July 24, 1956 N. FELICI ET AL 2,756,352

ELECTROSTATIC GENERATOR

Filed Sept. 21, 1955 4 Sheets-Sheet 1

Fig. 1

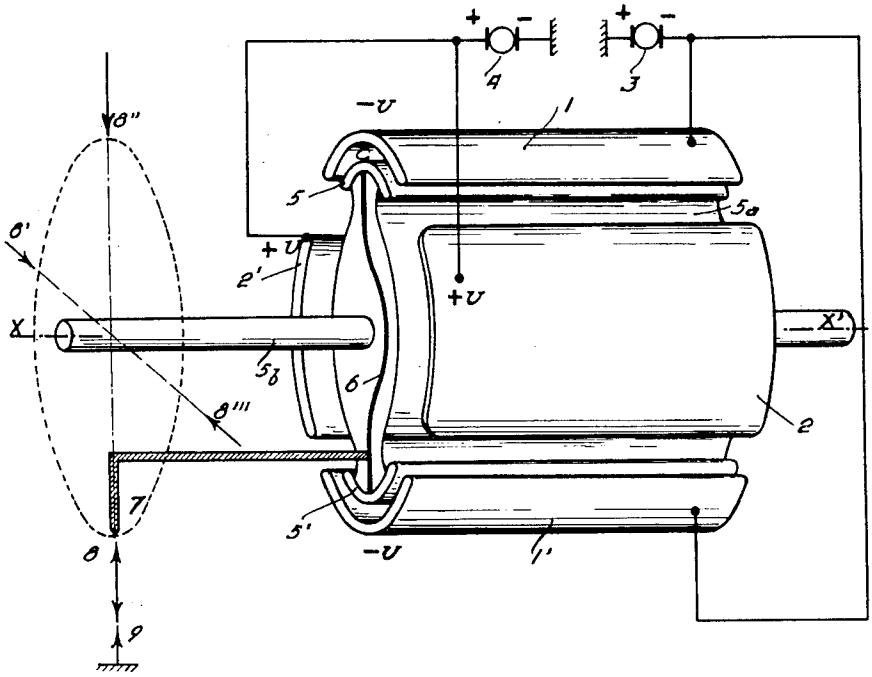
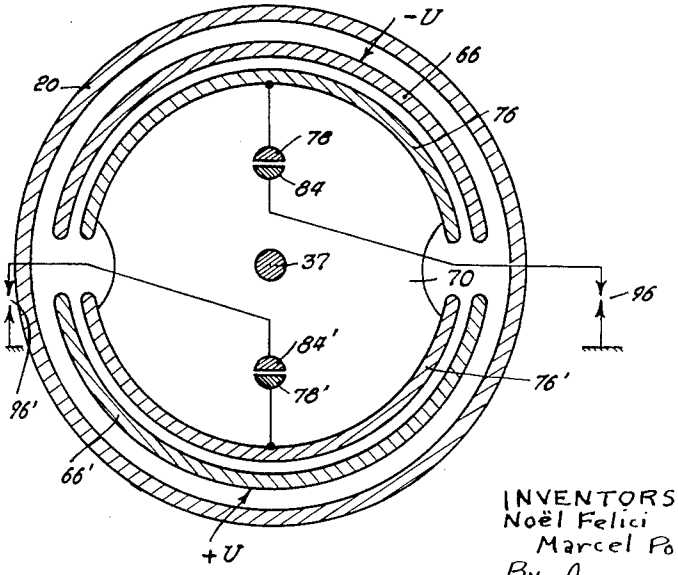


Fig. 4



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ELECTROSTATIC GENERATOR

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Fig. 2

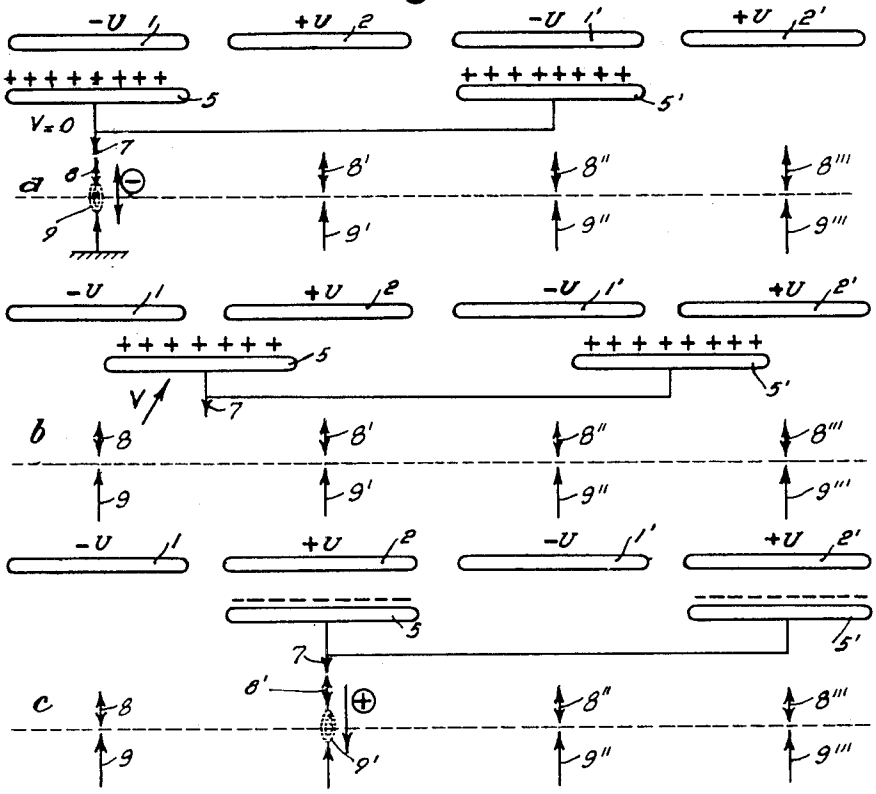
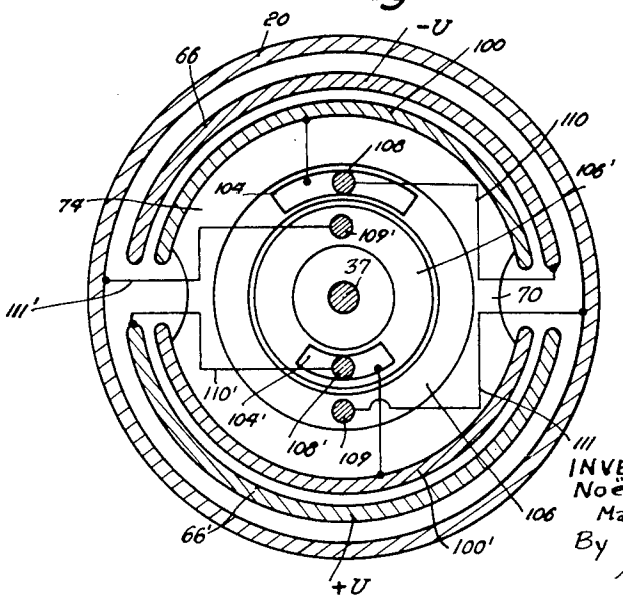


