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(54) IMPROVEMENTS IN AND RELATING TO AN IGNITION DEVICE FOR I/C ENGINES

(71) I, MISAO NAGAI, a Japanese Citizen, of 1925-55, Shimosakunobe, Takatsu-ku, Kawasaki-shi, Kanagawa-ken, Japan, do hereby declare the invention for

which I pray that a patent may be granted to me and the method by which it is to be performed to be particularly described in and by the following statement:-

This invention relates to an ignition device for an internal combustion I/C engine.

Conventionally ignition devices for IC engines have been used for motor-cars and the like. Those which have been used most and for the longest period of time are of the battery ignition contact point system. Recently, however, contact-less ignition systems comprising a combination of a coil and a magnet or a combination of a Hall element and a magnet have been used for cars and other I/C engine applications.

With the increase in designed engine speeds ignition devices incorporating contacts have become inadequate since the acceleration of the contacts leads to burning damage and consequent degeneration of the contact points. This results in the lowering of engine power, and increased maintenance and/or replacement of the contact devices.

However in an engine having contact-less ignition system, since there are no contacts no such drawbacks such as burning damage occur even if the rotation speed of the engine is increased.

Furthermore, no spark misfiring occurs in contact-less ignition systems and hence power consumption is lowered.

Contactless ignition devices however, are liable to be rather larger because they generally utilize a magnet and, moreover, notwithstanding its technical superiority over contact ignition failure does occur on occasion. Once an engine using a contact-less ignition device has ceased to function it is not usually possible to effect temporary repairs and hence a breakdown in a remote area, or in heavy traffic can lead to real difficulties.

According to the present invention, there is provided an ignition device for an I/C wngine comprising a contact ignition system and a contact-less ignition system, and means whereby either system may be selected at will, wherein said contact-less ignition system comprises a magnet and a signal generator, said magnet and said signal generator being spaced apart;

and a rotor, said rotor comprising a plurality of elements adapted to pass between said magnet and said signal generator and to interrupt a magnetic flux passing between said magnet and said generator.

In view of the foregoing, the present invention has been developed to provide an improved ignition device of an engine for motor-cars. Said ignition device comprises a conventional contact ignition device, and a contact-less ignition device having a combination of a small magnet and a Hall element, so that in ordinary use the contact-less ignition device may be used but in an emergency the conventional contact ignition device may be used by switching over the ignition circuits to thus eliminate any emergency situation.

The accompanying drawings show one preferred embodiment of the present invention, wherein:

Figure 1 is a transverse sectional view illustrating the main part of the ignition device of the embodiment;

Figure 2 is a longitudinal sectional view of the device of Figure 1; and

Figure 3 is a circuit showing the entirety of the embodiment of the present invention.

Now, the invention will be described in more detail with reference to the accompanying drawings.

The main parts of a distributor 1 having an ignition device comprising a conventional

contact ignition system and at the same time incorporating a contact-less ignition system. Thus a breaker arm 2, a contact point 3 and a cam 4 are all of conventional form.

A magnet 5 is so disposed as that its S-pole faces and is spaced apart from a signal generator 6 comprising, for example, a Hall element. An iron channel 7 has a U-shaped cross section, and the upper inside vertical wall 7*a* thereof is secured to the N-pole of the magnet 5. The upper inside vertical wall 7*b* supports said signal generator 6. By means of the iron channel 7 magnetic force is biased from the S-pole of the magnet 5, and although the magnet is small a strong magnetic force is supplied to the signal generator 6.

A timing rotor 8 has a plurality of slits 9 formed by cutting away equally spaced portions of the substantially cup-shaped peripheral wall portion thereof to form a plurality of blade-like breaker plates 10, formed by the remaining portion of the peripheral wall that has not been cut away.

A central axle portion 8' of the timing rotor 8 is fixed to a shaft 11 which is coaxial with a cam shaft 11' provided to rotate the cam 4. The rotation of the shaft 11 also rotates the timing rotor 8.

The breaker plates 10 are formed that they correspond with the number of cylinders of the I/C engine in which they are to be mounted. For example, four breaker plates 10 in the case of a 4-cylinder I/C engine and six breaker plates in the case of a 6-cylinder I/C engine.

The breaker plates 10 are positioned in the spacing between the magnet 5 and the signal generator 6 so that they may pass consecutively one after another through the spacing between the magnet 5 and the signal generator 6 via the rotation of the timing rotor 8.

The circuit of the embodiment of the present invention will be explained with reference to its operation.

A lead wire 12 leads from the contact point 3 to an ignition coil 13. Conventionally, ignition devices have been made such that a charge generated at the contact point flows via an ignition coil and a distributor to a spark plug. Recently, ignition systems have also been used which generate a high voltage by combination with a transistor ignition device. In either form, however, the lead wire 12 is connected to the contact point 3, that is, to the distributor.

By cutting a suitable portion of this lead wire 12 a terminal A' (the terminal A is on the side of the point 3) is formed. A lead wire 14 is connected to the terminal A and to the end of the wire 14 is connected a connector 15, and to the terminal A' is connected a lead wire 16 to the end of which is connected a connector 17.

