

May 3, 1966

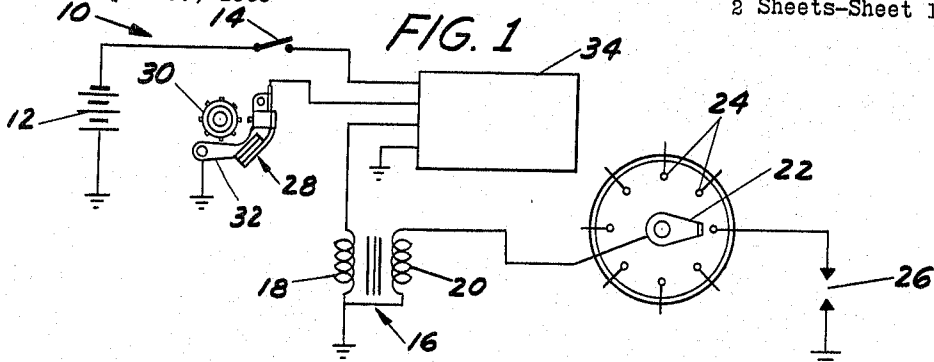
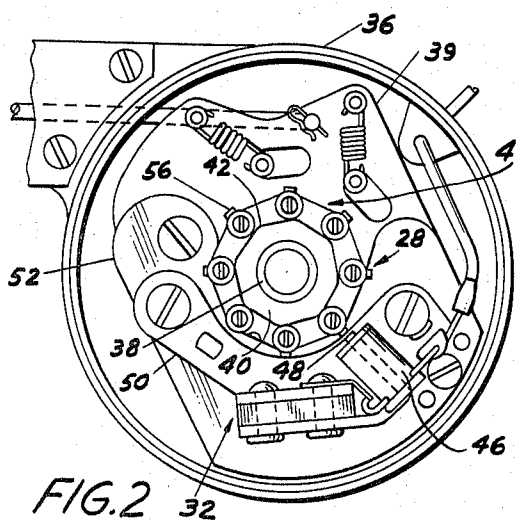
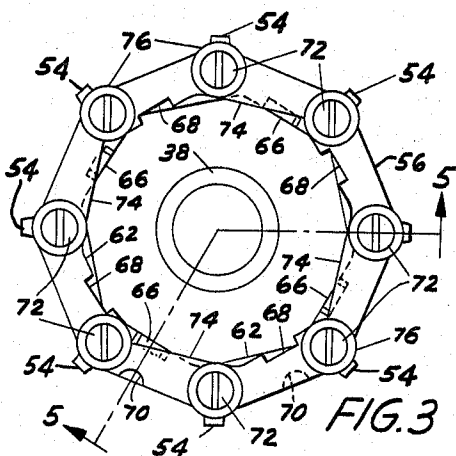
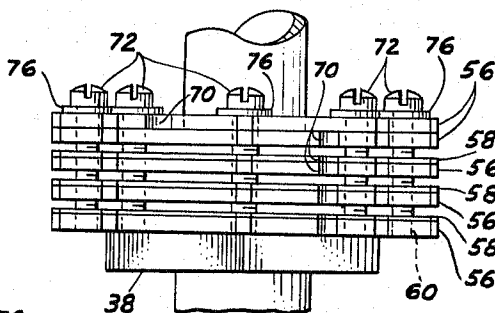
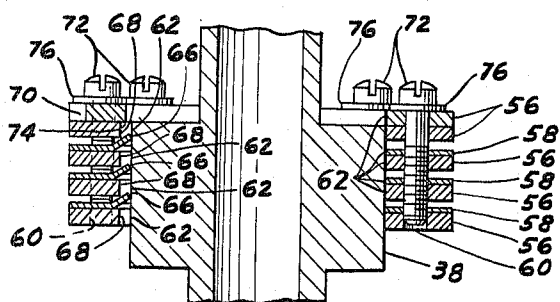
K. S. JOHNSON ETAL