Fig. 5



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ELECTROSTATIC GENERATOR

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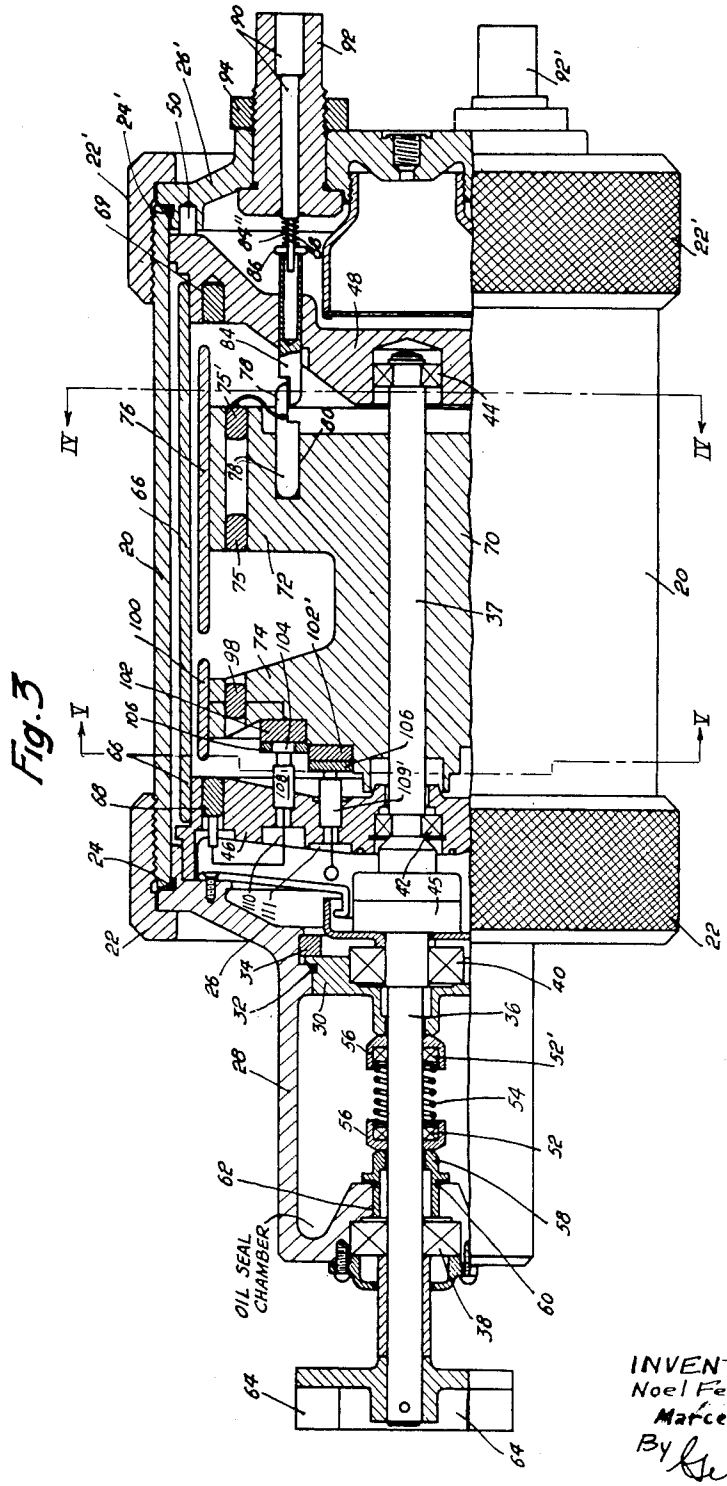


Fig. 3

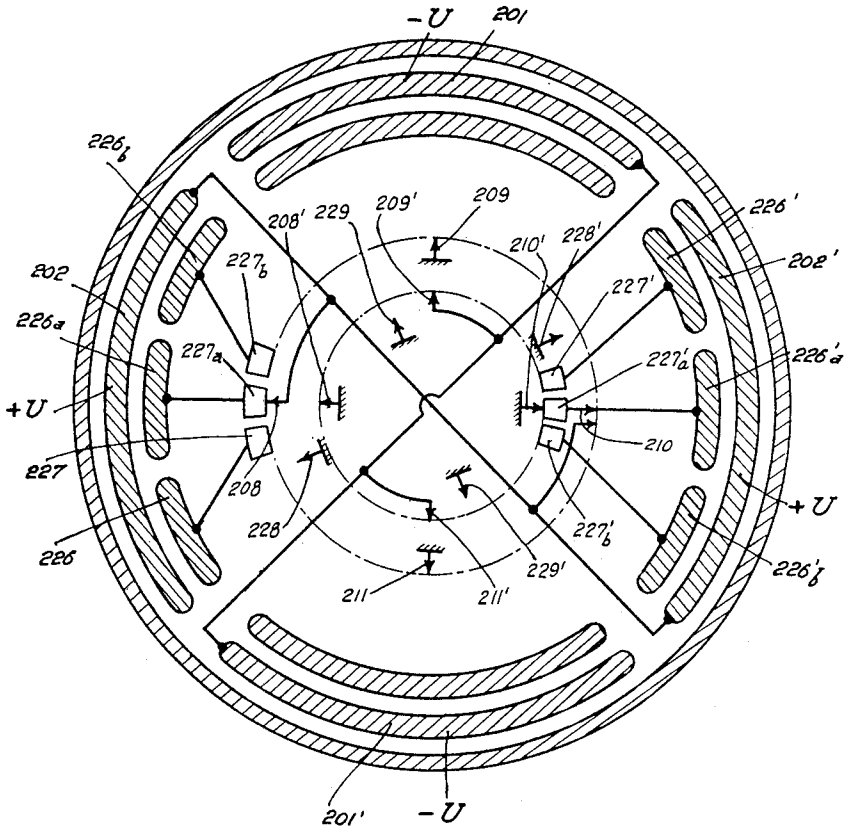
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ELECTROSTATIC GENERATOR

Filed Sept. 21, 1955 4 Sheets-Sheet 4

Fig. 6



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United States Patent Office 2,756,352 Patented July 24, 1956

2,756,352

ELECTROSTATIC GENERATOR

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Continuation of application Serial No. 258,348, November 27, 1951. This application September 21, 1955, Serial No. 535,722

Claims priority, application France November 29, 1950

20 Claims. (Cl. 310—6)

The present invention concerns the supply of short current impulses of very high voltage.

