

[54] AUTO IGNITION SYSTEM

[76] Inventor: **Michael R. Gallo**, 3733 Quarton Rd., Bloomfield Township, Mich. 49228

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[58] Field of Search **123/148**

[56] **References Cited**

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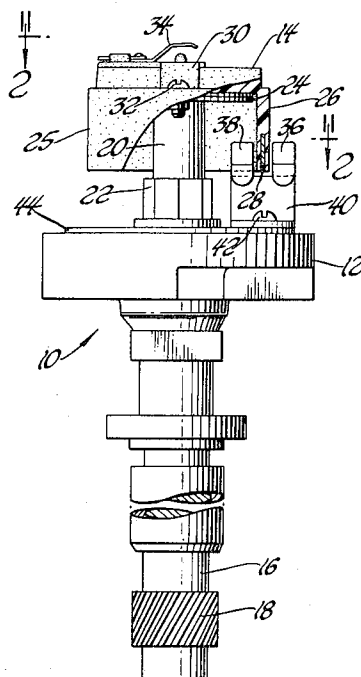
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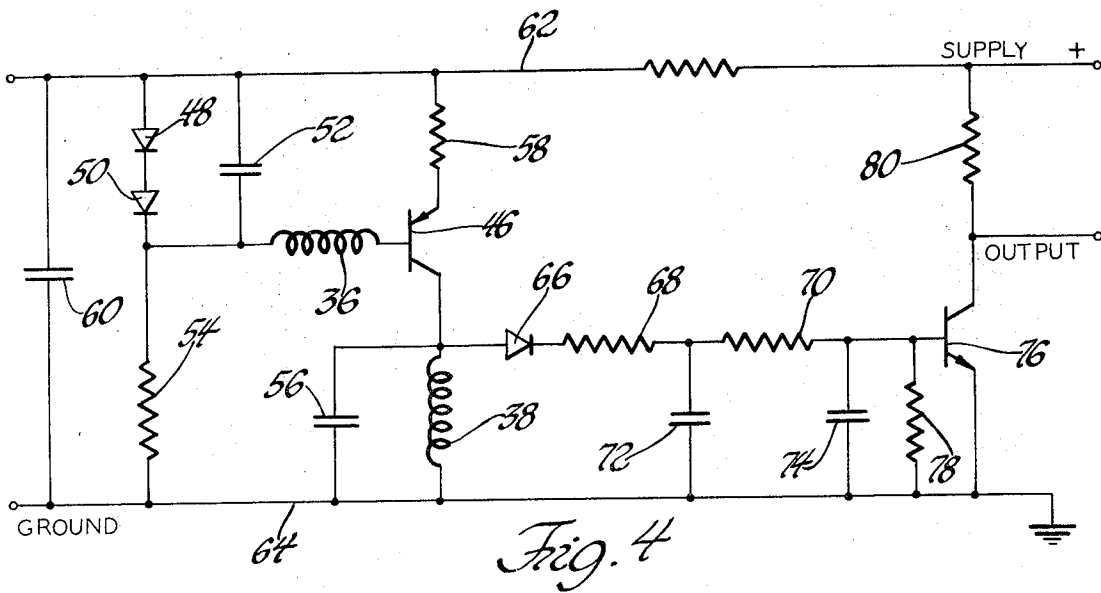
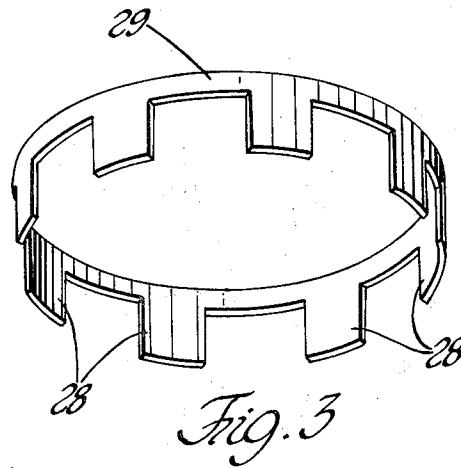
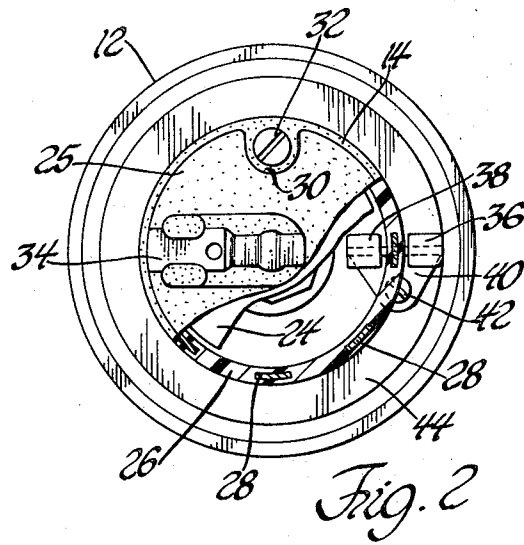
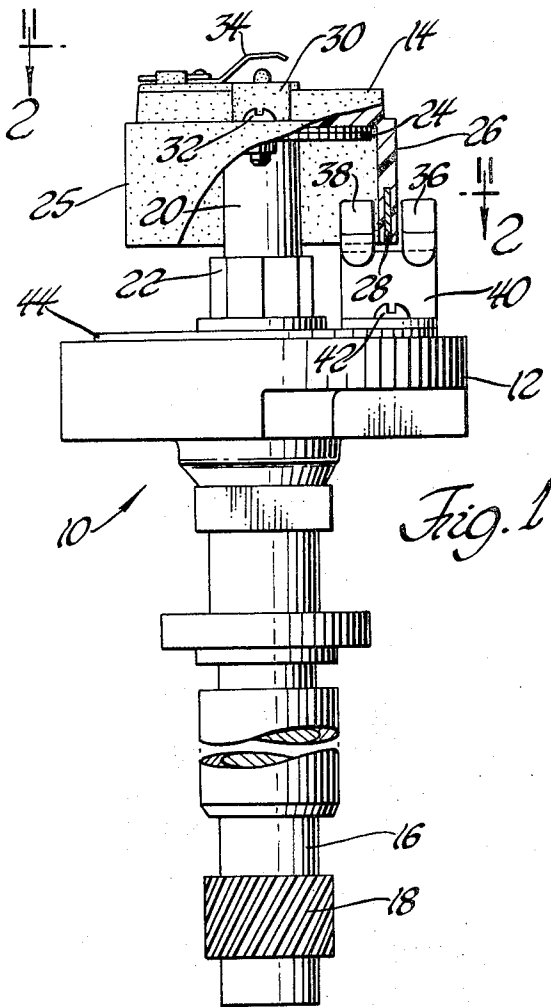
Primary Examiner—Laurence M. Goodridge
Assistant Examiner—Cort Flint

