United States Patent

Palazzetti et al.

[15] **3,683,880**

[45] **Aug. 15, 1972**

[54] **MAGNETIC IGNITION DISTRIBUTOR**

[72] Inventors: **Mario Palazzetti,** Via Fratel Teodoreto 7; **Bruno Cavallarin,** Via Principi d'Acaja 40 bis, both of Turin, Italy

[22] Filed: **Oct. 19, 1970**

[21] Appl. No.: **82,025**

[30] **Foreign Application Priority Data**

Oct. 17, 1969 Italy.....53720 A/69

[52] **U.S. Cl.**.....**123/146.5 A,** 123/148 E, 123/117 R

[51] **Int. Cl.**.....**F02p 3/02,** F02p 9/00

[58] **Field of Search**.....123/143 C, 146.5 A, 148 D, 123/148 F, 149 G, 148 E, 117 R; 200/19 M; 315/210, 211

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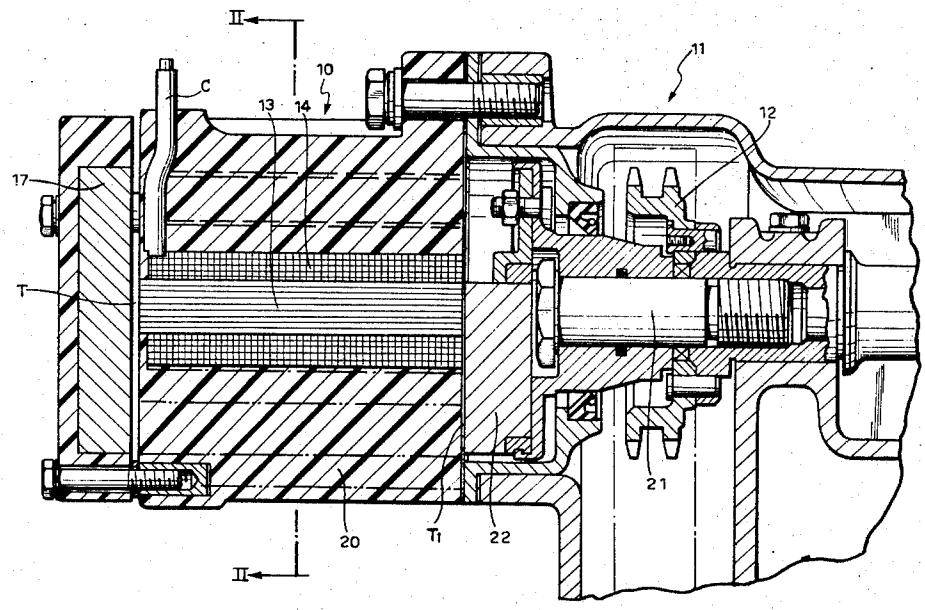
Primary Examiner—Laurence M. Goodridge
Assistant Examiner—Cort Flint
Attorney—Sughrue, Rothwell, Mion, Zinn & Macpeak

[57] **ABSTRACT**

A magnetic ignition distributor for an internal combustion engine comprising a transformer having a primary winding and a number of secondary windings, each secondary winding being connected to a respective spark plug. The secondary windings are arranged around the primary winding and each winding has a magnetic core the ends of which are all flush with each other. A yoke of magnetic material is provided to complete a magnetic circuit between the primary and one of the secondary windings, and this yoke is arranged to be rotatable about the axis of the core of the primary winding so that each secondary core is coupled into the magnetic circuit in turn. The rate at which the yoke rotates being governed by the speed of the engine.

