[Second Edition.]

PATENT SPECIFICATION

Convention Date (Germany): April 19, 1932. **405,727**

Application Date (in United Kingdom): Sept. 2, 1932. No. 24496/32.

Complete Specification Accepted: Feb. 15, 1934.

COMPLETE SPECIFICATION

Directional Radio Transmitting Arrangements particularly for use with Ultra-short Waves.

We, C. LORENZ AKTIENGESELLSCHAFT, a German Company, of Lorenzweg 1, Berlin-Tempelhof, Berlin, Germany, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

In radio direction finding systems, particularly in aerial navigation, directional antenna systems have been employed, which radiate at a certain angle to each other and are alternately manipulated in accordance with the so-called a-n- method. In such arrangements the bearing of the transmitting station is determined by a comparison of field strengths at the receiver.

The invention is concerned with devices for direction finding methods of this type. It employs instead of directional antenna systems which are alternately keyed, antenna arrangements, in which reflectors or only one thereof and an exciter antenna are provided. This exciter antenna is fed continuously from the high frequency generator and the reflector or reflectors are keyed.

The invention is illustrated by way of example in the accompanying drawings. Figure 1 is a schematic elevation of an example of the device. Figures 2, 3 and 4 are diagrams relating to the method of operation.

A dipole E is continuously energised by the transmitter S. On both sides of the dipole E and in line therewith are arranged two dipoles R1 and R2, which act as reflectors. These reflectors are interrupted in the middle and may be closed by relays M1 and M2. Instead of interrupting the reflectors, it is possible to provide for them to be detuned, for example. The relays M1 and M2 are alternately energised and de-energised by a commutator K, which is driven by a motor A. It is assumed in the drawing that the dipole R1 is opened, that is inactive, and the dipole R2 closed, that is active. Instead of the commutator a relay device may be employed, which is so arranged that both relays are keyed in parallel and thereby the contacts of the one closed and those of the other opened.

Figure 2 shows the radiation conditions. If both reflectors R1 and R2 are opened, the horizontal characteristic of the energiser dipole E is a circle *a*. If only the reflector R1 is closed, then the characteristic *b* is obtained. If only the reflector R2 is closed, the characteristic *c* is obtained. If both reflectors are closed, then the characteristic *d* is obtained. In the normal operation for radio-beacon purposes the characteristic *d* can be dispensed with. For certain purposes, however, characteristics of this type are desirable.

This arrangement which preferably operates with ultra-short waves, is quite sufficient for the purpose in view, that is the directional characteristics are sufficiently intense, as point of intersection of two characteristics is utilized, for example, the point of intersection P1 of *b* and *c*. Fundamentally, however, any other point of intersection, such for example as is shown by point P2, is suitable. It is therefore not always necessary to operate with two reflectors which are alternately keyed. A single reflector is quite sufficient for a simple device.

Figure 3 shows the influence of the distance between energiser E and, for the sake of simplicity, a single reflector R. The distance between E and R for the characteristic *e* amounts to $\lambda/5$, for *f*, $\lambda/3$, and for *g* $\lambda/2$, when λ is the wave length.

It is thus found that by increasing that distance to $\lambda/2$ the directional characteristic perpendicular to the line passing through the energiser E and the reflector R is intensified.

According to Figure 4, similar effects may be obtained by varying the length of the reflector R with respect to the length ($\lambda/2$) of the energiser dipole E. The length ratio, however, mainly determines the formation of secondary maxima, which extend oppositely to the intended direction. The characteristic *h* corresponds to an arrangement in which, with a fixed distance between the energiser E and reflector R, the length of the reflector R is smaller than $\lambda/2$, the characteristic

[*Price* 1/-]

i applies for $\lambda/2$, that is for a reflector which is the same length as the energiser, and characteristic k for an arrangement in which the reflector is longer than the energiser dipole. It is thus an advantage to make the reflector R longer than the energiser E, since thereby undesirable secondary maxima are avoided.

The interruption or detuning of the reflector or reflectors in the manner described renders it possible for the energiser E to be continuously and uniformly fed from the transmitter. Previously the high frequency current itself was keyed between the generator and directional systems, or diverted by choke-coil arrangements or the like. This may involve difficulties, particularly with short waves, and particularly with ultra-short waves. The present invention avoids keying the high frequency current since only the reflector or reflectors are influenced. The circuits of the relays M1 and M2 carry only direct current or low frequency, alternating current and can be easily protected against high frequency, for example by choke arrangements. The conductors to the relays may also consist of resistance wire, in order to prevent the passage of high frequency currents.

