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IGNITION DISTRIBUTOR WITH RADIALLY REMOVABLE CONTACT MECHANISM AND TERMINAL MEANS

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FIG. 1

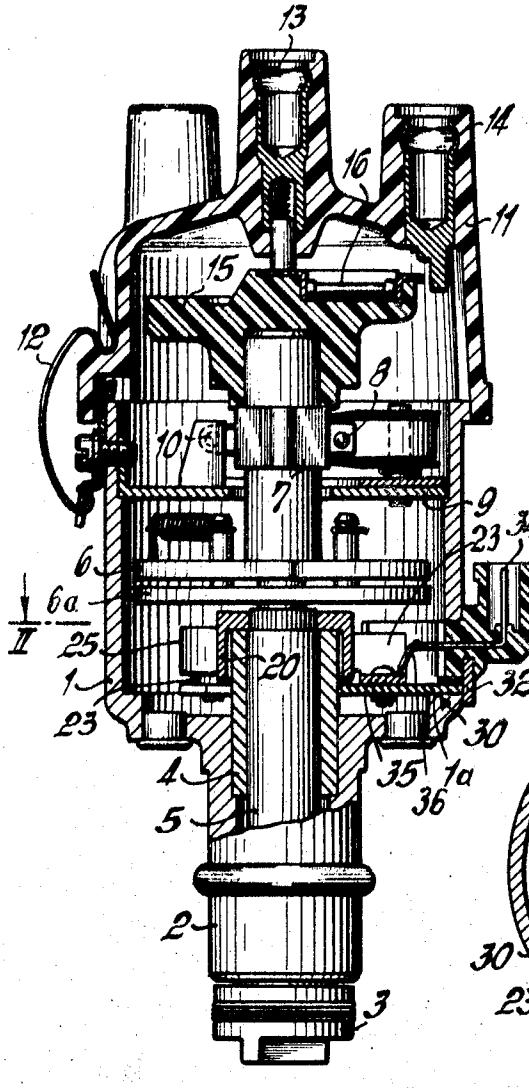


FIG. 3

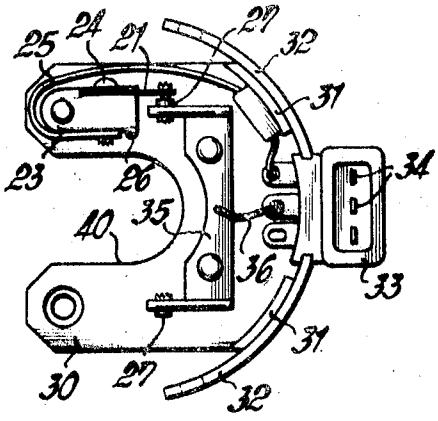
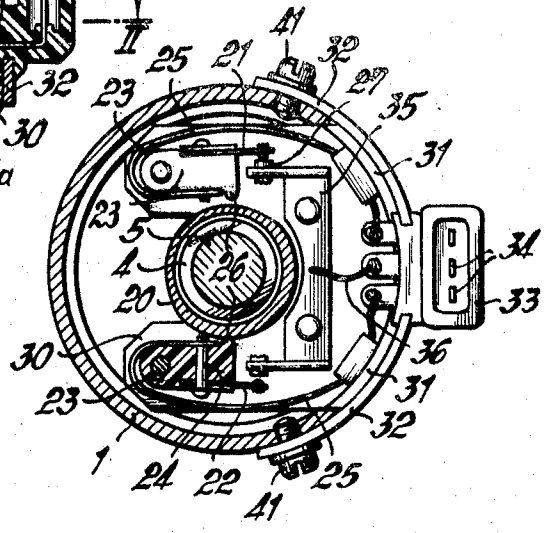


FIG. 2



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IGNITION DISTRIBUTOR WITH RADIALLY REMOVABLE CONTACT MECHANISM AND TERMINAL MEANS

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U.S. Cl. 200—19 8 Claims

ABSTRACT OF THE DISCLOSURE

The electric fuel injection system of a multicylinder internal combustion engine receives signals from a signal generating assembly which includes a trip mounted on the shaft of the ignition distributor and a carrier which is removably inserted into the base of the ignition distributor and includes a plate located in a plane which is normal to the shaft. The plate supports two movable contacts which are biased against two stationary contacts. Signals are generated in response to each half revolution of the shaft when the trip causes one of the movable contacts to move away from the associated stationary contact. The plate is withdrawable from the base by moving radially of and away from the shaft.

