

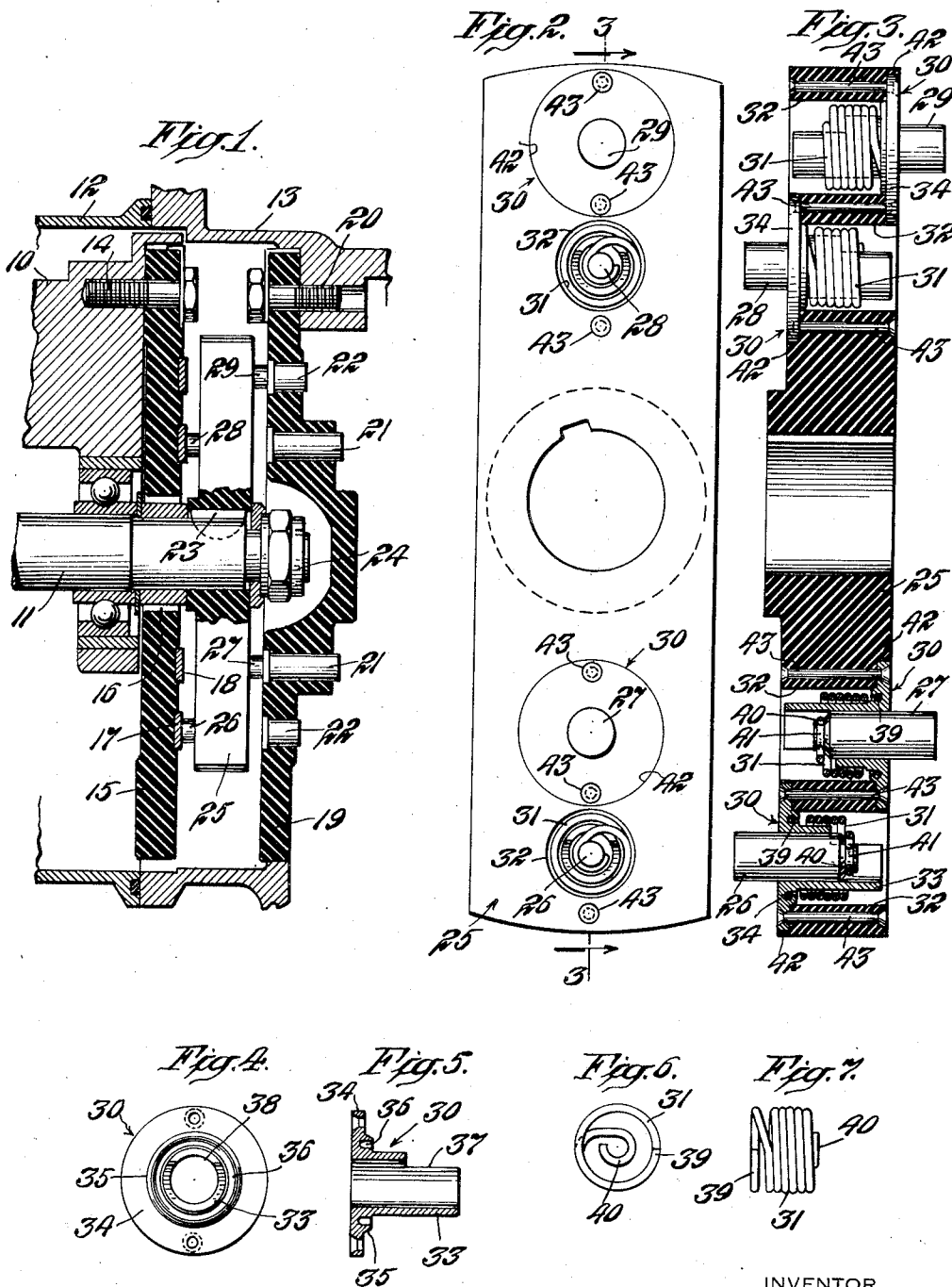
April 24, 1951

R. E. WHITE  
ELECTRICAL APPARATUS

2,549,871

Filed May 8, 1945

2 Sheets-Sheet 1



INVENTOR  
Raymond Edgar White  
BY  
Dale A. Bauer  
ATTORNEY

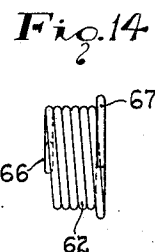
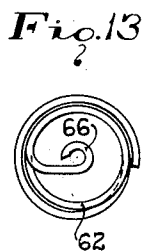
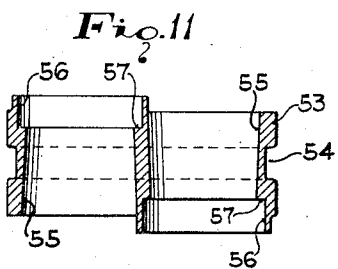
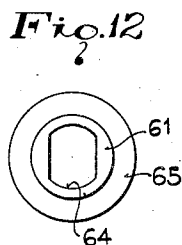
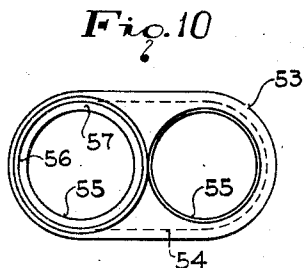
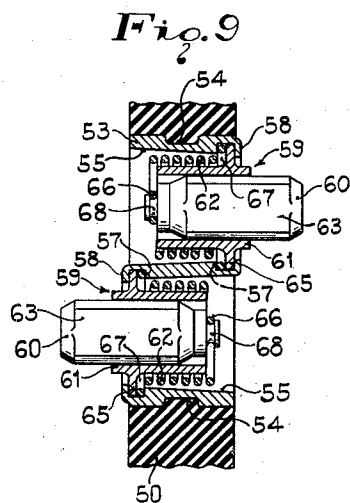
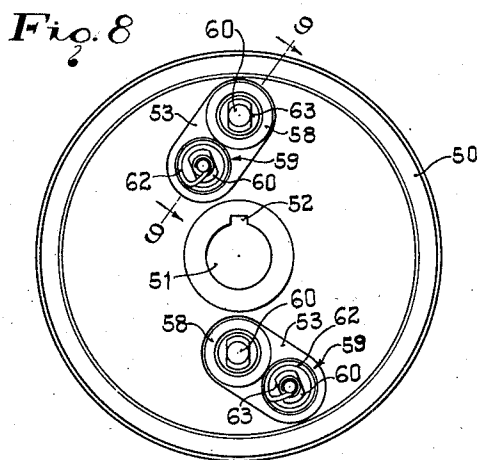
April 24, 1951

R. E. WHITE  
ELECTRICAL APPARATUS

2,549,871

Filed May 8, 1945

2 Sheets-Sheet 2



INVENTOR  
*Raymond Edgar White*  
BY *Dale A. Bauer*  
ATTORNEY

## UNITED STATES PATENT OFFICE

2,549,871

## ELECTRICAL APPARATUS

Raymond Edgar White, Sidney, N. Y., assignor  
to Bendix Aviation Corporation, New York,  
N. Y., a corporation of Delaware

Application May 8, 1945, Serial No. 592,638

11 Claims. (Cl. 200-19)

1

This invention relates to ignition distributor units for internal combustion engines, or the like, for controlling the distribution of electrical current impulses to a plurality of circuits in timed sequence.

One of the objects of the present invention is to provide in an ignition distributor unit novel means for mounting a spring pressed current carrying brush of carbon or like material in a rotating or other part thereof whereby said brush will be retained in said part during assembling and disassembling of said unit.

Another object of the invention is to provide novel resilient means for biasing a current conducting brush of carbon or like material into operative position and for holding said brush against displacement from a rotating or other part of an ignition distributor or like unit.

A further object is to provide a holder and spring of novel construction and arrangement for a current carrying brush of carbon or like material whereby said brush, holder and spring may be assembled as a single unit and will be maintained in assembled relation prior to and after mounting of the same on a rotating or other part of an ignition distributor or other apparatus.

