

# United States Patent

[11] 3,594,518

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**Coventry, England**  
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 [31] **59548/68**

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[54] **ELECTRIC SWITCHES**  
**6 Claims, 3 Drawing Figs.**

[52] U.S. Cl..... **200/19 M,**  
**335/206, 123/148 DK**

[51] Int. Cl..... **H01h 19/00**

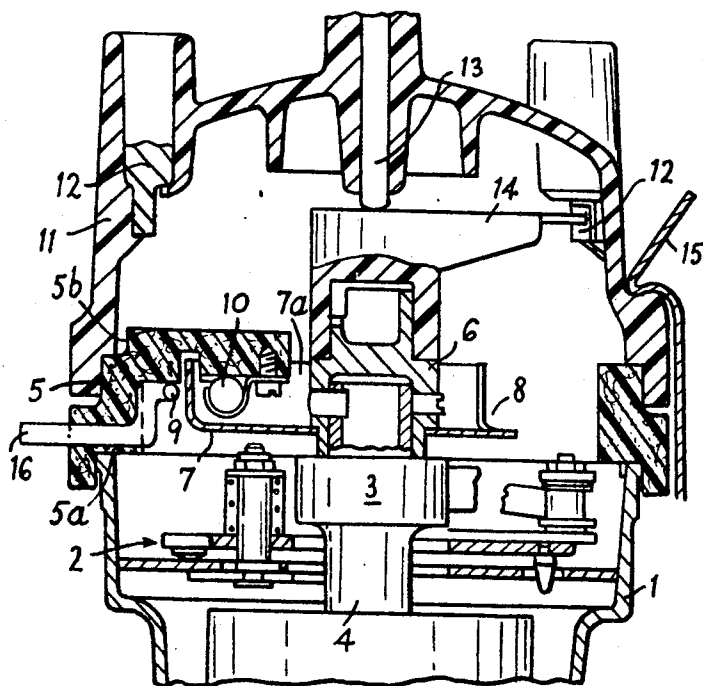
[50] Field of Search..... **200/19 M;**  
**335/206, 153; 123/148, 148 E, 148 DK**

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**ABSTRACT:** This invention relates to electric switches which are suitable for use as a trigger switch in a fuel injection system for a spark ignition internal combustion engine, in order to determine the instant of opening of one or more electrically actuated fuel injection valves. The invention provides the combination of an ignition distributor and contact breaker assembly with an electric switch having a movable member for effecting operation of the switch, the arrangement being such that rotation of a part of the ignition distributor causes movement of the movable member of the switch to effect its operation. Embodiments are described wherein the electric switch comprises one or more magnetically operable reed contact switches in combination with one or more magnet members for actuating the reed contact switch or switches.



