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ELECTROSTATIC MACHINE PRODUCING A PERIODICAL DISCHARGE

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Fig. 1.

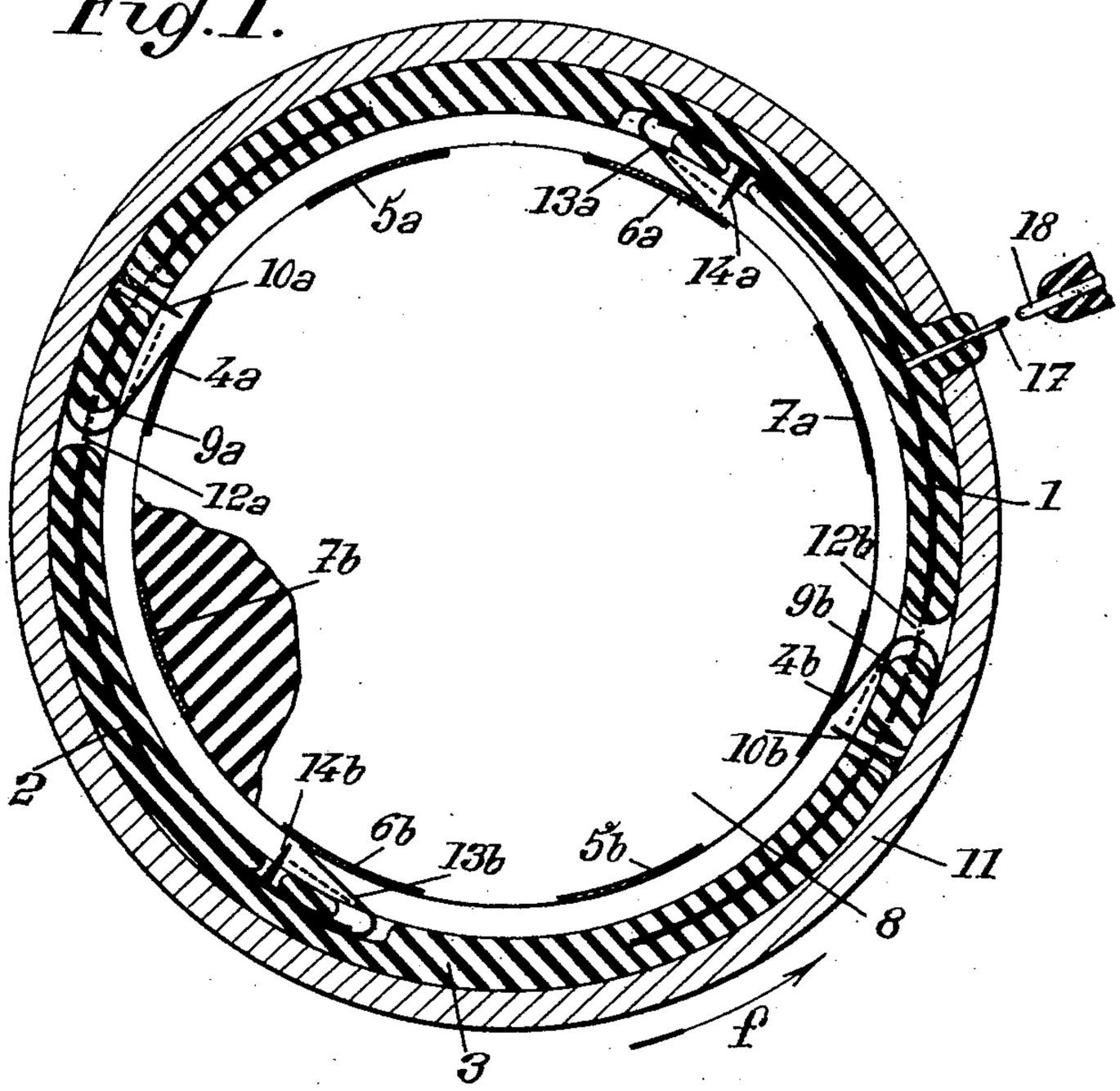
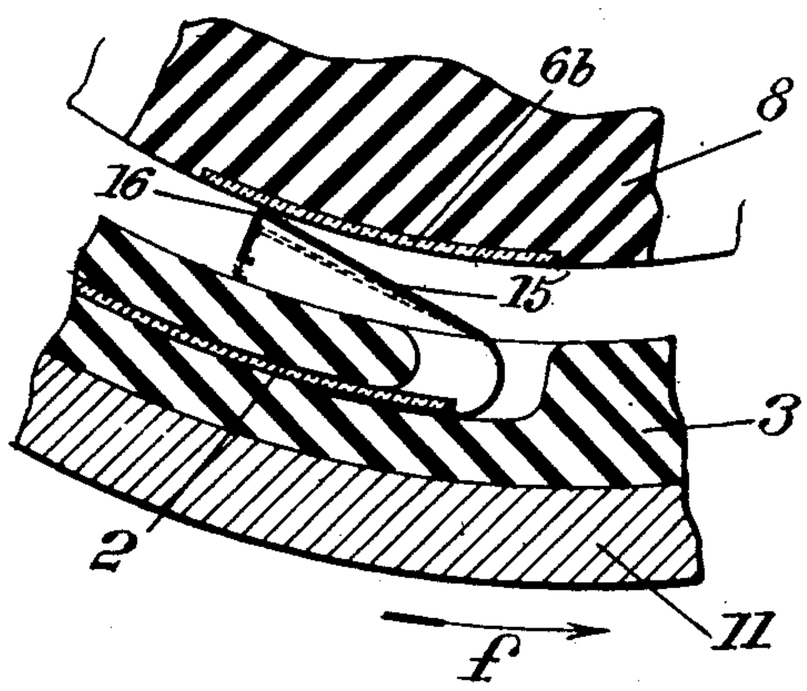


