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W. MOSER

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POLYDIRECTIONAL ANTENNA

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Fig. 1

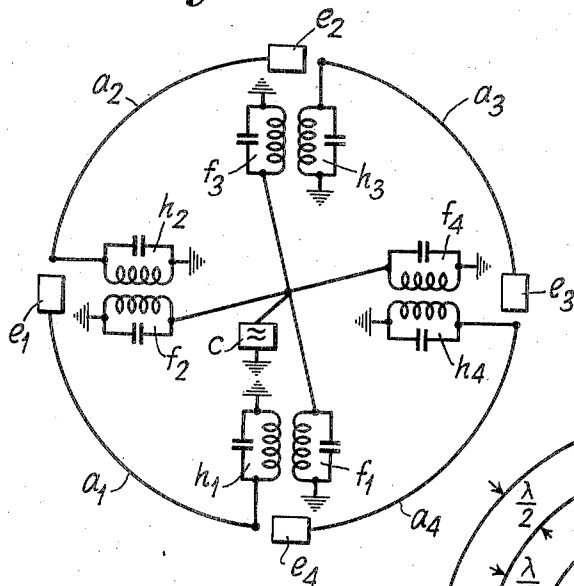


Fig. 3

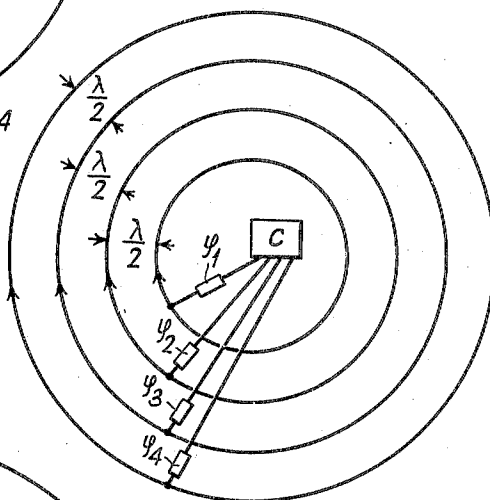
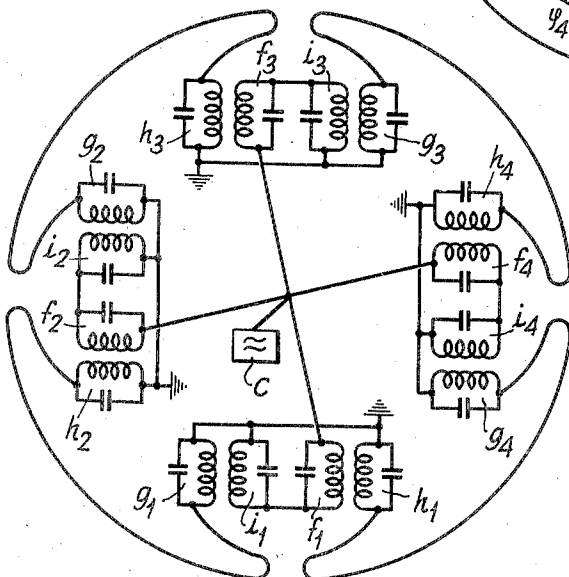


Fig. 2



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POLYDIRECTIONAL ANTENNA

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6 Claims. (Cl. 250—11.5)

It is known that wires which are combined or assembled to result in closed figures or configurations may be used as antennae. For instance, circles or polygons may be used as antenna forms. If these configurations are excited in a fundamental or in a harmonic wave, there result directional diagrams or patterns as a function of the wave length which, in some special instances, may also assume the nature of poly or non-directional characteristics. In a great many instances, it is desirable to secure characteristics of the latter nature as exactly as possible. Now, it is already known in the prior art to obtain exact non-directional characteristics by means of a plurality of radiators connected in parallel relation to one another and disposed around the contours of circle or of polygons. Quite apart from the simple case of excitation in phase of all of the constituent radiators, it is well known in the art that excitation may be insured also in such a way that the phase from one radiator to the next adjoining radiator varies always the same amount. The result is an exact poly-directional characteristic, provided that the sum total of the phase differences is a whole multiple of 2π for one rotation. However, an organization of this kind involves rather complex coupling and phase-rotation systems in order that the said effect may be secured. It has also been suggested in the prior art to use circular antennae for the transmission or the reception of horizontally polarized waves on which there are only progressive waves.