A still further object is to provide in an ignition distributor unit for a multi-cylinder internal combustion engine novel means for mounting a pair of current carrying brushes of carbon or like material in the rotor of said unit, said mounting means also serving as conductors to electrically connect said brushes, thereby simplifying the construction of said rotor and rendering the latter less expensive to manufacture.

The above and further objects and novel features of the invention will more fully appear from the following detailed description when the same is read in connection with the accompanying drawings. It is to be expressly understood, however, that the drawings are for the purpose of illustration only, and are not intended as a definition of the limits of the invention, reference for this latter purpose being had primarily to the appended claims.

In the drawings, wherein like reference characters refer to like parts throughout the several views,

Fig. 1 is a fragmentary vertical longitudinal section of an ignition distributor unit embodying the present invention;

Fig. 2 is a detail end elevation on an enlarged scale of the distributor rotor and showing brush

2

assemblies mounted therein and constructed in accordance with the present invention;

Fig. 3 is a vertical transverse section on the line 3-3 of Fig. 2;

Fig. 4 is a detail end elevation, looking from the right of Fig. 5, of one of the brush holders;

Fig. 5 is a detail section of said brush holder;

Fig. 6 is a detail end elevation, looking from the left of Fig. 7, of one of the brush springs;

Fig. 7 is a detail side elevation of said brush spring;

Fig. 8 is a detail end elevation of another distributor rotor and showing brush assemblies mounted therein and constructed in accordance with another aspect of the present invention;

Fig. 9 is an enlarged fragmentary section taken substantially on the line 9-9 of Fig. 8;

Fig. 10 is a detail top plan view of one of the dual brush containers shown in Figs. 8 and 9;

Fig. 11 is a vertical longitudinal central section of said container;

Fig. 12 is a detail end elevation of one of the brush holders shown in Fig. 9;

Fig. 13 is a detail end elevation, looking from the left of Fig. 14, of one of the brush springs shown in Fig. 9; and

Fig. 14 is a detail side elevation of said brush spring.

Referring to the drawings, the present invention is herein illustrated, by way of example, in connection with a distributor unit of well known construction which is adapted for use in the ignition system of a multi-cylinder internal combustion engine. As shown, said distributor unit comprises a main body 10 having journaled therein a rotatable shaft 11 which is drivably connected with a rotating part of the engine with which the distributor unit is associated. Body 10 and the various parts (not shown) carried thereby are surrounded by a tubular casing member 12 to one end of which is suitably secured a housing member 13, said tubular member being secured to and supported by said body.

Secured, as by bolts 14, one only being shown, to the right hand end of body 10, as viewed in the drawings, is a circular insulating plate 15 provided with an enlarged central opening 16 through which distributor shaft 11 extends. Partially embedded in plate 15 and projecting from one face thereof are two concentric metallic rings 17 and 18 which are electrically connected in a known manner to sources of electrical current (not shown). Facing plate 15 and spaced axially therefrom is a second insulating plate 19 which is secured to housing 13 by means of bolts

20, only one of which is shown. Embedded in plate 19 and exposed at the left face thereof, as viewed in Fig. 1, are two series of sets of contacts 21 and 22 arranged in concentric circles about the axis of rotation of shaft 11. Each contact 21 is in radial alignment with a contact 22, and each of the contacts 21 and 22 are electrically connected in a known manner to the spark plugs in the engine cylinders.

Removably mounted on the projecting end of shaft 11 for rotation therewith, such as by means of a Woodruff key 23 and a nut 24 threaded on the end of said shaft, is a rotor 25, commonly known as a distributor finger. This rotor or finger consists primarily of an elongated block of insulating material equipped with two pairs of carbon or like brushes 26, 27 and 28, 29 adjacent opposite ends thereof for continuously picking up electrical current from rings 17 and 18 and conducting the same to contacts 21 and 22, respectively, on distributor plate 19. Brushes 26 and 28 project from one face of finger 25 into engagement with rings 17 and 18, respectively, and brushes 27 and 29 project from the opposite face of said finger into engagement with contacts 21 and 22, respectively. Current picked up from outer ring 17 is conducted to the inner ring or series of contacts 21 by the brushes 26 and 27, and current picked up from the inner ring 18 is conducted to the outer ring or series of contacts 22 by the brushes 28 and 29.

