R. C. GALLETTI.

APPARATUS FOR PRODUCING ELECTRIC OSCILLATIONS.

APPLICATION FILED DEC. 4, 1908.

1,000,396. Patented Aug. 15, 1911.

Fig. 1.

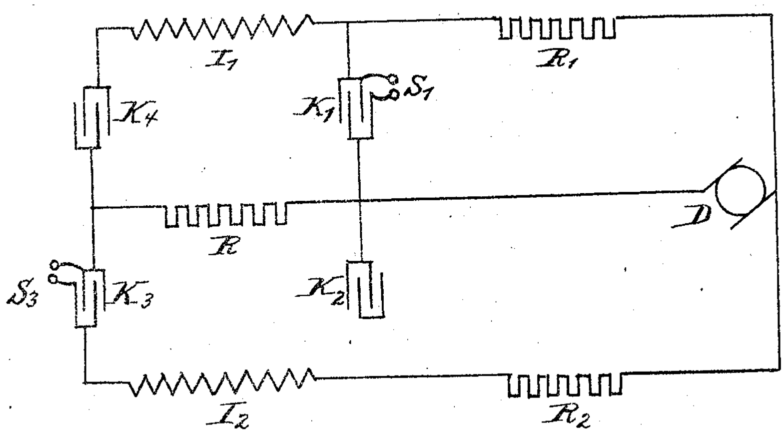
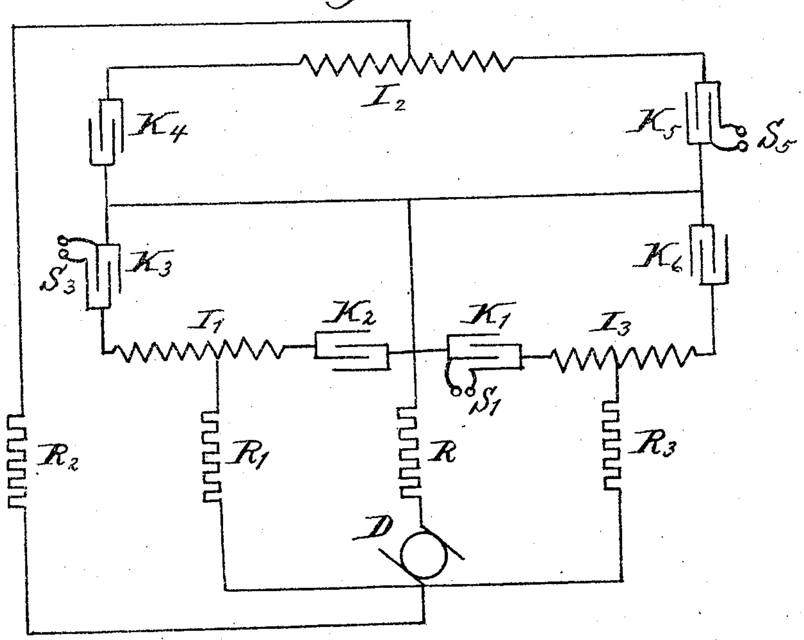


Fig. 2.



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APPARATUS FOR PRODUCING ELECTRIC OSCILLATIONS.

1,000,396. Specification of Letters Patent. Patented Aug. 15, 1911.
Application filed December 4, 1908. Serial No. 465,973.

To all whom it may concern:

Be it known that I, Roberto C. Galletti, a subject of the King of Italy, residing at Rome, in Italy, have invented certain new and useful Improvements in Apparatus for Producing Electric Oscillations, of which the following is a full, clear, and exact description.

This invention relates to apparatus for producing electric oscillations.

In my co-pending application filed on January 27, 1908, Serial No. 412902, a method and apparatus for producing electric oscillations are described according to which a main oscillating circuit has connected to it a number of auxiliary oscillating circuits so arranged that when discharge takes place in one of the auxiliary oscillating circuits it automatically causes the discharge to take place successively through the series of said auxiliary oscillating circuits, thus causing the main oscillating circuit to oscillate continuously.

