May 27, 1941. H. VON TAVEL 2,243,269

ELECTRIC CURRENT DISTRIBUTOR

Filed July 22, 1939 4 Sheets-Sheet 1

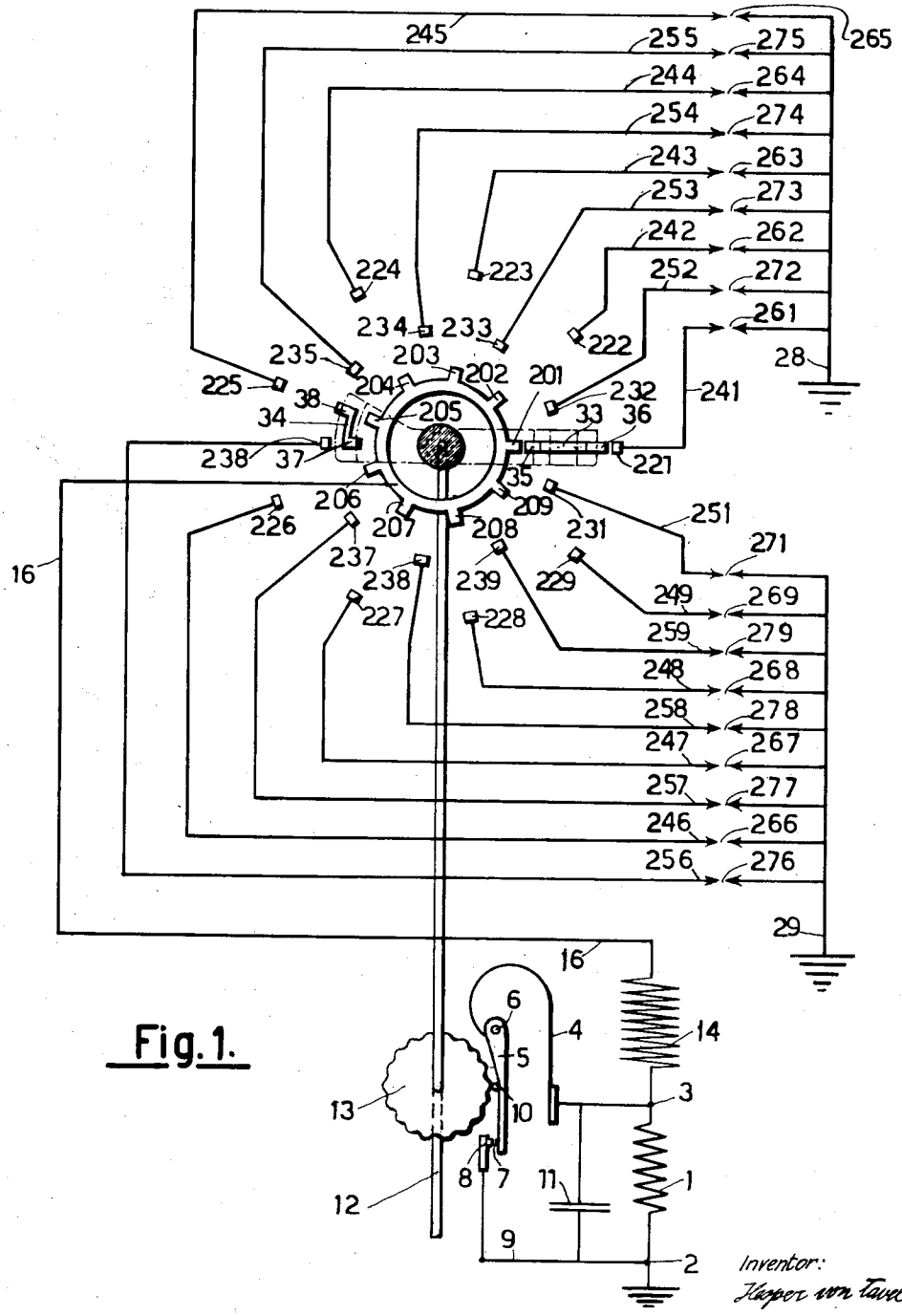


Fig. 1.

Inventor:
Hasper von Tavel

May 27, 1941. H. VON TAVEL 2,243,269

ELECTRIC CURRENT DISTRIBUTOR

Filed July 22, 1939 4 Sheets-Sheet 2

Fig.2.

