C. S. FRANKLIN.

AERIAL FOR WIRELESS SIGNALING.

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1,296,177. Patented Mar. 4, 1919.

Fig. 1.

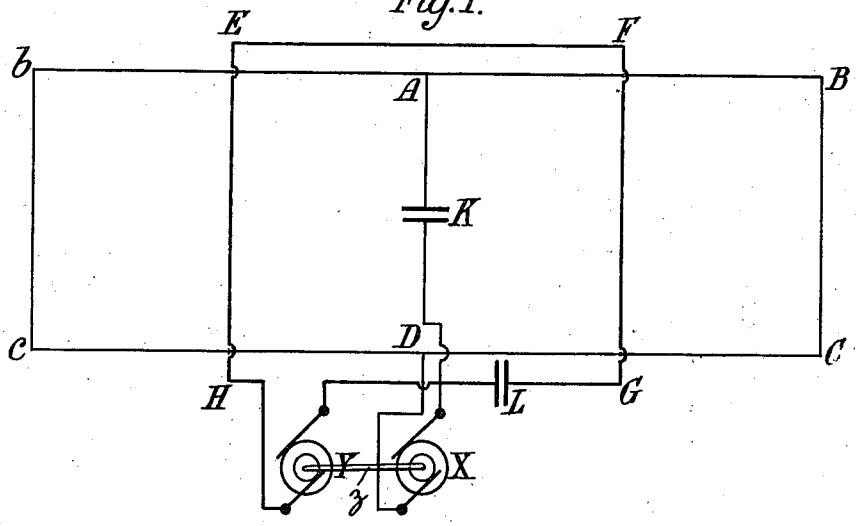
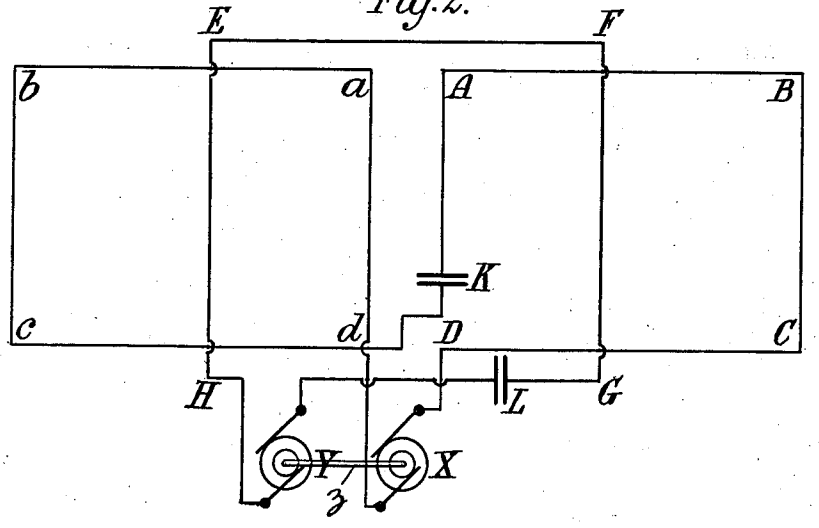


Fig. 2.



INVENTOR

CHARLES SAMUEL FRANKLIN

by Sheffield, Bentley & Betts

his attorneys

UNITED STATES PATENT OFFICE.

CHARLES SAMUEL FRANKLIN, OF LONDON, ENGLAND, ASSIGNOR TO MARCONI WIRELESS TELEGRAPH COMPANY OF AMERICA, OF NEW YORK, N. Y., A CORPORATION OF NEW JERSEY.

AERIAL FOR WIRELESS SIGNALING.

1,296,177. Specification of Letters Patent. Patented Mar. 4, 1919.

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To all whom it may concern:

Be it known that I, CHARLES SAMUEL FRANKLIN, a subject of the King of Great Britain, residing at Marconi House, Strand, London, England, have invented new and useful Improvements in Aerials for Wireless Signaling, of which the following is a specification.

The object of this invention is to provide a system of aerials for wireless signaling in which the radiation shall have a maximum value in one direction only, gradually diminishing in value to zero at 90 degrees on either side of this maximum direction, and being practically zero throughout the other 180 degrees.

It is well known that a frame such as a rectangular circuit of wire which is placed in a vertical plane and in which high frequency alternating currents are induced, radiates electric waves best in the two directions in the plane of the rectangle and not at all in the two directions at right angles to this plane. The polar curve of radiation is in fact the well known figure of 8 consisting of two equal figures which are nearly circles. The waves at any two points equidistant from and one on each side of the rectangle and in its plane are at any instant of time equal and of opposite phase.

