W. B. MOSES.

IGNITION APPARATUS.

APPLICATION FILED JAN. 17, 1916.

1,306,116.

Patented June 10, 1919.

2 SHEETS—SHEET 1.

Fig. 1.

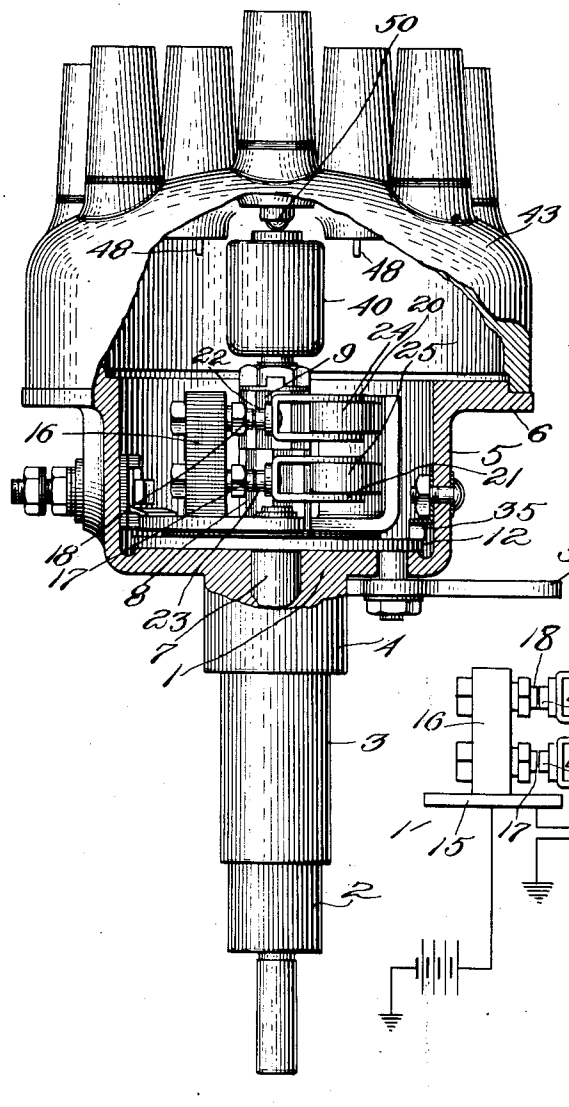


Fig. 6.

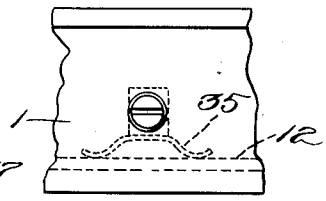
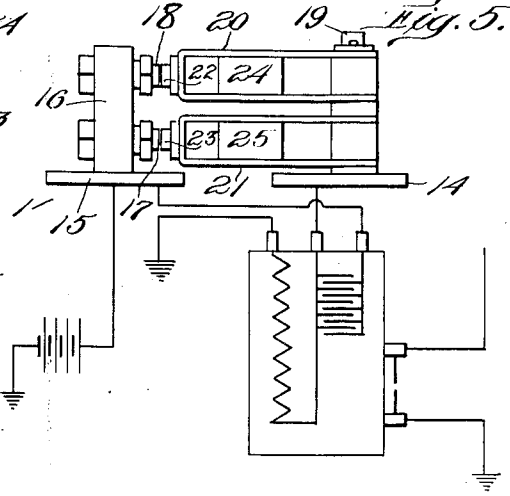


Fig. 5.



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2 SHEETS—SHEET 2.