The present invention relates to multi-cylinder internal combustion engines in general, and more particularly to improvements in internal combustion engines which are provided with electrically operated fuel injection systems. Still more particularly, the invention relates to improvements in internal combustion engines wherein the electronic control unit of the fuel injection system receives signals or impulses from the ignition distributor.

It is already known to provide a multi-cylinder internal combustion engine with a fuel injection system wherein the operation of electromagnetic fuel injection nozzles is regulated by a control unit which receives signals from the ignition distributor. The control unit comproses a monostable tilting stage which includes a set of transistors. The tilting stage assumes its unstable condition at least once during each revolution of the engine camshaft to thereby determine the length of intervals during which the fuel injection nozzles remain open. The tilting stage automatically reassumes its stable condition to thereby close the fuel injection nozzles after elapse of an interval whose duration is determined by electric energy storing devices. Certain engines which embody the just outlined fuel injection system are further provided with a signal generator which sends signals to the control unit and is permanently incorporated in the ignition distributor. In a battery-operated ignition distributor, the distributor shaft which receives motion from the engine camshaft carries a trip which operates a switch forming part of the signal generator. Problems arise when the ignition distributor is provided with a spark advance mechanism which must change the position of the distributor cam with reference to the distributor shaft or the position of the breaker plate with reference to the base of the ignition distributor. The spark advance mechanism renders it difficult to gain access to the switch of the signal generator for the control unit of the fuel injection system. In particular the spark advance mechanism renders it difficult to inspect the signal generator at regular intervals. As a rule, the spark advance mechanism must be dismantled and removed from the base of the ignition distributor in order to afford access to the signal generator.

Summary of the invention

It is an object of the present invention to provide an ignition distributor for multi-cylinder internal combustion engines which employ electrical fuel injection systems and to provide the ignition distributor with a signal generating assembly for the control unit of the fuel injection system whereby the ignition distributor and the signal generating assembly are constructed and assembled in such a way that the latter can be readily detached from the ignition distributor without necessitating even partial dismantling of the remaining parts of the ignition distributor.

Another object of the invention is to provide an ignition distributor which is provided with a spark advance mechanism and wherein the signal generating assembly for the fuel injection system is installed in such a way that its parts can be removed from the base of the ignition distributor without necessitating even partial dismantling of the spark advance mechanism.

A further object of the invention is to provide a removable signal generating assembly which can be used to transmit signals to the control units of presently known electrical fuel injection systems for multi-cylinder internal combustion engines.

The invention is embodied in an ignition distributor for multi-cylinder internal combustion engines of the type having an electrically controlled fuel injection system which preferably includes known electromagnetically operated fuel injection nozzles arranged to open in response to impulses transmitted by the transistorized output stage of an electronic control unit. The ignition distributor comprises a customary base which is provided with an opening, a distributor shaft rotatably mounted in a bushing provided in the base and arranged to operated a customary rotor through the intermediary of a distributor cam and a spark advance mechanism, and a novel signal generating assembly for the injection system of the engine. The signal generating assembly includes actuating means which preferably resembles a trip or cam mounted on the distributor shaft in the base of the ignition distributor, a preferably plate-like carrier which is removably inserted into the opening of the base, and switch means including stationary contact means mounted on the carrier and movable contact means provided on the carrier and operable by the trip to effect opening and closing of the switch means in predetermined angular positions of the distributor shaft. The switch means preferably includes two switches alternately open in response to each half revolution of the distributor shaft.

The carrier is inserted into the base in a manner similar to that in which a drawer is inserted into a table and is withdrawable radially outwardly of and away from the distributor shaft. In order to properly locate the movable contacts with reference to the tip on the distributor shaft, the carrier is provided with a cutout or recess which receives the bushing for the distributor shaft when the carrier is fully inserted into the base of the ignition distributor. Terminals which are connected to the stationary and movable contacts of the switch means extend into a socket provided on the carrier, and the socket can be coupled with a plug which contains conductors arranged to transmit signals to the control unit of the fuel injection system.