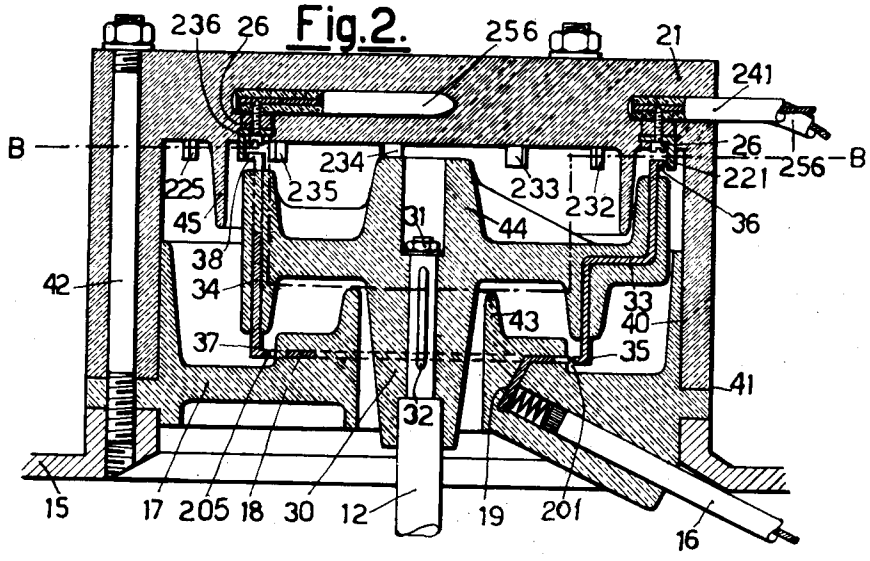
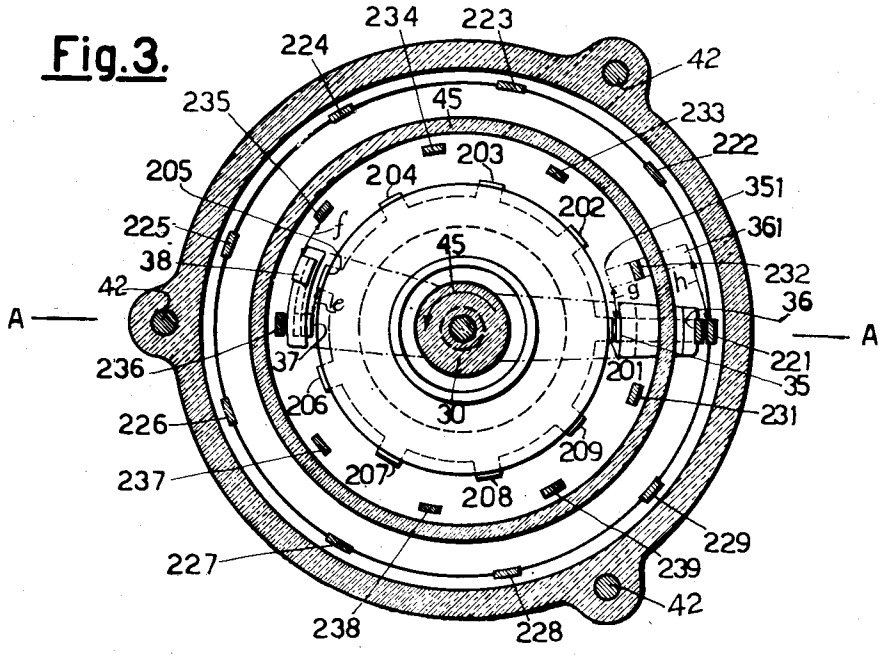


Fig.3.



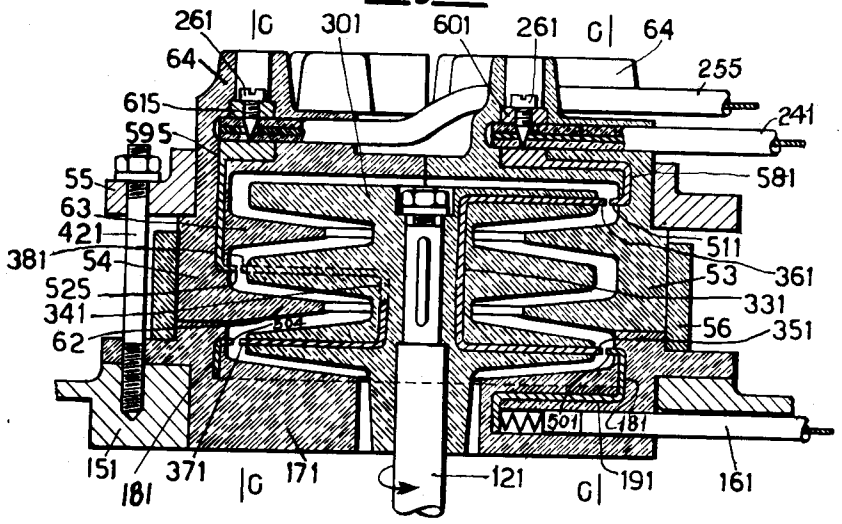
Inventor:
Hasper von Tavel

May 27, 1941. H. VON TAVEL 2,243,269

ELECTRIC CURRENT DISTRIBUTOR

Filed July 22, 1939 4 Sheets-Sheet 3

Fig.4.



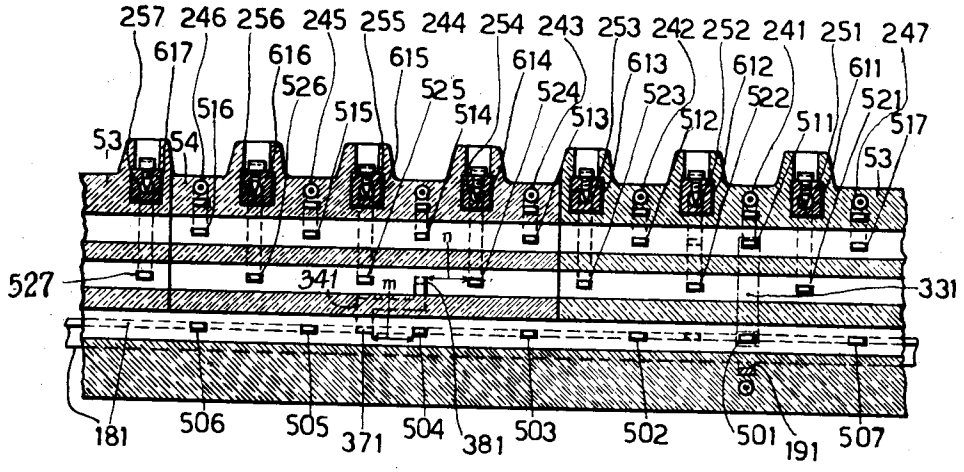


Fig.5.

Inventor:
Hesper von Tavel

May 27, 1941. H. VON TAVEL 2,243,269

ELECTRIC CURRENT DISTRIBUTOR

Filed July 22, 1939 4 Sheets-Sheet 4

Fig.6.

