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ELECTROMAGNETIC PICKUP DEVICE

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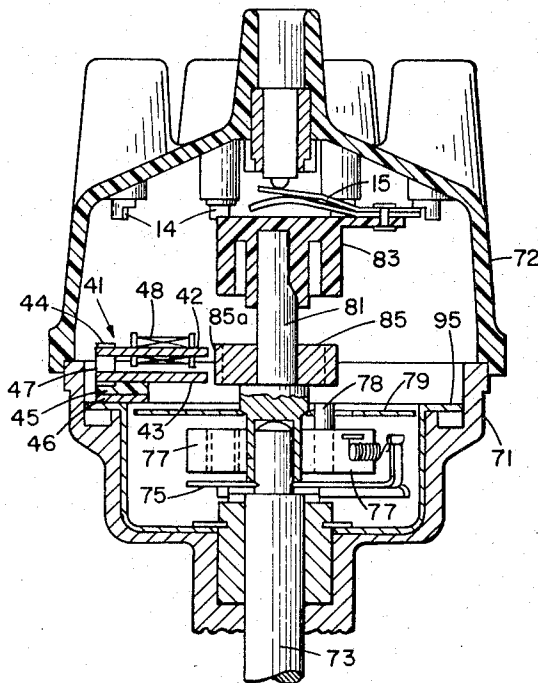
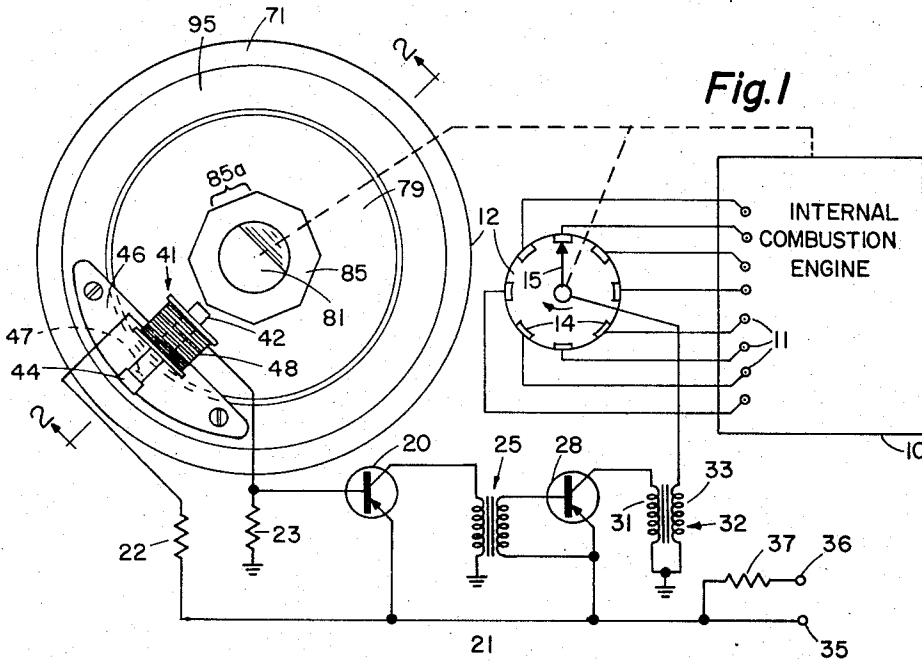


Fig. 2

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ELECTROMAGNETIC PICKUP DEVICE

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ABSTRACT OF THE DISCLOSURE

Ignition system for internal combustion engine including magnetic pickup device for operating semiconductor switching circuit. The magnetic pickup device operates with the breaker cam of a distributor commonly used to operate breaker points, and has a pair of pole pieces with ends adjacent the cam and forming air gaps therewith. A permanent magnet is positioned between the pole pieces to develop opposite poles therein, and as the cam rotates the plane surfaces and projecting edges of the cam change the lengths of the air gaps. A winding is provided on the pole pieces in which electrical pulses are developed by the change in flux through the pole pieces.

This invention relates to ignition systems for internal combustion engines, and more particularly to an improved magnetic pickup device for use with such ignition systems.

Ignition systems used with internal combustion engines generally include means for breaking an electrical current to provide timed pulses of electrical energy for producing sparks for igniting the fuel in the cylinders of the engine. It has been proposed to avoid using cam actuated mechanical breaker contacts to break an electrical circuit as such contacts become worn and must be replaced. One such means for accomplishing this is disclosed by the application of Oleh M. Kuritza and Edward V. Havel, Ser. No. 101,151, filed Apr. 6, 1961, and assigned to the assignee of the present invention.