Novel means are provided for mounting each of the brushes 26, 27, 28 and 29 in the distributor finger 25 at different radial distances from the axis of rotation of shaft 11, said mounting means serving to bias each brush into operative position and to prevent the same from moving completely out of the finger 25 when the latter is removed from shaft 11 or when housing 13 and, hence, plate 19 is detached and removed. Each brush and mounting means therefor constitutes a single assembly comprising said brush, a holder 30 and a coil spring 31 which are adapted to be assembled independently of the distributor finger 25 and inserted as a single unit in one of four circular openings 32 formed in and extending in an axial direction through said finger.

As shown, particularly in Figs. 4 and 5, each holder 30 is fabricated from a suitable conductive material, such as brass, and is in the form of a tubular sleeve 33 provided at one end thereof with an enlarged lateral circular flange 34. The underside of flange 34 is formed with a circular hub-like portion 35 which is of a diameter corresponding to the diameter of the openings 32 in finger 25 to facilitate centering of holder 30 in said opening. Hub portion 35 is provided with an annular groove 36 opening outwardly towards the free end of sleeve 33, and the latter has a portion of its periphery cut away, as indicated at 37 (Fig. 5) in a plane parallel to its axis to provide an elongated slot 38 therein extending from the free end of said sleeve to approximately half the overall length of holder 30.

As shown more particularly in Figs. 6 and 7, spring 31 is of the close wound tension type and is fabricated from a suitable conductive material, such as copper. Spring 31 is so formed that the coil or loop 39 at one end thereof is square with the axis of said spring and is spaced from the adjacent coil, and that the coil or loop 40 at the other end thereof is also square with the axis but smaller in diameter than the other coils of said spring.

In one manner of assembling the above described parts of a brush unit, the carbon brush may first be inserted lengthwise through the open end of spring 31 until it engages the small diameter end coil 40 of said spring. Coil 40 is then spread over the reduced inner end of the brush which is provided with an annular half-round groove as indicated at 41 (Fig. 3) to receive said coil. To insure a good electrical connection, coil 40 is preferably soldered to the brush. Thereupon the brush is inserted, free end first in the holder 30 through the free open end of sleeve 33, and spring 31 is guided over said sleeve, said brush and spring being then moved along the holder, permitted by the slot 38 therein, until the end coil 39 of spring 31 enters the annular groove 36 in holder 30. At this time the free end of the brush projects outwardly an appreciable distance beyond the flange 34 as illustrated in Fig. 3. Spring 31 is then secured to holder 30 by swaging and staking peripheral portions of hub 35 over coil 39 of said spring as illustrated in Fig. 3. Thus, the brush, the holder 30 and the spring 31 are mechanically and electrically connected together as a single unit assembly. If desired, the spring and holder 30 may be assembled first and the carbon brush then inserted.

The brush assemblies 26—30—31, 27—30—31, 28—30—31 and 29—30—31 are inserted in their respective openings 32 in distributor finger 25 with the hub portions 35 engaged in said openings and the flanges 34 engaged in counter-bores 42 formed in opposite faces of said finger, thereby insuring that said assemblies are properly centered in openings 32 to enable free sliding movement of brushes 26, 27, 28 and 29, and free operation of springs 31. The brush assemblies are secured to distributor finger 25 by pins 43 of brass or other conductive material which pass through and are riveted to said finger and the flanges 34 of holders 30. In securing the brush assemblies to finger 25 as described, it will be noted that the pins 43 which are located between the brush assemblies including the pairs of brushes 26, 27, and 28, 29, respectively, pass through both flanges 34 of each pair of assemblies, thereby also serving as conducting means to electrically connect the brush 26 with the brush 27, and the brush 28 with the brush 29.

It will be noted that since the brushes 26, 27, 28 and 29 are connected to the inner coils 40 of springs 31, said brushes may be pressed inwardly to expand said springs, thereby placing the latter under tension so that the brushes will be urged outwardly relative to finger 25 and firmly pressed against rings 17, 18 and contacts 21 and 22 when said finger is mounted on shaft 11 and in assembled relation with plates 15 and 19. It will further be noted that the brushes 26, 27, 28 and 29 have a limited outward movement and cannot at any time be moved completely out of the finger 25.