The present invention discloses an antenna arrangement, especially for the transmission or reception of horizontally polarized waves in which circular conductors fed with traveling waves are used and which is characterized by several circular or sector shaped conductors mounted in coplanar relation. Such an arrangement offers this distinctive advantage over other similar arrangements of this kind that higher radiation intensities are obtainable than is possible with a simple, circular antenna array because of its limited radiation resistance.

An exemplified embodiment of the present invention is shown in Figure 1, while Figures 2 and 3 show modifications of the invention. The structure shown in Figure 1 is so arranged that a circle of regular or of polygon shape is divided into several, say, four separate conductor sections a_1, a_2, a_3, a_4 . The coupling between each of these subdivisions or sections with the centrally mounted transmitter c by way of the coupling circuits f_1h_1, f_2h_2, f_3h_3 , and f_4h_4 is so chosen that for the circular ring, viewed as a whole,

there results a continuous phase. To this end, the ends of the conductor sections are each terminated by means of a non-reflecting arrangement e_1, e_2, e_3 and e_4 , respectively. Such a non-reflecting organization consists preferably of a series connection of an ohmic resistance, an inductance, and a space capacitance. These may be either concentrated or distributed, and the values are so chosen that the ohmic resistance is equal to the characteristic impedance of the antenna, and that the inductance is tuned with the capacitance to the working wave length.

Figure 2 shows an arrangement which corresponds to Figure 1 and which comprises a plurality of separately fed circular sectors in which the energy is returned in proper phase relation from each conductor end to the transmitter. In lieu of the non-reflecting termination at each conductor end there are here employed additional coupler circuits g_1h_1, g_2h_2, g_3h_3 and g_4h_4 , respectively. It will be understood that both in this embodiment as well as in Figure 1 the coupling circuits may be made variable.

Another arrangement adapted to carry the basic idea of the invention into practice is to retard (decelerate) or accelerate the phase speed on the conductor in comparison to the speed of light by ways and means well known in practice, such as by including inductances or capacitances, or combinations of both, and to be conceived as concentrated or evenly distributed.

Finally, Figure 3 shows an arrangement which comprises several concentric circles or polygonal conductor dispositions, preferably in accordance with one of the above exemplified embodiments. Arrangements in this connection are made so that the phase rotation times are the same for all of the circles. The speeds of propagation on the rings for this purpose are chosen inversely proportional to the ring radius. Moreover, the feeding of the consecutive rings starting from the inside in outward direction as to the input phase is so chosen that the waves propagating from the inside outwardly become added. This may be accomplished, as known in the prior art, by increasing the radii from the inside outwardly in each case an amount equal to $\lambda/2$, while the corresponding feeding phases lag an angle of π from one ring to the next. In the presence of radial distances between the various circles amounting to $\lambda/2$, as will thus be seen, the various feed phases will have to be chosen as follows: $\varphi_1=0, \varphi_2=\pi, \varphi_3=2\pi, \varphi_4=3\pi$, etc. It will be obvious that also other distances and correspondingly different phases may be chosen.

I claim:

1. An antenna for horizontally polarized waves comprising a plurality of conductors arranged in an end to end relationship in a complete circle, means connected to one end of each of said conductors for energizing said conductors with a traveling wave and reflection preventing means at the other end of each conductor.
2. An antenna for horizontally polarized waves comprising a plurality of conductors having a length which is great compared to the operating wavelength arranged in an end to end relationship on the circumference of a circle, means connected to one end of each of said conductors for energizing said conductors with a traveling wave and reflection preventing means at the other end of each conductor.
3. An antenna for horizontally polarized waves comprising a plurality of conductors having a length which is great compared to the operating wavelength arranged in an end to end relationship on the circumference of a circle in a horizontal plane, means connected to one end of each of said conductors for energizing said conductors with a traveling wave and reflection preventing means at the other end of each conductor, said means including a coupler for introducing energy arriving at said end into the next

adjacent conductor end in an in-phase relationship with energy from said energizing means.

4. An antenna arrangement comprising a plurality of antennae as set forth in claim 1 arranged about a common center the radius of successive circles differing by an odd multiple including unity of half the length of the operating wave, and means for so energizing said antennae that the radiation therefrom is additive in a horizontal plane.

5. An antenna arrangement comprising a plurality of antennae as set forth in claim 2 arranged about a common center the radius of successive circles differing by an odd multiple including unity of half the length of the operating wave, and means for so energizing said antennae that the radiation therefrom is additive in a horizontal plane.

6. An antenna arrangement comprising a plurality of antennae as set forth in claim 3 arranged about a common center the radius of successive circles differing by an odd multiple including unity of half the length of the operating wave, and means for so energizing said antennae that the radiation therefrom is additive in a horizontal plane.

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