3,249,707

IGNITION DISTRIBUTOR

Filed Sept. 30, 1963

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

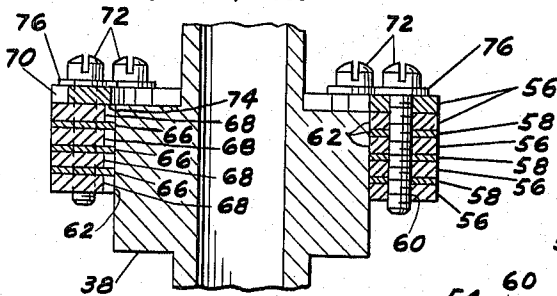


FIG. 6

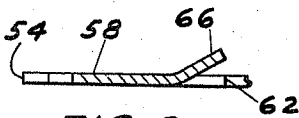


FIG. 8

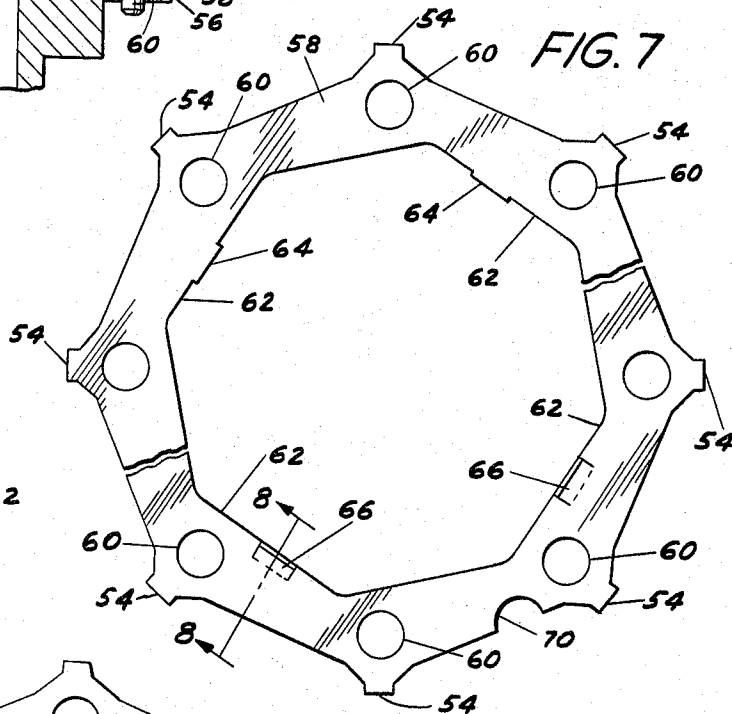


FIG. 7

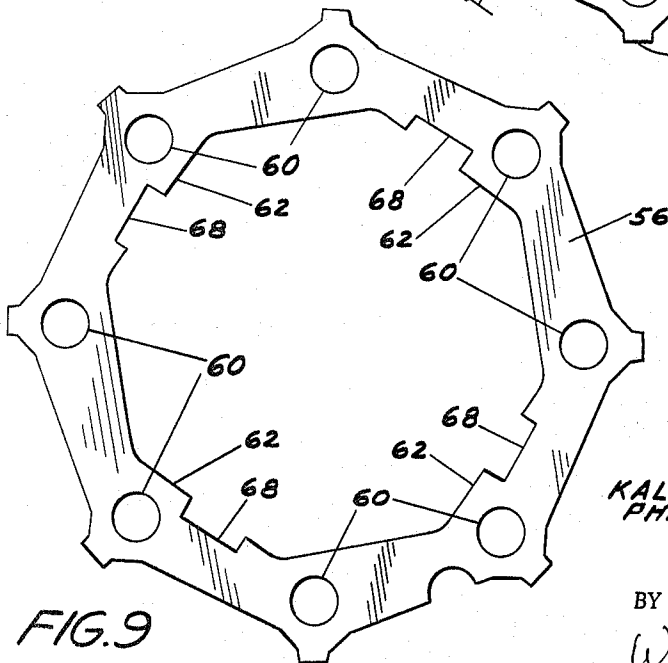


FIG. 9

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3,249,707

IGNITION DISTRIBUTOR

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Filed Sept. 30, 1963, Ser. No. 312,535
10 Claims. (Cl. 200—19)

This invention relates generally to ignition systems for internal combustion engines, and more particularly to a means for retrofitting a breaker contact-controlled system to provide a pulse generator type semi-conductor-controlled system.

The most common ignition system for an internal combustion engine includes an ignition coil and a so-called ignition distributor, the latter comprising a housing containing a set of breaker contacts operated by a multi-lobed cam driven by the distributor shaft so that opening of the contacts induces a relatively high voltage in the primary winding of the ignition coil. Such an ignition distributor is shown in Larges et al. 3,062,929.