Such pulses are necessary in a number of electro-technical applications in which considerable energy must be developed and utilized in a very short time, in some applications at predetermined instants and with a high timing accuracy.

This necessity occurs, for instance, in the electrical ignition of internal combustion engines, the production of electro-magnetic wave trains for detecting purposes, range finding of objects by an echo method, the production of physico-chemical reactions involving effects of a purely electric or magnetic nature without any undesirable increase of the ambient temperature, and other similar cases.

As regards more particularly ignition in internal combustion engines, it has already been proposed in the patent to Felici 2,590,168, March 25, 1952, to substitute for a discharge resulting from high voltage of inductive origin a purely capacitive discharge obtained by means of a circuit comprising a condenser capable of being charged periodically at a high voltage, a distributor having a rotating finger connected with one of the terminals of the condenser and capable of passing successively opposite to and at spark gap distance from stationary electrodes respectively connected with one electrode of the respective spark plugs of the engine, the other electrodes of these spark plugs and the other terminal of the condenser being grounded, the distributor being enclosed inside an air tight casing filled with pressurized gas. The condenser is discharged at each passage of the distributor finger opposite a stationary electrode across the interval between this finger and such stationary electrode in the circuit containing the spark plug corresponding to this stationary electrode, the ignition spark then taking place between the electrodes of said spark plug. The condenser then is charged anew before the finger passes opposite the next stationary electrode.

It has also been proposed in the Patent 2,590,168 to use for charging the condenser a high voltage electrostatic generator and, further, to use as a condenser for causing the discharge the electrodes themselves—inductor members and conveyor members—of an influence type electrostatic generator with conducting conveyor members.

The considerable advantages obtained with a purely capacitive discharge as compared with an inductive discharge for the ignition of internal combustion engines are already known. These advantages, the more important of which are that the quality of the spark is not influenced by the rotation speed of the engine, the steadiness of the ignition point, the possibility of shielding the ignition circuit and of obtaining good ignition even if the spark plugs are dirty or if their insulation is poor, as well as decreased wear of the spark plugs, result mainly from the very high concentration of the energy causing each discharge and from the fact that the ignition point or

instant is not determined by an interrupter, as in the coil and magneto systems, but by the distributor itself.

The object of the present invention is the provision of an electrostatic generator capable of generating very short current impulses at a very high voltage and capable of being used in a particularly convenient manner for ignition in internal combustion engines. This generator can also be used in all applications, such as those noted above, where impulses of the above mentioned type must be available.

The generator of the invention comprises, fundamentally, a pair of inductor members and preferably a plurality of pairs of inductor members arranged in two groups with the inductor members of one group insulated from those of the other group. The inductor members of the respective pairs in each group, that is, all the inductors of a group, are maintained at the same potential, the potentials of the two groups preferably being symmetrical with respect to an intermediate reference potential, for instance ground potential. To this end the inductor members of the respective groups may be connected to two sources of electrical potential difference. Respective terminals of these sources may be at the symmetrical potentials referred to, the other terminals both being connected to the reference potential.

The inductor members may be arranged symmetrically about the axis of a common shaft in such a manner that each inductor member of one group is disposed between two inductor members of the other group. A conveyor, and preferably at least one pair of conveyor members, for carrying the electrostatic charges is arranged symmetrically on a rotor rotating with the common shaft, the angular spacing about the shaft axis of these conveyor members being substantially equal to that of the inductors of like potential. The conveyors and inductors are arraged for movement of the conveyors into and out of inductive relation in succession alternately to the inductors of symmetrical potential as the shaft is rotated.

The conveyor members are connected with a conductive element or elements, a finger or fingers, supported on the rotor for rotation therewith and movable in such rotation into and out of successive positions at spark gap distance from the electrodes of as many pairs of fixed electrodes as there are pairs of inductor members distributed about the shaft axis. These electrodes are connected respectively with one of the terminals of a utilization circuit or circuits the other terminal of which may be connected to the reference potential above referred to, for example the ground. The rotary fingers and fixed electrodes are arranged in such a manner that a finger comes into registry with a fixed electrode when the conveyor member or members connected to this finger are in the position of maximum capacity with respect to the inductor member corresponding to this electrode. All of the inductors and conveyor members together with the moving fingers and fixed electrodes preferably are enclosed in a casing capable of confining theerin a gas under pressure.

The sources of electrical potential capable of raising the two groups of inductor members to symmetrical potentials are conveniently constituted by auxiliary electrostatic generator machines. These machines may be arranged on the same shaft as the main generator machine which generates the short current impulses and may operate within the same enclosure as the main generator machine. However, since in practice the "voltage-current" characteristics of these two exciters are of the "series" type, the potential will have a tendency to rise up to the breakdown value of the gas dielectric between the electrodes. In order to hold the two voltages of the two groups of inductors respectively supplied from the two auxiliary or exciter electrostatic gen-

erators constant and symmetrical, a voltage limiter is provided and may consist, for instance, in providing a grounded element into register with which a spark gap distance the fingers or other charge conductive means connected with the respective excitation conveyors move, each spark gap acting during the period when the exciter conveyor potential increases, i. e. the spark gap is disposed circumferentially between that exciter brush or collector which is grounded and that exciter brush or collector which is connected with the inductor of the main generator to be excited.

