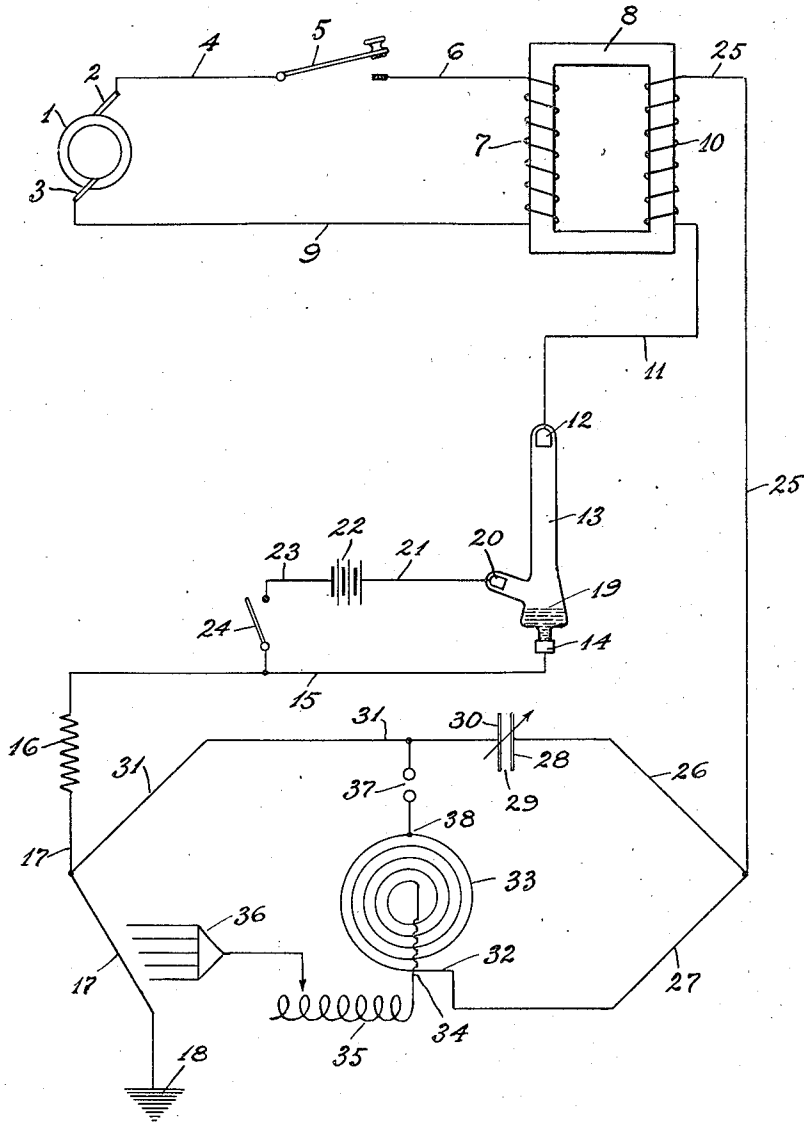


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TRANSMITTING APPARATUS FOR WIRELESS TELEGRAPH STATIONS.
APPLICATION FILED NOV. 24, 1915.

1,217,516.

Patented Feb. 27, 1917.



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TRANSMITTING APPARATUS FOR WIRELESS-TELEGRAPH STATIONS.

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To all whom it may concern:

Be it known that I, FREDERICK G. SIMPSON, citizen of the United States, residing at Seattle, in the county of King and State of Washington, have invented a certain new and useful Improvement in Transmitting Apparatus for Wireless-Telegraph Stations, of which the following is a specification.

My invention relates to improvements in transmitting apparatus of wireless telegraph stations, parts of which are disclosed in my co-pending application for United States Letters Patent for transmitting apparatus for wireless telephone and telegraph systems, which application was executed by me on date of November 4, 1915, and has become Patent #1203064 dated Oct. 31, 1916; and the object of my present invention is to provide electrical apparatus, including an antenna, electric circuits, an electric generator for supplying an alternating current of electricity, and a transformer, which apparatus shall be adapted to control and modify the alternating current of said electric generator to propagate successive groups of electrical impulses only of a like polarity in a charging circuit whereby oscillations may be generated in an associated oscillating circuit only during the period of each of the impulses of a like polarity that are generated by said electric generator; that is to say, only during the period of one-half of each cycle comprising two successive electrical impulses generated by said electric generator, and whereby distinctive electromagnetic wave trains representing intelligible messages may be radiated from said antenna to actuate suitable translating devices of a distant wireless telegraph station.