One problem with the above type of ignition system is that arcing at the breaker contacts results in their deterioration so that they must be periodically replaced. To cope with this problem, ignition systems have been proposed wherein switching of the primary coil current is accomplished by a semi-conductor device such as a transistor, rather than by a set of breaker contacts. In such systems, the transistor must be pulsed or triggered so that its switching function is accomplished in proper timed relation to the operation of the engine. While some of these proposed systems employ the prior breaker contacts to pulse the semi-conductor, a more desirable system is to completely eliminate the breaker contacts and substitute therefor a pulse generator having only one moving part, a so-called pulse wheel. Such a system is shown by Johnson 2,852,589.

As proposed in U.S. application Serial No. 309,790, entitled Ignition Distributor and filed on September 18, 1963 in the name of Robert K. Frank, it is believed that a novel and advantageous approach is to retrofit existing breaker contact-controlled ignition systems in a manner such that the ignition distributor unit thereof serves as the pulse generator. To accomplish this retrofit, it is necessary to convert the cam of the existing distributor to a pulse wheel having more discrete projections than the lobes on the cam so as to produce voltage pulses of proper magnitude and shape.

While the above referenced application discloses novel and inexpensive means of converting the came to a pulse wheel, the specific structure proposed therein may have certain objections in the assembly and retention thereof to the cam because the cam surface is very hard and smooth and because the distributor is subject to such things as engine heat and lubricating oil. That is, the nature of the cam and the conditions encountered, as well as the relatively high rotational speed of the distributor shaft, may present problems in properly mounting and retaining the pulse wheel on the cam.

Accordingly, an object of this invention is to provide a retrofit type pulse wheel assembly that will produce more suitable voltage signals than the distributor cam and that has novel means for locating and rigidly securing the same to the cam so as to prevent any shifting thereof in use.

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Another object of the invention is to provide such a pulse wheel assembly that is easy to manufacture and assemble on a distributor cam without removing the distributor from the engine.

Other objects and advantages of the invention will become more apparent when reference is made to the following specification and accompanying illustrations wherein:

FIGURE 1 is a schematic illustration of a semi-conductor-controlled magnetically-pulsed ignition system; FIGURE 2 is a plan view of a prior art distributor retrofitted in accordance with the invention for use in the system shown in FIGURE 1;

FIGURE 3 is an enlarged plan view of the cam and pulse wheel assembly shown in FIGURE 2;

FIGURE 4 is a side elevational view of the assembly, as viewed from line 4—4 of FIGURE 3;

FIGURE 5 is a cross sectional view taken on the plane of line 5—5 of FIGURE 3 and looking in the direction of the arrows;

FIGURE 6 is a view similar to FIGURE 5, but illustrating the pulse wheel assembly in the locked condition;

FIGURE 7 is an enlarged plan view of one of the elements making up the assembly shown by FIGURES 3—6;

FIGURE 8 is an enlarged cross-sectional view taken on the plane of line 8—8 of FIGURE 7 and looking in the direction of the arrows;

FIGURE 9 is an enlarged plan view of another element of the assembly shown by FIGURES 3—6.

Referring now to the drawings in greater detail, FIGURE 1 illustrates schematically a typical transistor-controlled ignition system 10, including the usual battery 12, ignition switch 14, ignition coil 16 having a primary winding 18 and a secondary winding 20, rotor 22 and distributor cap terminals 24, a spark plug 26 of which there would be one for each engine cylinder, a pulse generator 28 including a pulse wheel 30 and a magnetic pick-up 32, and a pulse amplifier and switching unit 34. Such a system is generally familiar to those versed in the ignition art.

FIGURE 2 illustrates a prior art distributor, such as that shown by Larges, having the rotor and cap removed and retrofitted in accordance with the invention to provide a pulse generator 28 for use in the ignition system shown by FIGURE 1. The distributor includes a housing 36 having an engine driven shaft 38 extending therethrough and through the movable breaker plate 39 and a cam 40 formed or fitted on the shaft, the cam having the same number of lobes 42 as there are cylinders on the engine.

By reference to Larges, it will be observed in FIGURE 2 that the prior art breaker contacts and condenser have been removed from the breaker plate 39. The pulse generator 28 comprises generally a pulse wheel assembly 44 applied to and secured to the distributor cam 40 and the magnetic pick-up device 32. The latter device includes a coil 46 wound around a magnetized core 48 secured to a bracket 50 that may be adjustably mounted either directly on the breaker plate 39 in the same manner as the replaced breaker contacts or on the adaptor plate 52 which is in turn secured to the breaker plate 39.

