Jan. 15, 1935. H. HARBICH 1,988,275

EQUAL WAVELENGTH BROADCASTING

Filed Sept. 11, 1931

Fig. 1

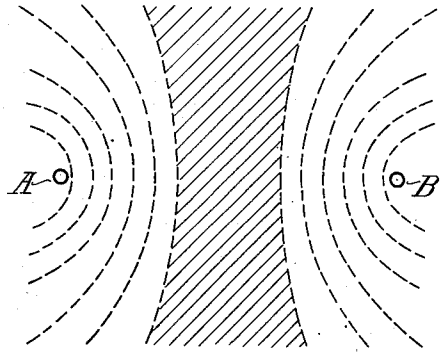


Fig. 2

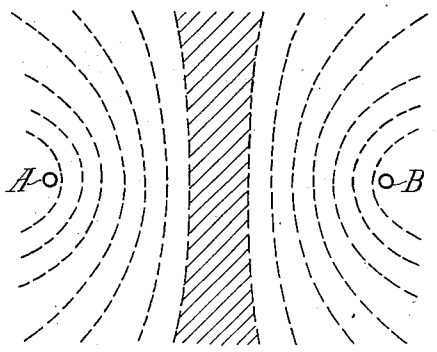
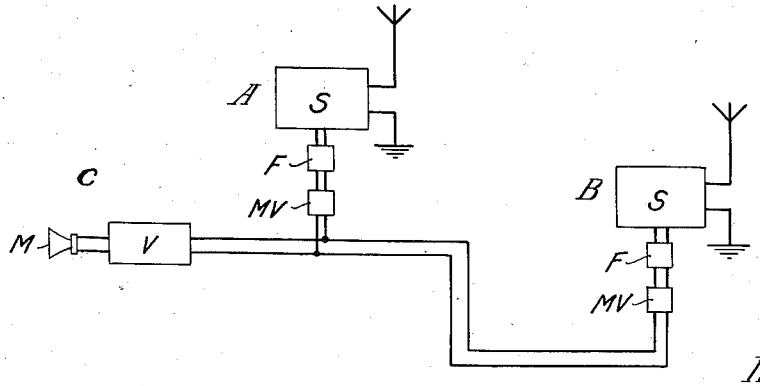


Fig. 3



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EQUAL WAVELENGTH BROADCASTING

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4 Claims. (Cl. 250—2)

This invention relates generally to radio transmitters, and more particularly to broadcasters simultaneously transmitting the same program on equal wavelengths.

Heretofore, this has usually been accomplished by two methods. According to one of these methods, different transmitters operating on the same wavelength are supplied from a central station with a fundamental frequency which is multiplied at the transmitters to form the carrier frequency; and in the other of which, synchronization of the transmitting apparatus at each of the different stations is effected by local means. Both these arrangements, however, result in disturbed areas between the transmitting stations in which the magnitudes of said disturbed areas are dependent on the magnitudes of the degree of control of the apparatus in the individual transmitting stations.

According to the present invention, it is proposed to limit the degree of modulation control, so that it never exceeds a predetermined value, by automatically regulating the amplifiers in each transmitting station.

Another object of the invention is to keep the size of the disturbed area constant, this size being dependent solely upon the degree of modulation chosen for the individual transmitting stations.

A further object of the invention is to position the disturbed area over a predetermined locality between the transmitting stations.

An embodiment of the invention is illustrated in the accompanying drawing, wherein:

Fig. 1 represents the disturbed area between two transmitting stations using earlier methods of modulation;

Fig. 2 represents the disturbed area between two transmitting stations using a method of modulation according to the present invention;

Fig. 3 is a schematic representation of two transmitting stations, each receiving the same program from a microphone in a central station and operating on the same wavelength.

In Figs. 1 and 2, A and B are broadcasters simultaneously transmitting on equal wavelengths. The hatched area between the two stations represents the disturbed area where the signals of each station are distorted.