The operation of such a limiter, however, is liable to cause fluctuations in the potentials of the inductors, and another object of the present invention is to limit these fluctuations by means of a special arrangement in which each conveyor member of the auxiliary excitation generators is divided, in the direction of rotation of the machine, into segments insulated from one another, the charge conductive means serving as "finger" corresponding to the conveyor thus divided into segments itself being divided into as many sectors insulated from one another as there are segments in the conveyor member, each conveyor member segment being connected with a sector. A spark gap is arranged, in relation to the direction of rotation of the machine, ahead of each one of the brushes or collectors which cooperate with the sectors to place them in connection with an inductor of the main generator, this spark gap being arranged so that the sectors pass at a predetermined spark gap distance from a grounded element to discharge through this spark gap before the sector is connected to the brush which is connected to the main inductor if the potential of the sector is excessive.

The invention is described in greater detail hereinafter with reference to the appended drawings wherein:

Fig. 1 is a diagrammatic view, in perspective, of a generator in accordance with the invention for the ignition of a four-cylinder, four-stroke, internal combustion engine.

Fig. 2 is an assembly of three diagrams illustrating the operation of said generator in three successive positions, *a*, *b* and *c*.

Fig. 3 is a view, partly in longitudinal section, partly in elevation, of a practical type of embodiment of a generator for ignition of a single cylinder engine with a simultaneous double ignition.

Fig. 4 is a diagrammatic view, in section along line IV—IV in Fig. 3, with an indication of the electrical connections.

Fig. 5 is a similar view, in section, along line V—V in Fig. 3.

Fig. 6 is a partial diagram of a modified embodiment of the generator of Fig. 1, illustrating, in addition, the arrangement for limiting the potential fluctuations of the inductors by means of the voltage limiter.

As represented in Fig. 1, the generator according to the invention comprises two pairs of inductor members **1**, **1'** and **2**, **2'**, consisting of cylindrical segments arranged symmetrically about an axis X—X', the inductors of each pair being diametrally opposite to each other. The inductors **1**, **1'** forming one pair are electrically connected together and to the negative terminal of a direct current supply **3**, the other terminal of which is grounded and in which the potential difference across the terminals is equal to U. Similarly, the inductors **2**, **2'** forming the other pair are electrically connected together and to the positive terminal of a direct current supply **4** the other terminal of which is grounded and in which the potential difference across the terminals is also equal to U. With the inductors **1**, **1'**, **2**, **2'**, cooperate two conveyor members **5** and **5'** carried on a rotor **5***a* of insulating material arranged on a shaft **5***b* rotatable on the axis X—X'. This shaft may be mechanically connected with the shaft of an internal combustion engine through a mechanism, known per se, not shown. The conveyors **5** and **5'** are electrically connected together through a conductor **6** to which is electrically connected a distributing finger **7** supported upon and for rotation with the rotor **5***a*.

Around the trajectory of the end of finger **7** are arranged four stationary electrodes represented diagrammatically at **8**, **8'**, **8''** and **8'''** distributed symmetrically, in such a manner that the finger **7** comes opposite to and at a short distance from one of the electrodes when the capacity between the conveyors **5**, **5'** and one of the inductor pairs **1**, **1'**, or **2**, **2'** passes through its maximum. These electrodes **8**, **8'**, **8''**, **8'''** are connected respectively with one of the electrodes of the respective spark plug in the engine the other electrode of which is grounded, a single one of the spark plugs being shown diagrammatically at **9**.

The assembly of the inductors, conveyors and electrodes **8**, **8'**, **8''** and **8'''** may be enclosed within sealed enclosure containing, for instance, air under a pressure of 20 atmospheres.

The device thus constituted operates as follows:

In the position *a*, Fig. 2, representing the first operating phase, the conveyors **5** and **5'** which are respectively opposite the inductors **1** and **1'** raised to the potential −U by the source **3**, Fig. 1, provide with these inductors a maximum capacity C and the distributing finger **7** is opposite the fixed electrode **8**. Two sparks take place, that is, between the finger **7** and the fixed electrode **8**, on the one hand, and between the electrodes of the spark plug **9**, on the other hand. As the resistance of the spark is low the conveyors **5**, **5'** are effectively grounded through the circuit thus set up. The potential V of the conveyors is then close to zero and the conveyors assume a charge +CU.

The conveyors **5**, **5'** are then rotated from position *a* facing the inductors **1**, **1'** toward the position facing the inductors **2**, **2'** maintained at the potential +U by the supply **4**, position *b*, Fig. 2. During this displacement, the potential V of the conveyors increases.

Continuing their displacement, the conveyors **5**, **5'** reach the position fully facing the inductors **2**, **2'**, position *c*, Fig. 2, in which their capacity with respect to the inductors **2**, **2'** is a maximum and equal to C and for which position the distributing finger **7** comes opposite the fixed electrode **8'**. Sparks are then initiated between the finger **7** and the fixed electrode **8'** and between the electrodes of the spark plug **9'**. The conveyors lose their charge +CU and being opposite inductors **2**, **2'** at a potential +U take on a charge −CU through the circuit closed by sparks. The total charge transferred is thus equal to **2CU**.

The cycle is then continued in a symmetrical manner when the conveyors **5** and **5'** come again under the inductors **1** and **1'** with this difference, with respect to the initial phase *a*, that when the finger **7** comes opposite the electrode **8''** there will flow in the circuit comprising the spark plug **9''** corresponding thereto a charge **2CU** as in the above described phase *c*.

In the case just described, the mechanical connection between the engine shaft and the shaft **5***b* of the generator is such that the latter rotates one revolution for every two revolutions of the engine shaft.

In practice, the sources of potential difference **3** and **4** conveniently may consist of exciter electrostatic generators keyed on the shaft **5***b* and operating in the same enclosure as the main generator. The construction of the main generator makes it possible to arrange these exciter generators, which may be of small dimensions since they deliver practically no current, in such a manner as to obtain a compact assembly of small bulk. The "voltage-current" characteristics of these two exciters are of the series type, i. e. the potential has a tendency to rise to the breakdown value of the gas dielectric between the electrodes. To avoid this drawback it is necessary to provide a limiter consisting, for instance, in an element

connected to ground into register with which the fingers or other collectors connected with the excitation conveyors move. The fingers or collectors in such register may be at spark gap distance from the limiter element. This spark gap acts during the period of increase of potential of the conveyor and limits this potential to a predetermined value according to the adjustment of the distance between the element and the rotating finger.

