

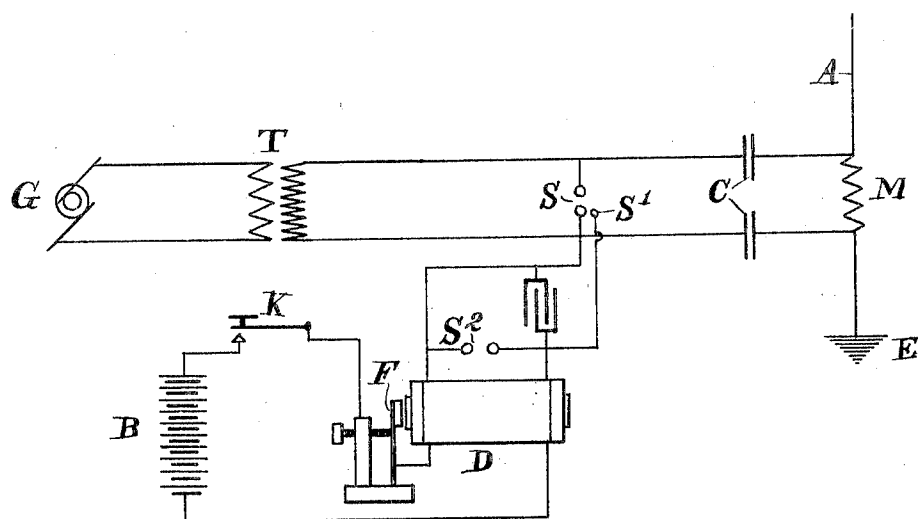
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L. DE FOREST.

SPARK DETERMINING APPARATUS FOR WIRELESS SIGNALING.

APPLICATION FILED SEPT. 21, 1903.



WITNESSES:

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SPARK-DETERMINING APPARATUS FOR WIRELESS SIGNALING.

No. 802,850

Specification of Letters Patent.

Patented Oct. 24, 1905.

Application filed September 21, 1903. Serial No. 173,972.

To all whom it may concern:

Be it known that I, LEE DE FOREST, a citizen of the United States, and a resident of the city, county, and State of New York, have invented certain new and useful Improvements in Spark-Determining Apparatus for Wireless Signaling, of which the following is a specification.

My invention relates to improvements in devices employed in wireless or spark telegraphy as a part of the transmitting apparatus to determine the intermittent production of the sparks in accordance with a method of code signaling. Its function is analogous to that of the key which has ordinarily been used to determine the time and duration of the spark-trains.

The object of my invention is to simplify and improve the apparatus employed for this purpose and to do away with or reduce many of the difficulties connected with the use of a make-and-break key with the heavy currents necessarily employed.

The object of my invention will be more fully set forth in the description hereinafter and in the claims terminating the same.

In the accompanying drawing I have shown the use of what I call a "trigger-spark" adjacent the main spark.

In operating powerful wireless-telegraph transmitters, such for instance as employ currents of five or six kilowatts and over, I have found that a direct make-and-break key inserted in the energizing-current has many disadvantages. The sudden full release and application of the load to the dynamic generator which is preferably employed as the source of such heavy currents, produces heavy and injurious strains, both electrical and mechanical. Independently of this, the heavy current produces arcs at the contact-points which soon consumes them. I have discovered that this may be avoided by the use of other means for producing the spark than a key making and breaking heavy current and by the use of mechanisms which are simple and reliable in their action and are not subject to rapid deterioration by use.

My new apparatus for determining the time of the spark is based upon the principle that ultra-violet radiations or an ionizing influence decrease the resistance of a dielectric and therefore, if the dielectric between the sparking terminals be subjected to radiations of an ultra-violet or ionizing character its conductivity will be increased and thereby a

spark-gap which is normally inoperative may be made operative for such a time as these ultra-violet or ionizing radiations are maintained.

Various methods for producing these radiations and of applying them to the spark-gap may be employed. I have herewith shown some preferred forms. As the action of ultra-violet rays set forth is supposed to be due to their ionizing influence, wherever one term is used the other may be substituted. A simple and practical means is shown in the figure. In this I have shown an alternating-current generator G, a step-up transformer T, spark-gap S, condensers C, a radiating antenna A, an earth or capacity connection E and an inductance M in the antenna-circuit. These features are common in transmitters and are shown only as illustrative of a form of transmitting mechanism which may be operated by my apparatus. My new device is however not limited to use with this type of apparatus but may be employed with most if not all types of wave generating or transmitting apparatus.

In the apparatus shown in the figure I have employed what I call a "trigger-spark" or "trigger-key." This comprises a key and apparatus working under relatively small electrical stress and volume of current, but adapted to act as a trigger or means for producing a condition which will permit the action of the more powerful operating-current to thereby produce the spark which charges the radiating antenna. The great efficiency of this combination of apparatus is probably especially due to the fact that the trigger-spark causes a variation of the electrostatic field of the main spark-gap. This trigger mechanism comprises a spark-gap adjacent the main spark-gap and operated by an auxiliary current, thereby emitting a radiation which, by ionization of the medium between said sparking terminals, or otherwise, breaks down the resistance between them sufficiently to enable the charge therein to jump across the gap. When the effect of this auxiliary mechanism ceases the normal condition is restored sufficiently to terminate the production of the spark.