3 Claims, 2 Drawing Figures



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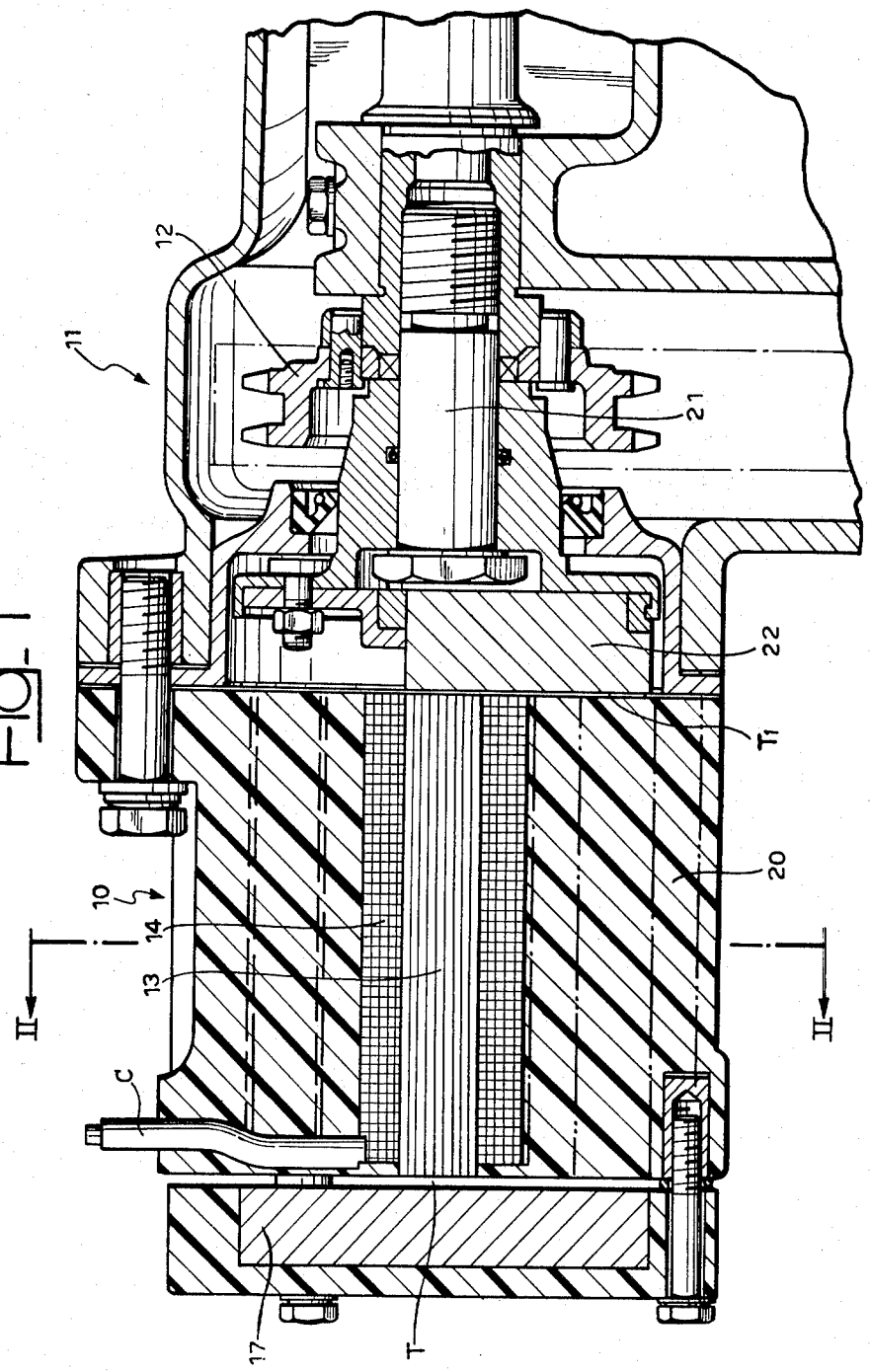
SHEET 1 OF 2