Figs. 3 to 5 show a practical example of embodiment of an ignition generator for a single cylinder engine with a simultaneous double ignition, i. e. having two spark plugs between the electrodes of which sparks are initiated simultaneously.

As shown, the generator comprises an outer metal casing consisting of a cylindrical body **20** on the ends of which are secured, in a tight manner, by means of threaded rings **22** and **22'** and with interposition of gaskets **24**, **24'**, two covers **26** and **26'**. The cover **26** comprises a gland chamber **28** closed inside by a partition **30** clamped by a threaded ring **34** against a shoulder provided in the wall of the gland chamber **28**, with the interposition of a gasket **32**.

Upon the axis of the casing **20** is arranged a shaft **36** and **37** in two portions coupled together by coupling **45** and rotating in bearings **38**, **40**, **42** and **44** supported respectively by the head wall of the gland chamber **28**, the partition **30**, an insulating flange **46** centered in the cover **26** and by an insulating flange **48** centered in the body **20** of the casing and prevented from rotating with respect to the cover **26'** by means of studs **50** entering the corresponding holes provided in this cover. The sealing of the passage through the casing for the portion **36** of the shaft is ensured by means of a gland housed in the chamber **28** which is filled with oil, this gland consisting of two packing rings **52** and **52'** held pressed, respectively, by a common spacing spring **54** in two cups **56** and **56'**. The cup **56** is carried on a sleeve **58** housed, with the interposition of a gasket **60**, in the bore **62** provided in the head wall of the chamber **28** for the passage of the shaft **36** through this wall. The cup **56'** is carried on the wall **30**. The shaft **36** carries, at its end exterior to the casing, a coupling member **64** for connection with the driving shaft normally provided on the engine for driving a coil type or a magneto type ignition distributor.

On the flanges **46** and **48** are supported two conducting inductors **66** and **66'**, Figs. 3, 4 and 5, secured on these flanges by means of clamping devices shown at **68** and **69**. These inductors consist of cylindrical segments coaxial with the casing **20** and having an arcuate extent slightly smaller than 180° as shown in Fig. 4.

On the shaft portion **37** is keyed a cylindrical rotor **70** of insulating material comprising two portions **72** and **74** having the same diameter and separated by an annular recess in the rotor **70**.

On the portion **72** of the rotor **70** are secured, by means of clamping devices **75** and **75'**, two conductive conveyors **76** and **76'**, Fig. 4, of the main generator constituted by cylindrical segments coaxial with the casing **20** and having an arcuate extent subtending substantially the same angle as the inductors **66** and **66'**. These conveyors are respectively connected with two distributing fingers **78** and **78'** secured in holes **80**, **80'** provided in the portion **72** of the rotor. These fingers are arranged for movement thereof successively during the rotation of the rotor **70** into positions opposite two fixed fingers **84** and **84'** secured in the flange **48**, a small interval being provided between the cooperating surfaces of the fixed fingers **84**, **84'** and of the movable fingers **78**, **78'** when they come opposite one another. The fixed fingers **84** and **84'** are respectively connected, through a stem such as **84''** on which a washer **86** urged by a spring **88** is frictionally mounted, with connection elements such as **90** arranged in insulating sleeves **92** and **92'** secured pressure tight in the cover **26'** by means of sealing rings **94**, **94'**. These connecting elements **90** are formed in a manner known per se for receiving the ends of the conductors leading to the insulated electrodes of the engine spark plugs. These spark plugs have been represented diagrammatically at **96** and **96'** in Fig. 4.

On the portion **74** of the rotor **70** are secured similarly, by means of clamping devices **98** and **98'** two conveyors **100** and **100'** of the auxiliary excitation generator, these conveyors having, however, a length about one-third that of the conveyors **76**, **76'**. The conveyors **100** and **100'** are respectively connected electrically with two concentric conductive rings **102** and **102'** secured on the transverse end face of the portion **74** of the rotor **70**, the ring **102** carrying a conductive sector **104** projecting through and with its surface flush with the surface of a ring **106** of insulating material which is wear resistant and which covers the rest of the ring **102**, while the ring **102'** carries a similar sector **104'**, Fig. 4, projecting through and flush with an insulating ring **106'** similar to the ring **106**.

In the flange **46** at a distance from the axis of the generator equal to the mean radius of the rings **102**, **106** are arranged two brushes **108** and **109**, Figs. 3 and 5, diametrically opposite to each other, arranged for frictionally wiping the ring **106** and the sector **104** flush therewith. Similarly, in the same flange **46** and at a distance from the axis of the generator equal to the mean radius of the rings **102'**, **106'** are arranged two brushes **108'** and **109'** opposite to each other on the same diameter as the brushes **108** and **109**, the brushes **108'** and **109'** being arranged for frictionally wiping the ring **106'** and the sector **108'** flush therewith. The brushes **108** and **108'** are connected respectively by conductors **110** and **110'** with the inductors **66** and **66'**, while the brushes **109** and **109'** are connected through conductors **111** and **111'** to the ground or to the casing of the generator.

The portion **72** of the rotor **70** and the conveyors **76** and **76'** constitute the rotor of the main generator, while the portion **74** of the rotor **70** carries the conveyors **100** and **100'** which are the conveyors of the respective excitation sources, the inductors **66** and **66'** which are common to the two assemblies constituting the inductors of both the main generator and the two exciters.

When the rotor **70** is driven in rotation, the conveyors **100** and **100'** function as those of a conventional electrostatic generator with conducting conveyors. Assuming the machine is charged so that the inductors **66** and **66'** respectively are at the potentials —U and +U and the conveyor **100**, for instance, is in position opposite the inductor **66'** at the potential +U, the conveyor **100** then is grounded through the sector **104** and the brush **109** and assumes a negative charge. Upon passing from the inductor **66'** to the inductor **66** the potential of the conveyor **100** rises to the value —U and the conveyor **100** then is connected with the inductor **66** through brush **108** to which it yields its charge at the potential —U, thus keeping up the potential of this inductor **66**. Similarly, by the operation of the brushes **108'** and **109'** cooperating with the sector **104'**, the conveyor **100'** assumes under the influence of the inductor **66** a positive charge which it transfers through brush **108'** to the inductor **66'** upon rotation of the conveyor **100'** to the position facing inductor **66'**, thus maintaining the potential of the inductor **66'** at +U.

