Nov. 24, 1970 F. J. MORAY 3,542,976

DISTRIBUTOR CAP AND ROTOR COMBINATION WITH COMPLETELY REMOVABLE STATIONARY ELECTRODE AND BROAD CONTACT FACE MOVABLE ELECTRODE

Filed Aug. 18, 1967 2 Sheets-Sheet 1

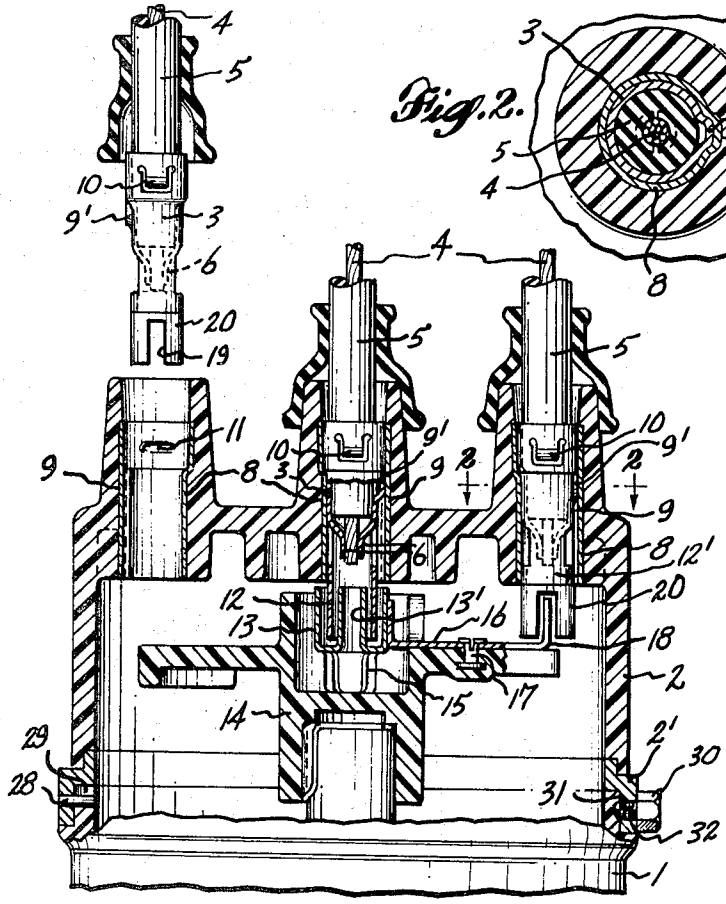


Fig. 1.

Fig. 2.

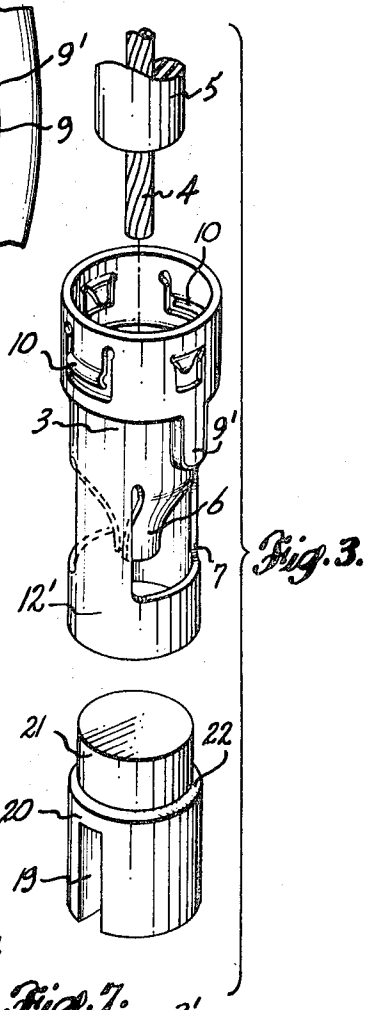


Fig. 3.

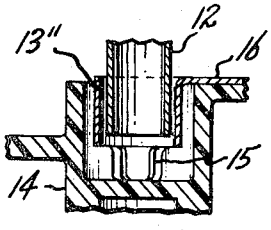


Fig. 4.

