on its axis in accordance with engine speed. Within the housing of the distributor is a plate **14** which is angularly adjustable about the axis of the cam **12,** such adjustment normally being effected by means responsive to manifold vacuum as is well understood. Rotation of the plate **14** and the breaker point assembly carried thereby has the effect of advancing or retarding the spark in accordance with manifold vacuum.

The contacts or breaker points which are connected in the primary of the transformer comprise a stationary contact or breaker point **16,** and a movable contact or breaker point **18** carried by a movable breaker arm **20** pivoted as indicated at **22** and urged in a counterclockwise direction by a spring (not shown). The spring has the effect of maintaining the contacts **16** and **18** closed except when they are opened and retained in open position by operation of the cam **12.** The movable breaker arm **20** is provided with a projection **24** which extends toward the cam **12** and which is adapted to be engaged by the lobes or high points of the cam as they pass the location of the projection or cam follower **24.**

The stationary contact **16** and the movable breaker arm **20** carrying the movable contact **18** are mounted on an adjustable sub-plate **26** movable on a bracket **28** about the axis of the pivot **22.** The bracket **28** is provided with an upstanding ear **30** carrying an adjusting screw **32** which is threaded through an opening in an ear **34** on the sub-plate **26** and is mounted for rotation only in the ear **30.** A compression spring **35** cooperates with the head **35*a*** of the screw to provide for positioning of the sub-plate **26** as a consequence of rotation of the screw **32.** (Accordingly, rotation of the screw adjusts the sub-plate **26** in a direction such that the projection **24** of the breaker arm **20** moves generally radi-

ally toward and away from the axis of the cam **12,** the stationary contact **16** of course partaking of such adjustment.)

The foregoing adjustment is normally provided in distributors so that the maximum operational gap between the contacts **16** and **18** may be adjusted, while the engine is not running. Such adjustment is necessary to maintain a predetermined maximum gap when the surfaces of the breaker points are dressed to remove pits or the like after extended use.

In accordance with the present invention, means are provided which connect to the adjusting screw **32** so that this screw may be rotated or adjusted during operation of the engine and independently of the position of the rotatable support plate **14** on which the remaining structure is mounted. This means, in the embodiment of the invention illustrated in FIGS. **1–4,** comprises a torsion wire **36** shown as forming a part of a wire assembly **38** including a flexible sheath **39,** the end of the wire extending into a suitable non-circular recess in the head **35***a* of the adjusting screw.

Inasmuch as the plate **14** which carries the bracket **28** and the sub-plate **26** for angular adjustment about the axis of the shaft **12,** is movable with respect to the housing **10** of the distributor, it is necessary to provide an enlarged opening **39***a* through which the wire assembly **38** passes to the interior of the distributor.

The means for rotating the torsion wire **36** may, as previously stated, be manual and operated from a remote position, or it may be automatic.

As seen in FIG. **1,** an automatic operation of the gap adjustment is provided. The conventional accelerator pedal of an automatic vehicle is connected by a link **40** to a carburetor diagrammatically indicated at **42.** Mounted adjacent the link **40** for movement in a direction longitudinally thereof is a slotted plate **42** having an elongated slot indicated at **44.** Adjustable longitudinally of the slot is an abutment indicated at **46** which includes a screw **48** which may be loosened to permit adjustment of the abutment longitudinally of the slot.