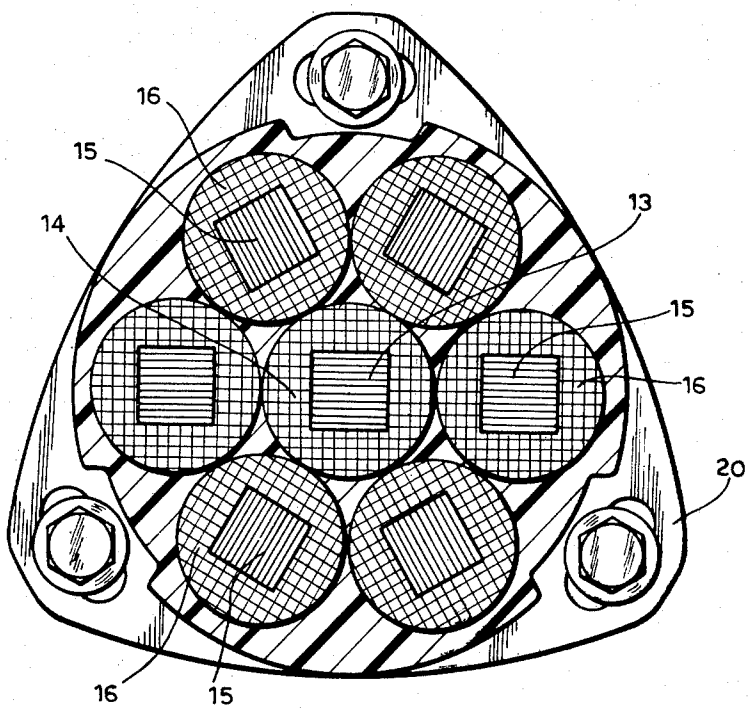
Fig. 1



INVENTORS
MARIO PALAZZETTI
BRUNO CAVALLARIN

BY Sughrue, Rothwell, Mion, Zinn & Macpeak
ATTORNEYS

Fig. 2



INVENTOR

BY

ATTORNEY

MAGNETIC IGNITION DISTRIBUTOR

The present invention relates to a distributor for the ignition circuit of an internal combustion engine and finds particular utility in the ignition circuits of internal combustion engines of motor vehicles.

In conventional internal combustion engine ignition systems, whether electrical or electronic, a high voltage is supplied to the ignition sparking plugs by an electric distributor which by means of a rotor arm, driven directly or indirectly by the motor, selectively connects the secondary of the high voltage transformer (or coil) with each sparking plug.

The use of an electric distributor of this type has a number of disadvantages due to the electrical nature of its operation. Probably the most important of these disadvantages from the point of view of safety of the passengers is that an electric distributor, in operation, induces a spark which, in the case of an accident may cause a fire by igniting any spilt petrol; this is clearly to be avoided if at all possible.

Another disadvantage of conventional distributors is that they do not function reliably in conditions of increased humidity, rain etc. In such conditions the insulation frequently breaks down causing irregular operation or complete failure.

This problem of insulation and high tension distribution requires special contrivances and construction, and also regular maintenance to prevent local breakdown of the insulation and 'tracking'—that is discharge along certain paths in parts of the insulator which have deteriorated. Moreover periodic checks are needed on the rotor arm and the co-operating fixed contacts, since these parts are subject to wear.

Finally, the presence of electric sparks is well-known as a cause of radio interference and normally steps must be taken to suppress this interference.

According to the present invention there is provided a magnetic ignition distributor for internal combustion engines comprising a primary winding having a core of magnetic material, a plurality of secondary windings for connection to respective spark plugs, each secondary winding having a core of magnetic material, and a rotatably mounted yoke of magnetic material the axis of rotation of which is coaxial with the magnetic core of the primary winding, the said yoke being rotatable at a speed related to the speed of the engine to complete a magnetic circuit between the core of the primary winding and the core of each of the secondary windings in turn.

Preferably there is provided a fixed yoke which cooperates with the ends of the magnetic cores remote from the rotatable yoke to form the remainder of the magnetic circuit.

One embodiment of the present invention will now be more particularly described, by way of example, with reference to the accompanying drawings, in which:

FIG. 1 shows a longitudinal section of one embodiment of a distributor constructed in accordance with the present invention and one possible drive system for the rotating yoke; and

FIG. 2 is a transverse section taken along the line II—II of FIG. 1.

Referring now to FIG. 1 there is shown a distributor generally indicated **10**, the distributor **10** has a

mechanical driving gear **11** which is driven by the engine with which the distributor is associated, the driving gear **11** comprises a driving chain and a co-operating gear wheel **12**.

The distributor, as is better seen in FIG. **2**, comprises a transformer having a central core **13** on to which the primary winding **14** is wound, and a number of other cores **15** spaced around the central core **13**, each bearing a corresponding secondary winding **16**.

The magnetic cores **15**, and hence the secondary windings, are equal in number to the ignition sparking plugs of the engine. In the embodiment illustrated in the drawings there are six secondary windings at an angular spacing of 60°; this embodiment is suitable for an engine having six ignition sparking plugs.