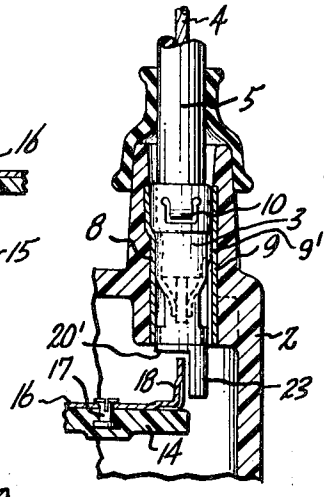


Fig. 5.

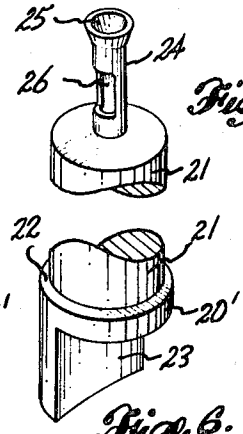


Fig. 6.

Fig. 7.

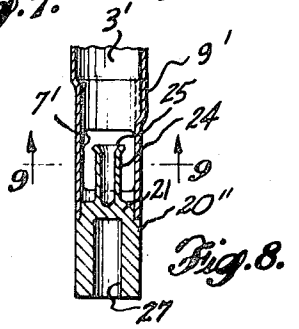


Fig. 8.

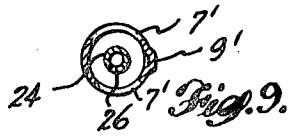


Fig. 9.

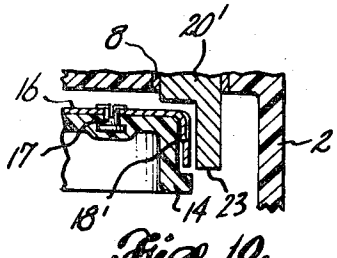


Fig. 10.

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DISTRIBUTOR CAP AND ROTOR COMBINATION WITH COMPLETELY REMOVABLE STATIONARY ELECTRODE AND BROAD CONTACT FACE MOVABLE ELECTRODE

Filed Aug. 18, 1967

2 Sheets-Sheet 2

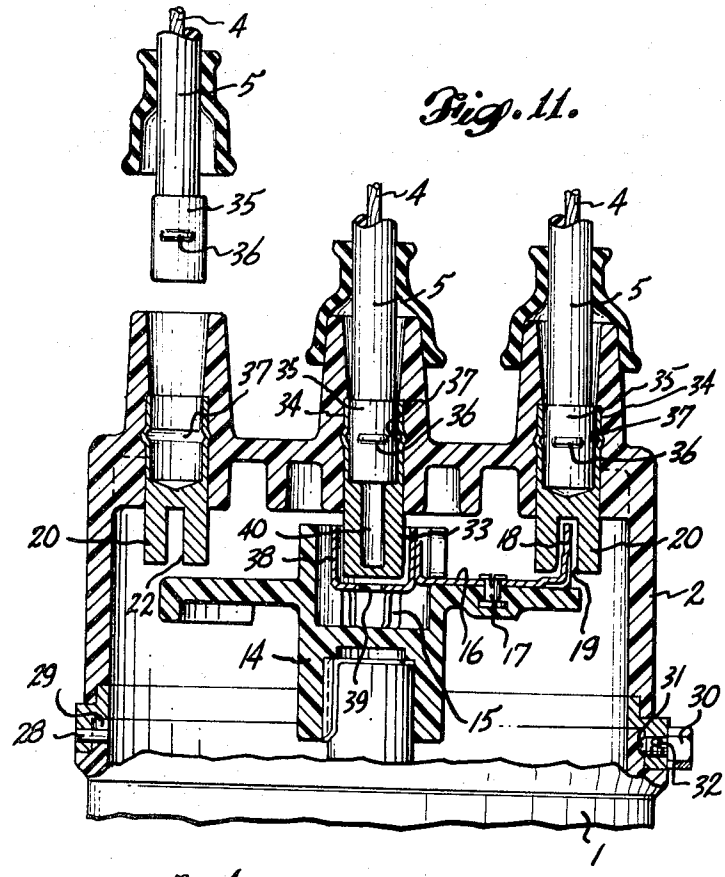


Fig. 11.

