Jan. 12, 1943. F. MORAWETZ 2,308,019

RADIO TRANSMISSION

Filed June 18, 1940

Fig. 1.

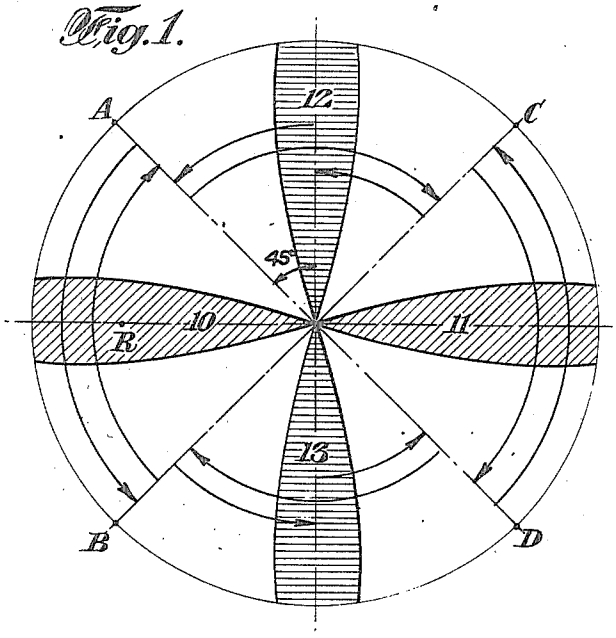
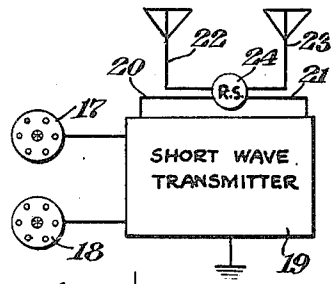


Fig. 2.



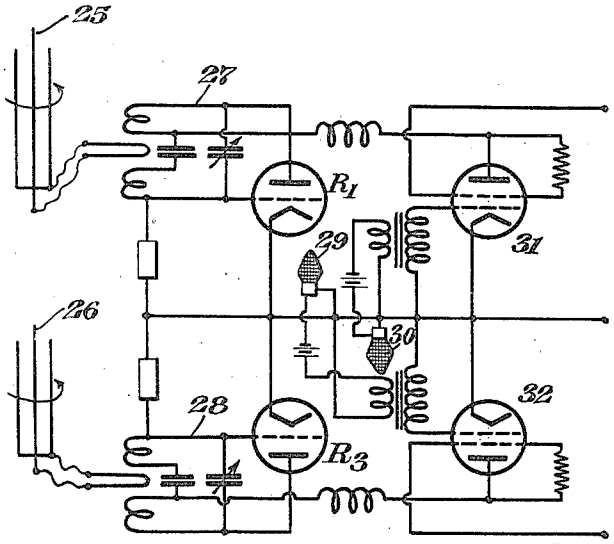


Fig. 3.

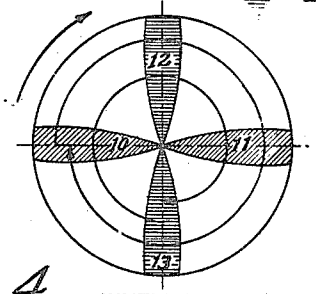


Fig. 4.

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RADIO TRANSMISSION

Friedrich Morawetz, Montreal, Quebec, Canada, assignor to Radio Watch Company, a corporation of Delaware

Application June 18, 1940, Serial No. 341,115

5 Claims. (Cl. 250—11)

My invention relates to radio transmitting systems and more particularly to a short wave, double beam radio transmitter for sending simultaneously at least two series of directed short waves having different characteristics.

The directed signals are concentrated in narrow beams and are of such intensity at the directed points within the operating range of the transmitter that they can be picked up and made audible by very simple, portable receiving sets such as crystal detector equipment or the watch size type of receiver disclosed in my Patent No. 2,256,323, granted September 16, 1941, on Portable detecting devices for ultra-short waves, copending application for which, Serial No. 238,919, was filed November 4, 1938.

An advantageous form of the transmitter for commercial use comprises two angularly displaced antennae that oscillate or rotate about a central point, each covering for example approximately one-half or 180° of the circle of propagation for all of the waves; thus creating two double beams each of which is directed to numerous points within the oscillating range so as to produce successive signals of short duration but of relatively great strength at the directed points even though the transmitter is of low power.

The signals sent out from the two antennae may be the same signal or may be two different signals. For example, signals announcing the time of day may be sent out by each antenna or one antenna only may transmit time signals and the other antenna transmit a different signal such as an advertising announcement, weather reports, alarms, military information or commands, etc.

My invention is based on the idea of providing two double beams which are displaced at an angle, for example perpendicular with respect to each other, and rotating or oscillating these two beams to produce closely concentrated directed signals for the broadcasting of information. A characteristic feature of the transmitted signals is that they are of short duration such as for example the announcement of the time of day, and if desired the name of the advertiser who is supplying this service. Because of the fact that the signals are directed to definite points within the operating field of the transmitter, they are substantially stronger than the usual broadcast signals that are transmitted uniformly in all directions. By using directed signals in this manner, it is not necessary to have the usual high power transmitting stations, nor to use the conventional type of receiver having auxiliary means for amplifying the received signal. Accordingly suitable receivers for these directed signals may be carried on the person of the listener.

