Sept. 16, 1947. E. K. VON MERTENS 2,427,583

PLANETARY GEAR IGNITION DISTRIBUTOR

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Fig. 1.

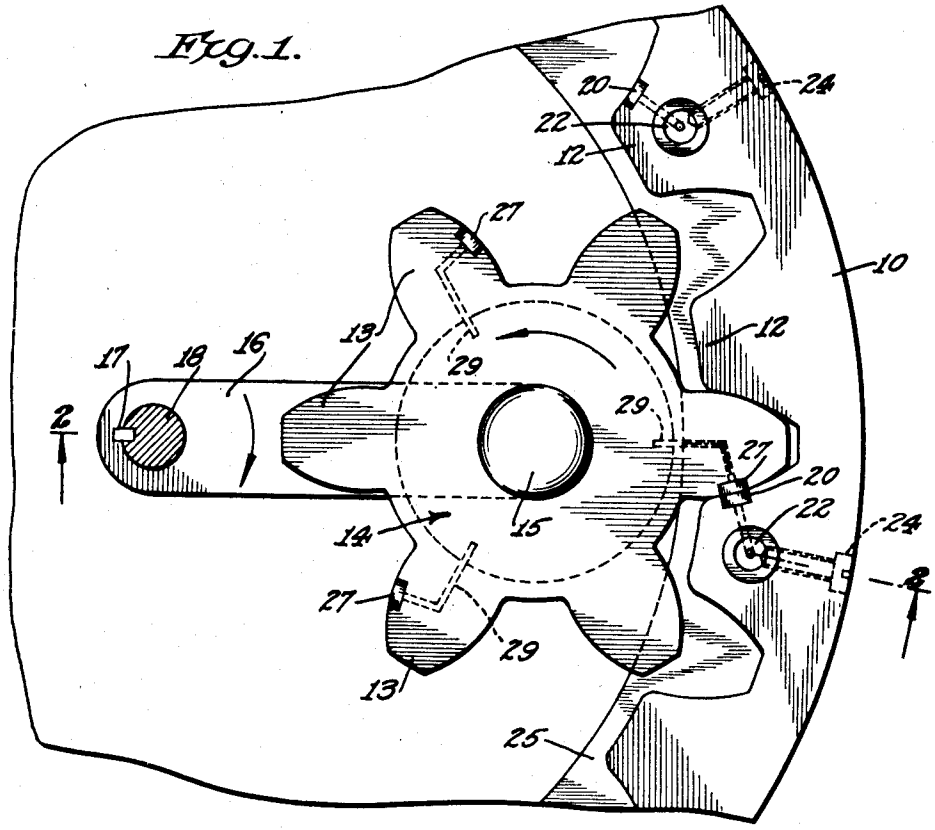

Fig. 2.