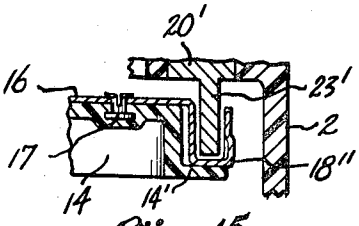


Fig. 15.

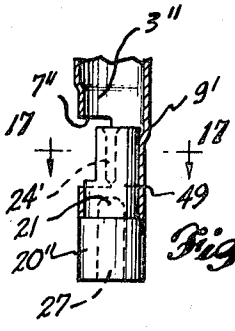


Fig. 16.

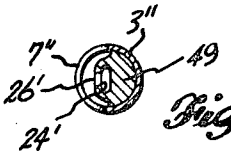


Fig. 17.

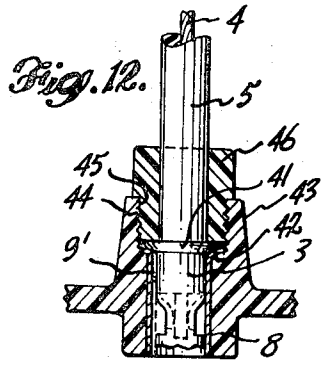


Fig. 12.

Fig. 18.

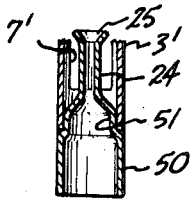
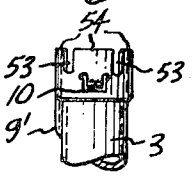


Fig. 20.



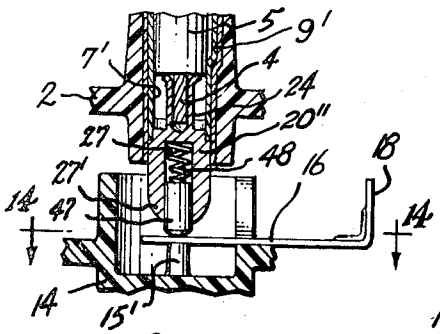


Fig. 13.

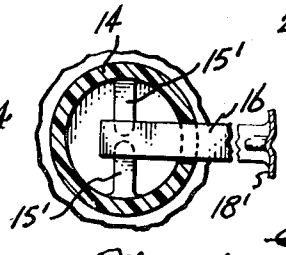


Fig. 14.

Fig. 19.

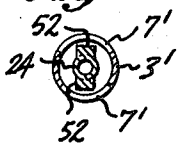




Fig. 21.

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DISTRIBUTOR CAP AND ROTOR COMBINATION WITH COMPLETELY REMOVABLE STATIONARY ELECTRODE AND BROAD CONTACT FACE MOVABLE ELECTRODE

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U.S. Cl. 200—24 12 Claims

ABSTRACT OF THE DISCLOSURE

The cap and rotor electrodes have overlapping electrode faces of large area, such as interfitting grooves and flanges, interfitting cups and cylinders and opposed facing plates which facilitate current transfer. The distributor cap electrodes can be solid or of sheet structure. The wires can be attached to terminals integral with the distributor cap electrodes. Alternatively, terminals on such wires can snap into sockets in the cap electrodes. The wire ends can be secured to the terminals or electrodes by lugs crimped against the wire ends or such wire ends may be inserted into sockets of the electrodes or terminals.

Conventional internal combustion engine ignition systems have not transmitted electric current efficiently from the ignition coil to the spark plugs of internal-combustion engines which has been one of the factors responsible for inefficient engine operation. Such inefficiency resulted from insufficient opposing areas at gaps in the secondary circuit across which current passes.

It is a principal object of the present invention to provide a distributor structure for reducing the number of gaps in the secondary circuit and for improving the transfer of electricity across unavoidable gaps, such as from the distributor cap to the rotor, by increasing the electrode area at opposite sides of such gaps, for producing an ignition spark of higher intensity energy.