[57] **ABSTRACT**

Automotive distributor apparatus for replacing the standard mechanical breaker points and including a molded plastic rotor cap adapted to fit onto a rotor cap plate in the same manner as a standard rotor cap and having a skirt portion with molded-in, circumferentially arranged metallic teeth. A coil pair is placed on the stator support plate in a preformed locator hole. The coils of the pair are radially spaced so that the rotor cap skirt extends into the air gap therebetween. An output circuit for receiving the timing pulses generated by rotation of the cap between the coils is also disclosed.

2 Claims, 4 Drawing Figures





AUTO IGNITION SYSTEM

INTRODUCTION

This invention relates to automobile ignition systems and particularly to an apparatus which is compatible with a standard distributor assembly for replacing the mechanical breaker points thereof.

BACKGROUND OF THE INVENTION

The standard automobile distributor typically comprises a stator in the form of a cast housing, a support member, such as a plate, within the housing for carrying such elements as the breaker points, condenser, and wiper, a rotor shaft extending through the housing and through the support plate and a rotor assembly which is carried by the shaft. The breaker points which are mounted within the housing comprise a spring biased arm carrying one of two metallic electrodes which intermittently contact one another as an octagonal cam on the distributor shaft rotates past and in contact with the arm. In this fashion, ignition timing pulses are generated in proportion to engine speed.

This well known prior art breaker points design has provided reasonably satisfactory service for years. However, it is well known that the mechanical breaker points deteriorate with time until ignition performance is so poor that the breaker points must be replaced. Such deterioration is due partly to the foul atmosphere in which the distributor is normally located, but is due largely to the physical deterioration of the electrode surfaces which results from the transfer of electrical impulses between the two surfaces over a long period of time. This deterioration affects not only engine performance but gas mileage and exhaust emission levels.