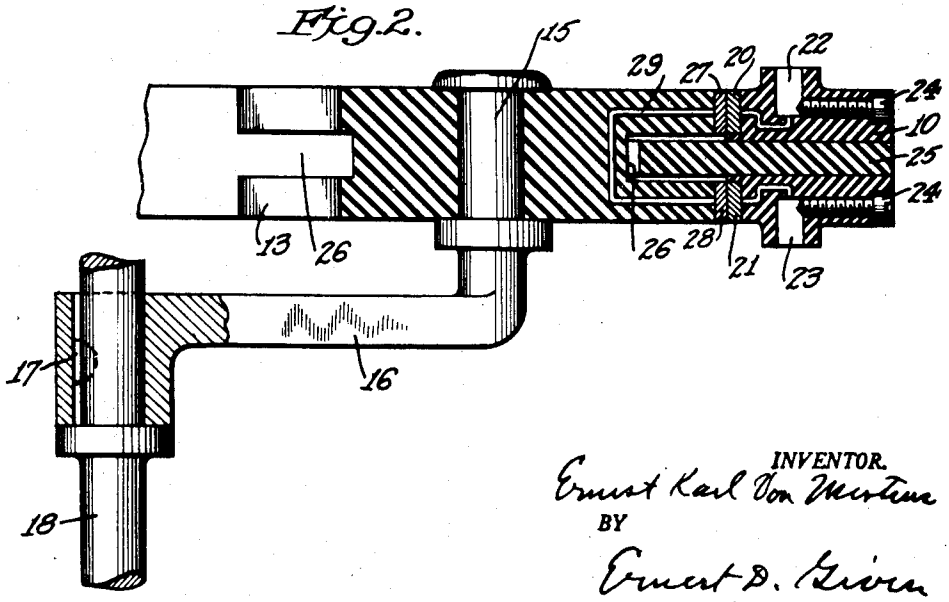

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Fig. 3.

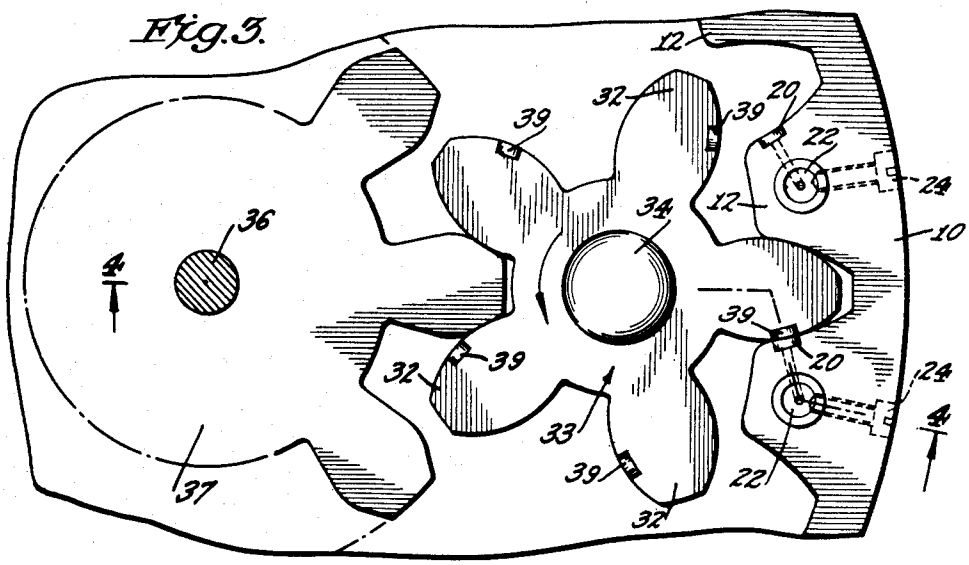


Fig. 4.

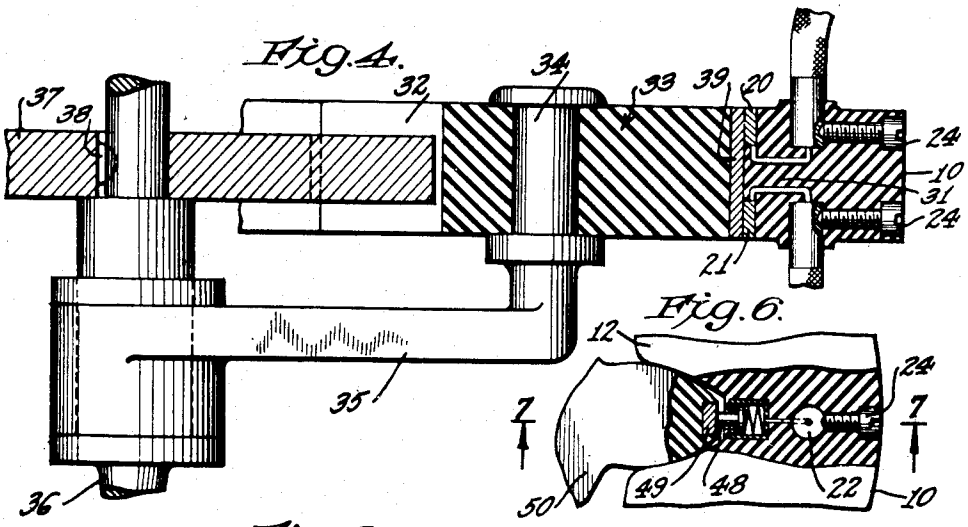


Fig. 6.