I accomplish this object by devices illustrated in the accompanying diagrammatical drawing wherein the numeral 1 designates an electric generator of alternating currents which generator 1 is provided with terminal contact brushes 2 and 3, and from the brush 2 extends a conductor 4 which connects with one terminal of a telegraph key 5 from whose other terminal extends a conductor 6 that connects with one terminal of the primary coil 7 of a transformer 8, the other terminal of said primary coil 7 being connected to the terminal brush 3 by a conductor 9.

The secondary coil 10 of the transformer 8 has one of its terminals connected by a conductor 11 with the anode 12 of a mercury

valve 13, of well known form, the cathode 14 of said mercury valve 13 being connected by a conductor 15 with one terminal of a resistance coil 16 whose other terminal is connected by a wire 17 to the earth 18.

The mercury valve 13 contains a quantity of mercury within its lower end portion, indicated by broken lines 19, which mercury constitutes a part of the cathode 14 and said mercury valve 13 is provided with an auxiliary anode 20 which is connected by conductor 21 to one terminal of a source of electricity, as a battery 22, whose other terminal is connected by a conductor 23 with one terminal of a switch 24 whose other terminal is connected to the conductor 15 at a point between the cathode 14 and the resistance coil 16, whereby is formed a switch-controlled local circuit between the anode 20 and the cathode 14.

The other terminal of the secondary coil 10 is connected by a conductor 25 to one end of both of two conductors 26 and 27, the other end of conductor 26 being connected to one side 28 of a variable condenser 29 whose other side 30 is connected by a conductor 31 to the conductor 17 at a point thereon between the resistance coil 16 and the earth 18, while the other end of the conductor 27 is connected to the outer end 32 of a spiral conductor 33 whose inner terminal 34 is connected to one terminal of a variable inductance 35, whose other terminal is connected with an antenna 36.

An adjustable spark-gap 37 is disposed with one of its terminals connected with the conductor 31 while its other terminal is connected at a point 38 on the outermost convolution of the spiral conductor 33.

The operation of the apparatus when arranged as illustrated and described is as follows:

First, the switch 24 is closed and then the mercury valve 13 is tilted sidewise in a direction to cause its mercury 19 to make connection with the auxiliary anode 20 thus completing the circuit through the battery 22, the switch 24, and part of the conductor 15, through which circuit current of the battery 22 may flow and thereupon the mercury valve 13 is moved back to its perpendicular position to cause the current from the battery 22 to form an electric arc between the auxiliary anode 20 and the mercury 19, thus to generate mercury vapor, in a well known manner, which vapor may

serve as a conductor between said anode 20 and the mercury 19.

The mercury valve 13 having been thus "primed" an operation of the telegraph key 5 will cause the alternating current of the generator 1 to effect the primary coil 7 of the transformer 8 whereby successive groups of electrical impulses will be generated in the secondary coil 10 of said transformer 8, of which electrical impulses only those of like polarity can be communicated to the conductor 31 to charge the condenser 29 by reason of the interposition of the mercury valve 13, and it is therefore apparent that a series of charges can be communicated to said condenser 29 only during the period of one-half of a cycle comprising two successive electrical impulses generated by the generator 1 each of which two impulses is of a different polarity.

The time required to charge the condenser 29 to a voltage sufficient to break down the spark-gap 37 with which it is connected as shown, depends upon its capacity and the amount of resistance and inductance of the charging circuit, and when it becomes charged to such degree as will break down said spark-gap 37, then it will discharge in the direction from the side 30 through the spark-gap 37, thence through the outer convolution of the spiral conductor 33 from the point 38 thereon to the conductor 27, thence through the conductor 26 to the side 28 of said condenser 29, and such discharge will be simply a single impulse that again will charge the condenser 29 in a direction to reverse its polarity.

In the circuit comprising the variable condenser 29, the spark-gap 37, a portion only of the outer convolution of the spiral conductor 33, and conductors 27 and 26, the amount of capacity in proportion to the amount of inductance is extremely large, the resistance of such circuit (which I call the discharge circuit or trigger circuit) being mostly situated in the spark-gap 37.