The magnetic cores of all of the windings are the same length; a fixed yoke **17** is arranged to overly one end of all of the cores **13**, **15** to provide a path for magnetic flux from the core **13** of the primary winding **14** to the cores **15** of the secondary windings **16**. This yoke comprises a plate of ferro-magnetic material **17** conveniently fixed onto the casing **20** of the distributor. In the embodiment shown in the drawings there is an air gap T between the yoke **17** and the magnetic cores **13**, **15**. It will be appreciated that in alternative embodiments this air gap may be dispensed with. At the end of the magnetic cores **13**, **15** remote from the yoke **17** there is a rotatably mounted yoke **22**, also of ferromagnetic material. The axis of rotation of the yoke **22** is coaxial with the axis of the core **13**. The rotatably mounted yoke **22** is secured to a shaft **21** and arranged to define an air-gap T_1 between itself and the magnetic cores **13**, **15**. The speed of rotation of the shaft **22**, and therefore the rotatable yoke **22** is controlled in dependence on the speed of the engine. The yoke **22** is so shaped that it completes a magnetic circuit formed by the magnetic core **13** of the primary winding **14** and each of the cores **15** of the secondary windings **16** in turn as it rotates.

The yoke **22** therefore acts substantially as a rotating contact but instead of transferring high tension electrical energy to the different sparking plugs, as occurs in distributors of the conventional type, it transfers magnetic energy into the cores of the different secondary windings whose induced voltage is then transmitted to the sparking plugs.

The yoke **22** is therefore so shaped and dimensioned as to substantially cover the end of the core of the primary winding and that of the core of whichever secondary winding over which it is positioned.

In practice it is advantageous to enclose the magnetic cores and their corresponding windings in an insulating mass, which can consist of a suitable resin or of a fluid dielectric which conveniently fills the interior of the casing **20**.

Connection of the primary and secondary windings is made preferably, as shown in FIG. **1**, through terminals, such as the terminal C shown connected to the primary winding **14**, at the ends of the windings adjacent the yoke **17**. The secondary windings may, alternatively, be connected directly by cable to their respective sparking plugs; this has the advantage of eliminating insulating problems connected with high voltage; such problems are always present with conventional distributors.

The primary winding **14** is fed with electric current during ignition, when the rotating yoke **22** is in the desired magnetic coupling position between the core of the primary winding and the core of one of the secondary windings. The supply circuit to the primary winding can be either of the traditional type, or electronic. The primary winding can also be fed directly from the vehicle's battery. In this case the rotating yoke would need to be suitably shaped in order to provide the requisite variations of the flow of current induced by its movement.

Various alternative embodiments will be apparent to those skilled in the art, for example, the transmission which drives the rotatable yoke **22** could well be different from that described depending on structural requirements.

The magnetic cores for the primary and secondary windings are shown with a square shape but they could have a different shape; round for example. From the above it can be seen that the magnetic distributor described includes, in one single container, the distributor and the ignition coil. Finally, the distributor according to this invention is particularly suitable for electronic ignition systems since in this case, the bulk of the secondary windings is greatly reduced.

What is claimed is:

1. A magnetic ignition distributor for an internal combustion engine having a plurality of spark plugs, said magnetic ignition distributor comprising:

a single primary winding, a magnetic core disposed between said primary winding,

a plurality of secondary windings arranged in circular fashion around said primary winding, with the axes of said secondary windings disposed parallel to each other and said primary winding each secondary winding adapted to be connected to a respective spark plug of said internal combustion engine,

a plurality of magnetic cores each arranged within secondary winding,

a yoke of magnetic material adapted to complete a magnetic circuit between said magnetic core of said primary winding and any one of said magnetic cores of said secondary windings, said yoke being rotatable about an axis of rotation which is coaxial with said magnetic core of said primary winding, and

means for interconnecting said rotatable yoke and said engine whereby said rotatable yoke is rotated, at a speed governed by the speed of said engine, to complete a magnetic circuit between said core of said primary winding and each of said cores of said secondary windings in turn.

2. The distributor of claim **1** wherein there is provided a fixed yoke which cooperates with the ends of said magnetic cores remote from said rotatable yoke to form the remainder of said magnetic circuit.

3. The distributor of claim **1** wherein said rotatable yoke is adapted substantially to cover both one end of said magnetic core of said primary winding and one end of said magnetic core of a respective one of said secondary windings, said rotatable yoke and said magnetic cores defining an air gap therebetween.

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