The result of such improved electrode and electrode-connection structure is to decrease leakage of high-voltage electricity to ground and provide a more intense spark across the spark plug gaps so as to cause combustion of the fuel in the engine cylinders to be completed more quickly. Also the sparks are more uniform from cylinder to cylinder. As a result, the noise and vibration of the engine is reduced, the engine produces more power and it operates more economically.

A further object is to prevent corona leakage from the distributor cap to ground through the conventional cap-retaining spring.

FIG. 1 is a central vertical transverse section through a preferred type of distributor cap and rotor combination, a terminal and electrode unit being shown in exploded relationship, and FIG. 2 is a detail section taken on line 2—2 of FIG. 1.

FIG. 3 is a top perspective of a wire terminal and electrode structure showing the parts in exploded relationship.

FIG. 4 is a fragmentary central vertical section through an alternative type of rotor structure.

FIG. 5 is a central vertical section through an alternative type of side electrode structure and FIG. 6 is a top perspective of a portion of such electrode structure.

FIG. 7 is a top perspective of a fragmentary portion of an electrode and FIG. 8 is a central vertical section throuhg an electrode utilizing structure of the type shown in FIG. 7.

FIG. 9 is a transverse section through such structure taken on line 9—9 of FIG. 8.

FIG. 10 is a detail vertical section through a portion of a side electrode structure of a different form.

FIG. 11 is a central vertical section through a distributor cap and rotor combination, a terminal and electrode unit being shown in exploded relationship, of a type different from that illustrated in the preceding figures.

FIG. 12 is a fragmentary vertical section through a different type of terminal structure.

FIG. 13 is a central vertical section through another type of electrode structure. FIG. 14 is a transverse section taken on line 14—14 of FIG. 13.

FIG. 15 is a detail vertical section through another form of side electrode structure.

FIG. 16 is a side elevation of still a different form of terminal and electrode, with parts broken away, and FIG. 17 is a transverse section through such terminal taken on line 17—17 of FIG. 16.

FIG. 18 is a central vertical section through another type of terminal.

FIG. 19 is a transverse section through still a different terminal.

FIG. 20 is a fragmentary side elevation of a portion of a terminal showing another type of structure.

FIG. 21 is a transverse section through a terminal showing still another type of structure.

The distributor base 1 and cap 2 may be of the type conventionally used for automotive purposes, such as automobile engines, except for the structure provided for receiving the supply and distribution wires and transferring electricity between them. In order to provide a secure and effective connection between a supply or distribution wire and a distributor cap electrode, a terminal 3 may be provided into which the end of a wire 4 and its insulation 5 can be inserted, as indicated in FIGS. 1, 2 and 3. The wire end can be placed in position between wire-engaging lugs 6 and such lugs can be crimped toward each other to pinch the end of wire 4 tightly between them by inserting suitable tools through apertures 7 in the opposite sides of the terminal 3. To solder the connection the tools may be heated.

Such terminal can be inserted into the appropriate bore of the distributor cap by sliding the terminal axially of such bore, in which bore a metal liner 8 has been installed. One side of such liner has a keyway 9 for receiving a projection 9' of the terminal constituting a key. Interengagement of the projecting key 9' in the keyway 9 will insure that the terminal 3 is positioned in the proper rotative relationship in the particular distributor cap before in which it is inserted. Each terminal can be secured in its bore by a spring leaf detent 10 engaging in a recess 11 in the liner 8. The engagement of such detents and recesses will, of course, not hamper appreciably intentional withdrawal of a wire and its terminal from a bore of the distributor cap.

It is preferred that the terminal and the electrode for each wire be formed as an integral structure. One type of construction, according to this principle, is utilized for the central supply wire in FIG. 1. In this figure the electrode 12 is formed simply as a tubular cylindrical extension of the terminal 3 so that when the terminal is inserted fully into the central bore of the distributor cap, the electrode will project a substantial distance downward below the inner surface of the cap into the electrode cup 13 mounted in the distributor rotor 14 on the upper edges of supporting fins 15 molded integrally with the bottom of the rotor cavity. Preferably, the cup 13 is of annular channel shape having an inner upstanding cylindrical wall 13' of sheet structure the principal faces of which are parallel to and concentric with the axis about which the rotor rotates and the inner wall of which is spaced from the outer wall of the cup so that the cylindrically tubular stationary electrode 12 fits down into the annular cup spaced approximately equidistantly from the outer

cup wall and the inner cup wall **13'**, providing facing areas generally parallel to the rotor's axis.

