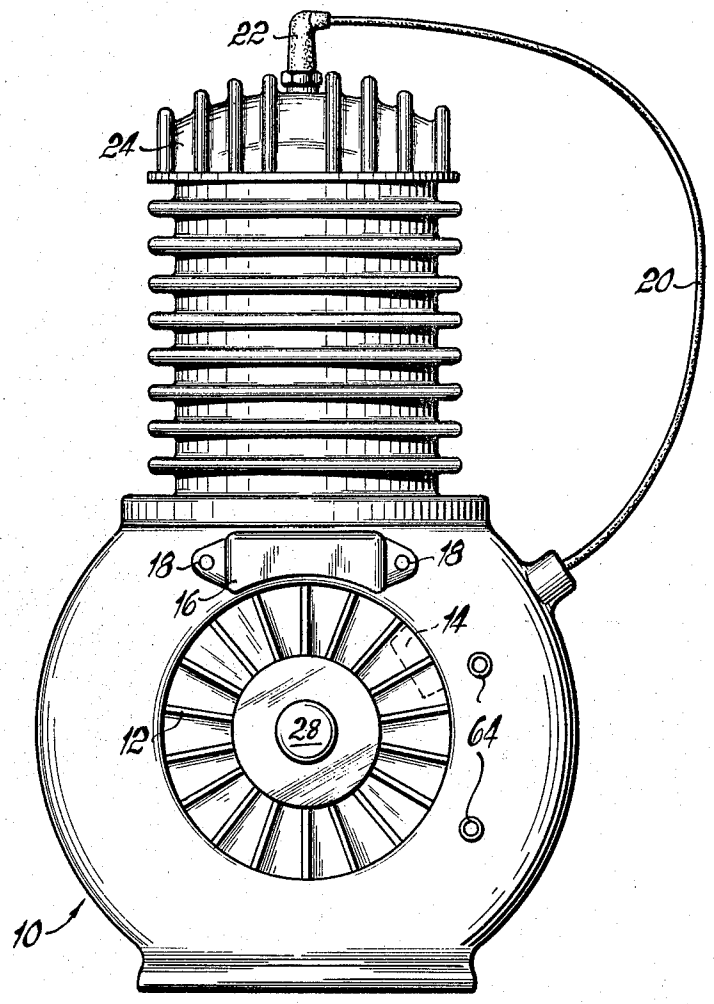
Aug. 9, 1966 F. FEND 3,265,051

BREAKER UNIT FOR THE IGNITION SYSTEM OF AN INTERNAL COMBUSTION ENGINE

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FIG. 1



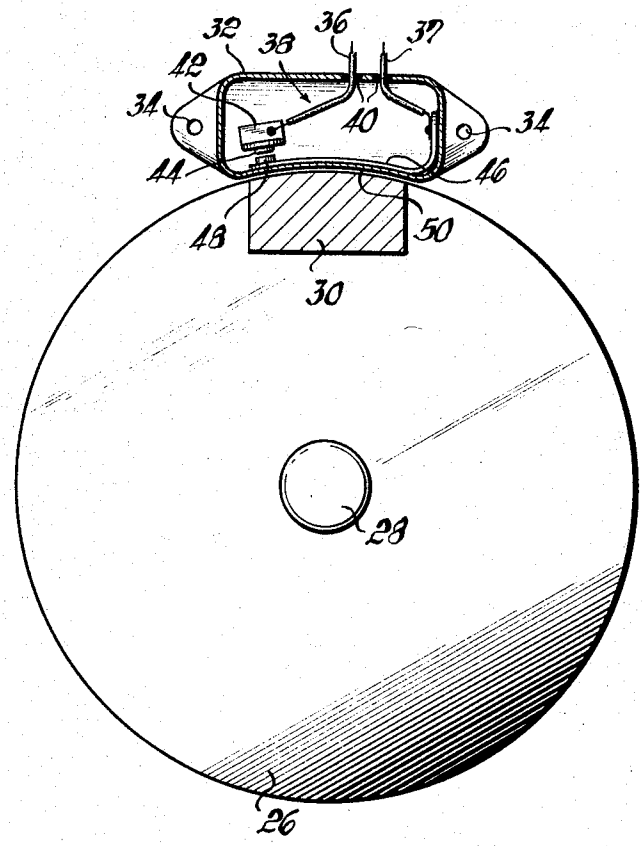
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BREAKER UNIT FOR THE IGNITION SYSTEM OF AN INTERNAL COMBUSTION ENGINE