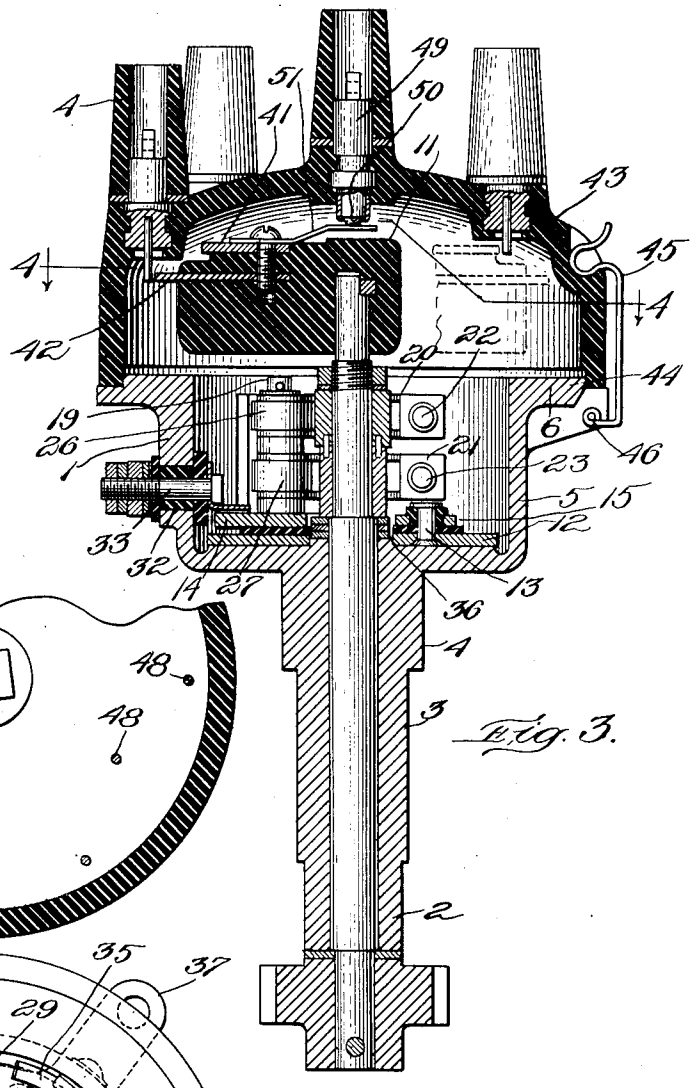


Fig. 3.

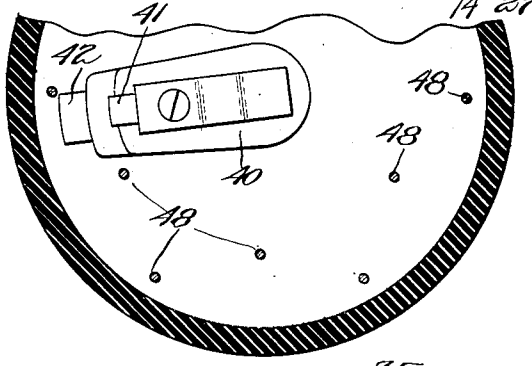


Fig. 4.

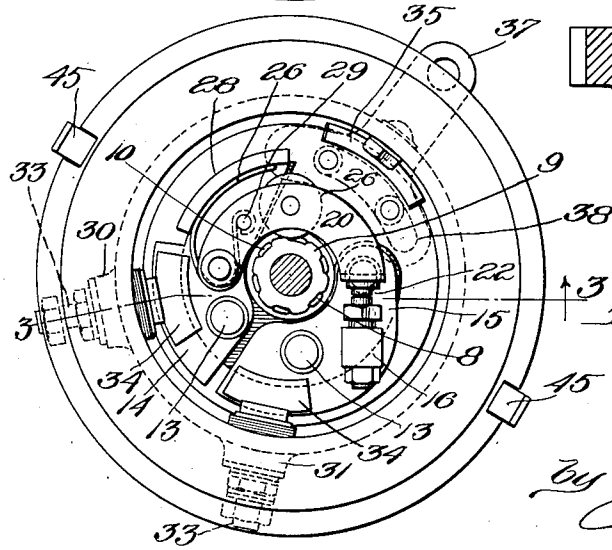


Fig. 2.

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UNITED STATES PATENT OFFICE.

WILLIAM B. MOSES, OF BROOKLINE, MASSACHUSETTS, ASSIGNOR TO GRAY & DAVIS INC., OF CAMBRIDGE, MASSACHUSETTS.

IGNITION APPARATUS.

1,306,116. Specification of Letters Patent. Patented June 10, 1919.

Application filed January 17, 1916. Serial No. 72,496.

To all whom it may concern:

Be it known that I. WILLIAM B. MOSES, citizen of the United States, and resident of Brookline, in the county of Norfolk and State of Massachusetts, have invented certain new and useful Improvements in Ignition Apparatus, of which the following is a specification.

This invention relates to ignition apparatus and with regard to certain more specific features thereof to breakers and distributers.

It is one of the objects of the invention to provide a simple, durable and extremely compact device of the character above stated.