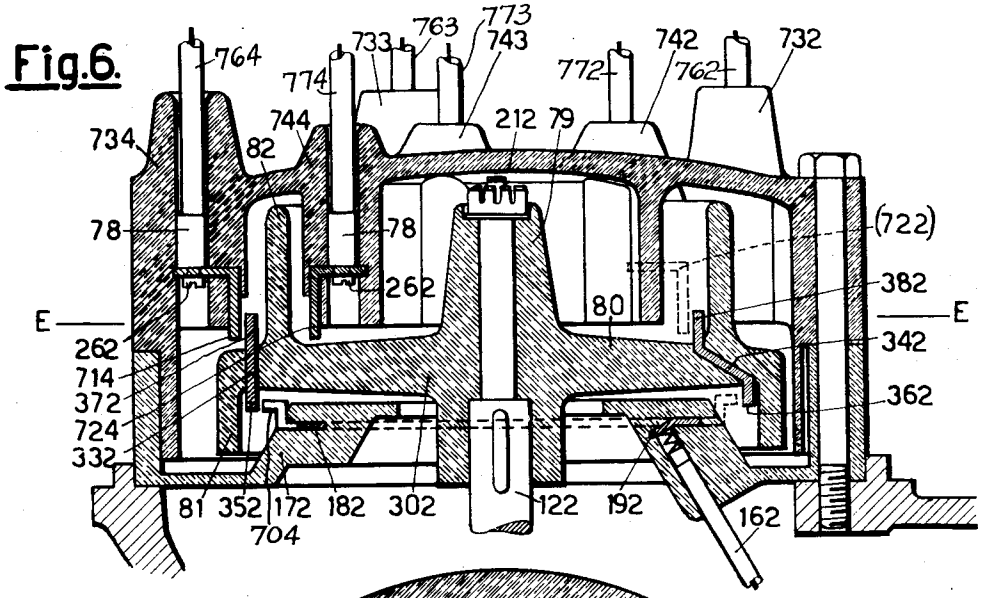
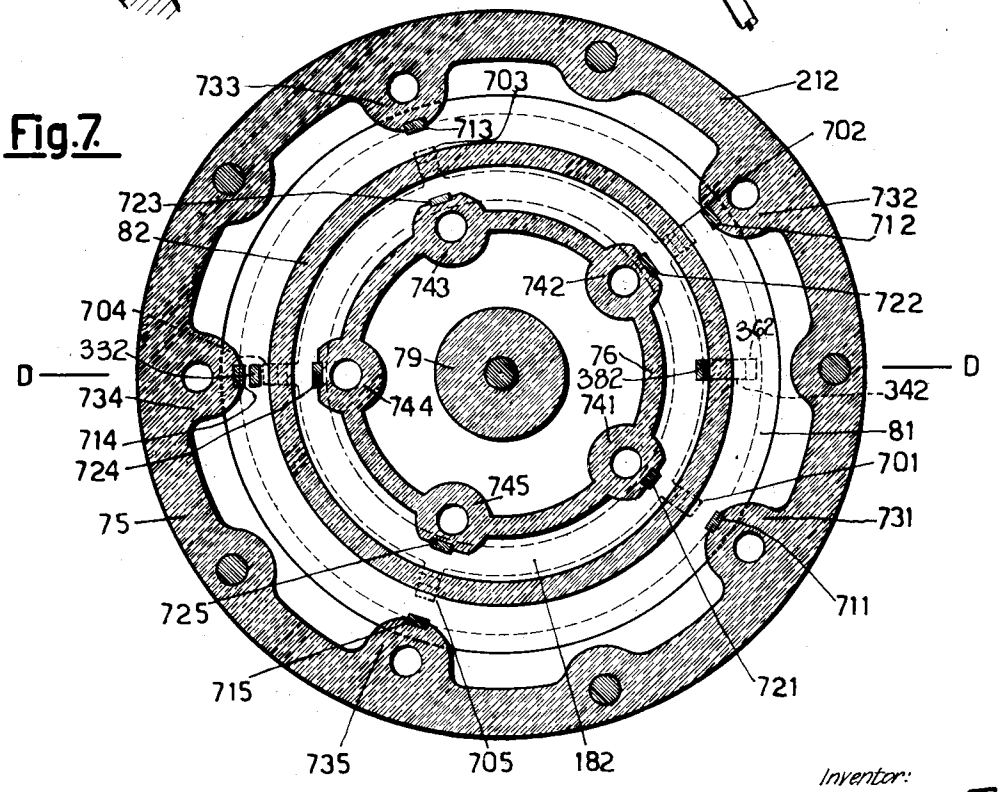


Fig.7.



Inventor:
Hasper von Tavel

Patented May 27, 1941 2,243,269

UNITED STATES PATENT OFFICE

2,243,269

ELECTRIC CURRENT DISTRIBUTOR

Hesper von Tavel, Soleure, Switzerland, assignor to Scintilla Ltd., Soleure, Switzerland, a corporation of Switzerland

Application July 22, 1939, Serial No. 286,045
In Switzerland July 22, 1938

9 Claims. (Cl. 200—21)

The present invention relates to an electric current distributor and more particularly to an ignition current distributor for internal combustion engines. The distributor is connected to an incoming conductor through which it is supplied with timed current impulses, and to a plurality of outgoing conductors, and the function of the distributor is to direct the said current impulses in turn to each one of the said outgoing conductors. The distributors of the type on which the invention is an improvement comprise a plurality of supply electrodes electrically connected with each other and with the incoming conductor, a plurality of leading-out electrodes insulated from each other and connected each with one of the said outgoing conductors, and a distributing member which rotates in timed relation with the occurrence of the said current impulses and which carries a distributing conductor so as to connect in turn each one of the said leading-out electrodes to one of the said supply electrodes, at the time at which the said current impulses occur.

In ignition apparatus for internal combustion engines, the function of the distributor is to complete in turn circuits each including the source of the current impulses and a spark plug.

At the moments at which the current impulses are supplied to the distributor, the incoming conductor is at high potential for a short period. With the current generators provided as a source of current impulses, in the usual ignition apparatus, the incoming conductor remains at a substantial though much lower residual potential between the short periods in which it is at high potential. This residual potential tends to maintain current flowing through the distributor even in the interval between the high potential current impulses.

In the distributor, each current impulse finds its way from the incoming conductor to a supply electrode and thence to a distributing conductor, and from the latter across a small air gap to a leading-out electrode. It leaves the distributor through the outgoing conductor connected to the last-mentioned leading-out electrode. In the said air gap, it creates an electric arc. After the passage of the high potential current impulse, the current produced by the residual potential tends to go the same way, maintaining this electric arc. It is a secondary, though important, function of the distributor to ensure extinction of this arc, to prevent misleading of the subsequent high potential current impulse. This result is brought about by increasing the said air gap while the distributing member proceeds in its rotation.