Clamped to the link **40** is an abutment device **50** having a portion **52** extending through the slot and carrying a nut **54** and screw **56** which retains the two halves of the abutment assembled in the relationship illustrated in FIG. **2.** It will be observed from this FIGURE that the location of the abutment **46** determines the length of an elongated slot in which the abutment device **50** is longitudinally movable. Connected to one end of the plate **42** is a Bowden wire device **58** comprising the flexible wire **60** longitudinally slidable in a flexible sheath **62.** Upon predetermined movement of the accelerator link **40** the abutment device **50** engages one end or the other of the portion of the slot determined by the position of the abutment **46** and will effect a longitudinal movement of the wire **60.** The other end of the wire is positioned adjacent a transmission housing **64** details of which are best seen in FIG. **3.** The sheath **62** of the Bowden wire is mounted in fixed position relative to the housing **64** and the projecting end of the wire **60** is connected through a tension spring **66** to a rod **68** which in turn connects to a spring biased rack **70** slidable in the housing **64.** A dashpot device is provided comprising a cylinder **72** in which a piston **74,** connected to the rod **68,** is longitudinally slidable. The interior of the cylinder **72** is charged with hydaulic fluid and the piston **74** is provided with one or more restricted passages **76** having a check valve **78** associated therewith. Each check valve is provided with a small passage (not shown) permitting a restricted flow of hydraulic fluid therethrough when the valves are in closed position. It will be observed that when a pull is exerted on the wire **60,** the spring **66** is tensioned but with the check valve **78** in closed position, movement of the rack **70** will be retarded until the hydraulic fluid can flow through the restricted ports provided in the check valve **78.** Accordingly, when the accelerator pedal is moved abruptly to a position corresponding to wide open throttle, which will increase the engine speed to a maximum consistent with the engine loading, the adjustment of the distributor is delayed so that it does not take place until the engine speeds up in response to opening movement of the throttle.

Longitudinal movement of the rack **70** is transmitted through a pinion **80** to a gear **82** carrying an output shaft **84** at the end of which is provided a toothed clutch element **86** received in a cylindrical housing **88.** A second cup-shaped clutch element **90** is received within the housing and the parts are retained in assembled position by a closure **92.** Accordingly, rotation of the shaft **84** is transmitted to an output shaft **94** recessed as indicated at **96** for the reception of a non-circular or square end portion **98** of the torque transmitting wire **36.**

With the foregoing construction it will be observed that when the accelerator pedal link **40** is moved in a direction to open the throttle (upwardly in FIG. **1**), predetermined movement of the link **40** will cause engagement between the abutment device **50** and the end of the slot **44** as determined by adjustable abutment **46.** This will exert a pull on the wire **60** and, where the dashpot construction including the cylinder **72** is employed, will tension the spring **66.** Tension in the spring **66** will urge the rack **70** upwardly as seen in FIG. **3** at a rate determined by the escapement ports in the check valves **78,** thus introducing a timed delay in adjustment of the breaker point gap and hence, the duration of closure period of the breaker points to permit the engine speed to increase in response to throttle opening. With the Bowden wire device **58** stationary and with the engine stopped, an adjustment may be made in the position of the sub-plate **26** to provide a predetermined maximum gap between the breaker points, such as is required after the breaker points have been dressed so as to remove material therefrom. This is accomplished by removing or loosening the closure **92** from the housing **88** to permit the teeth of the clutch elements **86** and **90** to be separated. Thus, with the clutch element **86** stationary the shaft **94** and wire **36** may be rotated to effect the required adjustment of the sub-plate **26,** after which the closure **92** is again threaded down to maintain the clutch elements in engagement. It will be understood that this adjustment is made periodically only as required by wear and/or pitting of the breaker points. While a lost motion arrangement is provided by the elongated slot **44** and the adjustable abutment **46,** it will be appreciated that if desired, longitudinal movement of the accelerator link **40** might be used to effect a continuous adjustment of the sub-plate **26.** However, this continuous adjustment is not required and the adjustment means illustrated in FIGS. **1** and **2** is satisfactory. With this arrangement the breaker points may be provided with the maximum separation suitable for starting and low speed operation and will retain this adjustment until the throttle opening is increased to a pre-

determined amount, after which the adjustment of the breaker points is initiated.