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FIG. 2



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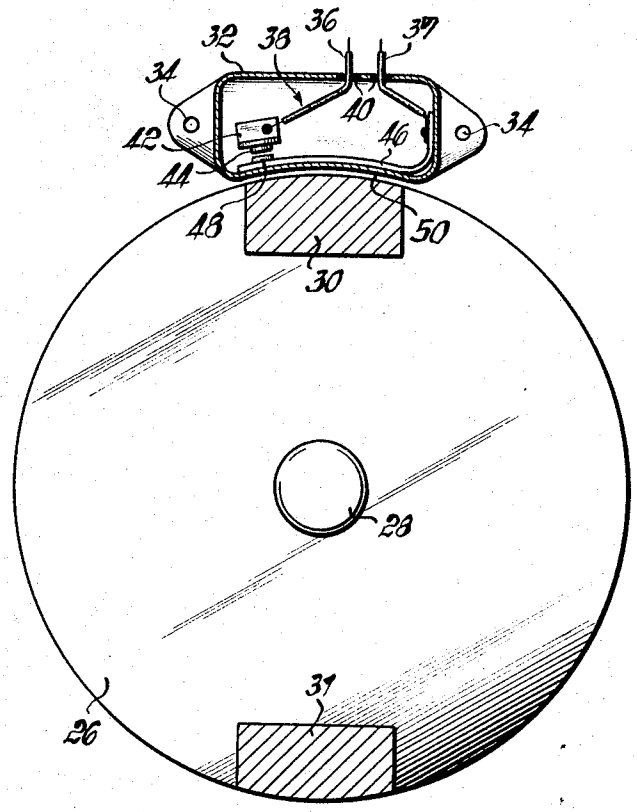
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FIG. 3



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BREAKER UNIT FOR THE IGNITION SYSTEM OF AN INTERNAL COMBUSTION ENGINE

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FIG. 6

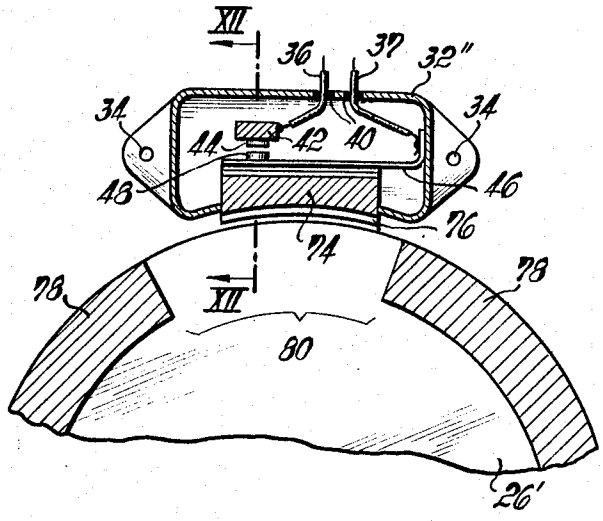


FIG. 7

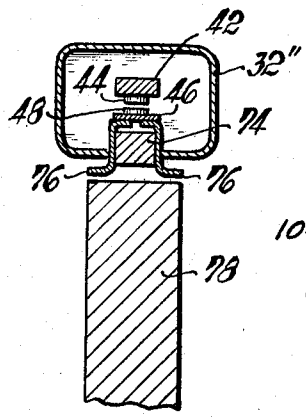


FIG. 4

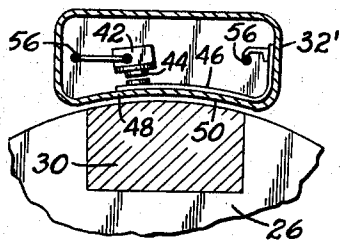
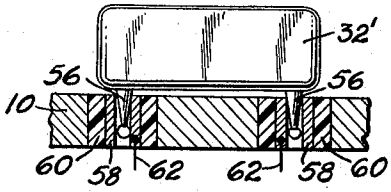


FIG. 5



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United States Patent Office 3,265,051 Patented August 9, 1966

3,265,051

BREAKER UNIT FOR THE IGNITION SYSTEM OF AN INTERNAL COMBUSTION ENGINE

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Claims priority, application Germany, June 6, 1963
F 39,933
12 Claims. (Cl. 123—148)

This invention relates to internal combustion engines, and particularly to a breaker unit for the ignition system of such an engine.