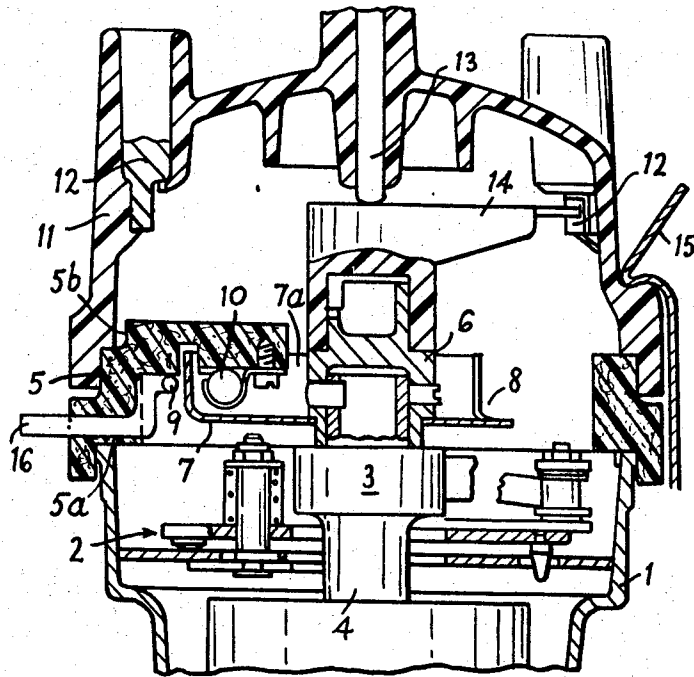


Fig.1

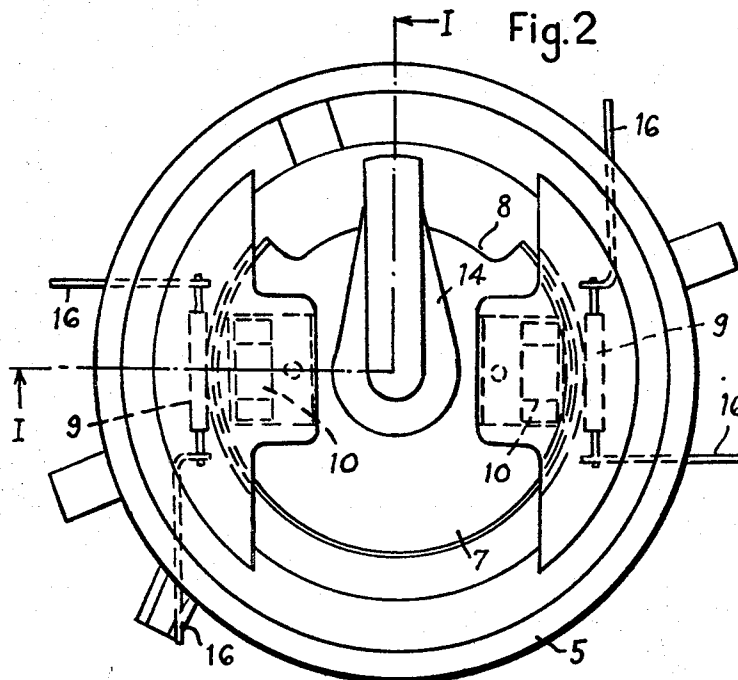


Fig.2

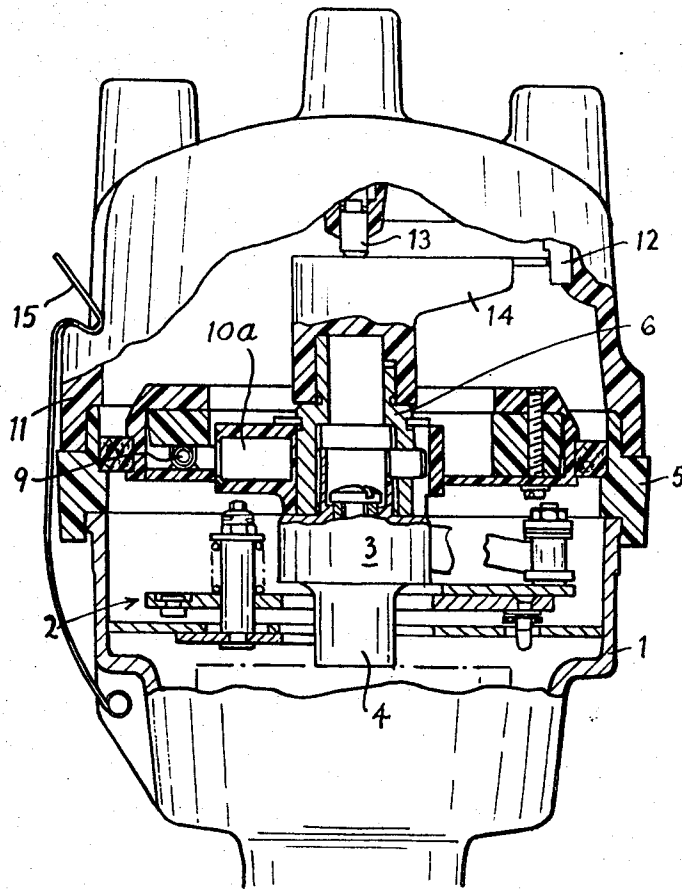


Fig.3

## ELECTRIC SWITCHES

The present invention relates to electric switches which are suitable for use as a trigger switch in a fuel injection system for a spark ignition internal combustion engine, in order to determine the instant of opening of one or more electrically actuated fuel injection valves.