Referring now to FIG. **5** there is illustrated an arrangement in which means responsive directly to engine speed are provided for effecting adjustment of the sub-plate **26.** In this case the shaft **102** is suitably connected to be driven at a speed which is a direct function of engine speed. Fixed to the shaft **102** is a ring **104** and slidably longitudinally on the shaft **102** is a second ring **106.** The rings **104** and **106** are interconnected by links **108** which in turn are connected to centrifugal weights **110.** A compression spring **112** is provided intermediate the rings and urges the lower ring **106** downwardly as seen in FIG. **5.**

Another ring **114** is provided which is longitudinally slidable on the shaft **102** but does not partake of rotation therewith. Rings **106** and **114** are interconnected by bearings diagrammatically indicated at **116** and the ring **114** is retained in engagement with the bearings **116** by compression springs **118.** Vertical movement of the ring **114** is transmitted to the wire **60** of the Bowden wire device **58** by connectors **120.** It will be understood that the illustration of FIG. **5** is diagrammatic and the support for the shaft **102** and the associated centrifugal mechanism is indicated at **122.**

With this mechanism, movement of the wire **60** may be continuous in accordance with changes in engine speed. Conversely, however, the spring **112** may be selected such that movement of the actuating ring **114** does not commence until a predetermined minimum engine speed has been attained.

Referring now to FIG. **6** there is illustrated an arrangement in which the mechanism may be manually operated by the driver of a motor vehicle from a position within the vehicle. In this embodiment of the invention the distributor is diagrammatically indicated at **130** and the torsion wire assembly **38** is shown as entering the interior of the distributor through an opening **132.** A cable **134** is illustrated as wound around a rotatable drum **136** connected to a crank **138** located within the driver's compartment. The crank **138** includes an indicating pointer **140** which may be associated with a dial if desired. The housing **142** contains suitable gearing (not shown) for converting longitudinal movement of the cable **134** to rotational movement of the torsion wire included in the wire assembly **38.** It will be appreciated that the cable **134** may be connected to a rack **142***a* identical with the rack **70** shown in FIG. **3,** connected to a tension spring **143** urging the rack in a direction away from the cable **134.** Accordingly, rotation of the drum **136** may move the rack against the tension of the spring within the housing **142** and when the crank **138** is moved in the opposite direction the spring will maintain the cable **134** taut and will move the rack in the opposite direction.

In this embodiment of the invention the adjusted position of the sub-plate **26** may be indicated by indicia associated with the pointer **140** or an indicator **144** may be provided. The indicator **144** is a dwell indicator which is available on the market and which will show the duration of closure of the breaker points. As the length of time which the breaker points are closed becomes shorter upon higher speed, the crank **138** may be rotated in the appropriate direction to increase the length of each period during which the breaker points are closed. In general, the pointer **146** of the dwell indicator will move in one direction as the dwell period shortens upon an increase in speed, and can be brought back into a desirable intermediate range by suitable rotation of the crank **138.** When engine speed falls off, the needle will move in the opposite direction and will indicate that suitable rotation of the crank in the opposite direction is required to bring the dwell period back within the optimum range.

What I claim as my invention is:

1. In combination, a spark distributor for an internal combustion engine of a motor vehicle comprising a housing, a rotary cam within said housing, a support plate within said housing, a stationary contact on said plate, a movable contact on said plate movable toward and away from said stationary contact, a cam follower engageable with said cam and connected to said movable contact for moving said movable contact away from engagement with said stationary contact when engaged by said cam, means within said housing for adjusting said stationary and movable contacts as a unit in a direction to cause said cam follower to move generally radially of said rotary cam, and actuating means operable during operation of said vehicle for operating said adjustment means, in which said actuating means comprises means responsive to engine speed for effecting an adjustment which is a function of engine speed.

2. The combination defined in claim **1** in which said speed responsive means comprises a centrifugally operated speed responsive device connected to the engine.

3. The combination defined in claim **1** in which said speed responsive means comprises means connected to the throttle positioning mechanism of the engine.