In known distributors of the type characterised above, the same distributing conductor after having connected a first leading-out electrode to a supply electrode, for one first period of high potential, connects a neighbouring second leading-out electrode to a supply electrode for the subsequent period of high potential. The arc built up under high potential during the first said period, and subsequently maintained at the lower potential between the distributing conductor and the first leading-out electrode produces a bridge of ionised air which extends from the said first leading-out electrode to the place occupied by the distributing conductor at the time of the rupture of the arc, which place may be quite near to the second electrode. It is known that ionised air offers materially diminished resistance to the passage of electric current. Thus, at the time when the said second period of high potential begins, the conductivity of the air gap between the distributing conductor and the first leading-out electrode, which air gap includes the path of ionised air, may be as good as the conductivity of the air gap between the distributing conductor and the second electrode, although the latter air gap is made as short as possible. This may have the undesirable result that in the second period of high potential the resulting current impulse reaches the first leading-out electrode instead of the second one. The distributors of ignition devices for aircraft engines having a great number of cylinders and working at high altitude are particularly liable to such misleading of current because their leading-out electrodes are at a short distance from each other and because they work in an atmosphere of comparatively high conductivity.

One of the objects of the present invention is to provide a distributor suitable for distributing current impulses to a comparatively great number of outgoing conductors.

Another object of the present invention is to provide a distributor of small overall dimensions.

A further object of the invention is to provide a distributor adapted for working reliably in an atmosphere of comparatively high conductivity.

With these general statements of the objects and purposes of the invention it will now be proceeded to the description of some embodiments of the invention and of the manner in which the invention is carried out, and it will be understood that while the description relates to what may be considered as preferable embodiments of the in-

vention, the invention is not limited to the precise conditions, proportions, or number of members herein set forth, as they may be varied by those skilled in the art in accordance with the particular purposes for which they are intended, and the conditions under which they are to be utilised.

In the accompanying drawings—

Fig. 1 is a diagram showing generally the ignition installation of an internal combustion engine.

Fig. 2 shows, in a diametral section on line A—A of Fig. 3, the distributor of the ignition installation shown in Fig. 1.

Fig. 3 is a cross-section on line B—B of Fig. 2, through the same distributor.

Fig. 4 shows another distributor in a diametral section.

Fig. 5 is the development of a section taken on a cylinder C—C, through the distributor shown in Fig. 4.

Fig. 6 represents a third distributor in a diametral section taken on the line D—D of Fig. 7 and

Fig. 7 is a cross-section on line E—E of Fig. 6.

The ignition installation diagrammatically represented in Fig. 1 has a primary circuit comprising the primary winding 1 of an ignition coil, one end of which is "earthed" at 2 by connection to the metallic parts of the internal combustion engine. The opposite end 3 of the winding 1 is connected through a spring 4 to a contact lever 5 which is mounted on a pivot 6, but electrically insulated therefrom. The contact lever carries a contact 7 which co-operates with a stationary contact 8. The latter has a connection 9 to the "earth" 2, so that the described primary circuit is closed when the contacts 7 rest on the stationary contact 8. The spring 4 tends to press the contact lever 5 into this circuit closing position. The contact lever 5 carries a finger 10 of insulating material. A condenser 11 is also provided in the primary circuit with its armatures connected to both ends 2 and 3 of the winding 1.

The internal combustion engine drives, in a way not shown in the drawings, a contact breaker and distributor shaft 12. The gear ratio between the crankshaft of the engine and the distributor shaft is such that the latter does one revolution in each working cycle of the internal combustion engine, i. e. for two revolutions of the engine crankshaft in the case of four-stroke engines. The shaft 12 carries a contact breaker cam 13 having as many notches as the ignition installation comprises spark plugs, eighteen in the present instance. The cam 13 co-operates with the finger 10 of the contact lever 5, the arrangement being such that each time when a crest of the cam 13 meets the finger 10 the contact 7 on the contact lever is lifted from the stationary contact 8, whereby the primary circuit is interrupted.

Means not shown in the drawings are provided for producing an alternating magnetic flux in the core of the winding 1, whereby a current is developed in the primary circuit before each one of its interruptions.

A secondary winding 14 having a great number of turns is connected at 3 to the primary circuit, this winding being wound on the same core (not shown) as the primary winding 1. The opposite end of the secondary winding 14 is connected to the incoming cable 16 of the distributor.

When the current developed in the primary circuit is interrupted by the contact 7 parting from the stationary contact 8, this results in an abrupt change of the magnetic flux passing through the core of the two windings 1 and 14. Because of the high number of turns of the secondary winding 14, this change of flux causes a sudden rise of potential in the cable 16.

The device thus far described is a magneto-electric current generator as commonly used for ignition purposes and forms no part of the invention. It is preferably enclosed in a metallic housing, which is indicated by the reference number 15 in Figs. 2 and 3.

Although the conducting parts of the distributor have also been shown in Fig. 1, which shows the electric connections of the distributor to the other parts of the ignition installation, Figs. 2 and 3 will now preferably be referred to. The bottom piece 17 (Fig. 2) of the distributor is made from insulating material; the latter encloses a metal ring 18, an extension 19 of which is connected to the end of the incoming cable 16. At its outer edge, the metal ring 18 has equidistant teeth 201, 202—209 which project from the insulating material and which constitute the supply electrodes.

The cover piece 21 of the distributor is made from insulating material and centered on the bottom piece 17. The pieces 21 and 17 are clamped together and fastened to the housing 15 by stud bolts 42.

Leading-out electrodes 221—229 and 231—239 consisting each of a piece of metal are mounted on the inside face of the cover piece 21. The electrodes 221—229 are disposed on a circle of larger diameter and the electrodes 231—239 on a circle of smaller diameter. On each of these circles the leading-out electrodes are equidistant and their number is equal to the number of the supply electrodes 201—209. The electrodes 221—229 are situated in the same radial plane as the supply electrodes 201—209, while the electrodes 231—239 are set off in relation thereto by one-half of their angular interval.

