Dec. 27, 1938.

E. KRAMAR ET AL

2,141,247

ARRANGEMENT FOR WIRELESS SIGNALING

Filed May 14, 1936

Fig. 1

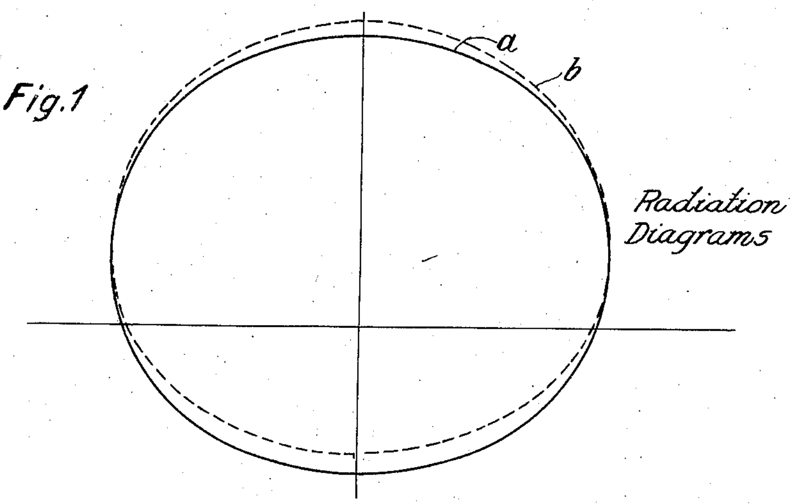


Fig. 2

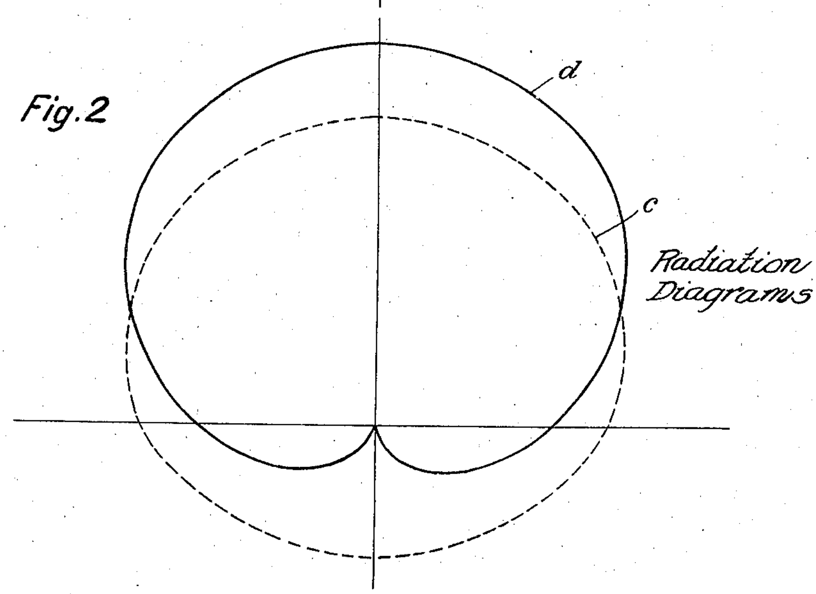
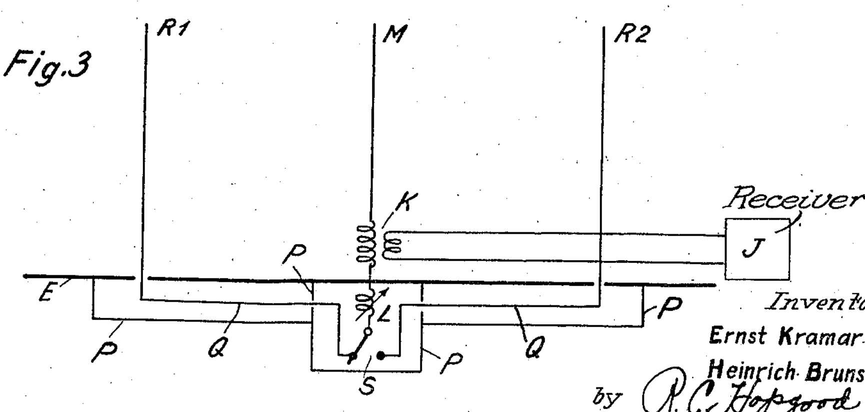