On the other hand, the assembly consisting of the inductors **66** and **66'**, the conveyors **76** and **76'**, the movable fingers **78** and **78'** and the fixed fingers **84**, **84'** operates in a manner similar to that described in connection with Fig. 1, with the difference that at each revolution of the rotor **70** sparks are produced simultaneously and respectively between the electrodes of the two spark plugs **96** and **96'**.

It will be understood that it is possible to design, in the same manner as in the case of Fig. 1, a generator for the ignition of six or eight cylinder engines, for instance by arranging respectively six or eight pairs of inductors. On the other hand, a device similar to that of Fig. 1 could

be used for the simple ignition of a two cylinder engine by connecting the two contact points 8 and 8'' to one spark plug and the two contact points 8' and 8''' to the other spark plug.

In a generator like that of Fig. 1 in which the number of conveyors is less than that of the inductors, the dimensions of the assembly can be reduced further by inserting the conveyors of the auxiliary exciter generators circumferentially between the conveyors of the main generator. The diagram of a generator so designed is shown in Fig. 6.

The generator represented in Fig. 6 comprises two pairs of inductors **201**, **201'** and **202**, **202'** which are maintained respectively at the potentials —U and +U. The brushes or collector elements **208**, **209**, **210** and **211** are disposed adjacent the path of movement of the collector sectors corresponding to one of the auxiliary exciter generators and the brushes or collector elements **208'**, **209'**, **210'** and **211'** are disposed adjacent the path of movement of the collector sectors corresponding to the other auxiliary exciter generator.

The auxiliary conveyors are divided into three cylindrical segments designated respectively by **226**, **226***a*, **226***b* for one of the auxiliary generators and by **226'**, **226'***a*, **226'***b* for the other one. Similarly, three conductive sectors cooperating with the brushes are provided, for one of the sets of auxiliary conveyors, that is, sectors **227**, **227***a* and **227***b* connected respectively with the conveyor segments **226**, **226***a* and **226***b*, these sectors in succession being engaged by or passing adjacent the brushes **208**, **209**, **210** and **211** in succession. Correspondingly sectors **227'**, **227'***a* and **227'***b* are connected respectively with the conveyor segments **226'**, **226'***a* and **226'***b*, these sectors being engaged by or passing adjacent the brushes **210'**, **211'**, **208'** and **209'** in succession.

Two pairs of fixed spark gaps **228**, **228'** and **229**, **229'** are arranged relative to the direction of rotation of the conveyors so as to be passed by the conveyors ahead of the brushes **208** and **210** respectively as regards the spark gaps **228** and **228'** and ahead of the brushes **209'** and **211'** as regards the spark gaps **229** and **229'**. These spark gaps are arranged in such a manner that the sectors **227**, **227***a*, **227***b* for the spark gaps **228** and **228'** and the sectors **227'**, **227'***a* and **227'***b* for the spark gaps **229** and **229'** pass respectively opposite the fixed grounded elements of these spark gaps at a predetermined distance, this distance being so selected that the sectors discharge to the fixed elements of the spark gaps only when the potential of the conveyor segment connected to a sector is above predetermined potential difference with respect to ground.

The device operates as previously described, i. e. the main conveyors **231**, **231'** facing the inductors **201**, **201'** maintained at the potential —U by the first exciter provide with the respective inductors the maximum capacity C, and the distributing finger or fingers (not shown in Fig. 6) connected to these main conveyors is opposite the corresponding fixed collecting electrode. Two sparks take place simultaneously, one between said finger and this fixed collecting electrode and the other between the electrodes of that spark plug to which this fixed collecting electrode is connected. The conveyors are grounded through the circuit thus set up, since the resistance of the spark when established is low. The potential of the conveyors in this position thus becomes approximately zero.

The main conveyors **231**, **231'** then move from the inductors **201**, **201'** to the inductors **202**, **202'** maintained at potential +U by the second exciter. During this displacement, the potential V of the main conveyors increases. The regulation impedance Z is infinite so long as the voltages are not sufficient to cause discharge across the fixed spark gaps **228**, **228'** and **229**, **229'** corresponding to the respective pairs of inductors during the priming period of the machine, i. e. during the time when the potential increases as indicated above. When the main conveyors, continuing their displacement, reach a position in which their capacities with the corresponding inductors is maximum and equal to C, at that time the machine operates normally and the whole current delivered by the exciter passes through the spark gap corresponding to the spark gaps **8**, **8'**, **8''**, **8'''**, Fig. 1, thus causing an impedance which is in inverse proportion proportion to the rotation speed, so that the product Zi of the regulation impedance by the regulating current is always equal to a constant.

Considering now a first group of auxiliary conveyor segments and corresponding sectors, Fig. 6, if the potential U of said auxiliary segments at the time when the grounded element, for example, of a spark gap **228** or **228'** and a corresponding sector are opposite each other is higher than the breakdown voltage of the dielectric medium, the charges flow to ground through a spark. The potential of the successive groups of inductors thus will not have the tendency to increase excessively.

In the case of application of the invention to the ignition of an internal combustion engine, a four stroke engine, for instance, a simple modification of Fig. 6 may be realized by inserting in between each other the auxiliary and main conveyor members. In such a case four subdivisions in each group of conveyor members will be made, one conveyor member raising the corresponding inductor member to the potential +U following one conveyor member raising the corresponding inductor to the potential —U.

Respectively four brushes will be inserted in between each other, one output brush being followed by one brush connected to the ground, the second brush connected to the ground being followed by the second output brush.

Respectively four fingers will be able to come facing said brushes, said fingers being connected respectively to four fixed contacts connected to the voltage limiter as hereinabove described. The four fixed contacts are connected respectively to the four spark plugs of the engine.

This application is a continuation of the application of Noël Felici and Marcel Point, Serial No. 258,348, filed November 27, 1951, now abandoned.

We claim:

1. An electrostatic generator comprising a pair of inductor members in spaced relation to each other, a conveyor member, said conveyor member and said pair of inductor members being supported for relative movement thereof with respect to each other into and out of inductive relation of said conveyor member to said inductor members in succession, means for maintaining said inductor members at different potentials, charge conducting means connected to said conveyor member for conducting a charge carried by said conveyor member, said charge conducting means and said pair of inductor members being supported for relative movement thereof with respect to each other concomitantly with said relative movement of said conveyor member and said pair of inductor members with respect to each other, and charge transfer elements disposed in spaced relation to each other along and adjacent the path of said relative movement of said charge conducting means and said pair of inductor members with respect to each other so that said charge conducting means becomes disposed at spark gap distance from said charge transfer elements in succession concomitantly with said movement of said conveyor member and said inductor members into and out of inductive relation to each other.