The present invention relates to a new apparatus for carrying this principle into effect.

According to this invention a closed oscillating circuit is employed comprising inductances and capacities connected in series, spark gaps being arranged across the terminals of two or more of the capacities, the connections being such that a discharge taking place at one spark gap increases the difference of potential between the electrodes at another spark gap so that discharge takes place at the latter gap and so on successively, thus causing the closed circuit to oscillate continuously. The inductances, condensers and leads from the dynamo or other source of electric energy are so arranged that discharge does not take place at the various gaps simultaneously but successively as just referred to.

The closed oscillating circuit, in one of its functions, may be considered the equivalent of the solenoids attached to the auxiliary oscillating circuits referred to above and described in the specification of my before-mentioned application for patent, Serial No. 412902, and according to the present invention it acts also as the main circuit of the former arrangement, the single capacities bridged by spark gaps acting as the auxiliary circuits of the former arrangement.

An important distinction of the present invention from that described in the specification of said application Serial No. 412902, is that no supplementary spark or sparks, such as that due to the action of the induction coil X, disclosed in that case, or any equivalent thereof, are employed to break down the di-electric at the spark gaps.

The arrangement of circuits according to the present invention may be considered as being derived from the arrangement of circuits shown and described in the prior specification referred to above as will now be explained. Considering two auxiliary oscillating circuits alone, instead of employing additional electrodes at each spark gap connected to the other oscillating circuit through an inductance, the inductances in this case are connected through condensers to one of the electrodes of each spark gap.

In the accompanying drawings two arrangements of circuits according to this invention are illustrated diagrammatically by way of example.

Referring to Figure 1, two inductances I_1 and I_2 are connected in series by two pairs of condensers K_1, K_2 and K_3, K_4, each of these pairs being in cascade. One pole of the dynamo D is connected to the common plate of the condensers K_1 K_2 and through the resistance R to the common plate of the condensers K_3 K_4; the other pole of the dynamo D is connected through branched resistances R_1 R_2 to the inductances I_1 and I_2, whereby the four condensers K_1, K_2, K_3, K_4 are charged in parallel from the dynamo D. Spark gaps S_1 and S_3 are arranged across the terminals of the condensers K_1 and K_3.

The resistances R_1 and R_2 serve to protect the dynamo from the oscillations. They also cause the condensers K_1 and K_3 to be charged independently, that is, as if they were connected to independent sources, for without these resistances the dynamo current would be wholly diverted to the first spark gap, for instance S_1, that happened to break down and would result in potential disturbances that would prevent the capacity around the other gap S_3 from attaining a charge sufficient to break down the di-electric of S_3.

The resistance R is optional; if it is short circuited oscillations will occur also in the circuits I_1 K_1 K_4 and I_1 K_2 K_3. Taking into consideration the more simple case in which R has some suitable value such that these oscillations mentioned do not occur, it will be seen that a spark occurring in S_1 for example, will consist of a decreasing train of waves whose period is determined by the electric constants of the oscillatory circuit formed by the spark gap S_1, the condenser K_1 and the leads from this last to the gap S_1.

The spark gaps S_1, S_3 may have their electrodes at a distance apart less than the maximum distance apart of these electrodes which the maximum potential of the generator is competent to break down.

The following may be taken as a probable theoretical explanation of the action of the circuits: On a spark discharge taking place at one of the gaps, S_1 for instance, there is excited in the condenser circuit to which it is connected, a train of oscillations, with the result that the main oscillating circuit, comprising the two inductances I_1, I_2, and the four condensers K_1, K_2, K_3, K_4, being in resonance therewith also oscillates giving rise to oscillatory potential at the other spark gap S_3, causing the breakdown of its di-electric and so discharging the capacity bridging that gap S_3, which, of course, is at the same time being charged by the dynamo. The discharge of the condenser K_3 sets up oscillations in the main oscillating circuit and produces a reaction on the spark gap which discharged first.