To alleviate the aforementioned problems which attend the use of mechanically-contacting breaker points, there has developed in the prior art an electromagnetic apparatus for generating ignition timing pulses by passing a metallic rotor through an air gap between a pair of inductively linked coils. The rotor of such an electromagnetic system operates as a shutter or interrupter and has a plurality of circumferentially spaced conductive teeth. This shutter is normally secured to the distributor rotor shaft in a predetermined angular position relative to the coils which are carried by the stator or nonrotating portion of the distributor assembly. To install the shutter member and coil set into the distributor normally involves careful placement so as to ensure that the proper timing is achieved. Many of the prior art disclosures at least suggest that a completely customized distributor assembly is required. Accordingly, installation does not appear to be easily carried out by the ordinary automobile owner who might wish to purchase such an electromagnetic ignition timing pulse generator and install it on a "do-it-yourself" basis. Moreover, even factory installation is complicated by the requirement for substantial distributor redesign and a change in installation procedure.

BRIEF SUMMARY OF THE INVENTION

In accordance with the present invention, an ignition timing signal generator of the nonmechanical, electromagnetic type is provided for replacing the standard breaker points, this assembly being of such design as to afford the advantages of rapid and simple installation

as well as complete compatibility with existing distributor design so as to automatically provide the proper position relationship between a rotor carried interrupter and a stator mounted coil set.

In general, the invention is carried out by way of the fabrication of a rotor cap which is adapted to be mounted on a standard distributor shaft as a replacement for the standard rotor cap, said improvement rotor cap comprising a skirted body of dielectric material, such as phenolic plastic, and an interrupter which is fixedly bonded such as by molding into the skirted portion of the cap. The interrupter comprises a plurality of uniformly spaced metallic teeth which are disposed in a circumferential pattern. The electromagnetic breaker points assembly further comprises a coil set which is adapted for ready installation on a stator element, such as a standard distributor stator support plate, in the screw holes which are normally provided for other standard elements, such as the coil or standard breaker points. In accordance with the invention, the disposition of the interrupter teeth on the interior of the rotor cap is related to the rotor cap fastener positions as well as to the proposed location of the coil set so as to establish the proper timing relationship between the various rotating and nonrotating parts of the improvement breaker points assembly as a direct result of straightforward installation.

In the preferred form, the interrupter band is a continuous band of thin metal having integral therewith a plurality of depending teeth, this interrupter element being totally encapsulated by the thermosetting plastic material of the rotor cap by means of an insert injection molding process.

As will be apparent to those skilled in the art, the passage of the spaced teeth of the interrupter between a pair of inductively linked coils produces a modulation or variation in the inductive link which gives rise to a time-varying reactance in the circuit which comprises the two coils. In one preferred form, the two coils form a feedback circuit for a blocking oscillator so as to modulate the condition of oscillation in a sequence and at a rate related to engine speed thereby to generate timing signals. The blocking oscillator then drives additional pulse forming and shaping circuitry which in turn drives the final output stage, such as an SCR, to provide ignition pulses which are applied to the coil primary in the standard ignition system. Other forms of circuitry responsive to the signals generated in the spaced coils are well known and may be selected as alternatives to the circuit described herein.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side view of a distributor with parts cut away to illustrate the installation of the improvement of the present invention;

FIG. 2 is a top view of the distributor of FIG. 1, again with parts cut away to illustrate the interior design of the preferred embodiment of the invention;

FIG. 3 is a perspective view of an interrupter element useable in conjunction with the embodiment of FIG. 1; and,

FIG. 4 is a schematic circuit diagram of a pulse-forming circuit which is useable with the apparatus of FIGS. 1 through 3.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIGS. 1 and 2, there is shown a distributor 10 for an automotive ignition system and comprising a stator in the form of a cast housing 12 and a rotor assembly 14 including an elongated shaft 16 which is rotatable relative to the stator housing 12 about a longitudinal axis. Rotor shaft 16 carries at the lower end thereof as seen in FIG. 1 a gear 18 which is driven by the automobile engine so as to rotate the rotor assembly 14 at a speed which is directly proportional to engine speed.

At the upper or inner end of the rotor shaft 16, as shown in FIG. 1, a portion 20 of reduced diameter extends through and rotates with an octagonal cam 22 which, in the standard distributor arrangement, operates to open and close the mechanical breaker points but which in the present assembly serves no operational function. The reduced diameter portion 20 of rotor shaft 16 also carries a rotor cap support plate 24 to which a cup-shaped distributor rotor cap 25 of molded thermo setting plastic, preferably a phenolic plastic having high heat resistance, is secured.