Referring now to Figs. 8 to 14 of the drawings, which illustrate another embodiment of the present invention, the distributor rotor 50 is in the form of a disc of insulating material and provided with a central opening 51 and a keyway 52 to receive the distributor shaft 11 and key 23, respectively. Embedded in rotor 50 so as to be an integral part thereof are two dual brush containers 53, 53 which are arranged diametrically opposite each other and at an angle such that one container extends to one side of the axis of the rotor and away from the

periphery of the latter, and the other container extends to the opposite side of said axis and towards said periphery. The described arrangement of containers 53, 53 enables the use of a smaller diameter rotor.

As shown in Figs. 10 and 11, each dual brush container 53 is fabricated from a suitable conductive material, such as soft brass, and is in the form of an elongated block provided intermediate its upper and lower faces with an external groove or recess 54 which may completely surround the same. In molding rotor 50 the material flows into groove 54, as shown in Fig. 9, and thus permanently holds container 53 in said rotor. Container 53 is provided with two longitudinally spaced and aligned openings 55 extending therethrough and which are slightly tapered, the direction of taper being such that the small end of one opening 55 is adjacent one face of the container and the small end of the other opening 55 is adjacent the opposite face of said container. Openings 55 terminate at their small ends in counterbores 56 which form internal annular shoulders 57 and thin external annular rims 58 that project outwardly beyond opposite faces of container 53.

Each container 53 is adapted to receive and electrically connect two brush assemblies indicated generally at 59, 59, each comprising an elongated carbon or the like brush 60, a holder 61, and a coil spring 62. Brush 60 is formed with flattened sides as indicated at 63 (Figs. 8 and 9), and is slidably and nonrotatably mounted in a correspondingly shaped opening 64 (Fig. 12) formed in holder 61. The latter is fabricated from a suitable conductive material, such as brass, and is in the form of a sleeve provided adjacent one end thereof with an enlarged lateral circular flange 65 which is slightly smaller in diameter than the diameter of the counterbore 56.

As shown in Figs. 13 and 14, spring 62 is of the close wound tension type and is fabricated from a suitable conductive material, such as copper. Spring 62 is so formed that the coils or loops 66 and 67 at opposite ends thereof, respectively, are square with the axis of said spring, and are smaller and larger, respectively, in diameter than the intermediate coils. The bore of spring 62 is slightly greater than the external diameter of holder 61, and the outside diameter of said spring is slightly smaller than the diameter of opening 55 at the small end thereof.

In one manner of assembling the above described parts of each brush assembly 59 in containers 53, the carbon brush 60 may first be inserted lengthwise through the open end of spring 62 until it engages the small diameter end coil 66 which is in line with the axes of said spring and brush. Coil 66 is then spread over the reduced inner end of brush 60 which is formed with an annular half-round groove as indicated at 68 (Fig. 9) to receive said coil. To insure good electrical connection, coil 66 is preferably soldered to brush 60. Thereupon, the spring 62 with brush 60 soldered thereto is inserted into opening 55 through counterbore 56 until coil 67 rests on shoulder 57 in said container. Holder 61 is then engaged over brush 60 and inserted in the bore of spring 62 through counterbore 56 until the inner end of said holder engages the end coil 66. Pressure is then applied on the outer end of holder 61 until the flange 65 on said holder engages the coil 67 of spring 62, at which time the latter will be slightly expanded as shown in Fig. 9. Thereupon, the rim 58 on container 53 is bent in-

wardly over flange 65, as shown in Fig. 9, thereby firmly securing holder 61 and the coil 67 of spring 62 to container 53. To insure a good electrical connection, rim 58 is also soldered to flange 65. Thus, the brush 60, the holder 61 and the spring 62 of each brush assembly 59 are mechanically and electrically connected together, and a pair of brush assemblies in each container 53 are electrically connected together by said container. If desired, the spring 62 and holder 61 may be inserted and secured first in container 53, and the carbon brush 60 then inserted in said holder and secured to said spring, or the brush, the holder and the spring may first be assembled and then inserted as a unit in container 53.