In Fig. 3, where a schematic broadcasting system employing the invention is shown, two broadcast stations and a central station are indicated as A, B and C, respectively. At the central station C there is a microphone M and an amplifier V. At each of the broadcasting stations there is a modulation-amplifier MV, an amplitude-limiter F, and a transmitter S, together with the necessary antenna, ground connection and connecting land lines to the central station C.

In the event of 100% modulation, the disturbed area between the two transmitting stations emitting waves of the same frequency will be very large, in fact, comprising practically the entire territory between and around said transmitting stations. However, if the modulation be reduced to 30% the ratio of the field strengths considered at a predetermined point may amount to 1: 2 without any distortion becoming noticeable. If the modulation be still further reduced to 20%, a ratio of field strengths amounting to 1: 1½ would be permissible at the predetermined point. For example, assuming that two transmitting stations, radiocasting waves of the same frequency are situated at a distance of 100 kilometers apart, and possess the same emission, and that, in addition, normal conditions of absorption, such as prevail during the daytime, are taken as a basis, and that the length of the waves be 200 meters, experiment shows that the disturbed area in this case has an approximate width of 10 kilometers, that is to say, it extends 5 kilometers to either side of the bisector of a line drawn connecting the two transmitting stations. Thus, a maximum limit for the percentage modulation is determined by experiment which gives a minimum disturbed area. This percentage when determined is used as a fixed maximum above which the modulation-amplifier MV (Fig. 3) will not pass energy to the transmitter S. Therefore, the modulation-amplifier functions merely to prevent excessive modulation. The maximum percentage modulation of the individual broadcasters is so limited by the automatic regulation of MV, that the size of the disturbed area between broadcast stations emitting waves of the same frequency is kept a constant minimum.

The location of the disturbed area between the broadcasters depends upon the ratio of the amplitudes of the carrier frequency of the individual transmitters. If the broadcasters do not possess the same amplitude of carrier frequency, the disturbed area is shifted toward the less powerful of the two stations. This area can, therefore, be so positioned that it covers either poorly inhabited tracts or, perhaps, lakes. Thus limits of amplitude for the carrier frequencies are determined, which place the disturbed area where it gives the least trouble to broadcast receivers. The maximum amplitude of the indi-

vidual broadcaster is so limited by the automatic regulation of the amplitude-limiters F (Fig. 3) that the disturbed area is positioned over a predetermined locality.

In carrying out this method of control over the disturbed area between broadcasters, care must be taken that the percentage modulation of both transmitters is the same, since it can be easily proved by experiment that in such a case the smallest area of distortion will occur between the broadcasters. This is further achieved through devices for limiting the field strength which will take care that the transmission efficiency of the broadcaster is the same, even though there is a different amplitude of the carrier frequency. It is not necessary to describe devices, such as variable antenna couplers, for limiting the transmission efficiency of a broadcaster, since these arrangements are well known and there are various modifications thereof available, all of which can be used for the purpose in question.

I claim:

1. Method of equal wavelength broadcasting from two transmitting stations which comprises the following steps, modulating and amplifying signals, and adjusting the degree of modulation so as to reduce to a minimum the area of the interference in the reception from said stations.

2. Method according to claim 1 characterized by the step of adjusting the amplitude of the carrier frequencies to determine the location of said interference.

3. Method of equal wavelength broadcasting from two transmitting stations comprising the following steps, modulating and amplifying signals at said stations, broadcasting said signals from said stations, adjusting the degree of modulation to a point for reducing to a minimum the area of the interference in the reception from said stations, and determining the location of said interference by adjusting the amplitude ratios of the unmodulated transmitters at said stations.

4. Method of equal wavelength broadcasting from two transmitting stations linked with a control station which comprises, modulating and amplifying signals at the control station, transmitting the signals to the two transmitting stations, amplifying the signals received at each transmitting station, adjusting at each transmitting station the degree of modulation to a point for reducing to a minimum the area of the interference in the reception from said stations, and determining the location of said interference by adjusting the amplitude ratios of the unmodulated transmitters at said transmitting stations.

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