Due to the fact that signals transmitted in accordance with my invention are sent out over at least two double beams, the time required for transmitting the directed signals to the numerous points of location is substantially reduced as compared with the time required for the usual single beam rotating antenna system. The system of my invention therefore offers advantages of commercial value both over the common broadcast systems transmitting non-directed signals and also over the directional systems employing a single rotating beam.

The transmitter of my invention operates advantageously with short waves and preferably with ultra short waves. Such waves permit the use of small size antennae, which facilitates their operation. Also, the ultra short waves are more easily transmitted in concentrated or narrow beams to directed points, and are substantially less susceptible to electrical disturbances and to atmospheric effects during day and night.

When the system of my invention is operated so that both beams transmit the same message, for example a time signal, the time required for transmitting and receiving the signal at any desired point is so reduced that the system can cover an extended range or territory. If both beams are transmitting the same signals to two different points, the capacity of the system is twice that of the usual system employing a single directional antenna which provides only one broadcast beam. When it is desired to broadcast two different forms of communication, this can be effected simultaneously by feeding the two different signals to the two angularly displaced antennae, and the two messages can be transmitted concurrently without any interference. These two messages may be transmitted to each directed point in the oscillating range of each of the two antennae. When the two antennae have covered their respective operating oscillatory ranges, the signals supplied to the two antennae may be reversed by any suitable means such as, for example, a reversing switch or commutator so that the antenna which originally transmitted a time signal for example, may now transmit an advertising announcement, a weather report or other signal, and vice versa for the other antenna.

When the two antennae are both rotated around the entire transmitting circle of 360°, one of them may, for example, transmit a time signal

and the other an advertising announcement; the latter would serve to fill in the time interval between time signals so that the listener would know his receiver was operating and would be prepared for the time announcement. At the end of each complete rotation, the signals on the two antenna could be reversed, if desired, by a suitable reversing switch.

The system of my invention is described herein with particular reference to two or more antennae that oscillate over predetermined ranges, that is scan all points within the set limit of their oscillation. This type of operation offers practical and commercial advantages, but it is to be understood that if desired, the antennae may be caused to rotate continuously rather than oscillate. In the latter arrangement the two beams would be angularly displaced the same as before and the same or different signals might be transmitted over the two different double beams. In each of these instances each beam will be moved angularly at such a speed that each period of transmission toward each of the directed points will be at least equal to the time required to transmit each announcement one time. By the use of the double beams, the interval during which the listener has to wait between successive signals, is reduced by half as compared with what would be necessary with one transmission beam.

The novel features of this invention are defined in the appended claims. The details of operation of the system of my invention will be more completely understood from the further description taken in conjunction with the accompanying drawing, in which

Fig. 1 is a diagrammatic showing of the two double oscillatory beams showing the beams oscillating in non-overlapping 90° arcs.

Fig. 2 is a diagrammatic illustration of one form of suitable transmitting system;

Fig. 3 is a wiring diagram of a suitable circuit for the transmitter; and

Fig. 4 is a diagram of the two double beams showing the beams as rotating around the full circle of 360°.

As shown in Fig. 1, the double beams 10—11 and 12—13 are angularly displaced and in the preferred operation they each oscillate in a horizontal direction from a given original position through an arc of 45° in one direction and through a similar arc of 45° in the opposite direction from the original position. This oscillation transmits the directed ultra short waves uniformly into the space covered by this oscillating range. The oscillating velocity of the directional beams depends upon the duration of the signal, that is the announcement being transmitted. Specific but non-limiting examples of the oscillating or rotating of the beams and the length of time announcements are as follows:

(a) Length of time announcement—2 sec.,
Width of the beam—15°,
One part of the beam has to cover 90°,
90/15=6 positions at 2 sec. is 12 sec.,
Speed of rotation or oscillation—12 sec.

(b) Length of time announcement—4 sec.,
Width of the beam—15°,
One part of the beam has to cover 90°,
Speed of rotation or oscillation—24 sec.

(c) Length of time announcement—3 sec.,
Width of the beam 15°,
Speed of rotation or oscillation—48 sec.

In the usual case the system is arranged so that the duration of the time signal just corresponds to, or is less than the length of time required for the beam to pass completely a given receiving point.

To prevent interference between the two double oscillating beams, particularly where two different signals are being transmitted by the two beams, the double beam 10—11 is displaced at least 45° from the double beam 12—13 at the beginning of the operation. In other words, the two directional beams may operate in a phase displacement of at least 45°. For example, when the double beam 10—11 has reached the center of its oscillation, the other double beam 12—13 will have reached the limit or end of its oscillation. In operation the component 10 of the double beam 10—11 oscillates between the points A—B while the component 11 oscillates between the points C—D covering in all 180° of the entire transmitting circle. Likewise, the component 12 of the double beam 12—13 oscillates between the points A and C and the component 13 oscillates between the points B and D, thereby covering the remaining arc of the transmitting circle. The rest positions of the two oscillating double beams are indicated in Fig. 1 as midway between the points A—B and C—D respectively.