Upon mounting of the rotor assembly on distributor shaft 11 in proper operating position, the brushes 60 are further depressed in rotor 50, thereby further expanding springs 62 so that the brushes will be urged outwardly relative to rotor 50 and firmly pressed against rings 17, 18 and contacts 21, 22. It will be noted that the outward movement of brushes 60 by springs 62 is limited through engagement of the end coils 66 of said springs with the adjacent ends of holders 61, with the result that said brushes cannot at any time be moved completely out of rotor 50.

There is thus provided novel simplified means for mounting a brush of carbon or like material in a rotating or other part of an ignition distributor or other unit whereby said brush will be biased under spring tension into operative position and retained against displacement from said part during assembling and disassembling of said unit. The novel construction of the mounting means enables assembling of the latter and the brush as a single independent unit. Further, the novel construction, arrangement and operation of the brush springs eliminates all lateral binding and bending of said springs and rubbing of the same on the rotor or finger, and since the springs are expanded rather than compressed to apply pressure to the brushes, all rubbing of the coils or turns against each other is also eliminated, with the result that said springs may be made from heavier wire and will last for an indefinite period. The novel arrangement of brush and mounting means has particular utility in a rotating distributor rotor or finger equipped with a plurality of brushes in that it simplifies construction of said rotor or finger, decreases the width or thickness thereof, and renders the same less expensive to manufacture. Novel and reliable means are also provided for electrically connecting two adjacent brushes of the character disclosed.

Although only two embodiments of the invention are illustrated and described in detail, it is to be expressly understood that the same is not limited thereto. Various changes, particularly in the design and arrangement of the parts illustrated, may be made without departing from the spirit and scope of the invention as will now be apparent to those skilled in the art. For a definition of the limits of the invention, reference is had primarily to the appended claims.

What is claimed is:

1. A brush assembly of the class described comprising a tubular member having a lateral flange at one end thereof and an elongated axially extending slot in the opposite end thereof, a conducting brush, such as a carbon brush, slidably mounted in said member and having one end thereof projecting outwardly beyond said flange and the opposite end disposed with-

in said member, and a coil spring surrounding said member, said spring having the coil at the end thereof adjacent said flange secured to the latter and the coil at the opposite end thereof extending through said slot and secured to said opposite end of said brush.

2. In an ignition distributor, a rotatable current distributing rotor comprising a block of insulating material having a pair of axially extending openings in opposite faces thereof and spaced radially and in close proximity with each other, a pair of conducting brushes, such as carbon brushes, means for mounting said brushes in said openings comprising a pair of tubular member of conductive material adapted to be inserted in said openings and to slidably support said brushes therein, said members having lateral flanges at one end thereof adapted to engage opposite faces of said block, a coil spring of conductive material surrounding each of said members and having one end thereof secured to the respective flange and the opposite end secured to the respective brush, and means including a pin of conductive material passing through both said flanges and said block for securing said members to the latter and for electrically connecting said brushes.

3. In apparatus of the class described, an insulating member having an opening therein, a sleeve mounted in said opening and fixed against movement relative to said member, a conducting brush, such as a carbon brush, slidably mounted in said sleeve and having a portion projecting outwardly beyond the latter, and a coil spring contained in said opening and surrounding said sleeve, said spring having the coil at the end thereof adjacent the outer end of the brush fixed against movement relative to said member and said sleeve, and the coil at the opposite end thereof extending laterally across the adjacent end of said sleeve and into axial alignment with the axis of said brush.

4. In apparatus of the class described, a container of conductive material having a pair of spaced openings therein, a pair of conducting brushes, such as carbon brushes, and means for mounting said brushes in said openings and for urging the same outwardly in opposite directions, comprising a pair of flanged sleeves of conductive material slidably supporting said brushes and adapted to be inserted in said openings, means for securing said sleeves to said container, and a coil spring of conductive material disposed in each of said openings and surrounding each of said sleeves, said spring having the coil at one end thereof fixed to said container and the coil at the opposite end thereof extending laterally across the adjacent end of the respective sleeve and into axial alignment with the axis of the respective brush.