As illustrated in the figure this trigger mechanism comprises an induction-coil D, spark-gap S² connected therewith, a battery B, interrupter F, and key K. This mechanism may however be replaced by any other suitable mechanism for the production of a spark.

One terminal of the secondary of the induction-coil is connected with one of the terminals of the auxiliary spark-gap S^2 and also with one terminal of the main spark-gap S . The other terminal of the coil secondary is connected with the other terminal of the auxiliary spark-gap S^2 and with a sparking terminal S' placed adjacent to and cooperating with that one of the terminals of the main spark-gap S , to which the other terminal of the coil is connected, to form therewith a small spark-gap. I have shown this terminal S' as placed at right angles to the direction of the main spark-gap although it may be placed in various other positions, as for instance in line with the main spark-gap and between its terminals. Also two auxiliary sparking terminals S' may be employed and their circuit kept wholly independent of the main sparking circuit. It is sufficient that the trigger-spark occurs in the vicinity of the main spark-gap.

The connection of the terminal S' with the induction-coil or other source of high potential may be omitted, in which case a single wire connection, preferably with one of the terminals S is retained. In this case when the trigger-key is depressed a brush-discharge is produced from this terminal S , which ionizes the insulating-dielectric and allows the main oscillating discharge to take place.

The action of the trigger-spark is probably due to the action of ultra-violet rays produced thereby, or else to the variation of the electrostatic field of the main spark-gap or both.

It will be seen that the key for operating this device is in a circuit carrying but a small amount of current and at a low potential. As a consequence all troubles due to the use of a key for making and breaking large currents are eliminated.

The discharges produced in using my apparatus commence promptly with the application of the trigger-spark, or brush-discharge, and cease abruptly with its cessation, and is therefore exactly controlled in its action by the trigger-key. So closely is this main spark governed by the auxiliary influence that I have found its frequency closely governed by that of the trigger-spark when such is employed. So that although the generator G may be a high-frequency alternating-current generator, yet if the interrupter of the trigger induction-coil be of the ordinary hammer type and of a low frequency, the frequency of the main spark is generally that of the trigger-spark. By these means I am enabled to not only exactly control the discharge of a powerful transmitter by a simple Morse key operating in a small current, but to also easily and exactly control the spark frequency of the transmitter, independently of the frequency of the generator and of any fluctuations thereof, and thus to effectively avail myself of the

principle known in the art as "mechanical tuning" with an accuracy difficult if not impossible by other means where an alternating current is employed of varying or fluctuating frequency.

I have described my invention as employing a normally inoperative spark-gap which by an exterior influence is made operative for the time when a spark is desired. It is evident that the same effect might be produced by using a spark-gap which is normally operative and employing as the controlling agent an influence which is capable of choking or destroying the spark. Either type of device might be employed in either one of two ways to send signals, first, in the ordinary manner of defining the signal elements by the production of the sparks or by defining the signal elements by intermissions made in an otherwise continuous production of sparks.

My invention briefly stated consists in means for subjecting a spark-gap or the media between its terminals to an exterior influence or influences which alternately make it operative and inoperative in such manner that the discharges thereby produced may be utilized to produce signal-waves, whether or not these means are the same as herein shown and described and whether by these means a normally inoperative spark is made operative or a normally operative spark is made inoperative.

It is evident to one familiar with the art that the principle of employing an auxiliary trigger or pilot mechanism or influence to render a normally inoperative spark-gap operative, may be applied in a great variety of ways. I do not therefore wish to be understood as limiting myself to the use of the exact means herein shown and described but to be understood as claiming all variations which fall within the terms of the accompanying claims when broadly interpreted.

What I claim as my invention is—

1. In spark telegraphy, the combination with a transmitting apparatus including a normally inoperative spark-gap, of means for intermittently producing an auxiliary or trigger spark discharge adjacent to the main spark-gap and in accordance with a signal-code.

2. In spark telegraphy, the combination with a transmitting apparatus including a normally inoperative spark-gap, of means for rendering the same operative consisting of an auxiliary or trigger spark adjacent said normally inoperative spark-gap and means for producing a controllable intermittent discharge across said trigger-spark gap.

3. In spark telegraphy, the combination with a transmitting apparatus including a spark-gap, of an auxiliary electric-circuit terminal in the vicinity of the spark-gap, and a signaling-switch cooperating with said auxiliary terminal to control the spark-gap.

4. In spark telegraphy, the combination
with a transmitting apparatus including a
spark-gap and a main source of energy there-
for; of an auxiliary source of energy and a
5 coöperating signaling-switch and electric cir-
cuit all constructed and arranged to produce
an electrical discharge to make operative the
main source of energy and spark-gap.

In testimony whereof I have hereunto af-
fixed my signature, this 9th day of September, 10
1903, in the presence of two witnesses.

LEE DE FOREST.

Witnesses:

GEORGE W. THOMAS,
H. L. REYNOLDS.