4. In combination, a spark distributor for an internal combustion engine of a motor vehicle comprising a housing, a rotary cam within said housing, a support plate within said housing, a stationary contact on said plate, a movable contact on said plate movable toward and away from said stationary contact, a cam follower engageable with said cam and connected to said movable contact for moving said movable contact away from engagement with said stationary contact when engaged by said cam, means within said housing for adjusting said stationary and movable contacts as a unit in a direction to cause said cam follower to move generally radially of said rotary cam, and actuating means operable during operation of said vehicle for operating said adjustment means, in which said contacts are mounted on a sub-plate movable on said support plate, an arm pivoted to said sub-plate on which said movable contact ia mounted, said arm having cam-engaging means positioned in the path of a cam portion when the contacts are closed, and means mounting said sub-plate on said support plate for the aforesaid adjustment in a direction which moves said cam-engaging means generally radially of said rotary cam, in which said actuating means comprises means responsive to engine speed for effecting an adjustment which is a function of engine speed.

5. In combination, a spark districtor for an internal combustion engine of a motor vehicle comprising a housing, a rotary cam within said housing, a support plate within said housing, a stationary contact on said plate, a movable contact on said plate movable toward and away from said stationary contact, a cam follower engageable with said cam and connected to said movable contact for moving said movable contact away from engagement with said stationary contact when engaged by said cam, means within said housing for ad-

justing said stationary and movable contacts as a unit in a direction to cause said cam follower to move generally radially of said rotary cam, and actuating means operable during operation of said vehicle for operating said adjustment means, in which said means within said housing for adjusting said contacts as aforesaid is rotary means and in which said actuating means comprises means movable generally in a straight line, and gearing operable to convert such motion to rotary motion, and means for applying such rotary motion to said rotary means.

6. In combination, a spark distributor for an internal combustion engine of a motor vehicle comprising a housing a rotary cam within said housing, a support plate within said housing, a stationary contact on said plate, a movable contact on said plate movable toward and away from said stationary contact, a cam follower engageable with said cam and connected to said movable contact for moving said movable contact away from engagement with said stationary contact when engaged by said cam, means within said housing for adjusting said stationary and movable contacts as a unit in a direction to cause said cam follower to move generally radially of said rotary cam, actuating means operable during operation of said vehicle for operating said adjustment means, and additional means for adjusting said contacts to provide the aforesaid adjustment thereof independent of the aforesaid means for making the aforesaid adjustment, in which said additional means comprises relatively adjustable clutch members located in said actuating means.

7. The combination defined in claim **6** in which said first mentioned adjusting means within said housing is rotatable, and in which said clutch members are angularly adjustable and located in said first mentioned adjusting means.

8. In combination, a spark distributor for an internal combustion engine of a motor vehicle, comprising a rotary cam, a first support mounted for angular adjustment about the axis of rotation of said cam, a stationary contact on said support, a movable contact on said support movable into and out of contact with said stationary contact, a member movably carried by said support on which said movable contact is mounted, a cam follower on said member engageable with said rotary cam, resilient means connected to said member urging said member in a direction to cause said cam follower to engage said cam and said movable contact to engage said stationary contact, whereby said movable contact is moved away from said stationary contact as a result of engagement between said cam follower and said cam, actuating means operable during operation of said vehicle to effect an adjustment of at least one of said contacts independent of the adjustment resulting from angular adjustment of said first support to effect opposite variations in the intervals during which said contacts remain in closed and open condition, and a second support on which said stationary contact and said movable member are mounted, said second support being movably mounted on said first support for adjustment in a direction which moves said cam follower generally radially of said cam, in which said actuating means comprises means responsive to engine speed for effecting an adjustment which is a function of engine speed.

9. The combination defined in claim **8** in which said speed responsive means comprises a centrifugally operated speed responsive device connected to the engine.

10. The combination defined in claim **8** in which said speed responsive means comprises means connected to the throttle positioning mechanism of the engine.

* * * * *