2. An electrostatic generator as defined in claim 1, in which said charge transfer elements are disposed in positions such that said charge conducting means becomes disposed at spark gap distance from said transfer elements in succession at predetermined positions of said conveyor member respectively in relation to said inductor members.

3. An electrostatic generator as defined in claim 1,

in which said charge transfer elements are disposed so as to be in spark gap relation to said charge conducting means in the positions respectively of said conveyor member in which said conveyor member is substantially in full inductive relation to the respective inductor members.

4. An electrostatic generator as defined in claim 1, in which said charge transfer elements are disposed so as to be in said spark gap relation to said charge conducting means in positions of said conveyor member in which said conveyor member is moving into inductive relation to the respective inductor members.

5. An electrostatic generator as defined in claim 1, in which said charge transfer elements are disposed so as to be in said spark gap relation to said charge conducting means in positions of said conveyor member in which said member is moving out of inductive relation to the respective inductor members.

6. An electrostatic generator as defined in claim 1, which comprises means for confining in dielectric relation to said inductor and conveyor members and to said charge conducting means and said charge transfer elements a gaseous dielectric medium under super-atmospheric pressure.

7. An electrostatic generator comprising a pair of inductor members in spaced relation to each other, a conveyor member, said pair of inductor members and said conveyor member being supported for movement thereof relative to each other into and out of inductive relation of said conveyor member to said inductor members in succession, means for maintaining said inductor members at different predetermined potentials, charge conducting means connected to said conveyor member for conducting a charge carried by said conveyor member and supported for movement of said charge conducting means and said pair of inductor members relative to each other concomitantly with said relative movement of said conveyor member and said pair of inductor members with respect to each other, and charge transfer elements respectively associated with said inductor members and disposed in spaced relation to each other along and adjacent the path of said relative movement of said charge conducting means and said pair of inductor members with respect to each other so that said charge conducting means becomes disposed at spark gap distance from said charge transfer elements in succession in a predetermined relation to the movement of said conveyor member and said inductor members into and out of inductive relation to each other.

8. An electrostatic generator comprising a pair of inductor members in spaced relation to each other, a pair of conveyor members, said pair of conveyor members and said pair of inductor members being supported for relative movement of said pairs with respect to each other into and out of inductive relation of said conveyor members in succession to said inductor members in succession, means for maintaining said inductor members of said pair of inductors members at different potentials, charge conducting means connected to said conveyor members for conducting the charges carried by said conveyor members, said charge conducting means and said pair of inductor members being supported for relative movement of said charge conducting means and said pair of inductor members with respect to each other concomitantly with said relative movement of said pair of conveyor members and said pair of inductor members with respect to each other, and charge transfer elements disposed in spaced relation to each other along and adjacent the path of relative movement of said charge conducting means and said pair of inductor members with respect to each other so that said charge conducting means becomes disposed at spark gap distance from said charge transfer elements in succession concomitantly with said movement of said conveyor members and said inductor members into and out of inductive relation to each other.

9. An electrostatic generator as defined in claim 8 which comprises means for connecting a charge transfer element at a given position along said path relative to the positions of said inductor members to a potential intermediate between said potentials of said inductor members.

10. An electrostatic generator comprising a pair of inductor members, said inductor members of said pair being disposed in circumferentially spaced relation to each other about an axis of rotation, a pair of conveyor members supported in circumferentially spaced relation to each other about said axis of rotation, said pair of conveyor members and said pair of inductor members being supported for relative rotational movement of said pairs about said axis with respect to each other into and out of inductive relation of said conveyor members in succession to said inductor members in succession, means for maintaining said inductor members of said pair at different potentials, charge conducting means connected to said conveyor members for conducting the charges carried by said conveyor members, said charge conducting means and said pair of inductor members being supported for relative rotational movement of said charge conducting means and said pair of inductor members with respect to each other concomitantly with said relative rotational movement of said pair of conveyor members and said pair of inductor members with respect to each other, and charge transfer elements disposed in circumferentially spaced relation to each other about said axis along and adjacent said path of relative rotational movement of said charge conducting means and said pair of inductor members with respect to each other so that said charge conducting means becomes disposed at spark gap distance from said charge transfer elements in succession in predetermined positions of said conveyor members relative to said inductor members in said movement of said conveyor members and said inductor members into and out of inductive relation to each other.

11. An electrostatic generator comprising at least two pairs of inductor members, the inductor members of each pair being disposed in angularly spaced relation to each other peripherally about an axis of rotation and in interspersed relation to the respective inductor members of another pair, at least two conveyor members supported in angularly spaced relation to each other about said axis substantially the same as the angular spacing between the inductor members of each pair of said inductor members and for rotation about said axis, means for maintaining the inductor members of alternate pairs at two different predetermined potentials, charge conducting means respectively connected to said conveyor members for conducting the charges carried by said conveyor members and supported in angularly spaced relation to each other about said axis similar to the angular spacing of said conveyor members and for rotation about said axis with said conveyor members, charge transfer elements respectively associated with said inductor members of said pairs and disposed in angularly spaced relation about said axis corresponding to the angular spacing of said inductor members of each pair and adjacent the path of movement of said charge conducting means so that said charge conducting means in said rotational movement thereof with the respective conveyor members with respect to said inductor members become disposed in succession at spark gap distance from said charge transfer elements in succession, and means for connecting said charge transfer elements to a potential intermediate between said potentials of said inductor members.

12. An electrostatic generator as defined in claim 11, in which said intermediate potential is ground potential and said different predetermined potentials are symmetrical with respect to ground potential.