The invention may also be employed in arrangements in which instead of transmitting signals according to the a-n-method or the like, the radiated high frequency is modulated with different modulation frequencies, viz, at a particular frequency in each direction. In this case, in accordance with the invention, the carrier frequency, which is conveyed to the energiser antenna, is modulated differently in the same rhythm in which the reflectors are keyed. In this manner the characteristic modulation frequency is transmitted in the corresponding angular space.

The keying of the reflector may be effected by the means A, K, M1, M2 shown in Figure 1, and a further commutator or relay arrangement provided for controlling the alternate modulation of the transmitter at two modulation frequencies, or a two-frequency machine may be used which is provided with a cam disc arrangement for the actuation of contacts controlling the supply of the modulation frequencies.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. Radio direction finding system particularly for ultra-short waves, in which the transmitting device comprises an energiser antenna which is fed from a high frequency generator and a reflector structure which is keyed, and in which the bearing of the transmitter is determined by a comparison of field strengths at the receiver.

2. Direction finding system as claimed in claim 1, characterised in this, that the reflector structure consists of two reflectors which are alternately keyed.

3. Direction finding system as claimed in claim 1, characterised in this, that the energiser antenna and the reflector structure consists of dipoles, the reflector dipole or dipoles being longer than the energiser dipole.

4. Direction finding system as claimed in claim 1 or 2, characterised in this, that the reflector structure consists of one or more reflectors which are interrupted or closed at their centre by the keying means, and thereby rendered ineffective or effective.

5. Direction finding system as claimed in claim 4, characterised in this, that the keying means consists of a commutator arrangement and switching means which is actuated thereby.

6. Direction finding system as claimed in claim 4, characterised in this, that the reflectors are alternately inserted by switching means actuated simultaneously by the same key.

7. Direction finding system as claimed in claim 5, characterised in this, that the conductors to the said switching means consist of material of high resistance.

8. Direction finding system as claimed in claim 1, characterised in this, that the high frequency current conveyed to the energiser (E) is modulated at different modulation frequencies in the rhythm of the keying.

9. Direction finding system as claimed in claim 1, characterised in this, that the keying is effected by detuning said reflector structure.

10. Direction finding system for ultra-short waves substantially as described and as illustrated in Fig. 1 of the accompanying drawings.

Dated this 1st day of September, A.D. 1932.

R. J. BERRY,
Chartered Patent Agent,
Agent for the Applicant,
Telephone Building, Aerodrome Road,
London, N.W.9.

Abingdon: Printed for His Majesty's Stationery Office, by Burgess & Son.
[Wt. 8138.—50/8/1939.

Fig.1

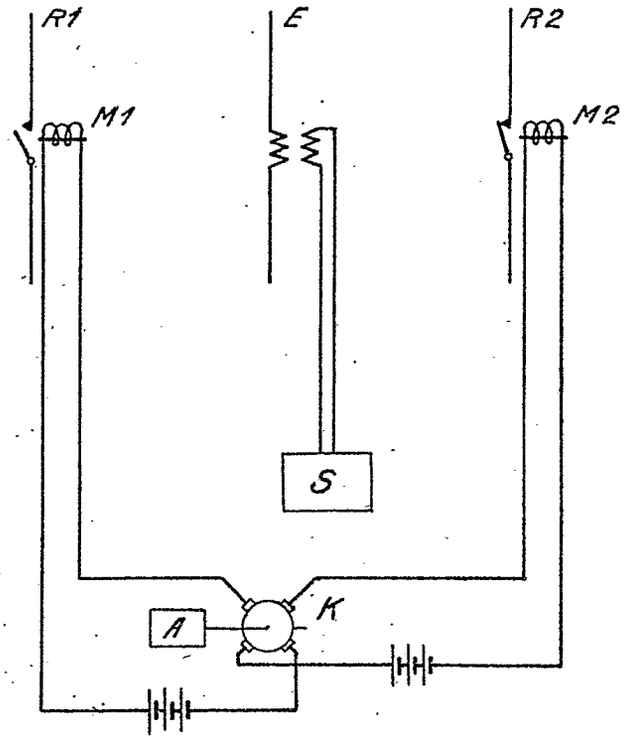
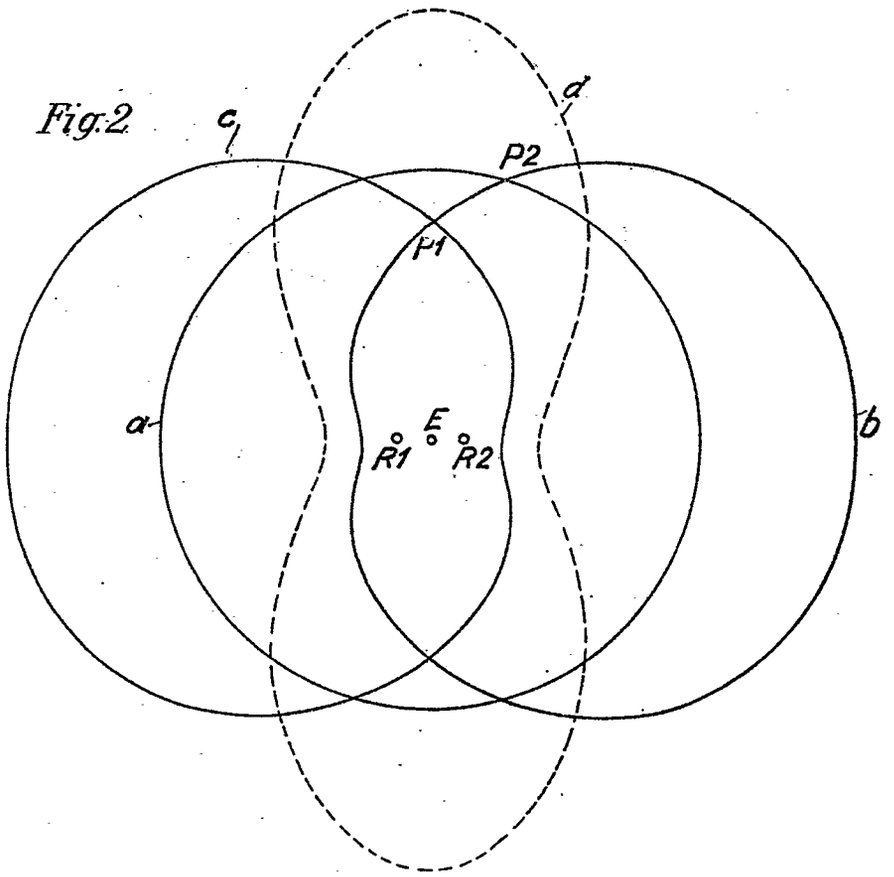