Fig. 2.



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ELECTROSTATIC MACHINE PRODUCING A PERIODICAL DISCHARGE

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8 Claims. (Cl. 310—6)

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The present invention relates to electrostatic machines working by influence, in particular to rotary machines producing a periodical discharge, and it is more especially concerned with internal combustion engine spark ignition machines.

The chief object of my invention is to provide a machine of this kind which is better adapted to meet the various requirements of practice than those existing at the present time.

The machines with which my invention is concerned include at least two parts in relative movement with respect to each other, one of these parts carrying an even number of insulated collecting plates initially provided with electricity charges the polarities of which alternate from one plate to the next one, and the other part carrying a plurality of insulated influenced plates, with means for short-circuiting by pairs the influenced plates, and means for discharging these plates onto the collecting plates.

They are characterized in that at least one of said means is constituted both by combs enabling the electric charges to pass through a thin layer of a gaseous dielectric and by brushes establishing a sliding contact, these brushes being arranged to retract automatically under the action of a physical force developed by the operation of the machine, when this machine reaches speed conditions for which electric discharge can be conducted through the combs.

Preferred embodiments of my invention will be hereinafter described with reference to the accompanying drawings, given merely by way of example, and in which:

Fig. 1 of this drawing diagrammatically shows in cross section a spark ignition machine according to my invention.

Fig. 2 shows a detail of a machine made according to a modification of that of Fig. 1.

The machine includes at least two portions in relative movement with respect to each other, preferably a fixed portion and a rotary portion, one of these portions including an even number of insulated plates (collecting plates), which are supposed initially to carry electric charges the polarities of which alternate from one plate to the next one, and the other portion including a plurality of insulated plates (influenced plates) which come successively opposite each of the first mentioned plates, together with means for successively short-circuiting the pairs of influenced plates which are opposed with respect to the axis of the machine, and means for conveying onto the collecting plates the electric charges which have been generated on the influenced plates.

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Concerning the means for successively short-circuiting by pairs the plates which have been electrified by influence, and the means for transferring to the collecting plates the charges which have been induced in the influenced plates, at least one of them, and preferably both, include simultaneously combs (i. e. sharp points) which enable the electric charges to pass through a thin layer of a gaseous dielectric (of the order of magnitude of one tenth of a millimetre for instance) and brushes which establish a sliding contact between the fixed and rotating plates, and the brushes are arranged in such manner that they retract automatically, under the effect of a physical force developed by the operation of the machine, when this operation reaches conditions (and in particular a rotational speed) such that the transmission of charges can take place through the combs.

This physical force may be for instance a suction created by the operation of the machine, but it is more advantageous to use the centrifugal force developed in elements carried by the rotating portion.

In this case, the brushes are disposed on the rotating portion of the machine and they are arranged in such manner as to be subjected, on the one hand, to the action of this centrifugal force, for instance through a kinematic device (link system or other) and, on the other hand, to an antagonistic elastic action.

Preferably, the brushes themselves are subjected to the centrifugal force and they are given a natural elasticity such that, when the machine rotates at a speed lower than a given value, the brushes establish a sliding contact with the conducting pieces located opposite them, whereas, when the machine rotates at a speed higher than this value, the brushes are bent out of contact, the electric charges then passing through the combs associated with the brushes.