Fig. 5.

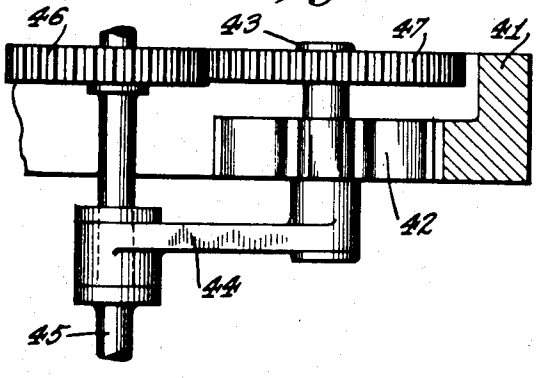
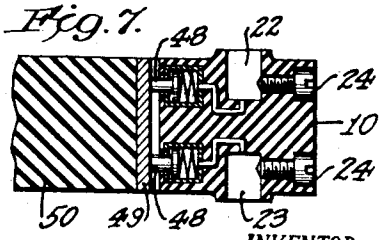


Fig. 7.



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PLANETARY GEAR IGNITION DISTRIBUTOR

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Fig. 8.

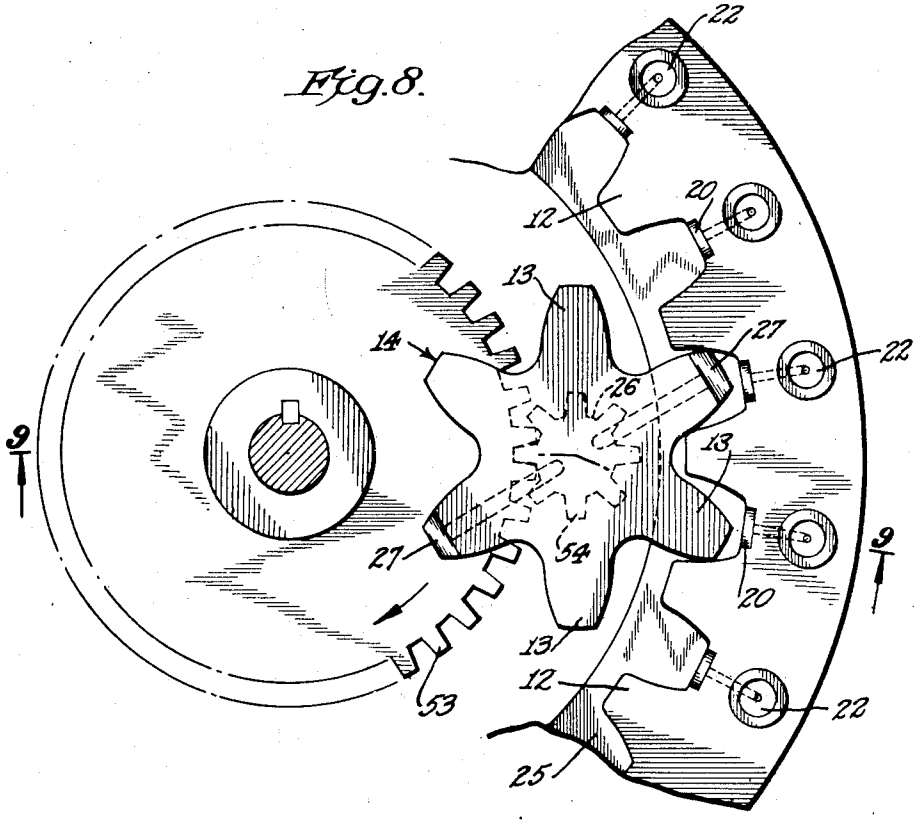
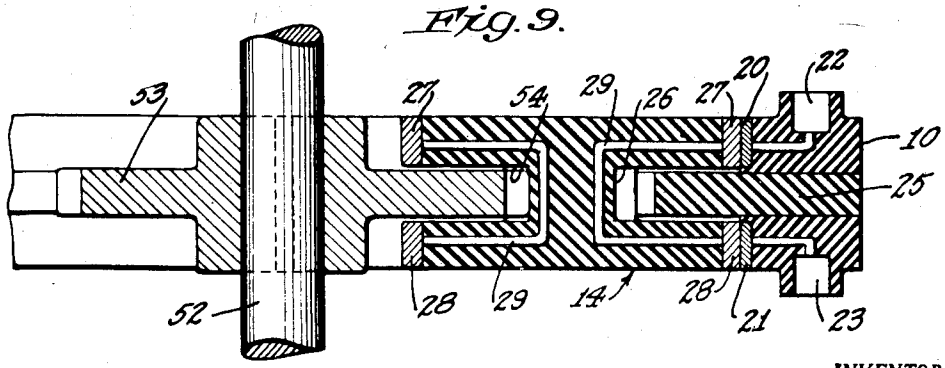