Conventional ignition systems have a primary circuit in which current from a storage battery or other current source is interrupted in timed sequence with the desired explosion of a fuel mixture in an engine cylinder. The interruption of the current in the primary circuit causes a high voltage to be generated in a secondary circuit to which the primary circuit is connected by an induction coil or a transformer. The high voltage is fed to a sparkplug to initiate the explosion of the fuel mixture.

This invention is concerned more specifically with a breaker unit suitable for interrupting the primary ignition circuit. Known breaker units have two breaker points which respectively provide a fixed and a movable contact and are normally in circuit-closing engagement under the pressure of a spring. They are periodically disengaged by a rotating cam which is linked to the crankshaft of the engine.

The breaker points of the conventional units are exposed to the atmosphere. They oxidize under the influence of atmospheric oxygen and have to be replaced when their contact resistance exceeds a tolerable limit because of the build-up of an oxide layer. The primary object of the invention is the provision of a sealed beaker unit which can be effectively and permanently protected from atmospheric oxygen, and thus can operate for a very long period without replacement of breaker points. Other objects of the invention and the attendant advantages will become apparent hereinafter.

In one of its basic aspects, the invention resides in a sealed housing which encloses a fixed contact and a movable contact. Yieldably resilient means permanently urge the movable contact into circuit-closing engagement with the fixed contact. In order to avoid passage of moving parts through the housing, magnetic actuating means are provided for actuating movement of the movable contact away from circuit closing engagement with the fixed contact. Spark-generating means are arranged in circuit with the contacts in the housing and with the sparkplug or sparkplugs of an internal combustion engine for applying a spark generating voltage to the sparkplug or plugs in response to movement of the movable contact out of engagement with the fixed contact.

Other features of the invention will become apparent to those skilled in the art as the disclosure is made in the following detailed description of preferred embodiments of the invention as illustrated in the accompanying drawings in which:

FIG. 1 shows an internal combustion engine equipped with the breaker unit of the invention in front elevation;

FIG. 2 is a fragmentary elevational and partly sectional view of a modified engine equipped with the breaker unit of the invention;

FIG. 3 shows a further modification of the engine of FIG. 2;

FIG. 4 is a fragmentary side-elevational and partly sectional view of another modified breaker unit;

FIG. 5 shows the mounting of the unit of FIG. 5 on an engine in fragmentary plan view, partly in section;

FIG. 6 illustrates yet another modification of the apparatus of FIG. 2; and

FIG. 7 shows the device of FIG. 6 in radial section on the axis of the non-illustrated engine crankshaft.

Referring now to the drawing in detail, and initially to FIG. 1, there is seen a single-cylinder, aircooled internal combustion engine whose principal illustrated stationary elements are a crankcase **10** and a cylinder **24**. The movable engine elements are represented by a fan wheel **12** which is mounted outside the crankcase **10** on the crankshaft **28**.

A permanent magnet **14** is mounted on the periphery of the fan wheel **12**. Once during each rotation of the crankshaft **28**, the magnet **14** passes closely by a brass housing **16** which is fixedly attached to the crankcase **10** by two screws **18**. The housing **16** encloses the contacts of the breaker unit as will presently by shown. The secondary ignition circuit is represented only by a high-tension lead **20** which leads to a sparkplug **22** in the head of the cylinder **24**. It will be understood that the secondary circuit of the ignition unit, not further illustrated, includes the conventional coil and condenser, and that the coil is connected to the contacts in the housing **16** and to a current source in the usual manner, not shown.

Two sockets **64** are mounted in a position angularly offset from the location of the housing **16** with respect to the axis of the crankshaft **28** for a purpose which will become apparent hereinafter.