The electrodes 221—229 and 231—239 are connected each to one of the insulated outgoing ignition cables 241—249 and 251—259, by pointed screws 26. The point of each screw traverses the insulation and the core of the cable and holds the latter in place in lodgings provided within the cover piece 21. Each one of the outgoing cables 241—249 and 251—259 is connected to one electrode of a spark plug 261—269 and 271—279 of the internal combustion engine as indicated diagrammatically in Fig. 1. The opposite electrodes of the spark plugs are connected back to "earth" terminal 2 of the current generator, by connection to the metal parts of the engine as diagrammatically indicated at 28 and 29.

A two-armed distributing member 30 made from insulating material rotates in the space into which the supply electrodes 201—209 and the leading-out electrodes 221—229 and 231—239 project. This member is mounted on the shaft 12, above referred to, and secured thereto by a nut 31 and a key 32.

The distributing member 30 carries two distributing conductors 33 and 34. They are insulated from each other, and only their tips 35, 36, 37 and 38 project into the air surrounding the distributing member. The tips 35 and 36 of the distributing conductor 33 both are in the same radial plane through the axis of rotation of the distributing member 30. The tip 35 is

placed so as to pass at a small distance from each of the supply electrodes 201—209 in turn while the distributing member rotates. Similarly, the tip 36 is placed so as to pass close to the leading-out electrodes 221—229. When the tip 35 faces one of the supply electrodes e. g. 201, the tip 36 faces the corresponding leading-out electrode, e. g. 221. The tip 37 of the conductor 34 passes in front of the supply electrodes 201—209 as does the tip 35 of the conductor 33, but these tips are 180° apart from each other. The tip 38 of the conductor 34 is placed so as to pass in front of the leading-out electrodes 231—239 of the other set. Relatively to the tip 37, the tip 38 is set off by the angle by which the electrodes 231—239 are set off against the supply electrodes 201—209, i. e. by one half of the angular interval between the electrodes 221—229. Thus, when the tip 37 of the conductor 34 faces a supply electrode, e. g. 205, the tip 38 faces the corresponding leading-out electrode, e. g. 235. The moments at which potential is high in the cable 16 coincide with each of the moments at which either the tip 35 of the distributing conductor 33 or the tip 37 of the distributing conductor 34 faces one of the supply electrodes 201—209.

A circular rib or rim 40 of insulating material is formed on the bottom piece 17 at its joint 41 with the cover piece 21. The air path through the joint 41, from any one of the supply electrodes 201—209 or of the distributing tips 35 and 37 to the stud bolts 42, is longer than it would be without this rib. The rib 40 thus helps preventing the current from jumping over to the said stud bolts when the conductivity of the air is high due to its ionisation and low density.

Another insulating rib 43, of tubular shape, also formed on the bottom piece 17 prevents direct passage of current through the air, from the supply electrodes 201—209 and the distributing tips 35 and 37 to the distributor shaft 12.

The distributing member 30 has a tubular extension 44 into which the end of the shaft 12 and the nut 31 are sunk. This extension 44 opposes the discharge of current from the distributing tip 38 to the shaft 12 and nut 31.

To prevent the passage of current from the distributing tip 36 to the leading-out electrodes 231—239 and from the distributing tip 38 to the leading-out electrodes 221—229, a further circular rib 45 is formed on the inside face of the cover piece 21.

In Figs. 2 and 3 of the drawings the parts are shown in the position when the tip 35 faces the electrode 201 and the tip 36 faces the leading-out electrode 221.

At the moment at which the parts occupy this position, the contact lever 5 is actuated by a crest of the cam 13, so that the primary circuit is interrupted by the contacts 7 and 8 being separated. This results in a temporary rise of potential in the cable 16.

This rise of potential then creates a current impulse which flows from the cable 16 through the extension 19 to the ring 18 and thence jumps from the electrode 201 to the tip 35 of the distributing conductor 33. Through the latter, the current impulse flows to the tip 36 and then jumps to the leading-out electrode 221. Thence, it returns to the current generator through the leading-out cable 241, the spark plug 261 where it produces the igniting spark, and through the "earth" conduit 28.

In the gaps between the supply electrode 201 and the tip 35, and between the tip 36 and the leading-out electrode 221 the air becomes ionised and arcs are produced by the passing current.

In creating the current impulse, the potential in the cable 16 drops to a value which is much lower than its previous high value, but which is still higher than the potential of the metal parts of the engine. As the shaft 12 and the distributing member 30 proceed in their anti-clockwise rotation in the direction indicated by the arrow 45 in Fig. 3, the air gaps increase between the supply electrode 201 and the tip 35, and between the tip 36 and the leading-out electrode 221. While the length of the said air gaps increases and in spite of the drop of potential in the cable 16, current continues to flow across these air gaps because the air in the latter has become a comparatively good conductor due to its ionisation. The arcs bridging these air gaps only break off when their added lengths have reached a rather considerable value. In breaking off, the arcs leave the air in a highly ionised state in the air gaps between the supply electrode 201 and the place occupied by the tip 35 at the time of rupture of the arc, and between the leading-out electrode 221 and the place occupied by the tip 36 at the said time.

In the further course of rotation of the shaft 12 the tip 37 of the distributing conductor 34 faces the supply electrode 206. At the same time, the tip 38 of the same distributing conductor faces the leading-out electrode 236. At that time also, the potential in the cable 16 is again suddenly increased by the generator, so as to deliver a new current impulse through the distributor. This current impulse should pass from the supply electrode 206, which it reaches through the ring 18 and its extension 19, to the tip 37 of the distributing conductor 34, and from the tip 38 of the latter, to the leading-out electrode 236.