It is a well known fact that in circuits where the ratio of capacity to inductance is large, and where a condenser is permitted to discharge through a spark-gap, the tendency of such discharge is to create oscillations which at first are relatively of high amplitude but which rapidly decrease in amplitude and are therefore few in number; and thus in the trigger circuit, comprising the condenser 29, part of the conductor 31, the spark-gap 37, that portion of the spiral conductor 33 from point 38 to its terminal 32, and the conductors 27 and 26 there will be no current in a direction that is the reverse of the discharge current of said condenser 29, which fact is also partly due to the fact that the circuit comprising said condenser 29, conductors 26 and 27, the whole of the spiral conductor 33, the vari-

able inductance 35, the antenna 36, earth 18, a portion of conductor 17 and the conductor 31 constitutes an oscillating circuit wherein oscillations may have great persistency; and, contemplating the antenna 36 and earth 18 as constituting a condenser in series with condenser 29, the second half of any oscillation starting from condenser 29 will be directed through said oscillating circuit and subsequent oscillations derived therefrom will persist within that circuit and not pass across the spark-gap 37, provided said spark-gap is properly adjusted, since there can be no persisting arc between the electrodes of said spark-gap 37 by reason of the action of the mercury valve 13, because at the moment of the initial discharge of the condenser 29 the current through said mercury valve 13 is zero and therefore the voltage derived therefrom, between the electrodes of the spark-gap 37, is zero; and the mercury valve 13 also prevents condenser 24 from discharging any energy back through secondary coil 10 of the transformer 8.

A waste of energy of the initial discharge of the condenser 29 is prevented by the inductive relation between that portion of the outermost convolution of the spiral conductor 33 and the remaining convolutions of said spiral conductor 33, said portion of such outermost convolution forming a part of the circuit which includes the conductors 27 and 26 together with the condenser 29 and spark-gap 37, (which circuit I have hereinbefore termed the trigger circuit) while the remaining convolutions of said spiral conductor 33 form a part of the circuit which I have hereinbefore termed the oscillating circuit and which oscillating circuit includes the whole of the spiral conductor 33, the inductance 35, the antenna 36, earth 18, a part of the conductor 17, the conductor 31, the condenser 29, and conductors 26 and 27.

Such inductive relation between said trigger circuit and said oscillating circuit is not absolutely necessary but it improves the efficiency of the apparatus.

After a period of time the condenser 29 will be charged anew and the same cycle of operations will be repeated, the extent of such period of time being dependent upon the capacity of the condenser 29, the amount of resistance of the coil 16, the amount of the resistance of the mercury valve 13 and the amount of other resistances in the charging circuit together with the inductance distributed through said charging circuit including the inductances of the secondary coil 10 of the transformer 8.

Intelligible signals may be formed in the usual way by a manipulation of the telegraph key 5 which signals will be emitted in the usual manner from the antenna 36 in the form of groups of electromagnetic wave

trains, which groups of electromagnetic wave trains may sufficiently affect any detector of the commonly used types that may be employed in the receiving apparatus of a distant wireless telegraph station, and nothing of the nature of a "heterodyne" or "tikker" is required in such distant wireless telegraph station.

Manifestly, there may be substituted for the mercury valve 13 any one of many other well known forms of rectifiers, as, for instance, an electrolytic rectifier, without departing from the spirit of my invention.

What I claim is:

1. In a transmitting apparatus for wireless telegraph stations, the combination with a charging circuit which includes the secondary coil of an alternating current transformer, a rectifying valve, a resistance coil and a condenser, of a trigger circuit which includes a portion of a spiral conductor, a spark-gap and a part of said charging circuit within which is included said condenser; and an oscillating circuit which includes all of said spiral conductor, a variable inductance, an antenna, an earth

connection and that part of each of said charging and trigger circuits which includes said condenser.

2. In a transmitting apparatus for wireless telegraph stations, the combination with a charging circuit which includes the secondary coil of an alternating current transformer, a rectifying valve, and a condenser, of a trigger circuit which includes a portion of a spiral conductor, a spark-gap and a part of said charging circuit within which is included said condenser; and an oscillating circuit which includes all of said spiral conductor, a variable inductance, an antenna, an earth connection and that part of each of said charging and trigger circuits which includes said condenser.

In witness whereof I hereunto subscribe my name this 15th day of November, A. D. 1915.

FREDERICK G. SIMPSON.

Witnesses:

FRANK WARREN,
O. JOHNSON.