Fig.2



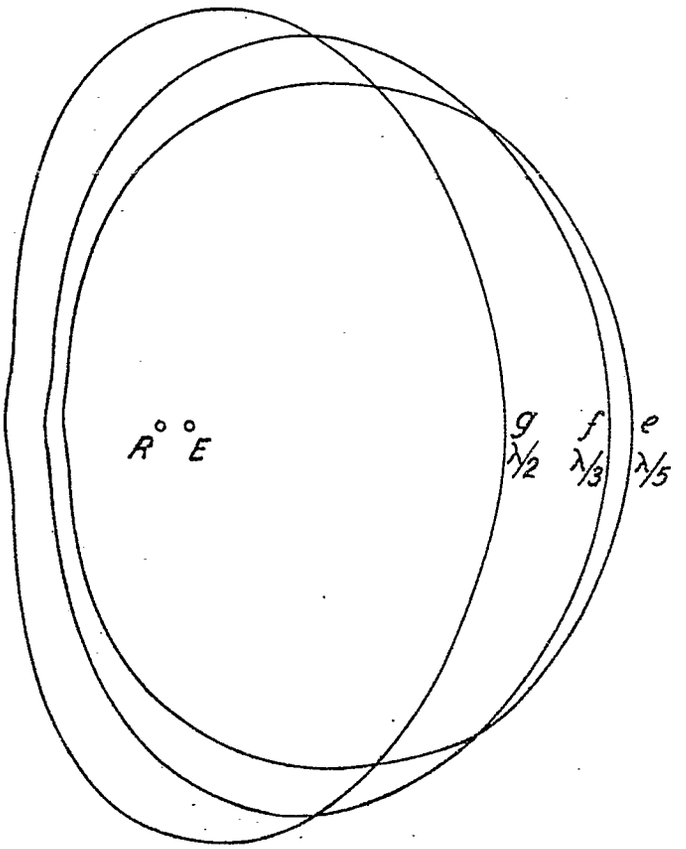


Fig. 3

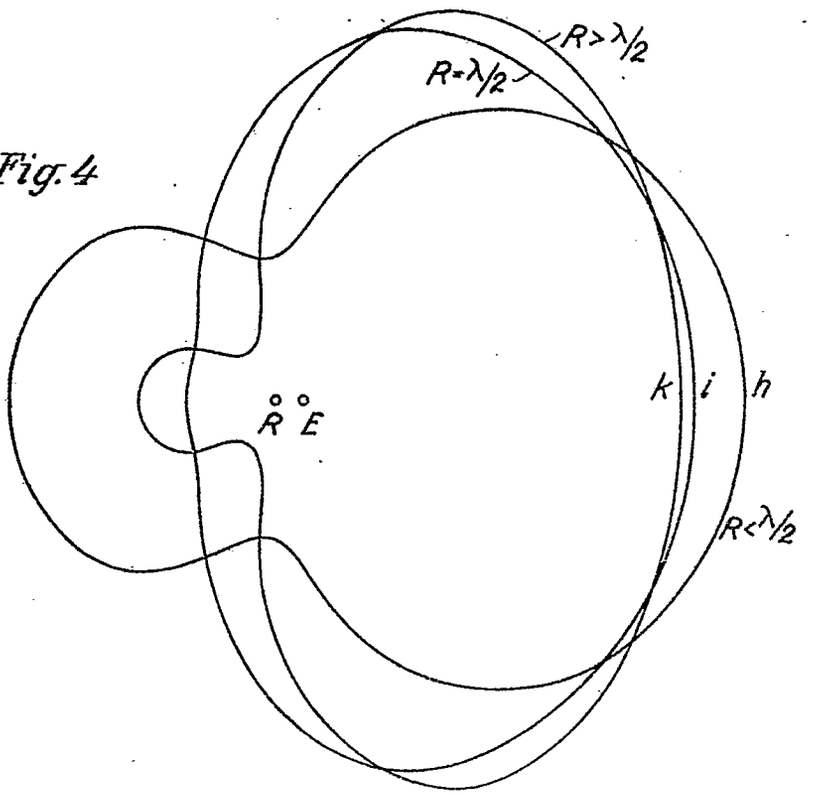


Fig. 4

Malby & Sons, Photo-Litho.

405,727 COMPLETE SPECIFICATION

2nd Edition

SHEET 1

2 SHEETS

SHEET 2

[This Drawing is a reproduction of the Original on a reduced scale.]