An amplifier circuit 18 comprises a transistor circuit, and this circuit 18 is connected to the signal generator 6 via a lead wire 19 and a connector 20.

On the output side of the amplifier circuit 18 there is connected a lead wire 21, and to the end of the lead wire 21 is connected a connector 22.

In normal use, the connectors 17 and 22 are connected to each other for operation and the connector 15 is kept free and reserved for connection in case of an emergency use.

When the engine is started under the conditions set forth above the shaft 11 rotates (the ratio of rotation of the shaft to the rotation of the engine being 1/2), the timing rotor 8 rotates and the breaker plates 10 pass successively through the spacing between the magnet 5 and the signal generator 6. At the same time the slit 9 comes round and passes this spacing the magnetic line of force reach the signal generator 6 from the S-pole of the magnet 5, but during the time when the breaker plate 10 is passing through the spacing the magnetic lines of force are interrupted and do not reach the signal generator 6. Accordingly, the magnetic lines of force are supplied intermittently to the signal generator 6 to generate therein electromotive force intermittently which becomes a sort of pulse signal and is transferred via the lead wire 19 to the amplification circuit 18 to be amplified therein and further transferred to the lead wire 12 through the lead wire 21, connectors 22, 17, the lead wire 16 and from the terminal A' and through the lead wire 12 to the side of the ignition coil 13.

In case of an emergency where the ignition circuit of contact point system has become unusable due to the failure of the Hall element 6, the connectors 17 and 22 are disconnected from each other. The connector 17 is then connected to the connector 15 thereby to form a circuit from the signal generator 6 to the ignition coil 13. Thus the contact-less ignition circuit will be replaced by the contact circuit from the contact point 3 to the lead wire 12 through the terminal A, lead wire 14, connectors 15 and 17, lead wire 16, terminal A'. Further detailed description of the operation will be omitted since it is conventional.

The ignition device of the present invention is constructed as described above so that in ordinary operation the contact-less ignition device which has a better performance is used. Where such a circuit has gone wrong resulting in the malfunction of a car, for example, the circuit can be switched over by a simple operation to a conventional contact ignition system to thus promptly recover the function of the car.

The present invention also employs a

contact-less ignition device including a combination of a Hall element and a magnet and, moreover, the magnet is enclosed within an iron plate so that the bias effect can be obtained and the magnet can be made small and effectively incorporated in a conventional distributor to allow the conventional system to be utilized sufficiently with an advantage of convenience and economy.

WHAT I CLAIM IS:-

1. An ignition device for an I⅓C engine comprising a contact ignition system and a contact-less ignition system, and means whereby either system may be selected at will, wherein said contact-less ignition system comprises a magnet and a signal generator, said magnet and said signal generator being spaced apart;

and a rotor, said rotor comprising a plurality of elements adapted to pass between said magnet and said signal generator and to interrupt a magnetic flux passing between said magnet and said generator.

2. A device according to claim 1 wherein said rotor comprises 4 or 6 elements.

3. A device according to either of claims 1 or 2 wherein the means whereby either system may be selected consist of a plug and socket assembly.

4. A device according to any one of claims 1 to 3 wherein the axis of said magnet is perpendicular to the axis of rotation of said rotor, and said elements are disposed on said rotor parallel to said axis of rotation.

5. A device according to claim 4 wherein said magnet and said signal generator are respectively carried toward the free ends of a U-shaped channel member.

6. A device substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.

7. A motor vehicle comprising an I/C engine having an ignition device according to any one of claims 1 to 6.

8. A method of supplying a spark to a spark plug of an I/C engine which comprises utilizing a device according to any one of claims 1 to 6.

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2 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
Sheet 1

FIG. 1

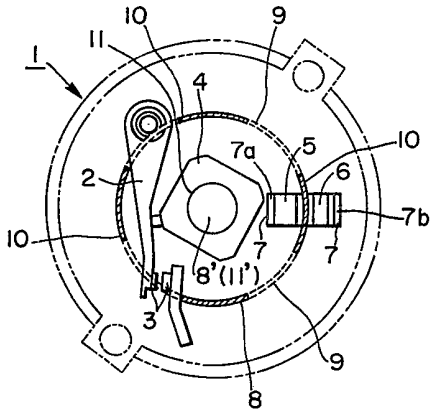

FIG. 2

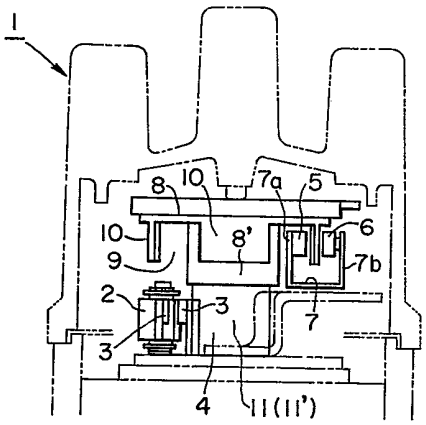

FIG. 3