Fig. 9.



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Patented Sept. 16, 1947 2,427,583

UNITED STATES PATENT OFFICE

2,427,583

PLANETARY GEAR IGNITION DISTRIBUTOR

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Application February 9, 1945, Serial No. 577,102

10 Claims. (Cl. 200—28)

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This invention relates to ignition systems for internal combustion engines and has for its object to provide a novel and improved ignition distributor for such systems.

Another object of the invention is to provide an ignition distributor for either high or low tension distribution embodying the principle of a planetary gear.

Another object is to provide a simple and compact planetary gear ignition distributor which eliminates carbon brushes and special contacts, greatly increases flashover distances and thus permits a reduction in size of the distributor or higher altitude operation in the case of an airplane engine, and which by eliminating spark gaps reduces the voltage in the system and avoids the necessity for ventilation.

Still another object is to provide an ignition distributor of the foregoing type having novel and improved details of construction and features of operation.

Various other objects and advantages will be apparent as the nature of the invention is more fully disclosed.

In the embodiments of the invention disclosed herein for purposes of illustration the ignition distributor comprises a fixed ring gear having magneto and spark plug terminals which are electrically connected in timed relation to the engine cycle by a contactor or conductor on the teeth of an engine-driven planet gear which meshes with said ring gear. The gear ratios may be readily selected to insure proper timing, and the gear design may be such as to provide any degree of rolling or wiping action desired on the contact portions of the gear.

Although the novel features which are characteristic of this invention are set forth more in detail in the claims appended hereto, the nature and scope of the invention may be better understood by referring to the following description, taken in connection with the accompanying drawings forming a part thereof, in which certain specific embodiments have been set forth for purposes of illustration.

In the drawings:

Fig. 1 is a fragmentary plan view, partly in section, of a planetary gear ignition distributor embodying the invention;

Fig. 2 is a transverse section taken on the line 2—2 of Fig. 1;

Fig. 3 is a fragmentary plan view illustrating a modification of the invention;

Fig. 4 is a transverse section taken on the line 4—4 of Fig. 3;

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Fig. 5 is a transverse sectional view illustrating a modification of the planet gear drive;

Fig. 6 is a detail plan view, partly in section, illustrating a modified construction of the contact members on the face of the ring gear;

Fig. 7 is a transverse section taken on the line 7—7 of Fig. 6;

Fig. 8 is a fragmentary plan view illustrating still another embodiment of the invention; and

Fig. 9 is a transverse section taken on the line 9—9 of Fig. 8.