In the ignition system described in the said application, a rotating toothed wheel operates to change the reluctance of a magnetic circuit through a pair of inductance coils in a pickup device, so that voltage pulses are developed therein. The inductance coils are connected in a circuit which amplifies the pulses produced by the change in flux through the coils, and selectively applies them to the spark plugs of the engine. Although such an ignition system has been found to be satisfactory, it cannot be incorporated in existing engines as it requires relatively extensive modification of the ignition system distributor from the usual distributor construction which has mechanical breaker points and a cam for operating them. This makes such ignition systems relatively expensive and impractical for installation in existing engines using cam operated mechanical breaker points, to convert such systems to contactless systems.

Accordingly, it is an object of this invention to provide a magnetic pickup device which may be readily incorporated in a distributor having a cam for operating mechanical breaker points.

Another object of the invention is to provide a magnetic pickup device for an electronic ignition system which utilizes the breaker cam in a magnetic pulser for synchronization of ignition pulses with the rotation of the engine.

A feature of the invention is the provision of a pickup device including a magnetic structure having a coil thereon, and a pair of pole pieces with ends disposed adjacent the periphery of the cam, so that pulses are developed in the coil in response to rotation of the cam. The coil may be small so that the pulses are developed with little delay.

Another feature of the invention is the provision, in a

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distributor, of a magnetic pickup having a pair of elongated pole pieces supported on the vacuum advance plate and generally parallel with each other and co-planar with the axis of rotation of the breaker cam, and with one end of each of the pole pieces disposed adjacent the periphery of the cam.

In the drawings:

FIG. 1 is a schematic diagram of an ignition system connected to a magnetic pickup device in a distributor, the distributor being shown with the distributor cap and rotor removed; and

FIG. 2 is a sectional view of the distributor taken along the line 2—2 of FIG. 1 and with the cap and rotor in place.

In accordance with the invention, a magnetic pickup device is incorporated in the distributor of an ignition system for an internal combustion engine. The distributor has a breaker cam rotatable in synchronism with the engine, which is of the type commonly used to operate breaker points. The pickup device comprises a pair of elongated pole pieces disposed generally parallel with each other. The pole pieces are mounted on the distributor substantially co-planar with the axis of rotation of the cam and with one end of each of the pole pieces being disposed adjacent the periphery of the cam. A permanent magnet extends between the pole pieces and renders the pole pieces of opposite polarity. A pickup winding surrounds at least one of the pole pieces and is responsive to the variation of flux through the pole piece produced by the rotation of the breaker cam to provide electrical pulses for the ignition system.

Referring now to the drawing, FIG. 1 includes a schematic representation of an ignition system similar to the ignition system disclosed by the aforementioned application of Oleh M. Kuritza and Edward V. Havel. The system is designed for use with an internal combustion engine 10 having a plurality of cylinders which are fired by signals applied to spark plugs 11. The engine is mechanically connected to a distributor 12 which selectively applies high voltage pulses to the spark plugs 11.

The operation of the ignition system circuitry will now be described. It is to be understood, however, that types of ignition systems other than that shown in FIG. 1 might be used in connection with the invention. The pickup device 41, which will be described subsequently, produces pulses in synchronism with the operation of internal combustion engine 10. The pickup device is connected through a resistor 22 between the emitter and the base of transistor 20, with the base of transistor 20 also being connected through resistor 23 to a reference potential. Bias potential is applied to the emitter electrode of transistor 20 from the bias supply line 21. This bias potential causes the transistor 20 to be normally conducting.

The collector electrode of transistor 20 is connected to transformer 25, which applies the pulses from the transistor 20 to the transistor 28. Bias is applied to the emitter electrode of transistor 28 from line 21 and through the secondary winding of transformer 25 to the base electrode. Transistor 28 is normally non-conducting and is rendered conductive by a pulse supplied between the base and emitter electrode thereof. Transistor 28 is cut off at the end of the pulse to develop a short pulse in primary winding 31 of transformer 32. This pulse is stepped up in the secondary winding 33 of transformer 32 and applied to the moving contact 15 of the distributor. The pulse is thereby selectively applied through the fixed contacts 14 of the distributor to the spark plugs 11 of the cylinders of the internal combustion engine 10.

The potential supply line 21 is connected to the electrical system of the vehicle in which the engine is used through terminals 35 and 36. Terminal 35 connects the

line directly to the vehicle voltage source and is used during starting to provide maximum ignition voltage. Terminal 36 connects line 21 to the electrical system through resistor 37, which causes a drop in the voltage and this connection may be used after the engine has started.

The pickup device 41 includes a pair of elongated pole pieces 42 and 43 disposed generally parallel with each other. The pole pieces are joined at one end by a permanent magnet 47, and the pole pieces and magnet 47 may be held together by a band clamp 44 of non-magnetic material. These parts may be held in assembled relation in any other convenient manner, as by welding. Pole pieces 42 and 43 are supported on a section of insulating material or non-magnetic material 45 and the entire assembly is secured to the vacuum advance plate 95 of the distributor 12 by means of a mounting plate 46. The entire magnetic pickup assembly can be mounted on the advance plate 95 by means of the mountings that are normally used to support the breaker points. This makes the installation of the pickup assembly in the distributor very simple. Distributor 12 will be described in detail subsequently. As is well known in the art, however, vacuum advance plate 95 is advanced and retarded in accordance with the carburetor vacuum to advance and retard the spark.