Another object of the invention is to provide a reliably operative device which will meet the demands of eight and twelve cylinder engines particularly as to speed of operation.

The invention has for another of its objects the provision of apparatus wherein the parts may be quickly and conveniently assembled or removed.

Still another object lies in the provision of a device of the above stated character wherein simple, inexpensive and reliable means are employed to obviate the necessity for moving the primary leads to obtain variations in spark timing.

Other objects will be in part obvious and in part particularly pointed out hereinafter.

The invention accordingly consists in the various features of construction, combinations of elements and arrangements of parts which will be exemplified by the construction hereinafter set forth and the scope of the application of which will be indicated by the following claims.

In the accompanying drawings wherein is shown one of various possible embodiments of the invention:

Figure 1 is a view in elevation of a breaker distributer embodying the invention. In this view portions of the casing and distributer head are broken away to show more clearly the interior structure.

Fig. 2 is a plan view of the same with the distributer head and contact carrying arm of the distributer removed.

Fig. 3 is a view in vertical section taken substantially along the line 3—3 of Fig. 2 but with distributer head and contact carrying arm of distributer included.

Fig. 4 is a view in horizontal section taken substantially along the line 4—4 of Fig. 3.

Fig. 5 is a wiring diagram illustrating the primary circuit.

Fig. 6 is a side view of a portion of the casing showing in dotted lines the brush and plate contact in the primary circuit.

Referring now more particularly to the drawings in which similar reference characters refer to similar parts throughout the several views, there is indicated at 1 a tubular casing, progressively increasing in diameter by several steps as indicated at 2, 3 and 4 until it finally develops into a cup 5 provided with a horizontal flange portion 6. Rotatively supported in this casing is a shaft 7 adapted to be driven in direct proportion to the speed of the crank shaft of an internal combustion engine. Shaft 7 has fixed thereon two cam elements 8 and 9 each provided with a plurality of cam portions 10. The bottom of the cup 5 of casing 1 serves to support a metal plate or disk 12 which in turn has fixed thereon as by means of rivets 13 a pair of plates 14 and 15 of conducting material. These plates are separated from each other and insulated from the plate or disk 12. An upright 16 of conducting material is fixed upon the plate 15 and carries two fixed contacts 17 and 18 one above the other. An upright pivot pin 19 is fixed upon plate 14 and serves as a pivot for two curved rocker arms 20 and 21, carrying respectively the movable contacts 22 and 23. These rocker arms are of sheet metal bent in substantially U shape providing side walls within which the cam rollers 24 and 25 are journaled. Leaf springs 26 and 27 bear against a curved upstanding portion 28 of the plate 14 and take in upon their respective rocker arms at points 29 as shown clearly in Fig. 2 of the drawings. These springs tend to urge the rockers against the action of the cam portions 10 and into closed contact position. Casing 1 is formed with bosses 30 and 31 and these are provided with suitable terminals for the leads of the primary circuit, the terminals being insulated from the casing 1 as indicated at 32. The conductors 33 of the terminals extend into the cup of the casing and carry flexible conducting brushes 34 which make electrical contact with the plates 14 and 15. These brushes serve not only as conductors but in

conjunction with a finger piece 35 mounted inside the cup at the opposite side of the casing they serve to hold the plate or disk 12 and its appurtenances against vertical displacement. A shoulder 36 projecting from the bottom of the cup 5 serves to prevent radial displacement of the plate 12.

From the foregoing it will be apparent that plate 12 supports two separate plates, which in turn carry respectively the fixed and movable contacts of the primary circuit interrupter. It will be obvious that the plate is restricted in vertical or radial movement but is free for angular movement. This angular movement is effected by means of an arm 37 secured to bolts or screws or rivets or in any other suitable manner to the plate 12, the shanks of the bolts or screws passing through an arcuate slot 38 in the bottom of the cup 5. The ends of the slot 38 limit the range of angular movement of the plate 12 and the plates 14 and 15 are sufficiently elongated to remain in contact with the brushes 34 throughout the entire possible range of movement of the plate 12. It is to be noted that the fixed contacts, movable contacts and the means for urging the contacts to closed position are merged into one instrumentality which is easily removable from the casing without disorganization and by simply removing the brushes 34, finger piece 35 and the arm 37.