5. In apparatus of the class described, a container of conductive material having a pair of spaced openings therein, a pair of conducting brushes, such as carbon brushes, provided with flattened opposite sides, and means for mounting said brushes in said openings and for biasing the same outwardly in opposite directions, comprising a pair of flanged sleeves of conductive material slidably and non-rotatably supporting said brushes and adapted to be inserted in said openings, means for securing said sleeves to said container, and a coil spring of conductive material disposed in each of said openings and surrounding said sleeves, said spring having the coil at one end thereof fixed to said con-

tainer, and the coil at the opposite end thereof extending laterally across the adjacent end of the respective sleeve and connected with the adjacent end of the respective brush.

6. In an ignition distributor, a rotatable current distributing rotor comprising a block of insulating material, a container of conductive material embedded in said block, said container being provided with a pair of spaced openings extending axially therethrough, a pair of conducting brushes, such as carbon brushes, and means for mounting said brushes in said openings so as to project beyond opposite faces of said block and for biasing said brushes outwardly into operative positions, comprising a pair of flanged sleeves of conductive material slidably supporting said brushes and adapted to be inserted in said openings, means for securing said sleeves to said container, and a coil spring of conductive material disposed in each of said openings and surrounding said sleeves, said spring having the coil at one end thereof fixed to said container, and the coil at the opposite end thereof extending laterally across the adjacent end of the respective sleeve and connected with the adjacent end of the respective brush.

7. In apparatus of the class described, an insulating member having an opening therein, an elongated conducting brush, such as a carbon brush, slidably mounted in said opening for movement to outward and to fully retracted position, and a coil spring contained in said opening and surrounding said brush, said spring having at one end thereof a coil of reduced diameter disposed coaxially with the axis of said spring and brush and connected with the inner end of said brush and the coil at the opposite end connected with said member.

8. In apparatus of the class described, an insulating member having an opening therein, an elongated conducting brush, such as a carbon brush, slidably mounted in said opening and having a portion adapted to project outwardly beyond said member and to be fully retracted, and a coil spring contained in said opening and surrounding the portion of said brush disposed in said opening, said spring having the coil at the end thereof adjacent the outer end of the brush connected with said member and the coil at the end thereof adjacent the inner end of the brush connected with the latter, said last-named coil being of reduced diameter and disposed coaxially with the axis of the spring and brush and both said coils being square with said axis.

9. A brush assembly of the class described comprising a tubular member having a lateral flange at one end thereof, a conducting brush, such as a carbon brush, slidably mounted in said member and having one end thereof adapted to project outwardly beyond said flange and to be fully retracted, and a coil spring surrounding said member, said spring having the coil at the end thereof adjacent said flange secured to the latter, the coil at the opposite end secured to the opposite end of said brush, and a portion adapted to serve as a limit stop by engaging the tubular member.

10. In apparatus of the class described, a block of insulating material having two openings extending therethrough and disposed in close proximity to each other, a pair of spring pressed conducting brushes, such as carbon brushes, means including a pair of flanged holders of conductive material mounted in said openings

with the flanges thereof disposed at opposite faces of said block and in overlapping relation for slidably mounting said brushes in said block so as to project beyond opposite faces of the latter, and common means carried by said block for mechanically and electrically connecting said holders.

11. In apparatus of the class described, a block of insulating material having two openings extending therethrough and disposed in close proximity to each other, a pair of spring pressed conducting brushes, such as carbon brushes, means including a pair of flanged holders of conductive material mounted in said openings with the flanges thereof embedded in opposite faces of said block and overlapping each other for slidably mounting said brushes in said block,

and means embedded in said block and fixed to the overlapping flanges of the holders for securing said holders in said block, said last-named means being adapted to electrically connect said holders.

RAYMOND EDGAR WHITE.

#### REFERENCES CITED

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

#### UNITED STATES PATENTS

| Number    | Name      | Date           |
|-----------|-----------|----------------|
| 934,715   | Denieport | Sept. 21, 1909 |
| 1,774,998 | Schroeder | Sept. 2, 1930  |