R. G. MARX AND L. F. FULLER.

RADIOTELEGRAPHY.

APPLICATION FILED AUG. 13, 1917.

1,344,052. Patented June 22, 1920.

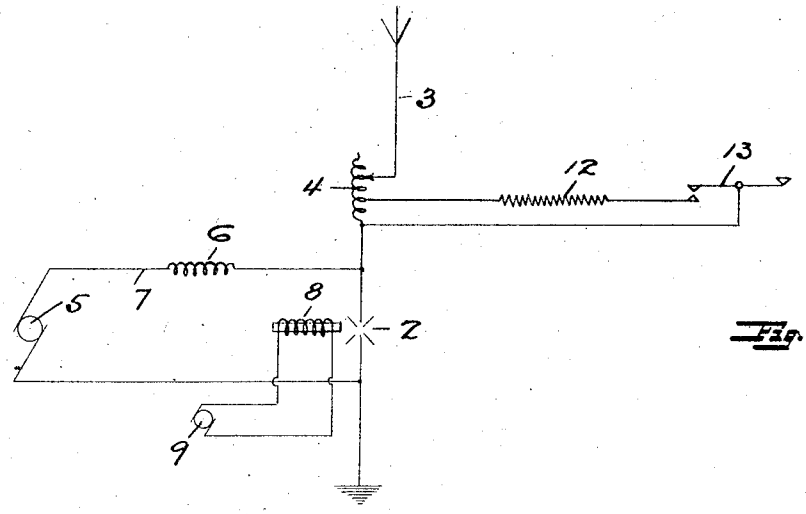
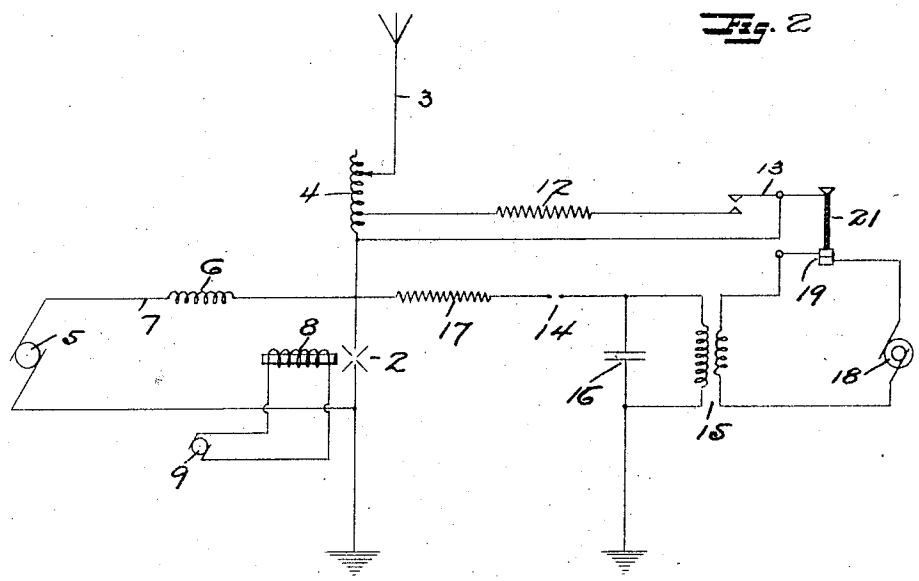


Fig. 1

Fig. 2



Witness:

J. B. Gardner

INVENTORS

R. G. MARX

L. F. FULLER

By White & Frost

ATTORNEYS

UNITED STATES PATENT OFFICE.

ROLAND G. MARX, OF PALO ALTO, AND LEONARD F. FULLER OF SAN FRANCISCO, CALIFORNIA, ASSIGNORS TO FEDERAL TELEGRAPH COMPANY, OF SAN FRANCISCO, CALIFORNIA, A CORPORATION OF CALIFORNIA.

RADIOTELEGRAPHY.

1,344,052. Specification of Letters Patent. **Patented June 22, 1920.**

Application filed August 13, 1917. Serial No. 185,907.

To all whom it may concern:

Be it known that we, ROLAND G. MARX and LEONARD F. FULLER, citizens of the United States, and residents, respectively, of Palo Alto, Santa Clara county, and the city and county of San Francisco, both in the State of California, have invented certain new and useful Improvements in Radiotelegraphy, of which the following is a specification.

The invention relates to means of signaling and particularly to means for signaling with arc radio transmitters.

An object of the invention is to provide means for signaling by varying the antenna current.

Another object of the invention is to provide means for signaling which requires the handling of only relatively small currents.

A further object of the invention is to provide means for successively establishing and interrupting the arc.

The invention possesses other advantageous features, some of which, with the foregoing, will be set forth at length in the following description, where we shall outline in full that form of the invention which we have selected for illustration in the drawings accompanying and forming part of the present specification. It is to be understood, however, that the invention as expressed in the claims is not limited to the specific embodiment shown in the drawings.

Referring to said drawings:

Figure 1 is a diagrammatic representation of one form of the system which is particularly applicable to high-powered stations.

Fig. 2 is a diagrammatic representation of a form of the system which is particularly applicable to low-powered stations.

The present system provides a means of signaling which contemplates a variation of the antenna current by varying the resistance of the antenna circuit and the resistance is inserted without opening or closing the antenna circuit. When the resistance of the antenna circuit is increased, the antenna current and the current across the arc is decreased, the amount of decrease depending upon the resistance added. In practice we prefer to reduce the radiation, that is antenna current, to nearly zero. With large arcs, that is, high-powered arcs, the arc does not go out when the arc current is reduced, but small arcs are more unstable and are liable to go out and in order to insure reliability of operation, we prefer to employ means for reigniting the arc, should it become extinguished.