From one aspect the invention provides the combination of an ignition distributor and contact breaker assembly for a spark ignition internal combustion engine, and an electric switch including a movable member for effecting operation of said switch, the arrangement being such that rotation of a part of the ignition distributor causes movement of the movable member of said switch to effect operation of said switch.

From another aspect the invention provides an ignition distributor for an engine comprising a distributor body containing a contact breaker assembly for initiating ignition pulses, a unit comprising an electric switch adapted to operate as a trigger switch for a fuel injection system, said unit including a stationary part mounted on the distributor body and a rotatable portion carrying a movable operating member for said switch and which is connected to a drive shaft in the distributor body, a distributor cap mounted on the unit and containing contacts and a rotor arm to enable said ignition pulses to be distributed via said contacts to spark ignition devices, said rotor arm also being connected to the rotatable portion of said unit. The electric switch may be of the type described in copending application Ser. No. 767,218 and comprise one or more magnetically operable reed contact switches in combination with one or more magnet members for operating the reed contact switch or switches, either by relative movement between the reed contact switch or switches and the magnet member or members, or by providing a relatively movable magnetic shunt member between the or each reed contact switch and its operating magnet member.

The invention will now be further described by way of example with reference to the accompanying drawings, in which:

FIG. 1 is a section on the line I-I in FIG. 2 of one embodiment of the invention,

FIG. 2 is a plan view of the same embodiment with the distributor cap removed, and

FIG. 3 is a sectional view, similar to FIG. 1, of a further embodiment.

Referring to FIGS. 1 and 2, a distributor comprises a body 1 containing a contact breaker assembly generally indicated at 2 and which is adapted to be connected to the low-tension section of an ignition coil for initiating the production of high-tension ignition pulses in the high-tension section of the coil—in accordance with well-known practice. The contact breaker assembly comprises a cam 3 mounted on a drive shaft 4 which operates to make and break the contact breaker contacts. The drive shaft 4 is driven from a spark ignition internal combustion engine to which the device is fitted.

An electric switch, which is basically of the type disclosed in FIGS. 1 to 3 of copending application Ser. No. 767,218 forms part of a unit having a body portion 5 made of a nonmagnetic material such as a plastics material. The lower face 5a of the body is shaped to fit on and locate with the upper face of the distributor body.

A rotatable hub portion 6 of the unit is keyed on to the upper end of the drive shaft 4 and carries a movable member 7 in the form of a dish-shaped magnetic shunt e.g. of mild steel, having a rim 7a provided with a cutout portion 8. The body 5 also carries two diametrically spaced reed contact switches 9, as well as two magnet members 10 which are arranged one opposite each of the reed contact switches 9. Connecting tags 16 are provided for making electrical connections to the reed contacts. The upstanding rim 7a of the magnetic shunt member 7 can thus rotate in the gap between each reed contact switch 9 and its associated magnet member 10. The upper edge 5b of the body 5 is shaped to receive and locate the lower edge of the distributor cap 11 which contains the peripherally

disposed distributor contacts 12 and also the central high-tension contact 13 which engages with the conducting portion of a rotor arm 14. The latter fits on and is keyed to the upper end of the hub portion 6. The cap 11 is retained in position by the securing clips 15.

Upon rotation of the drive shaft 4 the contact breaker assembly 2 and rotor arm 14 operate in the normal manner in association with an ignition coil to generate and distribute ignition pulses to spark ignition devices of an internal combustion engine, and the hub portion 6 drives the magnetic shunt member 7 in rotation so that the reed contact switches are operated when the cutout portion 8 in the rim 7a comes opposite each reed contact switch, thereby allowing the magnetic flux from the associated magnet to influence the reed contact switch.