The novel features which are considered as characteristic of the invention are set forth in particular in the appended claims. The improved ignition distributor itself, however, both as to its construction and its mode of operation, together with additional features and advantages thereof, will be best understood upon perusal of the following detailed description of a specific embodiment with reference to the accompanying drawing.

Brief description of the drawing

FIG. 1 is an axial sectional view of an ignition distributor which embodies our invention;

FIG. 2 is a horizontal sectional view as seen in the direction of arrows from the line II—II of FIG. 1; and

FIG. 3 is plan view of the carrier with one of the movable contacts omitted.

Description of the preferred embodiment

The ignition distributor of FIG. 1 comprises a cast aluminum base or housing **1** provided with a tubular extension or neck **2** which can be inserted into the block of a multi-cylinder internal combustion engine. The neck **2** accommodates a distributor shaft **5** which is rotatable in a bushing **4** and carries at its outer end a coupling **3** which can be driven by a gear on the engine camshaft. The shaft **5** extends into the base **1** and supports a weight carrying plate **6***a* for advance weights **6** which form part of a spark advance mechanism serving to control a distributor cam **7**. The cam **7** cooperates with a distributor lever **8** supported by a breaker plate **9** which is installed in the base **1**. The breaker plate **9** also carries a fixed contact **10** which cooperates with the distributor lever **8**.

The open end of the base **1** is connected with a plastic cap **11** which is secured thereto by two cap clamp springs **12** (only one shown). The cap **11** carries a center high tension terminal **13** which is connected with the secondary winding of an ignition coil (not shown) and four outer high tesion termials **14** connected to the engine spark plugs. A rotor **15** of plastic material rotates with the distributor cam **7** and carries an embedded shielding resistor **16** which directs the high voltage surges from the ignition coil to the individual outer terminals **14**.

The heretofore described parts of the ignition distributor are well known in the art. In addition, the ignition distributor serves as a means for transmitting signals to the fuel injection nozzles of the electrical fuel injection system for the internal combustion engine. The signal generator assembly of the ignition distributor comprises a tubular actuating cam or trip **20** which is mounted on the distributor shaft **5** and cooperates with two pivotable or movable contacts **21, 22**. The contacts **21, 22** are affixed to blocks **23** of insulating material and are electrically connected to leaf springs **25** by means of rivets **24** passing through the respective blocks **23**. This is best shown in FIG. 2. The leaf springs **25** urge the projections or lobes **26** of insulating blocks **23** against the periphery of the trip **20** and to thereby hold the movable contacts **21, 22** in engagement with stationary contacts **27**. When the distributor shaft **5** rotates, the contacts **21, 22** are moved alternately away from the respective fixed contacts **27** in response to each rotation of the shaft **5** through 180 degrees because the trip **20** pivots the blocks **23**. Thus, the signal generator assembly comprises two switches including the movable contacts **21, 22** and the corresponding stationary contacts **27**, and each of these switches produces a signal in response to movement of the contact **21** or **22** away from the corresponding stationary contact **27**.

In order to permit rapid and convenient inspection of movable contacts **21, 22** and stationary contacts **27** after extended periods of use, the contacts **21, 22**, their blocks **23**, leaf springs **25** and stationary contacts **27** are supported by a plate-like carrier **30** to form therewith a self-supporting unit which is best shown in FIG. 3. This unit can be inserted through an opening **1***a* in the base **1** in a direction radially toward the distributor shaft **5** and can be withdrawn, not unlike a drawer, in a direction radially of and away from the shaft **5**. The carrier **30** is located in a plane which is normal to the axis of the shaft **5** and is provided with two bent-over lugs **31** which are coupled to an arcuate bracket **32** whose configuration conforms to the outline of the base **1**. This bracket **32** is provided with a plastic coupling member in the form of a socket **33** which surrounds portions of three substantially L-shaped terminals **34**. Each terminal **34** comprises a horizontal leg (as viewed in FIG. 1) which extends toward the distributor shaft **5** when the carrier **30** is inserted into the base **1**. The central terminal **34** is connected by means of a short cable **36** with a plate-like conductor **35** which connects the stationary contacts **27**. Each of the two outer terminals **34** is connected with one of the movable contacts **21, 22** through the intermediary of the respective leaf spring **25**.