Fig. 3



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Patented Dec. 27, 1938

2,141,247

UNITED STATES PATENT OFFICE

2,141,247

ARRANGEMENT FOR WIRELESS SIGNALING

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Application May 14, 1936, Serial No. 79,704
In Germany May 17, 1935

5 Claims. (Cl. 250—11)

In Patent 2,028,510, issued January 21, 1936, it is proposed in order to obtain course lines, to feed a dipole continuously from a high frequency generator and to key suitably erected reflectors. This patent also specifies that by providing for different distances between transmitter dipole and reflector dipole or dipoles, different directional characteristics are obtainable. It is also stated there that the length of the dipoles may be different within narrow limits. However the directional characteristics only give useful angles of intersection if the length of the transmitter dipole and of the reflector dipole is approximately $\lambda/2$ and the distance between them approximately $\lambda/4$, λ being the operative wavelength.

The invention has for its object to so develop this arrangement that the spatial dimensions thereof shall be considerably diminished. This requirement, which for instance is to increase the safety of the traffic on landing grounds, is in accordance with the invention accomplished by reducing the spatial length of the reflector dipole or dipoles, as compared with the electrical length, and by electrically elongating the reflector dipole or dipoles to tune over to the operative wavelength. The electrical length should be adjusted to $\lambda/2$, if unearthed dipoles are used, and $\lambda/4$ if earthed dipoles are employed.

The principle of the antenna arrangement itself need not be explained more fully. The arrangement shown in the said patent is altered in such a manner that as stated the dimensions are diminished. The electric elongation of the reflector dipoles is accomplished preferably by inductances interposed in the current bulge or by other customary means of elongation. Also the means of elongation may be common to a pair of reflector dipoles, as will be understood from the following description, reference being had to the accompanying drawing in which—

Figs. 1 and 2 show diagrams of radiation obtained from experimental arrangements comprising freely erected dipoles, Fig. 1 relating to the known construction, Fig. 2 to the novel one. Fig. 3 is a schematic elevation of an embodiment of the present invention.

In Fig. 1 two diagrams of radiation *a* and *b* are represented which show that by changing the length of the transmitter dipole there is obtained only a trifling variation of the radiation diagram. For the sake of completeness it may be mentioned that in each case only the horizontal diagram has been illustrated. With the diagrams *a* and *b* the distance between transmitter and reflector dipole was $\lambda/14$ and the length of the reflector dipole $\lambda/2$ (in spatial as well as in electrical relation). In the case of the diagram *a* the length of the transmitter dipole amounts to $\lambda/8$, in the case of the diagram *b* to $\lambda/3$. While the spatial dimensions of this antenna structure, it is true, are considerably diminished, the configuration of the diagram however is approximately the same, as are consequently also the angles of intersection obtained in this way. As is well known however, in order to increase the sensitivity of indication, the angles of intersection should be as acute as possible.

If in accordance with the invention however the spatial length of the reflector dipole is diminished while at the same time an electric elongation to $\lambda/2$ or $\lambda/4$ is effected, then diagrams are obtained such for example as those shown in Fig. 2. In both cases the distance was again $\lambda/14$ and the length of the transmitter dipole was $\lambda/3$. The spatial and electrical lengths of the reflector dipole in the case of the diagram *c* were $\lambda/2$. In the case of the diagram *d* however the spatial length of the reflector dipole was $\lambda/5$ whilst in electric relation this dipole was elongated to $\lambda/2$. The elliptical diagram, i. e., curve *c* has changed into a cardioid. Spatial lengths between these values result in diagrams which are between the two diagrams represented in the drawing.

The principle of the invention is applicable both to directive transmitting and receiving arrangements. Further, each reflector dipole may be replaced by several individual dipoles, arranged to act conjointly.