To meet the demands of modern engine construction in which the number of cylinders has been increased, it is desirable to take steps to eliminate mechanical and electrical lag or in some manner to compensate for these detrimental characteristics. It will be noted that the cams 8 and 9 are substantially counterparts each having, in the present embodiment, six raised cam portions 10. It will be further noted that cam portions 10 of the respective cams are staggered so that they do not function on their respective rolls in the same way at the same time. By such construction the contacts move somewhat in opposite directions the primary circuit being open when both sets of contacts are open and one movable contact always nearer to closed position than the one last opened. This construction compensates for mechanical and electrical lag as will be hereinafter pointed out, and, furthermore, provides an extremely compact device which features are highly important in automobile construction.

A contact carrying arm 40 is fixed upon the upper end of the shaft 7 and carries inner and outer contacts 41 and 42. While these are spoken of as contacts it will be obvious that in the embodiment shown they are of the type known as jump contacts. The invention, however, contemplates as well the use of wipe contacts or any other form. A distributer head 43 of insulating material is arranged over the cup of the casing 1 fitting over a shoulder 44 formed on the flange 6 of casing. This head is secured in position by spring clips 45 located diametrically opposite and pivoted on the casing 1 as indicated at 46. The embodiments shown in the drawings is for use with a twelve cylinder internal combustion engine and has accordingly twelve terminals for connecting with the leads to the spark plugs. To secure further compactness these terminals are arranged in two or more annular paths and the fixed contact pins 48 of the terminals extend downwardly and coöperate with the corresponding movable contact on the carrying arm 40. It will be obvious that the inner movable contact 41 coöperates with the inner circular row of contacts 48 and that the outer contact 42 coöperates with those in the outer path. The high tension terminal of the distributer circuit is centrally located as indicated at 49 and connects by means of a carbon tip or brush 50 and a spring conductor 51 with the contacts 41 and 42.

Referring to Fig. 5, it will be seen that the contact sets are arranged in multiple in the primary circuit. It is therefore desirable that both sets of contacts shall be in open position for a brief period when either one of the contacts 41 or 42 is opposite a fixed contact of the distributer head.

In the operation of the present device each movable contact is given twelve movements; that is, six in each direction for one rotation of the cam shaft. Each set is therefore opened and closed six times. The contact carrying rocker arms 20 and 21 are co-extensive and the cam rollers 24 and 25 have their axes in alinement so that, assuming a point in the cycle of operation corresponding to the showing in Fig. 2 of the drawings, as a cam portion 10 of the lower cam 8 is passing away from its cam roll a cam portion 10 of the cam 9 is moving against the cam roll of the upper rocker. At this point then both sets of contacts are open. The primary circuit, however, having been opened finally through the contacts of the upper set the movable contact of the lower set is at this point moving by means of spring 27 back to closed position. It will be noted, therefore, that at the time the circuit is opened by disengagement of the upper set of contacts the lower movable contact has spent the outward velocity given by the cam and is under complete control of its spring which is tending to return it to closed position as quickly as the cam portion 10 is moved beyond its cam roller. This provides a brief but sufficient opening of the primary circuit and permits building up of the coil to a point of high efficiency.

When desired to vary the time of actuation of the contacts for the purpose of ob-

taining advance or retard of the spark in the engine cylinder the arm 37 is moved giving an angular range of movement to the plate 12 and the contacts carried thereon. This varies the position of the cam rolls with respect to the cams and the contacts 41 and 42 on the carrying arm 40 are elongated to insure completion of the secondary circuits.

As many changes could be made in the above construction and many apparently widely different embodiments of the invention could be made without departing from the scope thereof it is intended that all matter contained in the foregoing description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

Having described the invention what I desire to secure by Letters Patent is:

1. In apparatus of the character described, in combination, a casing containing two sets of interrupter contacts adapted to be arranged in a primary circuit, and means adapted to actuate contacts of the respective sets simultaneously, the arrangement of parts being such that one set is closing while the other is opening providing a brief period in which the primary circuit is open through both sets.

2. In apparatus of the character described, in combination, a primary circuit, two sets of interrupter contacts arranged in multiple in said circuit, means adapted to open said circuit by opening one said set of contacts while the other is open, and means for moving said other set of contacts to closed position while the first said set is open.

3. In apparatus of the character described, in combination, a casing, two sets of interrupter contacts, each set comprising a fixed contact element and a movable contact element, the movable contact elements being pivotally mounted with their axes in alinement, means for actuating the movable contacts to open position, and means coöperating with said last means for starting one of said movable contacts on its return to closed position during the period of opening movement of said other movable contact.