From the electrode cup **13** a conductor strip **16** extends radially outward along the arm of the distributor rotor to which such strip is secured by a split rivet **17**, the head of which is embedded in the molded plastic material of which the distributor rotor is made. The outer end of such strip is turned upwardly to form an electrode flange **18** of sheet structure including a narrow top edge joining opposite upright broad side faces which are substantially parallel to the axis about which the rotor rotates. The opposite faces of this flange are in opposed facing relationship to the opposite sides of a slot **19** in each distributor cap side electrode **20** through which the rotor electrode flange passes edgewise as the rotor rotates. Engagement of the keys **9'** in the keyways **9** of the side terminal assemblies will maintain the slots **19** oriented circumferentially of the distributor cap so that the rotor electrode flange can pass through the slots in such fashion.

More effective transfer of electricity may be effected if the electrodes are of solid construction rather than being of sheet metal construction. In the type of structure shown in FIGS. 1 and 3, the side electrodes **20** are shown as being of cylindrical shape with the slots **19** being cut in their lower ends. Their upper ends are reduced to form a plug **21** of a size to fit within the hollow cylindrical end of a terminal **3**. The reduction in size between the lower and upper portions of such side electrodes corresponds to the exterior and interior dimensions of the tubular end **12'** of the terminal **3** so that such tubular end can fit over the electrode plug **21** and abut the shoulder **22** at its base. Such tubular terminal end **12'** and electrode plug **21** can be bonded together to form an integral structure such as by soldering or a copper-brazing procedure. Consequently, when the terminal **3** of a side distribution wire **4** is pulled out of the distributor cap **2**, not only the terminal **3** but also the electrode **20** will be withdrawn from the distributor cap.

The alternative type of central supply-electrode structure shown in FIG. 4 includes the same type of hollow cylindrical distributor cap supply electrode **12**, as shown in FIG. 1, but in this instance the electrode could, if desired, be of solid structure. The central rotor electrode **13'**, in this instance, is formed simply as a tube **13''** on the end of the rotor arm conductor strip **16** into which the distributor cap electrode **12** fits in overlapping relationship. It will be evident that there is still a large area of closely adjacent overlapping electrode faces between which electricity can flow from the distributor cap supply electrode **12** to the distributor arm conductor electrode **13''**, although the opposed transfer area of the electrodes is considerably less than in the structure shown in FIG. 1.

The modified type of side distributor cap electrode shown in FIGS. 5 and 6 also provides an overlapping electrode transfer area considerably less than afforded by the structure of FIGS. 1 and 3, but the area is still much greater than in conventional distributor structures. In this construction, the overlapping electrode transfer area is approximately half as great as that provided by the construction of FIGS. 1 and 3 because in this instance the electrode body **20'** has only one projection **23** extending downward alongside the rotor electrode flange **18** instead of the distributor cap electrode having bifurcations forming the slot **19** to provide electrode surfaces opposite both sides of the rotor electrode flange. The electrode **20'** can be mounted in a terminal **3** in the manner explained in connection with FIGS. 1 and 3 so that the electrode would be integral with the terminal.

In FIGS. 7, 8 and 9, another type of connection for a supply or distribution wire is shown in which the wire end **4** would be attached directly to an electrode instead of being attached to a terminal which, in turn, is attached to an electrode. In this instance, a wire-receiving socket **24** is formed integral with the reduced end **21** of the electrode. The upper end of such tube has a flared opening **25** to facilitate reception of the wire end. Such tube can be crimped onto the wire end through openings **7'** in the opposite sides of the terminal **3'**, if desired, or an aperture **26** may be provided in one side of the tube through which solder can be supplied to bond the wire end to the socket **24**. The electrode using this type of wire attachment could be either a central electrode or a side electrode. If it were a central electrode **20''** of solid type, as shown in FIG. 8, a cavity **27** could be provided in its lower end to save metal and to enable such an electrode to be used with an electrode of the annular cup type, such as **13**, **13'** shown in FIG. 1, if desired. Alternatively, of course, such an electrode could be used with the type of electrode **13''**, as shown in FIG. 4.