In the construction shown by the drawing, there are two collecting plates **1** and **2**, charged respectively with negative and positive electricity and embedded in an insulating ring **3** carried by the rotating portion (rotor) of the machine, the direction of rotation of which is indicated by arrow *f*. There is a plurality of influenced plates diametrically opposed two by two (**4***a*—**4***b*, **5***a*—**5***b*, **6***a*—**6***b*, **7***a*—**7***b*) carried by the fixed portion (stator) of the machine, constituted by an insulating mass **8**.

According to a first embodiment (Fig. 1), the means for successively short-circuiting the pairs of influenced plates (**4***a* and **4***b*, **5***a* and **5***b*, etc.),

are constituted by two opposed systems including each a brush (9*a*, 9*b*) and a comb (10*a*, 10*b*) carried by the rotor and connected by conductor means. When said conductor means is disposed at the periphery of the rotor, the brushes and combs extend through apertures 12*a*, 12*b* provided in ring 3 and plates 1 and 2. When the rotor includes a metallic fly-wheel 11, this fly-wheel may be used as conductor means.

The means for transferring to the collecting plates 1, 2 the electric charges induced in the insulated plates (4*a*, 4*b*, etc.) are also constituted by two opposed systems including each a brush (13*a*, 13*b*) and a comb (14*a*, 14*b*) carried by the rotating plates 1, 2.

The brushes (9*a*, 9*b*, 13*a*, 13*b*) are constituted in the embodiment of Fig. 1, by bent elastic plates having their convexity turned toward the direction of rotation, as shown by the drawing.

According to another embodiment (Fig. 2), each comb and brush system is constituted by a single elastic conductor plate 15 the edge 16 of which plays the part of a comb when, under the effect of the centrifugal force, plate 15 is deformed to occupy the position shown in dotted lines in Fig. 2.

The operation of the machine is as follows:

When the machine is started, there is always a difference of polarity between plates 1 and 2. As a rule, due to the preceding operation of the machine, there is always some remaining electricity charges on these plates, whereby one of them is positively charged with respect to the other. Even without having to rely on the existence of these residual charges, it is pointed out that rotation of parts 11—3 with respect to the stator will produce by friction on air small electric charges, and as these charges are never exactly equal, one of the plates 1—2 will be charged more than the other and differences of polarity will thus be created. For the sake of simplicity, in the following explanations it will be supposed that plate 1 is negatively charged and plate 2 is positively charged. These plates charge by influence the plates 4*a*, 4*b* located respectively opposite them which are short-circuited through brushes 9*a* and 9*b* (Fig. 1) or 15 (Fig. 2) and fly-wheel 11. Plate 4*a* is thus charged with negative electricity and plate 4*b* with positive electricity and these plates remain thus charged when, the rotor having rotated, the connection between them is cut off. Then, after angular displacement of rotor 3, brush 13*a* comes into contact with plate 4*a* and brush 13*b* with plate 4*b*, whereby the charges carried by plates 4*a* and 4*b* are respectively transferred to collecting plates 1 and 2. Due to the rotation of the machine, the charges on the rotating plates 1 and 2 thus tend to be multiplied and, when the speed of rotation reaches and exceeds a certain value, these charges are such that communication can be established through combs 10 and 14, (in the case of Fig. 1), or 16 (in the case of Fig. 2) through the gaseous dielectric. At this time, under the effect of the centrifugal force, brushes 9 and 13 (or 15) are bent into the positions shown in dotted lines where they no longer contact the fixed plates. The operation of the machine remains the same, with the exception that the internal connections are established exclusively through the combs, i. e. without any friction.

According to another feature of my invention, which will be supposed to be applied to a machine such as that above described for the sparking

ignition of internal combustion engines, the rotating portion of the machine is carried by the fly-wheel of the engine, designated by 11, said fly-wheel is used to constitute one of the armatures of a condenser (the metallic plates 1 and 2 being for instance surrounded by annular fly-wheel 11 and the insulating ring 3 being interposed between said fly-wheel 11 and said plates 1, 2) capable of storing up a certain amount of electricity, and, preferably, the rotor, in particular if it includes a metallic fly-wheel, is then used as spark distributor.