While this current impulse is developed, the distributing conductor 33 is in the position indicated in dash-and-dot lines in Fig. 3. Its tip 35 occupies the position indicated by 351, at a distance g from the supply electrode 201. The tip 36 is in the position indicated by 361, and is at a distance h from the leading-out electrode 221. It can readily be seen that the passage of the current impulse to the leading-out electrode 221 is not only opposed by an air gap of the width h between the tip 36 and the electrode 221, but also by an additional air gap of the width g between the supply electrode 201 and the tip 35 of the distributing conductor 33. The combined length of these two air gaps makes up for the comparatively high degree of ionisation of the air in them. Thus, their resulting conductivity is lower than that of the shorter gaps of less ionised air between the supply electrode 206 and the tip 37 of the distributing conductor 34, and between the tip 38 of the latter and the leading-out electrode 236. Consequently, the current impulse goes to the leading-out electrode 236 as desired, and is not misled to the electrode 221 which was supplied with the previous current impulse.

It will now be explained how, on the other hand, misleading of the current impulse is prevented when the distributor member 30 is in the position represented in Figs. 1, 2 and 3. The current impulse preceding the attainment of this position has passed from the supply electrode 205 to the tip 37 of the distributing conductor 34 and from the tip 38 of the latter to the lead-

ing-out electrode 235. Although the potential of the cable 16 rapidly drops to a lower value, current continues for some time to flow through the said air gaps while the conductor 34 moves towards the position shown in the drawings. But finally the combined length of the air gaps becomes sufficient for preventing the passage of current, in spite of the ionised condition of the air in them. At the moment in which high potential is again supplied to the incoming cable 16 of the distributor, not only is the tip 38 at a distance *f* from the leading-out electrode 235, but the tip 37 is also at a distance *e* from the supply electrode 205. On account of their combined width *e+f*, and in spite of the weak condition of the air in them, the gaps 205/37 and 38/235 hold good against the increased potential. The current impulse resulting from the latter goes from the supply electrode 201 to the leading-out electrode 221, through the distributing conductor 33, as already described above. The subsequent current impulse is directed to the leading-out electrode 236, as already mentioned too. Then follows a current impulse to the leading-out electrode 222, and so on.

The distributor shown in Figs. 4 and 5 is provided for distributing current to fourteen spark plugs only while the distributor according to Figs. 1 to 3 is provided for eighteen spark plugs. The distributor according to Figs. 4 and 5 has otherwise quite the same functions as the distributor shown in Figs. 1 to 3. Therefore, the installation will no more be described as a whole, but only the distributor itself.

Supply electrodes 501—507, leading-out electrodes 511—517, and leading-out electrodes 521—527 are disposed on circles of equal diameter. The supply electrodes 501—507 are formed as teeth of a ring 181 which is disposed within the dished bottom piece 171 of the distributor. The said electrodes extend inwardly from the ring 181 and project to the inside of the rim of the bottom piece 171.

The leading-out electrodes are carried by two semi-cylindrical pieces 53 and 54 which abut against each other on a diametral plane. A ring 55 connected by stud bolts 421 to the housing 151 of the generator rests on a shoulder of each of the pieces 53 and 54 and holds them against the bottom piece 171 and the latter against the housing 151. Another ring 56 is centered on the bottom piece 171 and holds the pieces 53 and 54 against each other.

The piece 53 carries, on one level, the leading-out electrodes 511, 512 and 517, and on another level, the leading out electrodes 521, 522, 523 and 527. The remaining electrodes 513, 514, 515 and 516 on one level, and 524, 525 and 526 on the other level, are carried by the piece 54. Each one of the leading-out electrodes is integral with a conductor 581—587 and 591—597 provided within the respective piece 53 or 54. These conductors end in metal blocks 601—607 and 611—617 having each a hole into which the end of the corresponding one of the outgoing cables 241—247, and 251—257 is introduced.

These cables are secured and electrically connected to the blocks by pointed screws 261, which traverse the insulation and the core of the cable. These screws are accessible from the outside of the distributor.

The distributing member 301 mounted on the shaft 121 is of substantially cylindrical shape. It carries distributing conductors 331 and 341. The tips 351 of the conductor 331 and 371 of the conductor 341 travel past the supply electrodes 501—507, the tip 361 of the conductor 331 travels past the leading-out electrodes 511—517, and the tip 381 of the conductor 341 travels past the leading-out electrodes 521—527. The tips 351 and 361 of the conductor 331 are in the same radial plane, the tip 381 is in the diametrically opposed plane, and the tip 371 is set off with respect to the latter by one half of the angular interval between two supply electrodes.

Ribs 62 and 63 extending into corresponding recesses of the distributing member 301 are formed on the inside of the pieces 53 and 54. The rib 62 separates the supply electrodes 501—507 from the leading-out electrodes 521—527, and the rib 63 separates both the latter electrodes from the distributing tip 361 and the leading-out electrodes 511—517 from the tip 381. Pipes 64 of insulating material are also formed round the screws 261, to separate them from each other. All these separating ribs or pipes, are disposed so as to prevent the passage of electric current, through the air, between the conducting parts which they separate from each other.

The distributor works as that shown in Figs. 1, 2 and 3 and it is not necessary to describe its operation in detail. In Fig. 5, the distributing conductor 331 is indicated in the position for transmitting an impulse of current from the supply electrode 501 to the leading-off electrode 511. The previous impulse of current transmitted has gone from the supply electrode 504 through the distributing conductor 341 to the leading-out electrode 524. The last impulse which passed through the conductor 331 went from the supply electrode 507 to the leading-out electrode 517.

At the moment under consideration, bridges of ionised air resulting from former arcs exist at *m* between the electrode 504 and the tip 371 of the conductor 341, and at *n* between the tip 381 of the conductor 341 and the leading-out electrode 524. Further such bridges are between the tip 351 (now facing the electrode 501) and the supply electrode 507, and between the tip 361 (now facing the electrode 511) and the leading-out electrode 517.