Pole pieces 42 and 43 are mounted by plate 46 in the distributor 12 substantially co-planar with the axis of rotation of the breaker cam 85. One end of each of the pole pieces is disposed adjacent the periphery of the cam. The permanent magnet 47 extends between the pole pieces 42 and 43 and renders the pole pieces of opposite polarity. A winding comprised of an inductance coil 48 surrounds pole piece 42.

The distributor 12 includes a housing 71 and a cap 72. A distributor shaft 73 extends upwardly into the housing and drives a drive plate 75. Drive plate 75 is connected through the usual spring biased flyweights 77 and drive pins 78 to a centrifugal advance plate 79. Advance plate 79 drives the rotor shaft 81 upon which rotor 83 is mounted. Rotor 83 carries the moving contact 15 of the distributor, and the fixed contacts 14 of the distributor extend downwardly in the interior of cap 72. Rotor shaft 81 carries a cam 85 which is the type used to operate mechanical breaker points.

As is well known, the periphery of the breaker cam includes a plurality of substantially planar surfaces which intersect in lines extending parallel with the axis of rotation of the cam. As may be seen from FIG. 1, this forms a plurality of points 85a on the cam 85 and as the cam 85 rotates approximate the ends of pole pieces 42 and 43, the lengths of the air gaps between the cam and the pole pieces vary. When one of the points 85a is adjacent the pole pieces as shown in FIG. 1, the flux through the coil 48 will be at its maximum strength. When cam 85 has rotated such that one of the planar surfaces thereof faces the ends of pole pieces 42 and 43, the flux through coil 48 will be at a minimum. This change in flux produces pulses in the coil 48, and these pulses are applied to the transistor 20, as before described, for triggering the ignition system in synchronism with the engine 10. The coil 48 may have a small value of inductance so that the pulses developed therein are in substantial coincidence with the changes in flux produced by rotation of the cam.

It may therefore be seen that the invention provides an improved magnetic pickup device which may be readily substituted for breaker points in a distributor using a breaker cam. The magnetic pickup device utilizes the rotation of the breaker cam to produce variations in flux for triggering an ignition system connected thereto.

I claim:

1. A magnetic pickup device for use in an internal combustion engine ignition system having a distributor with a polygonal breaker cam rotatable in synchronism

with the engine, which cam has a periphery formed by planar surfaces intersecting at projecting edges substantially parallel to the axis of rotation of the cam, said pickup device including in combination, a pair of elongated pole pieces having portions disposed generally parallel to each other and with ends spaced from each other, means for mounting said pole pieces in the distributor with said ends of said pole pieces adjacent the periphery of the cam and forming a pair of air gaps therewith, said ends of said pole pieces being spaced from each other in the direction of the axis of rotation of the cam, a permanent magnet extending between said pole pieces and rendering said pole pieces of opposite polarity, said ends of said pole pieces being aligned with the same projecting edge of the cam and then with a planar surface thereof as the breaker cam rotates so that the lengths of said air gaps decrease and increase and the flux through said pole pieces increases and decreases respectively, with said gaps being of minimum lengths and the flux through said pole pieces being maximum when an edge of the cam is aligned with the ends of said pole pieces, and winding means surrounding at least one of said pole pieces and responsive to the change in flux therethrough to provide electrical pulses for the ignition system.

2. A magnetic pickup device in accordance with claim 1 wherein said means for mounting said pole pieces in the distributor is a non-magnetic member for connection to the advance plate of the distributor.

3. A distributor for the ignition system of an internal combustion engine including in combination, a polygonal breaker cam rotatable in synchronism with the engine, said cam having a periphery including a plurality of planar surfaces intersecting at projecting edges substantially parallel to the axis of rotation of said cam, a vacuum advance plate within said distributor, a pair of elongated pole pieces having portions disposed generally parallel with each other with ends spaced from each other, means for mounting said pole pieces in the distributor on said advance plate with said ends of said pole pieces adjacent the periphery of said cam and forming a pair of air gaps therewith, said ends of said pole pieces being spaced from each other in the direction of the axis of rotation of said cam, a permanent magnet extending between said pole pieces and rendering said pole pieces of opposite polarity, said ends of said pole pieces being aligned with the same projecting edge of said cam and then with a planar surface thereof as said breaker cam rotates so that the lengths of said air gaps decrease and increase and the flux through said pole pieces increases and decreases respectively with said gaps being of minimum lengths and the flux being maximum when an edge of said cam is aligned with the ends of said pole pieces, and winding means surrounding at least one of said pole pieces and responsive to the change in flux therethrough to provide electrical pulses for the ignition system.

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