FIG. 2 shows a portion of an engine which differs from that illustrated in FIG. 1 by a permanent magnet **30** which is peripherally mounted on the flywheel **26** of the engine, and by details of the housing **32** which is attached to the non-illustrated crankcase of the engine by rivets **34**.

The contact assembly **38** in the housing **32** is connected with the non-illustrated coil and current source of the ignition system by two insulated conductors **36**, **37** which pass through gas-tight seals **40** in the wall of the housing **32**. The sealed housing **32** is filled with a mixture of nitrogen and argon produced by removal of oxygen and carbon dioxide from atmospheric air. A connector **42** fixedly mounted in the housing **32** provides an insulated current path from the conductor **36** to a fixed contact or breaker point **44**.

The movable contact **48** is mounted on the free end of a leaf spring **46** of ferrous material. The other end of the spring **46** is attached to the housing **32** and is connected to the conductor **37**. The wall **50** of the housing **32** facing the flywheel **26** is partly of cylindrical shape so as to permit close passage of the correspondingly shaped magnet **30** to the spring **46** during rotation of the crankshaft **28**.

The force of the spring **46** normally holds the movable contact **48** in engagement with the fixed contact **44**. When the magnet **30** passes the housing, the magnet attracts the spring **46** until one of its wide longitudinal faces conformingly engages the wall **50**, and the primary igni-

tion circuit is opened between the contacts 44 and 48 as illustrated in FIG. 2.

Because of the inert gas filling in the housing 32, the breaker points 44, 48 remain bright and fully operative for an almost unlimited period. In the absence of movable parts passing through the housing 32, the entry of atmospheric oxygen is readily prevented.

It will be understood that the housing 16 in FIG. 1 encloses a contact assembly substantially identical with that illustrated in FIG. 2, and that the primary circuit of the engine shown in FIG. 1 is therefore interrupted once during each revolution of the fan wheel 12.

The engine partially illustrated in FIG. 3 differs from the apparatus shown in FIG. 2 by a second permanent magnet 31 arranged on the periphery of the flywheel 26 diametrically opposite the magnet 30. The ignition system in which the contact assembly 38 provides interruptions of the primary current thus produces two pulses of high voltage for energizing spark discharge in two associated cylinders in a manner not further illustrated since it may be entirely conventional.

The breaker housing 32' illustrated in FIGS. 4 and 5 differs from the units described hereinabove by being releasably attached to the stationary crankcase 10 by two contact pins 56. The pins partly project into the housing and are connected there to the connector 42 and to the spring 46. The main portions of the pins outside the housing are plugged into conductive sockets 58 which are mounted in the crankcase 10 by means of insulating bushings 60. Conductors 62, only partly seen in FIG. 5, respectively lead to the non-illustrated coil and current source of the ignition circuit.

A breaker unit arranged in the housing 32' can readily be replaced. It also provides a convenient arrangement for reversing the direction of rotation of the associated engine. This is shown in FIG. 1, where sockets 64 mounted on the crankcase 10 are wired into the primary ignition circuit and adapted to receive a plugged-in breaker unit of the type illustrated in FIGS. 4 and 5. Insertion of the unit, and removal or disconnection of the unit in the housing 16 causes reversal of engine rotation.

The embodiment of the invention illustrated in FIGS. 6 and 7 has a contact assembly generally similar to that illustrated in FIG. 2. The contact assembly is mounted in a housing 32'' the curved wall of which is partly constituted by a permanent magnet 74 and its two pole pieces 76. Each pole piece is partly within the housing 32'' and partly outside the housing. The spring 46 normally holds the contacts 44, 48 in engagement.

A flywheel 26' of non-magnetic material carries a heavy rim piece 78 which extends in a circular arc about most of the circumference of the flywheel 26', but has a gap 80. The rim piece 78 consists of soft magnetizable iron and normally provides a yoke of low reluctance which closes a magnetic circuit between the pole pieces 76 as shown in FIG. 7. When, during rotation of the flywheel 26', the gap 80 is aligned with the pole pieces 76, the magnetic field between the pole pieces 76 in the housing 32'' is sufficiently strong to attract the ferrous spring 46 which thereupon provides a yoke between the pole pieces 76. As is evident from the dimensional relationship of the spring 46 and of the rim piece 78 shown in the drawing, the magnetic circuit through the spring 46 has a much higher reluctance than that through the rim piece 78, and the spring is released as soon as the gap 80 passes the housing 32''.