It is practically impossible to insert into and remove from the antenna circuit at telegraphic speed, a sufficient resistance to vary the radiation to nearly zero, or to reduce it any considerable amount without severe sparking. In accordance with our invention we introduce into the system, a resistance which has the equivalent effect of introducing the resistance directly into the antenna circuit and this is so introduced that the handling of large currents and sparking or arcing at the contacts is practically avoided.

The transmission system comprises an arc oscillation generator 2 which is grounded on one side, preferably the negative, and connected on the other side to the antenna 3 through the variable inductance 4. Direct current is supplied to the arc generator by the generator 5, and a choke coil 6 is arranged in the lead 7 connected to the antenna side of the arc. The arc is subjected to a strong transverse magnetic field produced by the magnet coils 8 which may be separately excited by the generator 9.

Shunting several of the lower turns of the inductance 4 is a circuit containing a resistance 12 and a key 13. With the key closed, a radio frequency current will flow through the resistance causing an energy loss, so that the resistance has the equivalent effect of being inserted directly in the antenna circuit. The current through the resistance is probably not only the antenna current but also a certain amount of induced current due to the transformer action of the loading inductance 4 which becomes in effect an auto-transformer. We prefer to make the value of the resistance in ohms substantially equal to the reactance in ohms at radio frequency of the turns of the inductance which are shunted by the resistance circuit in order to cause a maximum energy loss in the resistance.

When the key 13 is open no current is flowing in the resistance circuit, so that the key may be closed without producing appreciable arcing. As soon as the key is closed, the arc current is reduced to nearly

zero, so that when the key is opened, no appreciable arcing will occur. When the key is pressed to open the resistance circuit the full current is delivered to the antenna. In small stations the arc is often not sufficiently stable to permit of this action, but goes out when the resistance losses occur in the antenna circuit, hence means are provided for reigniting it.

In Fig. 2 we have shown one means which may be employed in reigniting the arc, this means being so arranged that the arc is ignited as the resistance circuit is opened. Connected across the arc is a spark circuit containing the spark gap 14, the secondary of the transformer 15 and the capacity 16, shunting the secondary. A stopping resistance 17 is arranged between the spark gap and the antenna side of the arc to prevent direct current sufficient to maintain an arc across the spark gap from following the radio frequency current across the spark gap and passing through the secondary. The primary of the transformer is in series with an alternating current generator 18 and a switch 19 is attached to the key 13 by an insulating rod 21. When the resistance circuit is opened, the circuit through the primary of the transformer is closed, producing a high potential in the spark circuit and producing a spark across the spark gap which sets up radio frequency surges which ignite the arc.

We claim:

1. An arc system for radio signaling, comprising a current supply and antenna circuit connected to an arc and means for appreciably increasing the resistance of the antenna circuit whereby the current in the antenna is reduced below signaling value.

2. An arc system for radio signaling, comprising a current supply and antenna circuit connected to an arc, an inductance in the antenna circuit and a circuit containing an appreciable resistance arranged in shunt around said inductance, the closing of the resistance circuit serving to reduce the arc current below signaling value.

3. An arc system for radio signaling, comprising a current supply and antenna circuit connected to an arc, an inductance in the antenna circuit, a circuit containing an appreciable resistance in shunt around said inductance and means for opening and closing the resistance circuit, the closing of the resistance circuit serving to reduce the arc current below signaling value.

4. An arc system for radio signaling, comprising a current supply and antenna circuit connected to an arc, an inductance in the antenna circuit, and a circuit containing resistance arranged to shunt said inductance, the value of the resistance in ohms approximating the reactance at radio frequency in ohms of the shunted inductance.

5. An arc system for radio signaling, comprising a current supply and antenna circuit connected to an arc, an inductance in the antenna circuit, a circuit containing an appreciable resistance arranged in shunt around the inductance, the value of the resistance in ohms approximating the reactance at radio frequency in ohms of the shunted inductance, and a signaling key in said shunt circuit.

6. An arc system for radio signaling, comprising a current supply and antenna circuit connected to an arc, an inductance in the antenna circuit, an appreciable resistance connected across a portion of the inductance and a signaling key in the resistance circuit, closing of the key serving to reduce the arc current below signaling value.

7. An arc system for radio signaling, comprising an arc subjected to a strong transverse magnetic field, a current supply and antenna circuit connected to the arc, means for decreasing the antenna current whereby the arc is extinguished and means for reigniting the arc.

8. An arc system for radio signaling, comprising an arc subjected to a strong transverse magntic field, a current supply and antenna circuit connected to the arc, an inductance in the antenna circuit, a circuit containing resistance shunting a portion of said inductance, a signaling key in said resistance circuit, and means operative in time with the opening of said key for producing a spark across the arc.

9. An arc system for radio signaling, comprising a current supply and antenna circuit connected to an arc, an inductance in the antenna circuit, a circuit containing resistance shunting a portion of said inductance, a signaling key in said resistance circuit, the closing of said key serving to extinguish the arc and means for reigniting the arc.

In testimony whereof I have hereunto set my hand at Honolulu, T. H., this 19th day of July, 1917.

ROLAND G. MARX.

In testimony whereof I have hereunto set my hand at San Francisco, Calif., this 31st day of July, 1917.

LEONARD F. FULLER.