The pulse amplifying and switching unit 34, which, like the magnetic pick-up 32 and the adaptor plate 52, forms no part of this invention, includes suitable semi-conductor and/or other components for amplifying the relatively

low voltage pulse or signal produced when a projection 54 on the pulse wheel assembly 44 disturbs the magnetic field around the coil 46 of the magnetic pick-up device 32. As is well known in the art, each such pulse triggers a semi-conductor element, causing it to switch primary coil current, in a manner similar to operation of the breaker contacts in conventional ignition systems.

The specific pulse wheel assembly 44 contemplated by the invention is illustrated in the assembled condition in FIGURES 3-6. It comprises a generally circular body formed by properly stacking a plurality of thicker pulse wheel members 56 and thinner locking members 58. However, before discussing the assembly 44, the structures of the individual pulse wheel and locking members will be discussed.

One of the locking members is illustrated in FIGURES 7 and 8. It will be noted in FIGURE 7 that the locking member 58 is shown as being cut in half, merely to illustrate two possible steps in the manufacture thereof.

It will be seen that the locking member is generally circular and that it may be formed by stamping a relatively thin metal sheet. While FIGURE 7 is greatly enlarged in order to better illustrate the details of construction, it will be noted that the inner periphery of the member 58 forms an octagonal opening conforming to the shape of the cam, the opening being slightly larger than the cam 40 so that the member 58 may be fitted over the cam without interference. The outer periphery of the member 58 is formed to provide the same number of distinct radially extending projections 54 as there are lobes 42 on the cam 40. A circular opening 60 is formed at each projection for a purpose to be described.

Looking again at the inner periphery of the member 58, and particularly at the upper half of FIGURE 7, it will be noted that alternate straight edges 62 are formed with inwardly extending projections 64. Referring now to the lower half of FIGURE 7 and to FIGURE 8, it will be seen that the metal has been sheared at the ends of the projections 64 and that the resulting tab 66 has been bent upwardly at some angle, in this case about 30°, so that the free end of the tab, when projected to the plane of the otherwise flat member 58, lies approximately on the straight edge 62. In other words, the member shown by FIGURE 7 may be formed in two steps. That is, the member 58 may be first stamped from sheet metal to provide the configuration shown in the upper half of FIGURE 7 and then sheared and bent to provide the configuration shown in the lower half of FIGURE 7. It will thus be seen that the member 58 may be fitted over the cam without interference by the four tabs 66.

FIGURE 9 illustrates one of the pulse wheel members 56. While it is preferably formed from relatively thicker metal, it will be seen that it may also be formed by stamping, just as in the case of the locking member 58, and that its dimensions and configuration are substantially the same as the locking member. That is, the inner periphery of the member 56 conforms to the shape of the cam 40, and it is formed with the outer projections 54 and the circular openings 60. However, the projections 64 formed on the locking member are not formed on the pulse wheel member; instead, the alternate straight edges 62 of the inner periphery of the member 56 are formed with notches 68, the notches being longer than the width of the tabs 66 and for a purpose to be described. Thus, the pulse wheel members may also be fitted over the cam 40 without any interference.

It will be observed that the outer projections 54 on both the locking member 58 and the pulse wheel member 56 are offset some predetermined amount, 12° for example, from the cam lobes 42. This offset may or may not be required, depending upon the particular ignition distributor being retrofitted, the criterion being that the projections 54 have the same relationship with the cam lobes 42 when the pulse wheel assembly 44 is applied to the cam 40 as the relationship between the cam lobes and the rubbing

block of the movable breaker arm in the distributor before it was retrofitted.

It will also be noted that both the locking member 58 and the pulse wheel member 56 are formed at the outer periphery thereof with a notch 70 or other means of insuring that the members are stacked so that like projections 54 are at the same location. It is important, once a plurality of locking and pulse wheel members are stacked as shown in FIGURES 3-6, that the width of a particular vertical row of projections 54 be constant over the entire height thereof so that a proper pulse signal is provided. If like projections 54 were not aligned, it is conceivable that the projections making up a row would be staggered so as to give the effect of a wider row. Such a notch also generally facilitates assembly, since when the notches are lined up proper assembly is assured.

Referring now to FIGURES 3-5, it will be seen that the pulse wheel assembly 44 is made by properly stacking three locking members 58 between four pulse wheel members 56 and then placing an extra pulse wheel member 56 on top of the stack. The openings 60 in all of the members 56 and 58, except the bottom member 56, are of sufficient diameter to allow the screws 72 to be inserted through the stack, the openings in the bottom member 56 being threaded to engage the screws 72.