Fig. 1

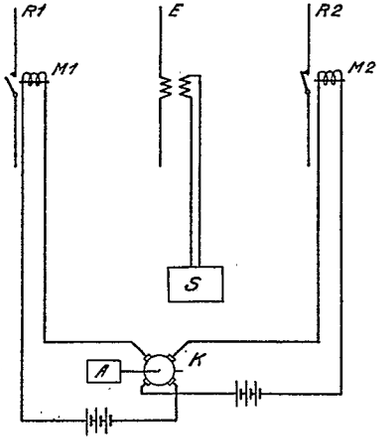


Fig. 2

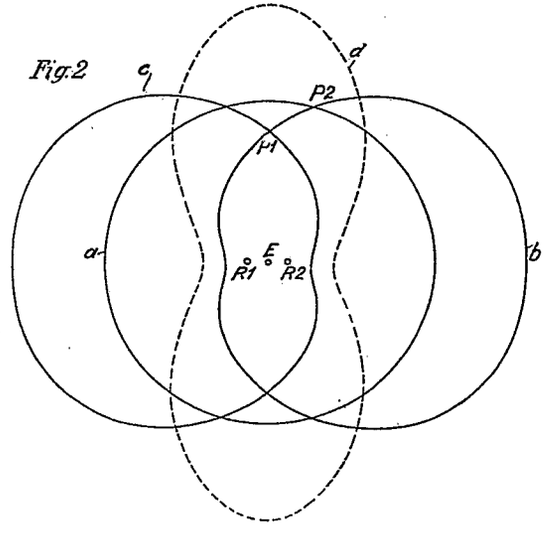


Fig. 3

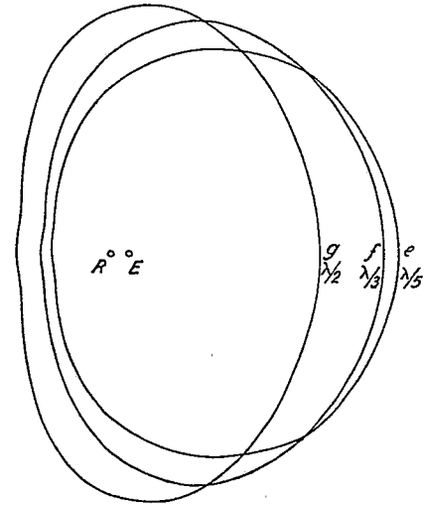
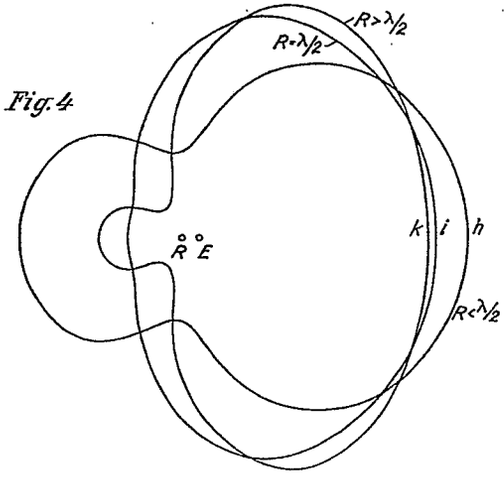


Fig. 4



Malby & Sons, Photo-Litho