It should be understood, of course, that the foregoing disclosure relates only to preferred embodiments of the invention, and that it is intended to cover all changes and modifications of the examples of the invention herein chosen for the purpose of the disclosure which do not constitute departures from the spirit and scope of the invention set forth in the appended claims.

What is claimed is:

1. In an internal combustion engine, in combination:
(a) sparkplug means;
(b) a sealed housing;
(c) a fixed contact in said housing;
(d) an elongated leaf spring of ferromagnetic material having two end portions;
(e) fastening means fastening one of said end portions to said housing for movement of the other end portion toward and away from said fixed contact;
(f) a movable contact on said other end portion and normally urged by the resilience of said spring into circuit closing engagement with said fixed contact;
(g) magnetic actuating means for moving said other end portion and the movable contact thereon away from said fixed contact in timed sequence; and
(h) spark generating means in circuit with said contacts and said sparkplug means for applying a spark generating voltage to said sparkplug means in response to said movement of said movable contact out of said engagement.

2. In an engine as set forth in claim 1, said fastening means fastening said one end portion to said housing for movement of the other end portion toward and away from a position in which said other end portion conformingly engages one wall of said housing and said movable contact is away from said fixed contact, said magnetic actuating means moving said other end portion into said position thereof in timed sequence against the resilient force of said spring.

3. In an engine as set forth in claim 2, said actuating means including a shaft having an axis, a carrier mounted on said shaft for rotation about said axis, and a magnet mounted on said carrier and spaced from said shaft for movement in a circular path when said carrier rotates, said one wall being closely adjacent said path and conforming thereto.

4. In an engine as set forth in claim 3, said magnet having a face of circular cross section in a plane transverse of said axis, said face moving in said path.

5. In an engine as set forth in claim 2, said other end portion having two wide longitudinal faces and two narrow longitudinal faces, one of said wide faces engaging said one wall in said position of said other portion.

6. In an engine as set forth in claim 1, said actuating means including a magnet in one wall of said housing, a first pair of pole shoe means in said housing to constitute a first magnetic circuit with said magnet and with said spring, ferromagnetic yoke means, a second pair of pole shoe means outside of said housing, and moving means for moving said yoke means toward and away from a position in which said yoke means, said second pair of pole shoe means, and said magnet constitute a second magnetic circuit having a lower reluctance than said first circuit, said magnet urging said leaf spring away from said fixed contact when said yoke means is away from said position thereof.

7. In an engine as set forth in claim 6, two sheet metal pole shoes on said magnet, each pole shoe having a portion in said housing and a portion outside said housing, said portions constituting said two pairs of pole shoe means.

8. In an engine as set forth in claim 7, said moving means including a shaft having an axis, a carrier mounted on said shaft for rotation about said axis, said yoke means being mounted on said carrier and extending in a circular arc about said axis and defining a circumferential gap between the ends of said arc, the pole shoe portions outside said housing being closely adjacent said arc and said gap during rotation of said carrier and conforming to said arc.

9. In an engine as set forth in claim 8, said yoke means having an outer face extending in said arc.

10. In an engine as set forth in claim 9, said carrier being of non-magnetic material.

11. In an engine as set forth in claim 1, a stationary engine part having an axis, a carrier member mounted on said engine part for rotation about said axis, at least a portion of said magnetic actuating means being mounted on said carrier member for movement in a circular path during rotation of said carrier member, and securing means for alternatively securing said sealed housing to two portions of said stationary engine part closely adjacent said path and angularly offset from each other relative to said axis.

12. In an engine as set forth in claim 11, said securing means including a plug member and a socket member adapted to receive said plug member, one member of said securing means being arranged on said engine part and the other member of said securing means being arranged

on said housing, said members of the securing means constituting elements of an electrical circuit connecting said contacts to said spark generating means.

References Cited by the Examiner

UNITED STATES PATENTS

2,112,214	3/1938	Tognola	200—19
2,584,907	2/1952	Nelson	200—19

FOREIGN PATENTS

1,244,994	9/1960	France.

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