It will also be noted in FIGURE 3 that the top pulse wheel member 56 is offset or rotated with respect to the other members in the assembly by one opening 60. The result is that portions 74 of the top pulse wheel member 56 extend inwardly to engage the top of the cam in the area of the lobes 42, thus providing a method of properly positioning the assembly 44 on the cam 40.

In FIGURES 4 and 5, the screws 72, which are provided with lock washers 76, have not yet been tightened down, and the assembly 44 is loose. Referring to FIGURE 5, it will be noted that each pulse wheel member 56 positioned above a locking member 58 is separated vertically from the locking member because of the bent up tabs 66. It will also be noted that the tabs 66 do not extend appreciably beyond the lined up inner edges of the pulse wheel member 56, thus enabling the loose assembly 44 to be easily fitted over the cam 40.

After the loose assembly 44 is fitted over the cam so that the cam lobes 42 engage the inwardly extending portions 74 of the top pulse wheel member 56, the screws 72 are tightened so as to draw all of the locking members and pulse wheel members together, as shown in FIGURE 6. Since the edge forming the bottom of each slot 68 engages a bent up tab 66 in the loose condition of the assembly shown by FIGURE 5, tightening the screws causes the pulse wheel members to force the tabs downwardly into the plane of the locking members 58 from which the tabs are formed. When this occurs, the free ends of the tabs extend beyond the inner edges 62 sufficiently to grip the adjacent faces of the cam. In this tightened condition, the assembly 44 cannot be easily removed or shift during operation of the pulse generator 28. Removal is easily accomplished by the loosening of the screws.

The cam shown has eight lobes for an eight cylinder engine application. Accordingly, the inner periphery of the pulse wheel assembly has an octagonal axial passage and eight equally spaced rows of projections are formed at the outer periphery thereof. In the particular design shown, four tabs are provided on the locking members, and four notches are provided in the pulse wheel members to receive the tabs in the loose condition shown by FIGURE 5. Obviously, different configurations would be provided for four and six cylinder applications, and other minor modifications may be made within the scope of the invention.

It is apparent that the laminated type pulse wheel assembly 44 shown is adapted to be inexpensively manufactured and very easily assembled and that effective means are provided to lock the assembly on a cam having hard smooth surfaces. Heat and the presence of lubri-

cating oil cannot deteriorate the assembly or cause it to loosen. An assembly of this type can be easily made for any existing distributor cam, and retrofit of a prior art distributor can be accomplished by any unskilled person without removing the distributor from the engine and without having to resort to any special tools or equipment. Any misalignment of the projections relative to the lobes of the cam that would effect timing may be corrected by a minor radial adjustment of the magnetic pick-up unit relative to the pulse wheel.

Although but one embodiment of the invention has been disclosed, it is apparent that other modifications are possible within the scope of the appended claims.

What we claim as our invention is:

1. A device for converting an ignition distributor having a multi-lobe cam mounted on the distributor shaft and adapted to open and close a set of breaker contacts to a distributor having a pulse wheel driven by the distributor shaft, said device comprising a generally cylindrical body having discrete equally spaced magnetically permeable projections extending radially from the outer surface thereof, said body having an axial opening conforming closely to the shape of said cam and adapting the same to be fitted over said cam, one end of said body having portions extending over said opening to provide shoulders for engaging the top of said cam and thereby limiting the extent to which said body may be applied over said cam, the inner surfaces of said body at said opening having means for frictionally engaging the exterior surface of said cam to prevent the removal thereof from said cam, and means for engaging and disengaging said last mentioned means.

2. A device such as that recited in claim 1, said device comprising a plurality of suitably formed ring-like members.

3. A device such as that recited in claim 2, wherein said engaging means comprises tabs extending from the inner periphery and bent out of the plane of some of said members, the free ends of said tabs frictionally engaging said cam.

4. A device for converting an ignition distributor having a multi-lobe cam mounted on the distributor shaft and adapted to open and close a set of breaker contacts to a distributor having a pulse wheel driven by the distributor shaft, said device comprising a generally cylindrical body consisting of a stack of generally circular plates and having discrete equally spaced magnetically permeable projections extending radially from the outer surface thereof, there being the same number of projections as there are lobes on said cam, said body having an axial opening conforming closely to the shape of said cam and adapting the same to be fitted over said cam, one end of said body having portions extending over said opening to provide shoulders for engaging the top of said cam and thereby limiting the extent to which said body may be applied over said cam, the inner surfaces of said body at said opening having means for frictionally engaging the exterior surface of said cam to prevent the removal thereof from said cam, and means for engaging and disengaging said last mentioned means.