The bridge between the electrode 507 and the tip 351 is of no effect because the electrode 501 faced by the said tip is connected to the electrode 507 by the ring 181. The air gaps at *m* and *n* have a combined width which is sufficient for preventing the passage of current in spite of the ionised condition of the air. The air gap between the tip 361 and the leading-out electrode 511 also forms an obstacle to the passage of current because of its width, which substantially equals the combined width of the air gaps at *m* and *n*. It is apparent that the width of the air gap 361/511 and the total width of the air gaps at *m* and *n* nearly equals two times the circumference of the circle on which the electrodes are disposed, divided by the total number of leading-out electrodes.

The distributor represented in Figs. 6 and 7 is intended for an ignition installation comprising ten spark plugs, the general arrangement of the installation being again similar to that shown in Fig. 1, with the outgoing conductors or cables being, of course, in the number of ten only in accordance with the number of spark plugs.

As in Figs. 1 to 3, equidistant leading-out electrodes 711—715 are arranged on an outer circle and similar electrodes 721—725 on an inner circle on the inner face of an insulating cover piece 212. The relative arrangement of the electrodes

on the two circles differs from that of Fig. 1 to 3 in that in the present example both the leading-out electrodes 711—715 on the outer circle and those, numbered 721—725 on the inner circle are in the same radial planes as the supply electrodes, 701—705. These latter are formed as teeth on the outer circumference of a ring 182 moulded into the bottom piece 172, from which they project. The ring 182 is connected to the supply cable 16 by a strip 192 integral with the ring 182.

Each one of the leading-out electrodes 711—715 and 721—725 is partly sunk into a socket 731—735 and 741—745, respectively, provided by the insulating material of the cover piece 212 and extending through the bottom of the latter. The sockets 731—735, into which the electrodes on the outer circle are sunk, are connected to each other by the rim 75 of the cover piece, while the sockets 741—745 into which the electrodes on the inner circle sunk are joined by a circular rib 76. The outgoing cables 761—765 and 771—775 of the distributor are connected to the spark plugs of the internal combustion engine, as are the cables 241—249 and 251—259 in Fig. 1. The ends of all the cables are provided with metal caps 78 soldered to the core of the cable. The cables 761—765 enter the sockets 731—725, and the cables 771—775 the sockets 741—745 from outside the distributor cover 212, and they are maintained and connected to the corresponding leading-out electrodes, by means of screws 262 screwed into the caps 78.

The rotating distributor piece 302 consists of a hub 79, a disk 80 and circular ribs 81 and 82 all made integral with each other from insulating material.

The disk 80 separates the supply electrodes 701—705 from the leading-out electrodes 711—715 and 721—725. The rib 81 encircles the supply electrodes 701—705 and is high enough to prevent direct passage of the current from these electrodes to the leading-out electrodes 711—715 even when the surrounding air has reached comparatively high degree of conductivity on account of its ionisation or low density. The rib 82 is provided on the opposite side of the disk 80 and extends into the circular recess between that portion of the sockets 731—735, on the outer side of the rib 82, and 741—745, on the inner side of the said rib, which extends to the inside of the cover piece 212 and which contains the caps 78 and screws 262 by which the leading-out electrodes are coupled to the corresponding out-going cables.

The distributing conductors 332 and 342 are lodged at diametrically opposed places from each other in the rotating member 302, the arrangement of their projecting tips being as follows:

The tips 352 of the conductor 332 and the tips 362 of the conductor 342 project from the disk 80 at the foot of the inner face of the circular rib 81. The path of these tips when the member 302 rotates is along the supply electrodes 701—705. The opposite tip 372 of the conductor 332 projects from the disk 80 on the outside the circular rib 82 and co-operates with the leading-out electrodes 711—715 on the outer circle. The tip 382 of the conductor 342 also projects from the disk 80 of the rotating member 302, but on the inside of the rib 82; it cooperates with the leading-out electrodes 721—725.

The distributor shown in Figs. 6 and 7 works quite in the same way as that shown in Figs. 1 to 3. At the time at which the rotating member 302 occupies its position shown in the figures, the current generator produces a rise of potential in the supply conduit 16. Current then passes from the supply ring 182 through the supply electrode 704, the distributing conductor 332 and the leading-out electrode 714. The preceding current impulse went through the supply electrode 701, the distributing conductor 342 and the leading-out electrode 721. At the moment under consideration, ionised air will therefore be found chiefly in the gaps between the supply electrode 701 and the tip 362 of the distributing conductor 342 and between the tip 382 and the leading-out electrode 721. As the current would have to cross both of these air gaps, which are in series, they form an effective resistance against misleading of the current impulse intended to reach the leading-out electrode 714.

The subsequent current impulse has to go through the supply electrode 702, the distributing conductor 342 and the leading-out electrode 722. At that time, the distributing conductor 332 has its tip 352 half-way between the supply electrodes 704 and 705 and its tip 372 half-way between the leading-out electrodes 714 and 715. The total width of the air gaps 704/352 and 372/714 containing freshly ionisated air in this case also presents sufficient resistance for preventing the current impulse to reach the previously supplied electrode 714 instead of the electrode 722.

What I claim is:

1. Electric current distributor comprising in combination a plurality of spaced supply electrodes; insulated connections between the said supply electrodes; a plurality of leading-out electrodes insulated from each other; a rotary member; a plurality of distributing conductors carried by the said rotary member and each adapted to occupy distinctive positions in the course of the rotation of the said rotary member, which distinctive positions are characterized by the distributing conductor facing simultaneously one of the said supply electrodes and one of the said leading-out electrodes; and the several distributing conductors being insulated from each other and arranged in relation to the said rotary member so that in the course of the rotation of the latter they alternate in occupying their said distinctive positions.

2. Electric current distributor comprising in combination a plurality of spaced supply electrodes; insulated connections between the said supply electrodes; a plurality of leading-out electrodes insulated from each other and arranged in at least two sets; a rotary member; a plurality of distributing conductors carried by the said rotary member and each adapted to occupy distinctive positions in the course of the rotation of the said rotary member, which distinctive positions are characterised by the distributing conductor facing simultaneously one of the said supply electrodes and one of the leading-out electrodes arranged in a definite one of the said sets; and the several distributing conductors being insulated from each other and arranged in relation to the said rotary member so that in the course of the rotation of the latter they alternate in occupying their said distinctive positions.

