

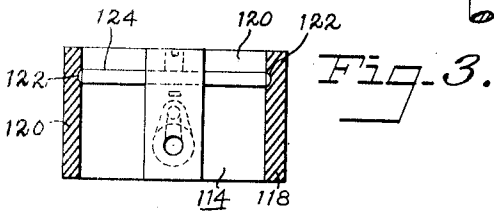
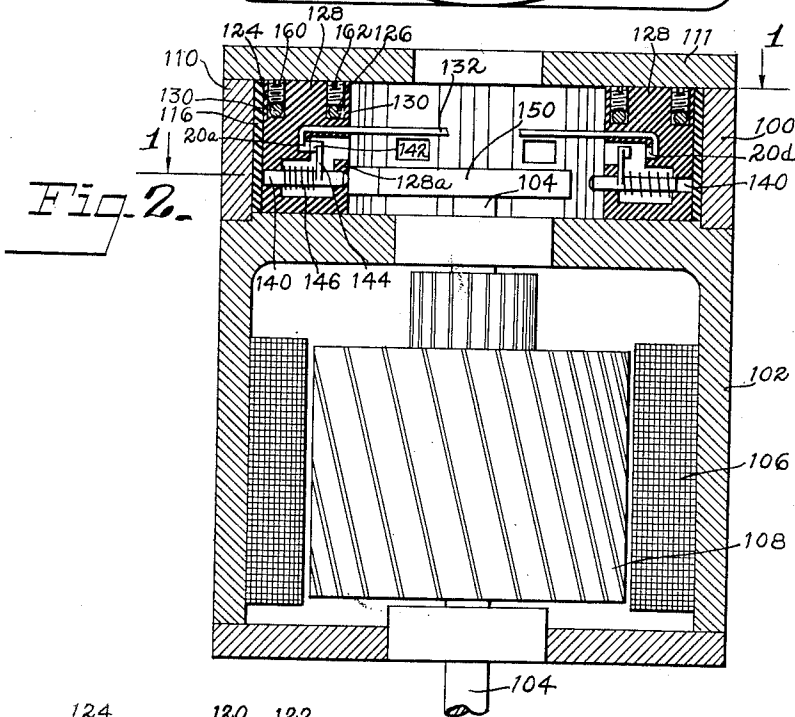
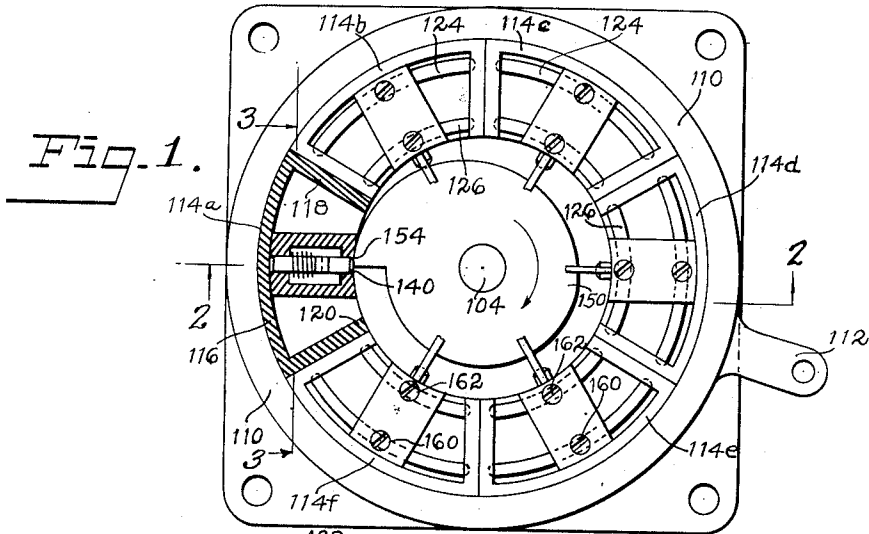
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2,261,158

IGNITION SYSTEM

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IGNITION SYSTEM

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3 Claims. (Cl. 200—27)

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The invention described herein may be manufactured and used by or for the Government for governmental purposes, without the payment to us of any royalty thereon.

This invention relates to ignition systems for internal combustion engines and more particularly to an ignition system having a transformer associated with each of the cylinders of the engine and a device for checking or testing the operation of the engine.

An object of this invention is to provide a rotary switching mechanism for the ignition system of an internal combustion engine wherein the relative timing of one cylinder may be adjusted without adjusting the timing of the other cylinders.