13. An electrostatic generator for an ignition system having a plurality of spark plugs, given electrodes of said plugs being connected in common to a reference potential, said generator comprising a pair of inductor members in

spaced relation to each other, a conveyor member, said pair of inductor members and said conveyor member being supported for movement thereof relative to each other into and out of inductive relation of said conveyor member to said inductor members in succession, means for maintaining said inductor members at different predetermined potentials, said reference potential being intermediate between said predetermined potentials, charge conducting means connected to said conveyor member for conducting a charge carried by said conveyor member; said charge conducting means and said pair of inductor members being supported for relative movement thereof with respect to each other concomitantly with said relative movement of said conveyor member and said pair of inductor members with respect to each other; and charge transfer elements disposed in spaced relation to each other in a predetermined relation to the spacing of said inductor members and along and adjacent the path of relative movement of said charge conducting means and said pair of inductor members with respect to each other so that said charge conducting means becomes disposed in spark gap relation to said charge transfer elements in succession, said charge transfer elements being disposed so as to be in said spark gap relation to said charge conducting means in the positions respectively of said conveyor member in which said conveyor member is substantially in full inductive relation to the respective inductor members for discharge through said spark plugs when said charge transfer elements respectively are connected to the other electrodes of the respective spark plugs of said ignition system.

14. An electrostatic generator comprising an inductor member, a conveyor member, said inductor member and said conveyor member being supported for movement thereof relative to each other into and out of inductive relation of said conveyor member with respect to said inductor member, means for maintaining said inductor at a given potential, said conveyor member being composed of a plurality of conveyor segments spaced in the direction along the path of relative movement of said conveyor member and said inductor member, charge conducting sectors respectively connected to said conveyor member segments for conducting the charges carried by said segments and supported in spaced relation in the direction parallel to said path of relative movement of said conveyor and inductor members for relative movement of said sectors and said inductor member with respect to each other concomitantly with said relative movement of said conveyor and said inductor member with respect to each other, and a charge transfer element disposed adjacent the path of relative movement of said charge conducting sectors and said inductor member with respect to each other so that the respective sectors become disposed in succession in charge transferring relation to said charge transfer element in a position of the respective segments in which such segment is in a predetermined inductive relation to said inductor member.

15. An electrostatic generator as defined in claim 14 which comprises an auxiliary charge transfer element disposed and adjacent said path of relative movement of said charge conducting sectors and said inductor member with respect to each other so that the respective sectors become disposed in succession at spark gap distance from said auxiliary transfer element in the position of the segment connected to the respective sector in which such segment is moving into inductive relation to an inductor member, said auxiliary transfer element being connected to a potential determining in relation to a predetermined potential of said conveyor segment in said position thereof a potential difference corresponding to discharge across said spark gap.

16. An electrostatic generator comprising at least two inductor members, a conveyor member, said inductor members and said conveyor member being supported for movement thereon relative to each other into and out of inductive relation of said conveyor member with respect to said inductor members in succession, means for maintaining said inductor members at different predetermined potentials, said conveyor member being composed of a plurality of conveyor segments spaced in the direction along the path of relative movement of said conveyor member and said inductor members, charge conducting sectors respectively connected to said conveyor member segments for conducting the charges carried by said segments and supported in spaced relation in the direction parallel to said path of relative movement of said conveyor member and said inductor members for relative movement with said segments of said sectors and said inductor members with respect to each other, charge transfer elements respectively associated with said inductor members and disposed in spaced relation similar to the spacing of said inductor members adjacent the path of relative movement of said charge conducting sectors and said inductor members with respect to each other so that said sectors in said relative movement thereof with said conveyor segments with respect to said inductor members become disposed in succession in charge transferring relation to said charge transfer elements in succession, and means for connecting the charge transfer element associated with a given inductor member to a potential intermediate between said predetermined potentials of said inductor members to charge said conveyor segments at said intermediate potential when said conveyor segments are in inductive relation to said given inductor member.

17. An electrostatic generator as defined in claim 16 which comprises means for connecting the other charge transfer element associated with the other inductor member to said other inductor member for transfer of charge therebetween.

18. An electrostatic generator as defined in claim 16 which comprises at least one additional conveyor member, said additional conveyor member and said inductor members being supported for movement thereof relative to each other into and out of inductive relation of said additional conveyor member with respect to said inductor members in succession, said additional conveyor member being composed of a plurality of conveyor segments spaced in the direction along the path of relative movement of said additional conveyor member and said inductor members, a plurality of additional charge conducting sectors respectively connected to said additional conveyor member segments and supported in spaced relation in the direction parallel to the path of relative movement of said additional conveyor member and said inductor members for relative movement of said additional sectors and said inductor members with respect to each other, additional charge transfer elements respectively associated with said inductor members and disposed in spaced relation similar to the spacing of said inductor members and adjacent the path of relative movement of said charge conducting sectors of said additional conveyor member with respect to said inductor members so that said additional sectors in said relative movement thereof with said additional conveyor segments with respect to said inductor members become disposed in succession in charge transferring relation to said additional charge transfer elements in succession, and means for connecting the additional charge transfer element associated with a selected inductor member to a potential intermediate between said predetermined potentials of said inductor members to charge said additional conveyor segments at said intermediate potential when said additional conveyor segments are in inductive relation to said selected inductor member, the other additional charge transfer element associated with a second inductor member being connected to said second inductor member for transfer of charge therebetween.

19. An electrostatic generator as defined in claim 16 which comprises a charge transfer element disposed forwardly in the direction of movement of said conveyor

member relative to said inductor members from said charge transfer element associated with said given inductor member so that said sectors in said relative movement thereof with said conveyor segments with respect to said inductor members become disposed in succession at spark gap distance from said forwardly disposed charge transfer element for spark gap discharge thereto of charges carried by said conveyor at a potential in excess of a predetermined potential.

20. An electrostatic generator comprising a pair of inductor members in spaced relation to each other, a pair of conveyor members, said pair of conveyor members and said pair of inductor members being supported for relative movement of said pairs with respect to each other into and out of inductive relation of said conveyor members in succession to said inductor members in succession, means for maintaining said inductor members of said pair of inductor members at different potentials, charge conducting means connected to said conveyor members for conducting the charges carried by said conveyor mem-

bers, said charge conducting means and said pair of inductor members being supported for relative movement of said charge conducting means and said pair of inductor members with respect to each other concomitantly with said relative movement of said pair of conveyor members and said pair of inductor members with respect to each other, and charge transfer elements disposed in spaced relation to each other along and adjacent the path of relative movement of said charge conducting means and said pair of inductor members with respect to each other, said charge conducting means being disposed at spark gap distance from said charge transfer elements to effect sparking therebetween concomitantly with said movement of said conveyor members and said inductor members into and out of inductive relation to each other in succession.

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