In FIG. 10 the same type of distributor cap side electrode **23** as described in connection with FIGS. 5 and 6 is shown, but in this instance the construction of the rotor **14** is modified so that the conductor strip **16** is mounted higher than in the types shown in FIGS. 1 to 5. In this instance, the end of the arm-conductor strip **16** is bent downward to form an end flange **18'** disposed in overlaping relationship alongside the distributor cap side electrode **23**, both surfaces being generally parallel to the rotor's axis.

The distributor cap **2** can be held on the distributor body **1** in conventional fashion by providing a metal reinforcing ring **2'** encircling the lower edge of the distributor cap. A locating pin **28** projects inward from the ring **2'** at a position to fit into a registering notch **29** in the upper edge of the distributor base. The cap can then be secured into place by at least one, and preferably three, lock screws **30** threaded through the metal ring **2'** so that the inner end of the screw or screws will engage in a retaining recess or recesses **31**. Such lock screws can be held in place by a plastic pellet **32** received in a cavity in the screw thread to prevent it from becoming loosened inadvertently.

In FIG. 11 an alternative type of terminal construction is shown in which the wire terminals are separable from the distributor cap electrodes instead of those two components being integral, as discussed in connection with FIGS. 1 to 10. It should be understood, however, that the electrode structure shown in FIGS. 1, 3, 4, 5, 6, 8 and 10 could, if desired, be used in the type of combination terminal and electrode structure shown in FIG. 11, if desired. In both types of construction the imporant relationship of cap electrodes and the rotor electrodes is that each of the electrodes has a face of substantial area disposed generally parallel to the rotor's axis of rotation and such face of the stationary electrode and of the rotor electrode whether central electrodes or peripheral electrodes are disposable in closely adjacent face-to-face relationship for transmission of electricity. The electrode areas are stated to be "generally parallel" to the rotor's axis of rotation because it will be evident that such surfaces might be inclined to a greater or lesser extent relative to the rotor's axis without altering the operation of the structure.

In FIG. 11 all of the distributor cap electrode structures are shown as being solid. Thus, the side electrodes **20** are of the bifurcated or slotted type, such as shown in FIGS. 1 and 3, and the central electrode **33** is of the solid cylindrical type generally like that shown in FIG. 8. The difference in construction between the distributor of FIG. 1 and the distributor of FIG. 11 resides principally in the separability of the wire terminals and such electrodes and the permanent mounting of the electrodes in the distributor cap instead of such electrodes being withdrawn from the bores of the cap when the wires are pulled from them. Thus, in the structure of FIG. 11 each electrode is formed integral with a sheet metal liner **34** molded into the plastic cap. The cavity in each such liner is of a size to receive a terminal **35** secured onto the end of a supply or distribution wire. Each terminal is held in the cavity of its electrode by a projection or detent

36 on such terminal being engaged in an annular groove 37 in the liner portion of the electrode. In order to provide good electrical conduction between such terminal 35 and the liner 34, in which it is inserted, the fit between such terminal and such liner should be quite snug.

The central electrode 33 could fit into a rotor electrode 13'' of the type shown in FIG. 4, if desired. In FIG. 11, however, the cup electrode 38 is shown as having a bottom in it, although a scavening hole 39 is provided in such bottom through which dust particles may fall to keep the cup bottom clean. A hollow 40 can be provided in the solid electrode 33 to save some metal, while preventing dirt and moisture from entering the distributor cap; or, alternatively, the electrode structure shown in FIG. 8 could be used in which the cavity opens downward, but still a moisture barrier for the lower end of the terminal-receiving socket is provided.

In FIG. 12 a different arrangement for securing a terminal is separate from or integral with the electrode. In this instance, the upper end of the terminal has a flange 41 which fits on a seat 42 formed by the upper end of the liner, the neck 43 of the distributor cap bore has a female thread 44 with which the male thread 45 of a securing collar 46 can engage. Rotation of such securing collar will cause the interengaged threads to draw the inner end of such collar against flange 41 to press the terminal firmly into the distributor cap and hold it in place.