FIG. 3 is a sectional view, similar to that of FIG. 1, of a further embodiment of the invention. The same reference numerals have been used for corresponding parts. As in the previous embodiment, the body 5 carries two stationary diametrically spaced reed contact switches 9, but in this embodiment the rotatable hub portion 6 carries a radially extending magnet 10a, and the movable member 7 is omitted. In operation, as the hub portion 6 rotates with the drive shaft 4, the magnet 10a operates each reed contact switch as it passes opposite to it. This embodiment is therefore basically similar to that of FIG. 6 of copending application Ser. No. 767,218.

The present invention enables an electric switch as described in application Ser. No. 767,218 to be readily incorporated in a conventional type of ignition distributor which is particularly desirable where the electric switch is to be used to trigger a fuel injection system on an internal combustion engine including such an ignition distributor.

Obviously various modifications and alternative constructions are possible. Thus the switch unit may comprise only one or more than two reed contact switches. Moreover the switch unit may be constructed in accordance with various of the other arrangements disclosed in the aforementioned copending application.

In particular the or each magnet member and the movable member may be movable together relative to the or each reed switch.

It will also be apparent that the unit may employ other types of trigger devices besides magnetic reed contact switches, for example magnetic or photoelectric devices.

I claim:

1. An ignition distributor and contact breaker assembly for a spark ignition internal combustion engine having an electronically controlled fuel injection system, said assembly comprising a distributor body containing a contact breaker for initiating ignition pulses, a shaft rotatably supported in said body and adapted to be driven in timed relationship with the internal combustion engine, means secured to the shaft for periodically opening and closing the contact breaker, a distributor cap containing a plurality of contacts one of which is adapted to be connected to an ignition coil of the internal combustion engine and others of which are respectively adapted to be connected to spark ignition devices of the internal combustion engine, and a rotor arm arranged to be driven by said shaft and arranged to sequentially distribute the ignition pulses from said one contact to the other contacts, characterized in that there is further provided an electric switching device for producing timed trigger signals for the electronically controlled fuel injection system, said switching device being in the form of a unit comprising a housing of plastics materials having one of its oppositely disposed faces shaped to fit on and locate with the face of the distributor body disposed towards the distributor cap and having the other of its oppositely disposed faces shaped to receive and locate with the underside of the distributor cap, at least one electric switch fixedly mounted in the annular housing, and a rotary member arranged to effect periodic opening and closing of the electric switch whereby to produce said timed trigger signals, the rotary member including a hub portion which fits coaxially

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between, and is keyed to, said rotor arm and the end of said shaft.

2. Apparatus as claimed in claim 1, wherein the electric switch comprises at least one magnetically operable reed contact switch in combination with at least one magnet member for actuating the reed contact switch.

3. Apparatus as claimed in claim 2, wherein the magnet member is secured to the rotary member for rotation therewith.

4. Apparatus as claimed in claim 3, wherein the magnet member is disposed substantially radially of the rotary member.

5. Apparatus as claimed in claim 2, wherein the or each

magnet member is fixedly mounted in the annular housing adjacent its respective reed contact switch, and a magnetic shunt member is secured to the rotary member for rotation therewith, the magnetic shunt member being movable between the or each reed contact switch and its respective magnet member.

6. Apparatus as claimed in claim 5, wherein the magnetic shunt member includes an aperture which allows a magnet member to actuate its respective reed contact switch only when the aperture is disposed between the magnet member and the reed contact switch.

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UNITED STATES PATENT OFFICE  
CERTIFICATE OF CORRECTION

Patent No. 3,594,518 Dated July 20, 1971

Inventor(s) GORDON F. BATES

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

[45] Patented July 20, 1971

Signed and sealed this 23rd day of November 1971.

(SEAL)

Attest:

EDWARD M. FLETCHER, JR.  
Attesting Officer

ROBERT GOTTSCHALK  
Acting Commissioner of Patents