Another object of this invention is to provide a movable contact for closing and opening the circuit through any one of a number of transformers, which contact has a sliding engagement with the stationary contact.

Another object of this invention is to provide a rotary switching mechanism for an ignition system adapted for use with a multi-cylinder internal combustion engine wherein the circuit is closed for a sufficient period of time through each transformer to permit a sufficient voltage impulse to be generated to cause a spark of sufficient duration to ignite the fuel charge within the cylinder.

Other objects and advantages reside in the construction of parts, the combination thereof and the mode of operation, as will become more apparent from the following description.

Figure 1 is a transverse cross sectional view of a rotary switching mechanism taken substantially on the line 1—1 of Figure 2.

Figure 2 is a longitudinal cross sectional view of the rotary switching mechanism and the generator taken substantially on the line 2—2 of Figure 1.

Figure 3 is a fragmentary cross sectional view of one contact support taken substantially on the line 3—3 of Figure 1.

In commercial aircraft the magneto, even though a dual ignition system is used, is still a single source of electrical energy. This is due to the fact that only one drive from the engine is used. In addition thereto, the operation of either half of a dual ignition system is dependent upon one high voltage coil in the magneto. Failure of this coil will cause inoperation of one spark plug in each cylinder. When magnetos are used, there is some difficulty in timing the magnetos, especially when used in connection with radial engines. Although the cylinders are equally spaced around the crankcase, the timing of the several cylinders cannot be equally spaced, because a common master rod is used. The deviation from equal timing may be as high as nine

degrees (9°) in seven (7) cylinder engines. This matter can be corrected by using a multi-lobe cam with the magneto. These lobes would be so located on the cam that the timing is always correct; but this solution is rather expensive, complicated and conducive to trouble.

It is the purpose of the present invention to overcome some of the objections to the prior art devices and to produce a more simple rotary switching device for use with an ignition system for a multi-cylinder internal combustion engine. This rotary switching mechanism may include a housing provided with a circular inner wall having a plurality of circular sectors nested when in the housing. Each of these sectors may include arcuate supporting means fixedly attached thereto for supporting contacts mounted for individual adjustment. One of the contacts in each sector is preferably mounted for movement so as to open and close the circuit in response to a cam for actuating the movable contacts at cyclic intervals. These cyclic intervals may be varied by adjusting the contacts upon the supporting means so as to change the relative timing of the closing of the contacts.

The rotary switching mechanism, which may be used as a distributor or as a timer, is mounted in association with the generator, as shown in Figures 1, 2 and 3. The rotary switching mechanism 100 and the generator 102 are driven from a shaft 104 actuated by the engine. This may be a projection on the cam shaft or it may be geared to the crank shaft or some other part rotating in synchronism with the crankshaft. The generator 102 includes the windings 106 and the armature 108. The details of the generator have not been shown, for the reason that the generator per se does not constitute a portion of this invention. It may be any conventional type of a generator.

The rotary switching mechanism 100 is mounted on the end of the frame enclosing the generator 102. This rotary switching mechanism includes a shell 110 provided with a cover or a capping member 111. The shell 110 is circular and is mounted for rotary movement, so as to advance or retard the spark of all of the cylinders in unison by merely actuating the lever 112. The shell 110 houses a plurality of arcuate shell portions 114a, 114b, 114c, 114d, 114e and 114f. Each of these arcuate shell sectors are identical in shape and are snugly nested within the shell 110. Each arcuate shell sector includes an arcuate wall 116 and a pair of radial walls 118 and 120. The radial walls 118 and 120 are provided with dents or recesses 122 receiving arcuate supporting members 124 and 126. These supporting members 124 and 126 provide supports for the insulated contact mounting 128 provided with a pair of holes 130 through which members

124 and 126 extend. The insulated contact mounting 128 houses and supports the stationary contact 20a, connected by a suitable lead 132 to one terminal of the primary windings not shown. There is one stationary contact, one insulated contact mounting and one arcuate shell for each of the cylinders in the engine. The insulated contact mounting 128 is provided with a radial aperture receiving a plunger 140 supporting a movable contact 142 upon a flexible arm 144. This plunger 140 is at all times biased by a spring 146 towards the center of the rotary switching mechanism. The movement of the plunger 144 and the contact 142 away from the stationary contact 20a is limited by a shoulder 128a, as clearly seen by referring to Figure 4. The shaft 104 carries a cam 150 provided with a cam lobe 154 engaging the plungers 140 during each cycle of rotation, so as to close the contacts 20 and 144 once for each revolution of the cam.