Let us now suppose that two equal rectangular or frame circuits are erected in the same vertical plane either so that they have one vertical edge common to both (in which case they may be considered as being in parallel) or so that they have one vertical edge of one rectangle adjacent to one vertical edge of the other, the two circuits being connected in series so that one is reversed as regards the other. Then if high frequency alternating currents are induced in the two circuits so that the currents traverse them in opposite directions, the combination will as before radiate best in the two directions in the plane of the rectangles and not at all in the two directions at right angles. The polar curve will again be a figure of 8 made up of two similar figures which are nearly circles. In this case, however, the waves at any two points equidistant from and one on each side of the rectangles and in their plane are at any instant of time equal and in phase with each other.

According to this invention there is employed such a double frame circuit in the same or substantially the same plane with a simple frame circuit placed symmetrically with respect to the double circuit. The two circuits will have no mutual inductance or coupling effect on one another if they are properly proportioned; that is to say, alternating currents existing in one will not affect alternating currents existing in the other. Under these conditions each circuit tends to produce its own radiation independently of the other circuit.

This invention is illustrated by the accompanying diagrams, Figure 1 showing the arrangement of two equal frames in parallel and Fig. 2 the arrangement of two frames in series.

In Fig. 1, ABCD, A*b*cD are two equal rectangular aerials having the vertical side AD common. In AD is inserted a tuning condenser K and an oscillation generator X.

EFGH is a simple rectangular aerial having a tuning condenser L and an oscillation generator Y; this aerial is erected in substantially the same plane as the double rectangular aerial and symmetrically with respect to it, so that there is no coupling between the two systems.

The two oscillation generators Y and X produce oscillations of the same frequency.

It is obvious that the phase of the currents in the two alternators may be varied as desired by changing their relative positions on the common driving shaft *z*. However, any suitable or known means may be used for producing a desired phase difference.

In Fig. 2 ABCD, *abcd* are two equal frames connected in series as shown.

In one direction in the plane of the system of either arrangement provided that the relative phase of the currents in the two circuits is correct, the magnetic fields from the independent circuits are in phase and produce a wave with an energy proportional to the square of their sum; while in the other direction the magnetic fields are of opposite phase and produce a wave having an energy proportional to the square of their difference.

Therefore the currents in the two independent circuits are so adjusted that they produce waves of equal strength, the magnetic fields in one direction in their plane will thus produce a wave with four times

the energy of the waves from either circuit separately and in the opposite direction the magnetic fields neutralize each other and no waves are produced.

In order that the fields may correctly cancel on the one side, it is necessary that the two sets of oscillations should have a phase difference of 90°.

In the two directions at right angles to the plane of the circuits neither produces any waves.

The result is therefore that practically all the energy is radiated only on one side of the plane through the system at right angles to its plane. On that side the polar curves of the two frames add; on the other side of the line the two curves practically neutralize each other.

In practice it is necessary to introduce condensers into the circuits which need not necessarily be rectangles, so as to tune them to the frequency employed.

To obtain the best directional effects the circuits should be entirely insulated from the earth but good directional effects may be obtained if the earth be used as part of one or both circuits.

Such a system of circuits may also be used for receiving, as will be obvious to those skilled in the art from a study of the foregoing description.

What I claim is:

1. The combination with a directive double looped aerial of a directive single looped aerial erected substantially in the plane thereof and symmetrically therewith.

2. The combination with a directive double looped aerial of a directive single looped aerial erected substantially in the plane thereof and symmetrically therewith, and means for producing in the two aerials waves of equal strength.

3. The combination with a directive double looped aerial of a directive single looped aerial erected substantially in the plane thereof and symmetrically therewith, and means for producing in the two aerials waves of equal strength but with a phase difference of 90°.

4. The combination with a double looped aerial of a single looped aerial positioned substantially in the plane of said double looped aerial and symmetrical therewith, and means for producing in the two said aerials waves of substantially the same length.

5. The combination with a double looped aerial, of a single looped aerial positioned substantially in the plane of said double looped aerial and symmetrical therewith, and means for producing in the two said aerials waves of substantially the same length but of different phase.

6. The combination with a double looped aerial, of a single looped aerial erected substantially in the plane thereof and symmetrically therewith, and means for producing in the two aerials waves of equal length but with a phase difference of 90°.

7. A radio signaling system comprising in combination a double looped aerial and a single looped aerial in proximity thereto, the said two aerials being parallel and arranged so that they have no mutual inductance.

CHARLES SAMUEL FRANKLIN.