In the following description certain specific terms are used for convenience in referring to the various details of the invention. These terms, however, are to be interpreted as broadly as the state of the art will permit.

The ignition distributor shown in Figs. 1 and 2 comprises a fixed ring gear 10 composed of insulating material and containing internal teeth 12 which mesh with the teeth 13 of a planet or pinion gear 14 also made of insulating material. The number of teeth 12 on ring gear 10 should be the same as, or a multiple of, the number of cylinders on the engine.

The planet gear 14 is rotatably mounted on a bearing 15 carried by arm 16 which is keyed at 17 to a rotatable shaft 18 driven by the engine. The arm 16 rotates in a clockwise direction as viewed in Fig. 1, carrying with it the planet gear 14 which is thus rotated in a counter-clockwise direction upon its bearing 15 as its teeth 13 mesh with the teeth 12 of stationary ring gear 10.

Two sets of electrical contacts 20 and 21 are molded or otherwise secured to the faces of the teeth 12 of ring gear 10, said sets of contacts 20 and 21 being provided only on alternate teeth 12 in the embodiment shown in Figs. 1 and 2 wherein the number of teeth 12 is double the number of cylinders to be fired.

The upper contacts 20 on ring gear 10 are connected to sockets 22 into which are inserted suitable plugs on cables leading to the spark plugs of the engine. The lower contacts 21 are connected to sockets 23 adapted to receive suitable plugs for connection to the coil of the magneto or other source of electrical energy. The aforesaid plugs for effecting the electrical connections may be locked in the respective sockets 22 and 23 by set screws 24.

An annular insulating shield 25 is inserted between the upper contacts 20 and the lower contacts 21 of ring gear 10 in order to increase the flashover distance between the said upper and lower contacts, especially when high tension distribution is employed. The inner periphery of

this shield 25 extends within slots 26 in the edges of teeth 13 of planet gear 14, as best shown in Fig. 2.

Alternate teeth 13 of planet gear 14 contain upper and lower contacts or grounding bars 27 and 28 which are connected by conductors 29. As the planet gear 14 rotates, its contacts 27 and 28 will engage the various upper and lower contacts 20 and 21 of ring gear 10 and thus momentarily connect the various spark plug leads with the magneto coil or other source of electrical energy.

The distributor of Figs. 1 and 2 may be used, for example, in a high tension ignition system for a nine-cylinder internal combustion engine. In such case the stationary ring gear 10 is provided with eighteen teeth; the distributor drive shaft 18 is rotated at one-half engine speed; and the six-tooth planet gear 14 rotates at one and one-half times the engine speed.

The distributor shown in Figs. 3 and 4 is especially suited for use in low tension ignition systems. In this embodiment of the invention the stationary ring gear 10 differs from that previously described in that the number of teeth 12 is the same as the number of engine cylinders to be fired, and each of said teeth 12 is provided with upper and lower contacts 20 and 21. Furthermore, the upper and lower contacts 20 and 21 on each tooth are separated only by a narrow shield of insulation 31 which may lie flush with the contact surface, making it unnecessary to provide slots in the edges of the teeth 32 of the cooperating planet gear 33.

The planet gear 33 of Figs. 3 and 4 is rotatably mounted on journal 34 of arm 35 which is rotatably mounted on the rotatable shaft 36. A sun gear 37 is keyed to shaft 36 at 38 and has its teeth meshing with the teeth 32 of planet gear 33 for positively rotating said planet gear as the latter travels around ring gear 10. Each of the teeth 32 of planet gear 33 has a single grounding bar or contact 39 which is adapted to engage the upper and lower contacts 20 and 21 on the ring gear 10 to momentarily connect the various spark plug leads with the source of electrical energy during the operation of the distributor.