In accordance with the present invention, the rotor cap 25 comprises a long skirt 26 of relatively thin walled design and which covers most of the interior components of the distributor assembly and further carries encapsulated therein a plurality of metallic interrupter teeth 28. The interrupter teeth 28 are circumferentially disposed around the skirt 26 in uniformly-spaced relation and are typically present in a number which is equal to the number of cylinders in the engine which accommodates the distributor 10; i.e., the typical eight-cylinder automotive engine requires eight uniformly-spaced metallic interrupter teeth 28.

Also in accordance with the present invention, the improved rotor cap 25 has formed in the dome portion thereof a pair of substantially diametrically opposed arcuate recesses 30 which accommodate fastener screws 32 for securing the rotor cap assembly 14 to the rotor support plate 24 in exactly the same angular and axial position as was previously occupied by the standard rotor cap, assuming, of course, that rotor cap 25 is installed as a replacement part. The domed portion of rotor cap 25 also carries a central, radially-extending, springbiased contact 34 for receiving the stepped up ignition voltage pulses from the ignition system coil and for distributing the pulses to the engine cylinders by way of a standard external distributor cap, not shown. Accordingly, the contact 34 and its location on the improvement rotor cap 25 is identical to that of a standard rotor cap in the distributor having standard mechanical breaker points.

Distributor 10 further comprises a pair of inductively linked and radially-spaced wound wire coils 36 and 38 mounted on a stator support plate 44 by means of an L-shaped bracket 40 and a screw 42. The screw 42 is preferably designed to be received by a preexisting hole in the standard stator support plate 44, such preexisting hole being present for the standard location of the breaker points, or condenser or other standard distributor element.

As best shown in FIG. 2, the bracket 40 carries the coils 36 and 38 in such a position as to define an air gap therebetween. Moreover, the position of the skirt 26 of the replacement distributor rotor cap 25, when

mounted on the plate 24, is such as to cause the lower extremity of the skirt and the interrupter teeth 28 to rotate continuously through the air gap between the coils 36 and 38, thus, to modulate the inductive link between the coils. This modulation, of course, occurs at a speed which is proportional to engine speed, thus, to produce ignition timing signals.

Looking now to FIG. 3, the interrupter teeth 28 are preferably formed as depending parts of an integral interrupter band 29 of very thin metal, such as aluminum or copper. The interrupter band 29 with its depending teeth 28 are molded into and encapsulated by a thermo setting phenolic plastic in the fabrication of the rotor cap 25 of the present invention and as such are fixedly mounted in a predetermined position relative to the rotor cap 25 and, thus, relative to the predetermined location of the fastener screws 32 which secure the rotor cap to the rotor plate 24 in the standard distributor. This molding process is known as "insert molding" and is a form of injection molding well known to those skilled in the molding art. As an alternative to the integral design shown in FIG. 3, the teeth 28 may be formed separately and separately molded into or bonded to the interior of the rotor cap 25, this and other alternative securement techniques being usable so long as the end result is a plurality of interrupter teeth fixedly carried by the skirt portion of the rotor cap 25 so as to occupy a predetermined physical position relative to the cap and to its fastener means.

The installation of the distributor components of the present invention may be quickly and easily carried out simply by removing the external distributor cap in the standard fashion and thence removing the rotor cap which is the standard counterpart of the improvement rotor cap 25 shown herein. Removal of the cap is accomplished by the removal of the diametrically opposite screws which fasten the standard rotor cap to the standard rotor cap support plate 24. The standard rotor cap is then removed in its entirety and replaced with the improvement rotor cap 25 simply by replacing the screws 32 in the standard fastener holes. Before installing the improvement cap 25, the bracket 30 carrying the coils 36 and 38 is secured in a predetermined position on the stator plate 44, this predetermined position being established by means of a supportfastener hole which is formed into the stator support plate 44 to carry some other component in the standard assembly. With the improvement rotor cap 25 then installed, the skirt 26 extends down between the spaced coils 36 and 38. The external rotor cap may then be reinstalled. Accordingly, the conversion of the distributor 10 itself involves only the removal and replacement of a few simple screw fasteners.