The electrode of FIG. 13 can be used with a terminal of the type shown in FIG. 1. The wire 4 is shown in this instance, however, as being received in a tube 24, such as illustrated in FIG. 7. The electrode 20'' can then be secured to a terminal 3', as shown in FIG. 8. A carbon button is fitted slidably in the downwardly opening cylindrical cavity 27. In this construction, the lower end 27' of the electrode 20'' can be rounded and shortened to provide a greater space between its lower end and conductor strip 16 in rotor 14. Such conductor strip can be supported on insulating ribs or fins 15' upstanding from the bottom of the rotor cavity. The carbon button or plunger 47 is urged downward by a spring 48 to assure good electrical contact between the plunger and the conductor strip. The lower end of such spring can be secured to a projection on the upper end of the plunger and the upper end of the spring can be flared to secure the spring in the cavity 27.

The side electrode in the arrangement of FIG. 15 can either be integral with the terminal as shown in FIG. 1 or separable from the terminal as shown in FIG. 11. The lower end of the electrode 20' is formed as a flattened projection 23' similar to the projection 23 shown in FIGS. 5 and 6, but in this instance the radially inner and outer sides are substantially flattened or concentric about the rotor's axis. The arm of rotor 14 has a shelf 14' projecting from the lower portion of its end to support a channel-shaped electrode 18'' formed on the end of the rotor-conductor strip 16. The depression between the sides of such channel is of a width sufficient to receive closely the electrode 23' projecting downward from the distributor cap.

The electrode and terminal structure shown in FIGS. 16 and 17 is best adapted for use in a distributor construction where the terminal and the electrode are integral in each instance. The terminal 3'' has a key 9', as shown in FIGS. 1 and 3, but only a single side aperture 7''. The reduced upper portion 21 of the electrode 20'', such as shown in FIG. 8, can be fitted into the lower end of the terminal and be bonded to it. In the upper end 49 of such electrode is a socket 24' adapted to receive the end of a connecting wire. Pressure can be inserted through the aperture 7'' onto the side of the electrode's upper end 49 to crimp such electrode end against the wire or the wire end can be soldered in place. In the latter case, an aperture 26', as shown in FIG. 17, can be provided in the side of the socket 24' through which solder can be supplied.

FIG. 18 shows an electrode and terminal arrangement providing a wire end socket 24 with a flared opening 25 generally like that shown in FIGS. 7 and 8. The terminal 3' can have apertures 7' in its opposite sides, as described for FIG. 8. In this instance, however, instead of the electrode being of solid construction, as shown in that figure, the electrode 50 is of shell or tubular structure having an upper reduced portion 51 which fits into and is bonded to the lower end of the terminal 3'. This type of electrode is similar to the hollow cylindrical electrode 12 of FIGS. 1 and 4 and can be used in installations of those types.

The electrode structure of FIG. 19 can be like that of FIG. 8 or 18. In these latter figures, however, a tool of special construction would be required to crimp the wire-receiving socket 24 tightly against the wire. By adding bosses 52 to the opposite sides of the wire-receiving socket 24, use of such a special tool is made unnecessary. Structure of this type enables the jaws of ordinary pliers to be moved through the opposite apertures 7' of the terminal 3' into engagement with such bosses for squeezing the tube 24 into flattened shape pressed against the wire in the socket.

FIG. 20 shows a terminal structure for holding the insulation of a supply or distribution wire as well as the wire end. The terminal otherwise may be of the type shown in FIGS. 1 and 3, for example. In this instance, three or more longitudinal slots 53 extend inward from the upper end of the terminal 3 to form tabs 54 between them. The ends of these tabs can be bent inward to bite into the insulation.

Where the wire insulation 5 is smaller than the interior of a terminal 3 or where it is desired to clamp the insulation in a manner different from that accomplished by the construction of FIG. 20, the terminal can be creased longitudinally at locations spaced circumferentially. Thus, in FIG. 21 the grooves 55 located at an angular spacing of 120° are formed by pressing the terminal inward locally to provide internal longitudinal ribs pressing against the wire insulation. The types of construction shown in FIGS. 20 and 21 can be utilized either with terminals of the type shown in FIGS. 1 and 3, for example, or with terminals of the type shown in FIG. 11.