Assuming that the distributor of Figs. 3 and 4 is employed in a low tension ignition system for an eighteen cylinder internal combustion engine, the stationary ring gear 10 will be provided with eighteen teeth each of which has a set of upper and lower contacts 20 and 21. The arm 35 carrying the planet gear 33 will rotate at ½ the engine speed; while driving gear 37 will be provided with eight teeth and will rotate at 1⅝ times the engine speed; and the five-tooth planet gear 33 will be rotated by gear 37 at 1.8 times the engine speed.

Fig. 5 shows another drive for a low tension distributor, in which 41 is the stationary ring gear and 42 is the cooperating planet gear. The planet gear 42 is keyed to a stub shaft 43 carried by arm 44 which is rotatably supported on the rotatable drive shaft 45. The shaft 45 carries a driving gear 46 meshing with a pinion gear 47 which is keyed to the sub shaft 43 carrying planet gear 42. The ratio of gears 46 and 47 may be selected to rotate the planet gear 42 at the speed required in any given installation.

Figs. 6 and 7 show a modification in which the upper and lower contacts on the stationary ring gear 10 are secured to the bottoms of the internal teeth 12 instead of to the side faces thereof, and in which said contacts comprise spring-actuated members or buttons 48 engageable with grounding bars or contacts 49 on the peaks of the teeth 50 of the cooperating planet gear.

In the embodiment illustrated in Figs. 8 and 9 the stationary ring gear 10 is similar to that shown in Figs. 1 and 2 except that the various upper and lower contacts 20 and 21 are mounted on the bottoms of the internal teeth 12 instead of on the side faces thereof. These contacts 20 and 21 are separated by an insulating shield 25, as in Figs. 1 and 2, to increase the flashover distance between the upper and lower contacts, and the inner peripheral edge of this insulating shield 25 extends into the annular slot 26 in planet gear 14. In Figs. 8 and 9, however, the upper and lower grounding bars or contacts 27 and 28 are secured to the peaks of only two diametrically opposed teeth 13 of the six-tooth planet gear 14.

In Figs. 8 and 9, furthermore, the distributor driving shaft 52 carries a gear 53 which extends within the annular slot 26 in planet gear 14 and meshes with a pinion gear 54 therein for the purpose of rotating plane gear 14 at a predetermined speed. In applying this high tension ignition distributor, for example, to a fourteen-cylinder engine, the planet gear 14 must be driven by the gear train 53—54 with a ratio of 12:7 if an eight-pole magneto is employed. Using two diametrically opposed contacts 27 on planet gear 14, said planet gear will rotate three times within the distributor (equal to 1½ times engine speed) for one cycle of firing.

Among other advantages of my planetary gear ignition distributor may be mentioned; the greatly increased flashover distances, permitting higher altitude operation or a reduction in size of the distributor; the elimination of spark gaps in the distributor will reduce the voltage in the system and eliminate requirements for ventilation; the elimination of carbon brushes or special contacts; and the possibility of eliminating air in the distributor by filling same with insulating liquids, such as transformer oil.

Although certain specific embodiments of the invention have been shown and described for purposes of illustration, it will be evident to those skilled in the art that various changes may be made therein without departing from the scope and spirit of the invention as defined in the appended claims.

What I claim is:

1. An ignition distributor for an internal combustion engine comprising a ring gear having spark plug terminals and electrical energy terminals thereon, and means cooperating with said ring gear for electrically connecting said terminals.

2. An ignition distributor for an internal combustion engine comprising a fixed ring gear having spark plug terminals and electrical energy terminals, and means including a planet gear cooperating with said ring gear for electrically connecting said terminals.

3. An ignition distributor for an internal combustion engine comprising a fixed ring gear having spark plug terminals and electrical energy terminals, and means including a planet gear cooperating with said ring gear and driven by the engine for electrically connecting said terminals in timed relation to the engine cycle.