5. A pulse wheel for a magnetically-pulsed, semiconductor-controlled type internal combustion engine ignition system, said pulse wheel comprising an ignition distributor shaft, said shaft having formed thereon a cam having the same number of lobes as there are cylinders in said engine, and a retrofit pulse wheel assembly mounted on said cam, said assembly comprising a generally cylindrical body consisting of a properly stacked plurality of generally-similar ring members, the top ring member of said assembly having inwardly extending portions for engaging the top of said cam and thereby positioning said assembly with respect to the axis of said cam, some of said ring members having inwardly extending tabs bent out of the plane thereof, said tabs being straightened so

that they grip the outer surfaces of said cam when said ring-like members are clamped together, said assembly having means for clamping said members.

6. An element for converting an ignition distributor having a multi-lobe cam mounted on a distributor shaft and adapted to open and close a set of breaker contacts to a distributor having a pulse wheel driven by the distributor shaft, said element comprising a relatively thin ring-like member having an inner periphery generally conforming to the shape of said cam, at least one tab extending inwardly from the inner periphery of said element and bent out of the plane thereof to the extent that the project of the free end of said bent tab lies substantially along said inner periphery, the free end of said tab when bent back into the plane of said element extending inwardly beyond said inner periphery, the outer periphery of said element being formed with equally spaced discrete projections, there being the same number of projections as there are lobes on said cam, and an opening adapted to receive a screw formed in said member adjacent each of said projections.

7. An element for converting an ignition distributor having a multi-lobe cam mounted on a distributor shaft and adapted to open and close a set of breaker contacts to a distributor having a pulse wheel driven by the distributor shaft, said element comprising a relatively thin ring-like member having an inner periphery generally conforming to the shape of said cam, at least one tab extending inwardly from the inner periphery of said element and bent out of the plane thereof to the extent that the projection of the free end of said bent tab lies substantially along said inner periphery, the free end of said tab when bent back into the plane of said element extending inwardly beyond said inner periphery, the outer periphery of said element being formed with equally spaced discrete projections, there being the same number of projections as there are lobes on said cam, and an opening adapted to receive a screw formed in said member adjacent each of said projections, said projections being offset radially a predetermined amount from that portion of said inner periphery adapted to receive a cam lobe.

8. An element for converting an ignition distributor having a multi-lobe cam mounted on a distributor shaft and adapted to open and close a set of breaker contacts to a distributor having a pulse wheel driven by the distributor shaft, said element comprising a relatively thin ring-like member having an inner periphery generally conforming to the shape of said cam, the outer periphery of said element being formed with the same number of equally spaced discrete projections as there are lobes on said cam, an opening formed adjacent each projection for receiving a screw, the inner periphery of said element being formed in said member with at least one notch.

9. A device for converting an ignition distributor having a multi-lobe cam mounted on the distributor shaft and adapted to open and close a set of breaker contacts to a distributor having a pulse wheel driven by the distributor shaft, said device comprising a generally cylindrical body having discrete equally spaced magnetically permeable segments near the outer surface thereof, said body having an axial opening receiving said cam, one end of said body having portions extending over said opening to provide shoulders for engaging the top of said cam and thereby limiting the extent to which said body may be applied over said cam, said body having means for frictionally engaging the exterior surface of said cam to prevent the removal thereof from said cam, and means for engaging and disengaging said last means.

10. An ignition distributor of the type wherein current flow to the primary winding of the ignition coil is controlled by the semiconductor device triggered by a pulse generator operated by a distributor comprising a housing, a shaft mounted for rotation in said housing, a multi-lobed cam provided on said shaft, a pulse wheel fitted on said

cam, comprising a generally cylindrical body having discrete equally spaced magnetically permeable segments near the outer surface thereof, said body having an axial opening receiving said cam, one end of said body having portions extending over said opening to provide shoulders 5 for engaging the top of said cam and thereby limiting the extent to which said body may be applied over said cam, said body having means for frictionally engaging the exterior surface of said cam to prevent the removal thereof 10 from said cam, and means for engaging and disengaging said last means.

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