It will be understood that for any particular distributor various structural features described above can be selected, but usually it would not be desirable to make one peripheral terminal integral with its peripheral from its peripheral electrode and another peripheral terminal separable from its peripheral electrode in the same distributor. It would not be objectionable, however, to have all of the peripheral terminals integral with their respective peripheral electrodes and the central terminal separable from its electrode.

I claim:

1. In an automotive distributor including a body, a rotor in the body, means mounting the rotor for rotation about an axis relative to the body, a movable electrode carried by the rotor and stationary electrodes carried by the body and arranged in cooperative relationship to the movable electrode, the improvement comprising the movable electrode having an electricity conducting portion of sheet structure including a narrow edge joining opposite broad side faces and disposed with one of its broad side faces generally parallel to the axis about which the rotor rotates, and at least one of the stationary electrodes having a broad face generally parallel to the axis about which the rotor rotates and disposable in axially overlapping, closely adjacent face-to-face relationship to said broad side face of said movable electrode sheet structure disposed generally parallel to the rotor's axis of rotation when such movable electrode broad side face is in registry with said stationary electrode broad face but spaced radially therefrom, for transmission of high voltage elec-

tricity between such closely adjacent broad faces of said electrodes through the intervening gap.

2. The combination defined in claim 1, in which one of the electrodes includes a collar coaxial with the rotative axis of the rotor, and another electrode has a cylindrical portion received within and spaced radially from said collar, said collar and said cylindrical portion being relatively rotatable.

3. The combination defined in claim 2, in which the cylindrical electrode portion has a solid end.

4. The combination defined in claim 2, in which the cylindrical electrode portion has a tubular open end.

5. The combination defined in claim 4, and an inner wall located concentrically within and connected to the collar and forming therewith an annular trough into which the tubular open end of the cylindrical electrode portion projects in radially spaced relation both to the collar and to said inner wall.

6. The combination defined in claim 1, in which one of the electrodes has an arcuate slot concentric with the rotor axis and opening axially, and a cooperating electrode has a blade element movable circumferentially through said slot in radially spaced relationship to the walls thereof by rotation of the rotor.

7. The combination defined in claim 6, in which the cooperating electrode having the blade element is stationary and the electrode having the channel-shaped slot is rotated by the rotor.

8. The combination defined in claim 6, in which the electrode having the channel-shaped slot is stationary and the cooperating electrode having the blade element is rotated by the rotor.

9. In an automotive distributor including an interiorly hollow body, a rotor in the interior hollow of such body, means mounting the rotor for rotation about an axis relative to the body, a movable electrode carried by the rotor and stationary electrodes carried by the body and arranged in the interior hollow of the body in cooperative relationship to the movable electrode, the improvement comprising one of the stationary electrodes being removable from the body, a terminal integral with said removable stationary electrode, and a wire integrally connected to said terminal, said removable stationary electrode, said terminal and said wire forming an integral structure, the distributor body having a bore therethrough between its exterior and its interior hollow of a size for reception of said removable stationary electrode and said terminal into the exterior end of said bore and for axial movement through said bore a distance sufficiently great to slide said stationary electrode out of the interior end of said bore into a position projecting therebeyond for cooperation with the movable electrode, said bore further being of a size for withdrawal of said stationary electrode and said terminal therefrom by reverse sliding of said electrode and terminal outward through said bore.

10. The combination defined in claim 9, in which the removable stationary electrode is the central electrode and cooperates with the movable electrode carried by the rotor.

11. The combination defined in claim 9 and lugs on the terminal engageable with opposite sides of the wire.

12. The combination defined in claim 9 and means releasably securing the terminal in a predetermined position in the bore distributor body.

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CERTIFICATE OF CORRECTION

Patent No. 3,542,976 Dated November 24, 1970

Inventor(s) Forest J. Moray

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 8, line 15, after "9" insert a comma; line 17, after "9" insert a comma; line 19, cancel "bore distributor body" and insert --distributor body bore--.

SIGNED AND SEALED FEB. 9, 1971

FEB. 9,1971

(SEAL)
Attest:

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