4. An ignition distributor for an internal combustion engine comprising a fixed ring gear having spaced pairs of contacts, one contact of each pair being adapted for connection to a spark plug and the other being adapted for connection

to a source of electrical energy, a planet gear meshing with said ring gear, and contact means on said planet gear for selectively engaging the contacts of each pair for electrically connecting same.

5. An ignition distributor for an internal combustion engine comprising a fixed internally toothed ring gear, pairs of spaced contacts on the teeth of said ring gear, one contact of each pair being adapted for connection to a spark plug and the other being adapted for connection to a source of electrical energy, a planet gear having teeth meshing with the teeth of said ring gear, and contact means on the teeth of said planet gear for selectively engaging the contacts of each pair for electrically connecting same.

6. An ignition distributor for an internal combustion engine comprising a fixed ring gear having internal teeth composed of insulating material, pairs of electrical contacts on the teeth of said ring gear, one contact of each pair being adapted for connection to a spark plug and the other being adapted for connection to a source of electrical energy, a planet gear having teeth composed of insulating material meshing with the teeth of said ring gear, and contact means on the teeth of said planet gear for engaging the pairs of teeth on said ring gear to electrically connect same.

7. An ignition distributor for an internal combustion engine comprising a fixed ring gear having internal teeth composed of insulating material, electrical contacts arranged in pairs one above the other on the teeth of said ring gear, one contact of each pair being adapted for connection to a spark plug and the other being adapted for connection to a source of electrical energy, an insulating shield disposed between the upper and lower contacts of said ring gear to increase the flashover distance therebetween, a planet gear having teeth composed of insulating material meshing with the teeth of said ring gear, and contact means on the teeth of said planet gear for engaging the pairs of teeth on said ring gear to electrically connect same.

8. An ignition distributor for an internal combustion engine comprising a fixed ring gear having internal teeth composed of insulating material, electrical contacts arranged in pairs one above the other on the teeth of said ring gear, one contact of each pair being adapted for connection to a spark plug and the other being adapted for connection to a source of electrical energy, an insulating shield disposed between the upper and lower contacts of said ring gear to increase the flashover distance therebetween, a planet gear having teeth composed of insulating material meshing with the teeth of said ring gear, contact means on the teeth of said planet gear for engaging the pairs of teeth on said ring gear to electrically connect same, and means for driving said planet gear according to a predetermined engine cycle.

9. An ignition distributor for an internal combustion engine comprising a fixed ring gear having internal teeth composed of insulating material, electrical contacts arranged in pairs one above the other on the teeth of said ring gear, one contact of each pair being adapted for connection to a spark plug and the other being adapted for connection to a source of electrical energy, an annular insulating shield disposed between the upper and lower contacts of said ring gear and extending inwardly beyond the annulus of said ring gear to increase the flashover distance between said contacts, a planet gear having teeth composed of insulating material and having an annular slot extending inwardly from the edge thereof to straddle said annular insulating shield and permit the teeth of said planet gear to mesh with the teeth of said ring gear, and contact means on the teeth of said planet gear for engaging the pairs of teeth on said ring gear to electrically connect same.

10. An ignition distributor for an internal combustion engine comprising a fixed ring gear having internal teeth composed of insulating material, electrical contacts arranged in pairs one above the other on the teeth of said ring gear, one contact of each pair being adapted for connection to a spark plug and the other being adapted for connection to a source of electrical energy, an annular insulating shield disposed between the upper and lower contacts of said ring gear and extending inwardly beyond the annulus of said ring gear to increase the flashover distance between said contacts, a planet gear having teeth composed of insulating material and having an annular slot extending inwardly from the edge thereof to straddle said annular insulating shield and permit the teeth of said planet gear to mesh with the teeth of said ring gear, contact means on the teeth of said planet gear for engaging the pairs of teeth on said ring gear to electrically connect same, and gear means for driving said planet gear according to a predetermined engine cycle.

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The following references are of record in the file of this patent:

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Number	Country	Date
507,744	France	Dec. 27, 1919