For this purpose, every second electrifying plate, in particular one of the two plates 1 and 2 in the embodiment shown by the drawing, is provided with an insulated projection 17 extending in an insulated fashion through the metallic fly-wheel and I dispose externally to the rotor a fixed metallic rod 18 in communication with the engine spark plug, in such manner that at a given time of the rotation of the fly-wheel, projection 17 comes opposite rod 18 and at a small distance thereof. At this time, a short spark is produced between these pieces and causes the spark to be produced at the spark plug: the spark is thus produced at a time which is in relation with the position of the engine fly-wheel, that is to say with the position of the piston (or the pistons) in its cylinder (or their cylinders).

I use only every second plate for the production of the spark, for instance negative plate 1, so as to keep the other plate 2 constantly charged with electricity, which facilitates the production of electricity in the first plate and obviates risks of failure.

A great advantage of such a machine is that it creates no friction between the contact elements to be connected and, consequently, eliminates the most serious cause of wear and tear of these elements.

In a general manner, while I have, in the above description, disclosed what I deem to be practical and efficient embodiments of my invention, it should be well understood that I do not wish to be limited thereto as there might be changes made in the arrangement, disposition and form of the parts without departing from the principle of the present invention as comprehended within the scope of the accompanying claims.

What I claim is:

1. An electrostatic machine which comprises, in combination, two parts movable with respect to each other, an even number of insulated collecting plates carried by one of said parts, said plates being provided with electric charges of respective polarities alternating from one plate to the next one, a plurality of pairs of insulated influenced plates carried by the other part to place the two plates of each pair respectively opposite two successive collecting plates, means for short-circuiting said pairs of plates successively, and means for discharging said influenced plates onto said collecting plates respectively, at least one of said two means including both combs, intended for normal operation of the machine, arranged to pass the electric charges through a thin layer of a gaseous dielectric, and brushes, intended for the starting of the machine, arranged to achieve sliding contacts for the passage of said charges, said brushes being retractable into inoperative position in response to a given relative velocity of said two parts of the machine.

2. An electrostatic machine which comprises, in combination, two parts rotatable with respect to each other, an even number of insulated collecting plates carried by one of said parts, said plates being provided with electric charges of respective polarities alternating from one plate to the next one, a plurality of pairs of insulated influenced plates carried by the other part to place the two plates of each pair respectively opposite two successive collecting plates, means for short-circuiting said pairs of plates successively, and means for discharging said influenced plates onto said collecting plates respectively, at least one of said two means including both combs, intended for normal operation of the machine, arranged to pass the electric charges through a thin layer of a gaseous dielectric, and brushes, intended for the starting of the machine, arranged to achieve sliding contacts for the passage of said charges, said brushes being retractable into inoperative position by the centrifugal force developed by one of said parts, which is rotating, when the speed of revolution thereof reaches a given value.

3. A machine according to claim 2 in which the brushes are elastic and directly subjected to the action of the centrifugal force which deforms them into inactive position.

4. A machine according to claim 2 in which the brushes are constituted by bent resilient plates carried by the rotating part so as to be deformed into inoperative position by the centrifugal force.

5. A machine according to claim 4 in which each comb is constituted by the end of the corresponding brush.

6. A machine according to claim 2 for use as spark ignition machine in connection with an internal combustion engine, in which the rotating portion of the machine is carried by the engine fly-wheel.

7. A machine according to claim 6 in which the fly-wheel constitutes one of the armatures of a condenser capable of storing up electricity, the other armature being constituted by collecting plates carried by the rotating part.

8. An electrostatic machine which comprises, in combination, two parts movable with respect to each other, an even number of insulated collecting plates carried by one of said parts, said plates being provided with electric charges of respective polarities alternating from one plate to the next one, a plurality of insulated influenced plates carried by the other part so as to be brought successively opposite said collecting plates in recurrent fashion, whereby when each of said influenced plates is passing opposite one of said collecting plates, two charges of equal magnitudes and opposed polarities are formed on the opposed faces thereof respectively by influence from said collecting plate, means responsive to the relative movement of said parts for successively eliminating from every influenced plate as it is still passing along each of said collecting plates the electric charge, of the same polarity as that of said last mentioned collecting plate, which has been formed by influence on the side of said influenced plate opposed to that facing said collecting plate, and means for discharging said influenced plates onto said collecting plates as soon as they come opposite them, at least one of said two means including both combs, intended for normal operation of the machine, arranged to pass the electric charges through a thin layer of a gaseous dielectric, and brushes, intended for the starting of the machine, arranged to achieve sliding contacts for the passage of said charges, said brushes being retractable into inoperative position in response to a given relative velocity of said two parts of the machine.

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