3. Electric current distributor comprising in combination a plurality of spaced supply electrodes; insulated connections between the said supply electrodes; a plurality of leading-out electrodes insulated from each other; a rotary mem-

ber; a plurality of distributing conductors carried by the said rotary member and each adapted to occupy distinctive positions in the course of the rotation of the said rotary member, which distinctive positions are characterised by the distributing conductor facing simultaneously one of the said supply electrodes and one of the said leading-out electrodes; and the several distributing conductors being insulated from each other and arranged in relation to the said rotary member so that in the course of the rotation of the latter they alternate in occupying their said distinctive positions, and that when one of the said distributing conductors occupies one of its said distinctive positions, all the other distributing conductors are displaced from all of their said distinctive positions.

4. Electric current distributor comprising in combination a plurality of spaced supply electrodes; insulated connections between the said supply electrodes, a plurality of leading-out electrodes insulated from each other and arranged in at least two sets; a rotary member, a plurality of distributing conductors carried by the said rotary member and each adapted to occupy distinctive positions in the course of the rotation of the said rotary member, which distinctive positions are characterized by the distributing conductor facing simultaneously one of the said supply electrodes and one of the leading-out electrodes arranged in a definite one of said sets; the several distributing conductors being insulated from each other and arranged in relation to the said rotary member so that in the course of the rotation of the latter they alternate in occupying their said distinctive positions; and a rib of insulating material extending into the air gap between the leading-out electrodes of one set and those of another set.

5. Electric current distributor comprising in combination a plurality of spaced supply electrodes; insulated connections between the said supply electrodes; a plurality of leading-out electrodes insulated from each other; a rotary member; a plurality of distributing conductors carried by the said rotary member and each adapted to occupy distinctive positions in the course of the rotation of the said rotary member, which distinctive positions are characterized by the distributing conductor facing simultaneously one of the said supply electrodes and one of the said leading-out electrodes; the several distributing conductors being insulated from each other and arranged in relation to the said rotary member so that in the course of the rotation of the latter they alternate in occupying their said distinctive positions; and at least one rib of insulating material extending into the air gap between any supply electrode and any leading-out electrode.

6. Electric current distributor comprising in combination a plurality of spaced supply electrodes; insulated connections between the said supply electrodes; a plurality of leading-out electrodes insulated from each other and arranged in at least two sets; a rotary member; several pairs of distributing electrodes carried by the said rotary member in such arrangement that in the course of the rotation of the rotary member each pair of distributing electrodes is adapted to occupy distinctive positions in which simultaneously one electrode of the pair faces one of the said supply electrodes and the other electrode of the pair faces one of those leading-out electrodes which are arranged in a definite one of the said sets, and that in the course of the rotation of the rotary member the several pairs of distributing electrodes alternate in occupying their said distinctive positions; an insulated electric connection between the two distributing electrodes of each pair; and the said rotary member having wall portions of insulating material extending into the air gaps between, on one side, the said supply electrodes and, on the other side, the said leading-out electrodes, and into the air gaps between, on one side, any one of the said distributing electrodes adapted to face the leading-out electrodes arranged in a definite one of the said sets and, on the other side, all the leading-out electrodes arranged in at least one other of the said sets.

7. Electric current distributor comprising in combination a cover piece; a plurality of leading-out electrodes mounted on said cover piece in at least two concentric circular sets and insulated from each other; means associated with each one of the said leading-out electrodes for connecting a conductor thereto; said cover piece providing lodgings for the said conductor connecting means and having at least one circular recess extending between the lodgings of such of the said conductor connecting means as are associated with the leading-out electrodes of different sets; a rotary member having at least one circular rib of insulating material extending into the gaps between the leading-out electrodes of two different sets and into the said recess between the lodgings of their associated conductor connecting means; distributing electrodes insulated from each other and carried by the said rotary member on different sides of its said rib in such arrangement that in the course of the rotation of the said rotary member each one of the said distributing electrodes faces in turn the several leading-out electrodes of a definite one of the said sets; at least one current supply conductor; and means effective in the course of the rotation of the said rotary member to connect alternately the several distributing electrodes to the said supply conductor.

8. A distributor for timed electrical impulses comprising in combination a circular series of supply electrodes spaced from each other and all having an impulse supply connection; at least two circular series of leading-out electrodes spaced and insulated from each other, said series being concentric with the series of supply electrodes and each series including a number of electrodes equal to the number of supply electrodes; an insulating rotor mounted to turn on an axis concentric with all said series of electrodes; and a plurality of distributing conductors one for each series of leading-out electrodes and each offering a bridging conducting path from electrodes of the supply series to electrodes of the corresponding leading-out series, said conductors being mounted in spaced relation in said rotor, the rotor housing the conductors except the extremities thereof, and the spacing being such relatively to the electrode spacing that the conductors become effective individually and successively in recurrent sequence and successive impulses are thereby delivered to successive leading-out electrodes selected in recurrent sequence from different series.

9. A distributor for timed electrical impulses comprising in combination a circular series of supply electrodes spaced from each other and all having an impulse supply connection; at least two circular series of leading-out electrodes

spaced and insulated from each other, said series being concentric with the series of supply electrodes and each series including a number of electrodes equal to the number of supply electrodes; an insulating rotor mounted to turn on an axis concentric with all said series of electrodes; a plurality of distributing conductors one for each series of leading-out electrodes and each offering a bridging conducting path from electrodes of the supply series to electrodes of the corresponding leading-out series, said conductors being mounted in spaced relation in said rotor, the rotor housing the conductors except the extremities thereof, and the spacing being such relatively to the electrode spacing that the conductors become effective individually and successively in recurrent sequence and successive impulses are thereby delivered to successive leading-out electrodes selected in recurrent sequence from different series; an insulating housing enclosing said series of electrodes and supporting the same, and means comprising interleaved annular webs in the rotor and housing for lengthening the air gap between electrodes of the different series.

HESPER VON TAVEL.