4. In apparatus of the character described, in combination, a casing, two sets of interrupter contacts, each set comprising a fixed contact element and a movable contact element, the movable contact elements being pivotally mounted with their axes in alinement, means comprising a cam shaft for actuating the movable contacts to open position, and means coöperating with said last means for starting one of said movable contacts on its return to closed position during the period of opening movement of said other movable contact.

5. In apparatus of the character described, in combination, a primary circuit interrupting device, a secondary circuit distributing device comprising a plurality of fixed contact members arranged in two annular paths and a pair of rotatable contacts adapted to coöperate each respectively and alternately with fixed contacts in the different annular paths, and means in axial alinement for actuating said interrupting device and said movable contacts.

6. In apparatus of the character described, in combination, a pair of circuit interrupters adapted to be included in the primary circuit, a secondary circuit distributing device comprising a plurality of fixed contact members arranged in two annular paths and a pair of revoluble contacts adapted to coöperate each respectively and alternately with fixed contacts in the different annular paths, and means having their axes in alinement for actuating said interrupting device and said revoluble contacts.

7. In apparatus of the character described, in combination, a pair of circuit interrupters adapted to be included in the primary circuit, a secondary circuit distributing device comprising a plurality of fixed contact members arranged in two annular paths of different lengths and a pair of revoluble contacts adapted to coöperate each respectively and alternately with fixed contacts in the different annular paths, and means in axial alinement for actuating said interrupter device and said revoluble contacts.

8. In apparatus of the character described, in combination, a rotatable shaft, an interrupter for a primary circuit comprising actuators on said shaft, a plurality of fixed distributer contacts arranged at different distances radially from the axis of said shaft, and contacts moved by said shaft for coöperating with said fixed contacts to complete the secondary circuits alternately through fixed contacts of different radial positions.

9. In apparatus of the character described, in combination, a primary circuit having in parallel a plurality of contact sets, each set comprising a fixed and a movable contact element, means adapted to actuate the movable contacts of each set successively to open position, and means adapted to actuate said movable contacts to closed position, the arrangement of parts being such that the sets are simultaneously open for a brief period in the operation.

10. In apparatus of the character described, in combination, a casing, a primary circuit having terminals therein, a shaft rotatably mounted therein and provided with cam portions and a contact carrying element, a primary circuit interrupter actuated by said cam portions, a distributer head mounted on said casing carrying terminals

arranged in a plurality of annular paths, a fixed contact member for each terminal, a contact for each annular path, the same being movable by said carrying element into circuit completing relation with the contacts in the respective paths, and means for varying the time of interruption of the primary circuit by relative adjustment of the interrupter and cam portions independently of the terminals on the casing or head.

11. In apparatus of the character described, in combination, a casing, a distributer head thereon, a shaft journaled in said casing, a plate angularly movable in said casing and about said shaft, two contact plates fixed to said movable plate and supporting respectively a movable contact member and a fixed contact member in electrical communication with said plates, terminals in said casing having brushes contacting with said plates, a contact carrying member on said shaft coöperating with contacts carried by the distributer head and means adapted to move the first said plate through an angular range causing the contact plates to move relatively to said brushes.

12. In apparatus of the character described, in combination, a casing, a shaft rotatably mounted therein and provided with cam portions and a contact carrying element, a primary circuit interrupter actuated by said cam portions, a distributer head mounted on said casing carrying terminals arranged in a plurality of annular paths, a fixed contact member for each terminal, a contact for each annular path the same being movable by said carrying element into circuit completing relation alternately with the contacts in the respective paths.

13. In ignition apparatus, in combination, a casing having terminals therein, a rotatable element within said casing having means making electrical connection with said terminals throughout a range of movement of said element, a contact set carried by said element comprising a fixed and a movable contact, actuating means for said contact set, and means for moving said rotatable element within said casing and independently of said terminals.

14. In ignition apparatus, a casing, a plate arranged therein for relative movement therewith, a terminal in said casing, a fixed and a movable contact carried by said plate, an operating member whereby said plate may be moved relatively to said casing and independently of said terminal, and a brush connection between said terminal and one of said contacts.