The arrangement represented in Fig. 3 is a receiving arrangement whose dipoles M, R1, R2 are so-called half-dipoles and are tuned in conjunction with an electric or artificial earth E, that consists of wire gauze or sheet metal, for instance. The centre dipole M is coupled to the receiver J by a coupling device K and is also tuned over this device K. The reflector dipoles R1, R2 are tuned by means of a self-induction coil L which is common to them and is interposed in these two dipoles alternately by means of a switch S. The coil L and the leads Q to R1, R2 are contained in a screening P in order to avoid horizontal components of radiation.

This arrangement has the advantage that only one tuning means has to be varied for effecting the tuning to the proper wavelength. In the event of an inaccurate tuning both reflectors R1, R2 will be detuned to the same degree. The zone of equal field intensity, produced by connecting and disconnecting the reflectors alternately in a manner described in the said patent, will then always be located in the plane of symmetry. Only the angle of intersection of the diagrams will undergo variation, because the shape of the directional diagrams depends upon the phase of the reflectors. Therefore, in the case of prior arrangements a different tuning of the two reflectors causes the directional diagrams to be of different configuration and thus entails that the zones of equal field intensity will not be normal to the plane of symmetry. If however both reflectors are always detuned to the same degree, as will be the case in arrangements according to Fig. 3, then, it is true, the shape of the diagrams and thus the angle of their intersection vary in conformity with the degree of detuning, but the diagrams of R1, R2 remain congruent, that is to say, the zone of equal field intensity is in such case always normal to the plane of symmetry. The bearings here obtained will hence be faultless despite detuning. They will only be impaired as regards their sharpness.

This arrangement is likewise adapted for use both on the transmitting and receiving sides of such systems. It will however be of peculiar advantage when employed on the receiving side, because here the directional diagrams are difficult to supervise.

What is claimed is:

1. A compact arrangement for directive wireless signaling comprising a main antenna and two reflecting antennae cooperating therewith, the distance between said reflecting antennae and said main antenna being less than one-tenth wavelength and the spacial length of said reflecting antennae being shorter than the desired electrical length, means for electrically elongating said reflecting antennae for tuning them to the operative wavelength and keying means for interposing said means for elongating alternately in said reflecting antennae.

2. A compact arrangement for directive wireless signaling comprising a main antenna, a reflecting antenna arrangement comprising at least one reflecting antenna adapted to cooperate therewith, the distance between said reflecting antenna and the main antenna being less than one-tenth wavelength, the spacial length of this reflecting antenna arrangement being shorter than the desired electrical length, means for electrically elongating said reflecting antenna arrangement for tuning it to the operative wavelength, an electric earth, the said reflecting antennae arrangement being tuned to a half wavelength in conjunction with this earth, and a screening connected to such earth and encompassing the said means for elongating said reflecting antenna arrangement.

3. A compact arrangement for directive wireless signaling comprising a main antenna, reflecting antennae adapted to cooperate therewith, the distance between said reflecting antennae and the main antenna being less than one-tenth wavelength, the spacial length of these reflecting antennae being shorter than the desired electrical length, and means for electrically elongating said reflecting antennae for tuning them to the operative wavelength and keying means for rendering said reflecting antennae operative alternately to produce a desired intersecting field.

4. A compact arrangement for directive wireless signaling comprising a main antenna, a reflecting antenna adapted to cooperate therewith, the distance between said reflecting antenna and the main antenna being less than one-tenth wavelength, the spacial length of said reflecting antenna being shorter than the desired electrical length thereof, and means for electrically elongating said reflecting antenna for tuning it to the operative wavelength, whereby a radiation pattern is produced differing markedly from the radiation pattern which would be produced if the spacial length of the reflecting antenna were as great as its electrical length.

5. A directive wireless signaling arrangement comprising a main antenna, reflecting antennae, each having a physical length shorter than the desired electrical length and spaced from the main antenna less than one-tenth of the operative wave length, means for electrically elongating and tuning said reflecting antennae to said operative wave length, and means for keying said reflecting antennae alternately to cause cooperation thereof with the main antenna to produce a desired intersecting field.

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