Looking now to FIG. 4, an illustrative pulse-forming circuit for use in conjunction with the electromagnetic timing signal generator of the present invention comprises an oscillator-transistor 46 comprising base, emitter and collector electrodes, the base electrode being connected to one end of coil 36 and the collector electrode being connected to one end of coil 38. The other end of coil 36 is connected to the positive terminal of a supply source through a pair of diodes 48 and 50, the series combination of the diodes being interconnected with a parallel or shunt capacitor 52. Said other end of coil 36 is also connected to ground through a bias resistor 54. The other end of coil 38 is connected to ground as shown in FIG. 4. A capacitor 56 is connected in

shunt relation to the coil 38. The emitter electrode is connected to the supply voltage through a current limiting resistor 58, as shown. A decoupling capacitor 60 is connected across the supply lines 62 and 64, as shown.

The circuit for the oscillator 46 is reasonably conventional, the bias for the transistor 46 being provided by the diodes 48 and 50 so as to hold the base voltage at about 1.2 volts negative of the positive supply. The resistor 58 is preferably on the order of one-hundred fifty ohms and stabilizes the emitter current at about 4MA. This bias circuit keeps the average emitter current relatively constant through a wide range of voltage supply values and temperatures whether the transistor 46 is oscillating or not. The coils 36 and 38 provide a feedback path by way of the inductive link and, accordingly, this feedback path is modulated by the rotation of the interrupter teeth 28 through the air gap between the coils 36 and 38 in accordance with the description of FIGS. 1 and 2, previously given. When there is no metal between the coils, the circuit will operate as a normal oscillator with the collector voltage swing of about ten volts peak-to-peak and at a frequency of about 300 KC, assuming a supply voltage of approximately fourteen volts. With one of the metallic teeth 28 between the coils 36 and 38, the coupling between the coils is substantially shielded and the transistor 46 stops oscillating, thus, giving rise to a voltage on the collector electrode essentially at ground potential.

The output circuit for the transistor 46 comprises a diode 66 connected to the collector and a series resistor 68. A bandpass filter comprises resistor 70 with capacitors 72 and 74 connected to ground at opposite ends thereof. The output of the filter circuit is connected to the base electrode of an output transistor 76 having a base bias resistor 78. The emitter circuit of transistor 76 is grounded and the collector electrode is connected to the supply voltage through a resistor 80.

When transistor 46 oscillates, current flows into the base of transistor 76 causing it to saturate. When the oscillation of transistor 46 is stopped, the transistor 76 switches off and the output voltage on the collector terminal of transistor 76 rises to the supply voltage. Other pulse-forming circuits may, of course, be employed in various ways to receive the basic timing signal which is generated by the coils 36 and 38 in conjunction with

the interrupter teeth 28.

It should be understood that the subject invention has been disclosed with reference to a specific embodiment selected to represent the best present mode of carrying out the invention and that various alternative apparatus including mechanical components and circuitry may be employed.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. An improvement to automotive ignition systems of the type including a distributor having a stator and a rotor assembly including a shaft rotatable relative to said stator according to the engine speed, and a mounting plate disposed adjacent an end of the shaft and in a plane perpendicular to the longitudinal axis of the shaft, the plate having at least a pair of prelocated fastener holes therein for receiving in secured relationship a standard rotor cap, said improvement comprising: a cup-shaped, plastic replacement rotor cap adapted for mounting in a predetermined position on said plate to be rotated therewith; said cap comprising a flat, circular end portion adapted to mate flush against the plate, and a cylindrical skirt portion integral with the end portion and coaxial with said shaft when mounted on the plate, a pair of prelocated mounting holes in the end portion and adapted to register with the prelocated fastener holes in the plate to receive fastener means for securing the replacement rotor cap to the plate in a predetermined angular relationship with the shaft, and an interrupter including a plurality of metallic teeth molded into said skirt in a uniformly spaced, circumferential pattern; and a pair of inductively linked coils disposed in a predetermined position on said stator in radially spaced relation to define an air gap; said skirt portion and said interrupter being disposed for rotation with the shaft and plate through said air gap such that said teeth modulate the inductive link between said coils to produce ignition timing signals at a rate related to engine speed and at times determined by the positions of said cap relative to said shaft and said coils relative to said stator.

2. Apparatus as defined in claim 1 further including circuit means connected to at least one of said coils to receive said timing signals for producing ignition pulses in response thereto.

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