As an illustration, if a receiving set is stationed at the point R in Fig. 1, it will intercept twice the oscillating beam 10 in the course of one oscillation between the points A and B. This is true since the beam starts for example from its original rest position and rotates to the point B and then returns past the same rest position and continues rotation until it reaches the point A. This cycle is then repeated continuously during the operation. The same applies to the other components of the two double beams, namely 11, 12 and 13.

In Fig. 2 the system is diagrammatically illustrated as comprising two microphones 17 and 18 connected to a short wave transmitter means diagrammatically indicated at 19. The respective outputs from this short wave transmitter means resulting from the two signals coming from the microphones 17 and 18 are transmitted over the lines 20 and 21 respectively to the two antennae 22 and 23. Where the same signal is being transmitted by both antennae, the two microphones 17 and 18 will be actuated by the same input signal and this signal amplified in the short wave transmitter means 19 will be transmitted by the two antennae 22 and 23 respectively to various directed points, the two antennae rotating or oscillating as described hereinbefore. For short-spoken announcements, such as the time of day, an automatic announcer, e. g., a record, may be used to energize the two microphones 17 and 18, such for example as shown in my copending application Ser. No. 238,920, filed November 4, 1938, corresponding to my Australian Patent No. 106,062, specification accepted December 5, 1938.

Where it is desired to reverse the signals being transmitted by the two antennae 22 and 23 at the end of the oscillations of the two antennae, as in the case where each antenna is oscillated over only about a 90° arc this may be effected by any suitable switching means such as for example the reversing switch diagrammatically indicated at 24 in Fig. 3. A well-known form of commutator might be used here for this purpose, or the antennae may be oscillated over a 180° arc in which case such signal reversing

means is not required as the signals are successively received from the two beams.

A suitable form of electrical circuit for the transmitter of this invention is illustrated in Fig. 3. Referring to that figure, it will be noted that the two antennae **25** and **26** are separately fed from the two circuits **27** and **28**. The antennae **25** and **26** may comprise any short wave antenna of the type suited to radiate signals in the form of a directional beam. These two circuits are supplied with the signal or signals, which are to be transmitted, by the two microphones **29** and **30**. That is, the microphones are each inductively connected respectively as shown to a conventional type of oscillator-modulator circuit, such circuits comprising the modulator tubes **31**, **32** and oscillator tubes R_1, R_3, the plate and grid circuits of the latter being coupled by the tuned feed-back circuits **27**, **28** to the antennae **25**, **26** respectively.

While the invention has been described in detail with respect to particular preferred examples, it will be understood by those skilled in the art after understanding the invention that various changes and modifications may be made without departing from the spirit and scope of the invention, and it is intended therefore in the appended claims to cover all such changes and modifications.

What is claimed as new and desired to be secured by Letters Patent is:

1. A method for the substantially continuous radio transmission of a plurality of different and concurrent series of closely spaced short spoken announcements, adapted for reception by receiving means of low sensitivity, which comprises transmitting one series of announcements over a short wave directional radio beam, while directing said beam successively toward various points of the compass, meanwhile transmitting from the same location another series of different announcements over another and similar short wave directional beam, while directing the latter beam successively toward various points of the compass, maintaining said beams in an angularly spaced relationship sufficient to substantially avoid interference therebetween, the announcements of each series being transmitted in close succession, whereby the announcement are transmitted successively toward each of the numerous different points of the compass, and each beam being moved angularly at such speed that each period of transmission toward each of said points will at least equal the time required to transmit each announcement once, and periodically reversing the respective announcements transmitted over the two beams.

2. A short-wave, double-beam radio system for the transmission of directive waves, comprising antenna means propagating from a given location at least two angularly spaced directive radio beams, short-wave radio transmitting means feeding two different and independent sets of signals to said respective antenna means to propagate therefrom two short wave radio beams each carrying one of said sets of signals, and means causing said beams to sweep over all points in the complete circle about said location while maintaining said beams in angularly displaced relationship suited to avoid substantial interference therebetween, and to propagate said two sets of signals successively and periodically to each point in said circle.

3. A short-wave, double-beam radio system for the transmission of directive waves, comprising antenna means propagating from a given location at least two angularly spaced directive radio beams, short-wave radio transmitting means feeding two different sets of signals to said respective antenna means to propagate therefrom two short wave radio beams having differently characterized signals, and means causing said beams to oscillate over separate portions of the complete circle about said location while maintaining said beams in angularly displaced relationship suited to avoid substantial interference therebetween, said separate portions together covering the complete circle about said location, and means for reversing the two sets of signals transmitted from said transmitter means to the respective antenna means in synchronism with the oscillating movement of said beams, whereby at each point in the complete circle about said location the two different signals are successively and periodically received as said point is periodically swept by the oscillating beam.

4. A short wave double beam radio system as set forth in claim 2 in which said beams oscillate in non-overlapping arcs.

5. A short wave double beam radio system as set forth in claim 2 in which said beams each rotate around the full circle of 360°.

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