The discharges take place successively at a regular interval of time, this interval of time being a function of the potential difference of the dynamo or other source of electric energy, the magnitude of the resistances and of the capacities and of the "virtual" lengths of the spark gaps.

The maximum amplitude of oscillation in the main oscillating circuit owing to its small damping coefficient corresponds in time to the end of the train of oscillations, in for example the first condenser circuit which discharges across a spark gap. Plotting in coördinates of time and of potential the profile of tops of a train of rapidly diminishing waves in the spark circuit, which can be assumed to be a logarithmic curve, and the curve of the profile of the relative induced train of waves in the main circuit, it is clear that this last curve must start from the value of zero at the origin and present a maximum of potential so much closer to the time of cessation of the spark as the damping coefficient of the main circuit is less. On account of this being so the virtual discharge distance for the electricity accumulated by the dynamo in the condenser of the second spark gap has its minimum value when the train of oscillations in the single condenser circuit of the first spark is on the point of ceasing. As the number of discharges is increased by raising the voltage of the dynamo, the result is that the actual interval of discharge of the gaps will be decreased with respect to the interval that must elapse if there were no virtual discharge effect due to the resonant action between the main oscillating circuit and each of the auxiliary circuits. As the continuous oscillations in the main oscillating circuit increase in amplitude from starting so do the virtual discharge distances at the two spark gaps diminish, causing the number of sparks per second to increase and the quantities of electricity accumulated from the dynamo for each spark discharge to decrease. In this manner the circuit automatically regulates itself and a steady state is reached in which although the profile of oscillations in the main circuit must present slight humps just before the discharge of each spark owing to the effect of the previous train of induced oscillations, still it tends to become and practically does become a straight line parallel to the axis of time.

It is obvious that various modifications may be made in the method and apparatus for carrying this invention into effect; for example, the circuits described above and illustrated in Fig. 1 may be amplified or duplicated in any desired manner. An example of an amplification is shown in Fig. 2. Referring to this figure, three inductances I_1, I_2, I_3 are connected in series, each end of each inductance being joined to the next inductance through two condensers K_1 and K_2, or K_3 and K_4, or K_5 and K_6, joined in series. Resistances R, R_1, R_2 and R_3 are placed in the dynamo leads, one lead passing to the plates of the condensers which are joined directly together, and three leads from the other terminal of the dynamo going to the inductances I_1, I_2 and I_3. Spark gaps are provided on the condensers K_1, K_3 and K_5.

By "duplication" is meant that any number of the arrangements like Fig. 1 or Fig. 2 may be used to influence by induction a single circuit, closed by preference.

What I claim is:

1. An oscillatory circuit having inductances and capacities connected in series, spark gaps between the terminals of two or more of the capacities, and means whereby a discharge taking place in one spark gap increases the difference of potential between the electrodes of another spark gap, inducing a discharge of the latter and thus causing a continuous progression in the discharges of the several capacities.

2. A main oscillatory circuit and a number of auxiliary oscillatory circuits, the main circuit comprising inductances and capacities connected in series and the auxiliary circuit comprising spark gaps and leads connecting them across the terminals of two or more capacities of the main circuit, and a source of direct current whereby a progressive discharge across the spark gaps of the capacities of the main circuit is determined dependent upon its coefficient of damping

and whereby electric charges accumulate from the source on the several capacities and are successively applied to maintain the circuit in continuous oscillation.

3. A main oscillatory circuit and a number of auxiliary oscillatory circuits, the main circuit comprising inductances and capacities connected in series and the auxiliary circuit comprising spark gaps and leads connecting them across the terminals of two or more capacities of the main circuit, and a source of direct current whereby a progressive discharge across the spark gaps of the capacities of the main circuit is determined, dependent upon its coefficient of damping.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

ROBERTO CLEMENS GALLETTI.

Witnesses:

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