The cam lobe 154 is so shaped that the plungers 140 hold the contacts in closed position for a short period of time. This is very highly desirable, especially in high speed engines having a great number of cylinders, as for example, 24 cylinder engines. In such engines it is quite desirable to close the contacts for a sufficient period of time for the current to build up to the maximum value before the cam lobe clears the plunger, permitting the spring 146 to break the contact, so as to interrupt the current flow. The shape of the cam lobe 154 is dependent upon the number of cylinders used and the speed of the engine, together with the electrical constants found in the electrical circuit. The period of time that the contacts should be closed may be ascertained very accurately mathematically. For the purpose of this application, these calculations are not deemed necessary.

In radial type engines, even though the cylinders are equally spaced angularly as far as physical location is concerned, the shape and the arrangement of the crank arms and the movement of the pistons are such that the relative period of time between the firing of the several cylinders may vary 9° for a seven cylinder engine. That being the case, it is very desirable to provide a rotary switching mechanism such that each cylinder may be timed individually. In the present embodiment, this has been accomplished by angularly shifting or adjusting the insulated contact mountings 128 by merely loosening the set screws 160 and 162, which permits an angular adjustment of the insulated contact mounting on members 124 and 126, to thereby change the relative timing of the individual cylinders. This is a very desirable feature, in that the same cam lobe is then used to actuate all of the plungers before the timing of the plungers is effected by angular displacement or adjustment of the plungers without in any manner changing the cam lobe. This permits accurate adjustment of the timing of the firing of the several cylinders, without changing the cam lobe or the angular position of the cam lobe contacting the plungers.

By this arrangement there is one movable contact for each stationary contact within the rotary switching mechanism, so that in the event one of the movable contacts should fail, it would not incapacitate the entire engine, as would be the case in the event the contact were mounted for rotary movement so that the movable contact would contact each of the stationary con-

tacts in turn, as is the case in some of the conventional types of ignition systems now appearing on the market.

Due to the flexibility of arm 144, the movable contact has a slight sliding movement with respect to the stationary contact while contact is made. This insures a good contact. There is sufficient flexibility in member 144 to permit this wiping action. The snap action of the spring 146 results in a rapid break of the contacts, thereby reducing arcing.

Although the preferred modification of the device has been described, it will be understood that within the purview of this invention various changes may be made in the form, details, proportion and arrangement of parts which generally stated consist in a device capable of carrying out the objects set forth, in the novel parts, combination of parts and mode of operation, as disclosed and defined in the appended claims.

Having thus described our invention, we claim:

1. A rotary switching mechanism for use in an ignition system for a multi-cylinder internal combustion engine, said rotary switching mechanism including a housing provided with a circular inner wall, a plurality of circularly disposed sectors nested within the housing, arcuate supporting means fixedly mounted in the sectors, contact mounting means mounted for individual adjustment upon the arcuate supporting means, a plurality of stationary and movably mounted contacts carried upon the contact mounting means, and a cam for actuating the movable contacts at cyclic intervals, the adjustment of said contact mounting means upon the arcuate supporting means changing the relative timing of the closing of the contacts.

2. A rotary switching mechanism for use in an ignition system for a multi-cylinder combustion engine, said rotary switching mechanism including a housing, a plurality of arcuate supporting members fixedly mounted in the housing, a plurality of contacts, contact mounting members mounted for individual adjustment upon the arcuate supporting means, each contact mounting member supporting a pair of contacts, one of which is movably mounted for making and breaking the circuit, and a cam for actuating the movable contacts at cyclic intervals, the adjustment of said contact mounting means upon the arcuate supporting means changing the relative timing of the closing of the contacts.

3. A rotary switching mechanism for use in an ignition system for a multi-cylinder combustion engine, said rotary switching mechanism including a housing, a plurality of arcuate supporting members fixedly mounted in the housing, a plurality of pairs of contacts, a plurality of sectors circularly disposed within the housing, there being one sector for each pair of contacts, arcuate wire-like supporting members mounted in the sectors, contact mounting members mounted for individual adjustment upon said arcuate wire-like supporting members, each contact mounting member supporting a pair of contacts, one of which is movably mounted for making and breaking the circuit and a cam for actuating the movable contacts in seriatim at cyclic intervals, the adjustment of said contact mounting means upon the arcuate wire-like supporting members changing the relative timing of the closing of the contacts.

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