In order to insure that the movable contacts **21, 22** are properly positioned with reference to the actuating trip **20**, the carrier **30** is provided with a centrally located centering cutout or recess **40** which accommodates the bushing **4** when the carrier is properly inserted into the base **1**. When in fully inserted position, the carrier **30** can be detachably secured to the base **1** by means of two screws **41** or similar fasteners which extend through the bracket **32** and into tapped bores machined into the base. The socket **33** can receive a male coupling member or plug (not shown) which contains conductors connecting the terminals **34** with the input of the electronic control unit in the fuel injection system. Thus, the control unit will receive a signal in response to opening of the switch which includes the movable contact **21** or in response to opening of the switch which includes the movable contact **22**.

A fuel injection system which can receive signals from the assembly as shown in the drawing is disclosed in the British patent specification No. 976,340.

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 our contribution to the art and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the claims.

What is claimed as new and desired to be protected by Letters Patent is set forth in the appended claims:

1. An ignition distributor for multiple-cylinder internal combustion engines of the type having an electrically controlled fuel injection system, comprising a substantially closed housing; a distributor shaft rotatably mounted in said housing and distributor means including a distributor actuating member mounted on said shaft and a distributor member cooperating with said distributor actuating member mounted on said shaft; a signal-generating assembly for the fuel injection system including actuating means fixed to said shaft axially displaced from said distributor means; switch means including stationary contact means and movable contact means operable by said actuating means to effect opening and closing of said switch means in a predetermined angular position of said shaft; a single carrier located in a plane substantially normal to said shaft and carrying said contact means and forming a unit therewith, said unit being removable in radial direction through an opening in said housing without disassemblying said distributor means; a bracket fixed to said single carrier and closing said opening in said housing when said unit is located within said housing; and means for removably securing said unit together with said bracket to said housing.

2. A combination as defined in claim **1**, wherein said carrier is provided with means for locating said movable contact means with reference to said actuating means.

3. A combination as defined in claim **2**, wherein said locating means includes a recess provided in said carrier and further comprising a bushing for said shaft provided in said base, said bushing extending into said recess.

4. A combination as defined in claim **1**, wherein said actuating means comprises a trip affixed to said shaft and each of said contact means comprises a pair of contacts, said movable contacts being arranged to move alternately

away from the corresponding stationary contacts in response to each half revolution of said shaft.

5. A combination as defined in claim 4, wherein said signal generating assembly further comprises means for biasing said movable contacts against said trip.

6. A combination as defined in claim 5, wherein said signal generating assembly further comprises a first terminal electrically connected to both said stationary contacts and two additional terminals each electrically connected to one of said movable contacts.

7. An ignition distributor for multiple-cylinder internal combustion engines of the type having an electrically controlled fuel injection system, comprising a substantially closed housing; a distributor shaft rotatably mounted in said housing and distributor means including a distributor actuating member mounted on said shaft and a distributor member cooperating with said distributor actuating member mounted on said shaft; a signal-generating assembly for the fuel injection system including actuating means fixed to said shaft axially displaced from said distributor means; switch means including stationary contact means and movable contact means operable by said actuating means to effect opening and closing of said switch means in a predetermined angular position of said shaft; a single carrier located in a plane substantially normal to said shaft and carrying said contact means and forming a unit therewith, said unit being removable in radial direction through an opening in said housing without disassembling said distributor means; terminal means mounted on said single carrier outside of said housing

and connected to said contact means so that said terminal means are accessible from outside of said housing while said unit is located within said housing.

8. A combination as defined in claim 7, wherein said coupling member is a socket which can be connected with the plug of the electrical control unit in said fuel injection system.

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U.S. Cl. X.R.

200—166;123—32,