15. In ignition apparatus, in combination, a casing having a pair of terminals located therein, a shaft in said casing, a supporting plate journaled in said casing, circumscribing said shaft, a fixed contact and a movable contact both supported by said plate, a pair of conductor members insulated from said plate and from each other, one of the pair electrically communicating with the fixed contact and the other electrically communicating with the movable contact, conductor members extending from the terminals and communicating with the first said conductor members, and means for electrically connecting said conductor members with said terminals and permitting relative movement therebetween.

16. In ignition apparatus, in combination, a casing having a terminal therein, a contact set in said casing comprising a fixed contact and a pivoted movable contact, a rotatable supporting element for said contact set, a conductor member associated with one of said contacts and a brush connection between said conductor member and said terminal.

17. In ignition apparatus in combination, a cup shaped casing, a contact actuating shaft extending into said casing, a rotatable contact supporting-element journaled in said casing, terminals in said casing, a fixed contact and a movable contact mounted to be rotated with said contact-supporting element, conductor members carried by said supporting element and electrically communicating with said contacts respectively and brushes bearing on said conductor members in position to assist in holding said supporting element against displacement except through a range of rotatable movement, said brushes electrically connecting said conductor members respectively to said terminals.

18. In ignition apparatus, in combination, an interrupter mechanism comprising a plurality of contact sets arranged in parallel in a primary circuit and a distributer mechanism comprising a multiplicity of contacts arranged in a plurality of paths and a rotatable member having a plurality of contacts adapted to engage respectively with the contacts in different paths.

19. In ignition apparatus, in combination, a casing, primary circuit means therein comprising a plurality of contact pairs in parallel arrangement in said circuit, means for actuating said contact sets comprising a shaft extending within said casing, a plurality of rotatable distributer contacts carried by said shaft, and a head having a multiplicity of distributer contacts fixed therein, said rotatable distributer contacts being adapted to coöperate respectively with different contacts of said head to complete the secondary circuits.

20. In ignition apparatus, in combination, a pair of interrupter contact sets, each set comprising a movable and a relatively fixed contact, said sets being in parallel in the primary circuit and actuating means for

said contacts adapted to open one set before the other and close one set before the other, there being an overlap whereby both sets are open at the same time during the actuating operation.

21. In ignition apparatus for multi-cylinder engines, in combination, a casing, a shaft therein, a pair of contact sets, each set comprising a pair of contacts relatively movable into and out of engagement, the sets being arranged in parallel in a primary circuit, contact actuating means, a rotatable carrier on said shaft having a plurality of contacts rotatable in different paths and a single distributer head having contacts adapted to coöperate with said rotatable contacts to complete the secondary circuit.

22. In ignition apparatus for multi-cylinder engines in combination, interrupter and distributer mechanism arranged in a single unit with a pair of interrupter contact sets in the primary circuit and secondary contacts for all the cylinders of the engine arranged in a single head of said unit.

23. In ignition apparatus for multi-cylinder engines in combination, interrupter and distributer mechanism arranged in a single unit with a pair of interrupter contact sets in parallel arrangement in the primary circuit and secondary contacts for all the cylinders of the engine arranged in a single head of said unit.

24. In ignition apparatus for engines in combination, a pair of contact sets each set comprising relatively movable contacts, means for opening said sets at different times, and spring means for opposing the opening action, the opening means and the spring means being so arranged and related that the spring means has substantially overcome the action of the opening means on one set as the opening means acts to open the other set.

25. In ignition apparatus for engines in combination, a pair of contact sets each set comprising relatively movable contacts, means for opening said sets at different times, a casing for the aforesaid means and contacts, a head having distributer contacts for all the cylinders in the engine, and means driven with the opening means having a plurality of contacts adapted to coöperate respectively with different distributer contacts.

26. In ignition apparatus, in combination, a casing containing primary circuit terminals and a pair of contact sets in parallel arrangement, a distributer head having a multiplicity of contacts arranged in different rows, and a shaft carrying actuating means for said sets and a plurality of contacts adapted to coöperate with said distributer contacts.

27. In apparatus of the character described, in combination, a casing, a shaft adapted to rotate therein, two sets of interrupter contacts, each comprising coöperating fixed and movable contacts, said sets being arranged in different transverse planes lengthwise of said shaft, a primary circuit branching through the different sets, and means adapted to actuate the movable contacts of the respective sets simultaneously, the arrangement of the contacts and actuating means being such that one set is closing while the other is opening.

Signed at Cambridge in the county of Middlesex and State of Massachusetts this 8th day of January A. D. 1916.

WILLIAM B. MOSES.