

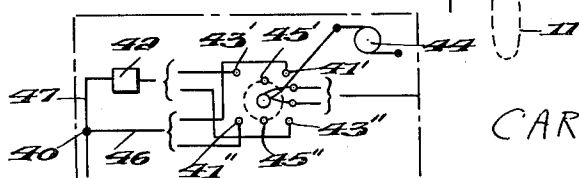
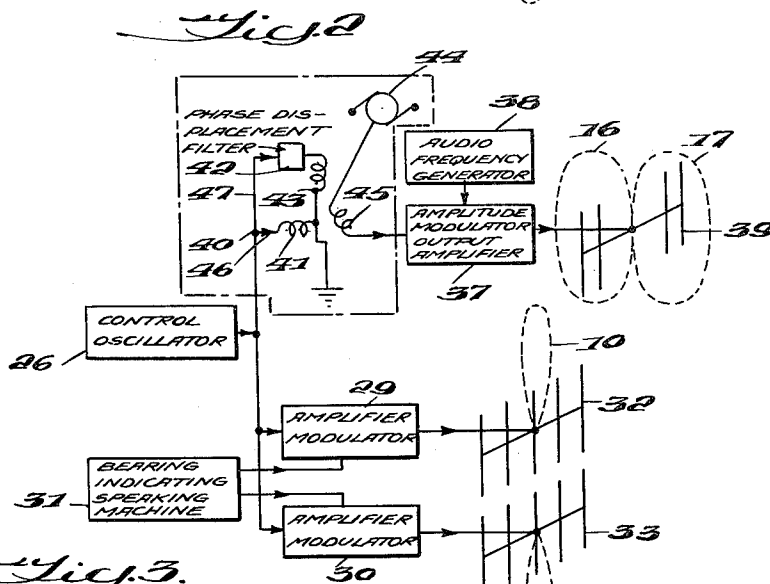
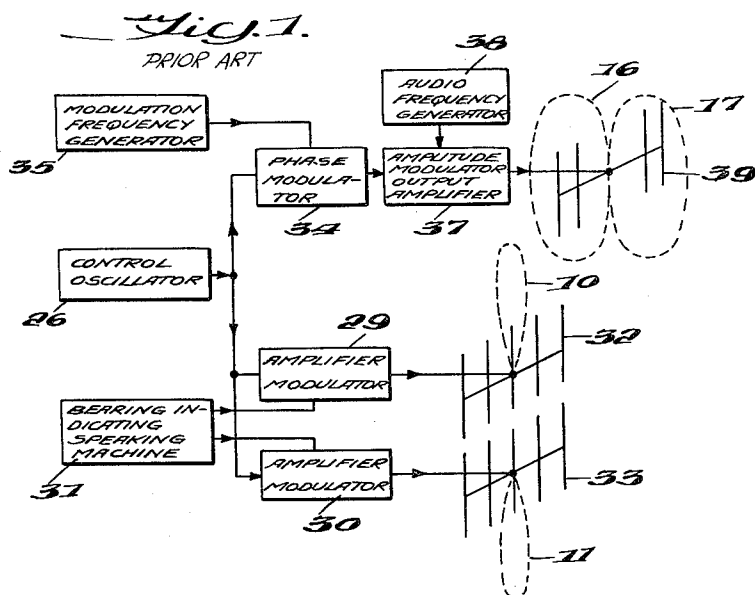
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ARRANGEMENT IN SPEAKING RADIO BEACONS

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ARRANGEMENT IN SPEAKING RADIO BEACONS
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A speaking radio beacon arrangement is known wherein a bearing indication modulation signal is transmitted to a vessel by a first antenna having a sharply limited direction characteristic in space and subjected to rotation in time with the statements or information forwarded by the beacon to the vessel, and a covering field of the same frequency for filling out the angles of the field where the bearing indicating field does not radiate, is transmitted by a second antenna and is modulated with an audio frequency oscillation.

In a development of the above-mentioned arrangement, also earlier known, the covering field is amplitude-modulated with the audio-frequency oscillation and furthermore frequency- or phase-modulated with an oscillation, the frequency of which is preferably essentially above the audio range.

Speaking radio beacons of the said kind practically always work with ultra high frequencies in the order of magnitude of 300 to 400 megacycles per second. A simplification of the above stated arrangement could be obtained, if instead of modulating the covering field with an audio-frequency oscillation, cause said field to work with a frequency, differing from the frequency of the bearing transmitting field by the audio-frequency which one hears when receiving the covering field. Thereby a surge modulation would be obtained on the receiver side, provided by means of the two received oscillations. However, in order not to create disturbing tone changes, which could be irritating for the listener, it is desired that the covering tone should be absolutely constant. Now, on the other hand, it is very difficult to keep two frequencies of such a high order of magnitude as 300 to 400 megacycles per second so closely constant and in such an exactly constant frequency difference, that after composing the two oscillations under surging, no change of tone height will be created in the surging tone, which is in the order of magnitude of 300 cycles a second. This tone, as a matter of fact, has a frequency in an order of magnitude of one millionth of the frequency of the two generator oscillations.

The phenomenon of "surging" can be explained with the following analogy. Where a piano has two strings for the same tone and one of these strings is slightly out of tune, the discordant string will swing with its own frequency. On occasion the two strings will cooperate, while at other times they will be in counter phase. When they cooperate they add their tone intensities to each other, but when they swing in counter phase, the sound intensity of one will detach itself from the other and while a single tone will result, this tone will be subject continuously to oscillation in its sound intensity. This oscillation is spoken of as "surging."

These difficulties are now solved according to this invention by controlling on the transmitter side the signal transmitting unit for the statement about the bearing and the covering transmission by one and the same generator, preferably crystal-controlled, but thereafter making the covering transmission signal in specific order subject to a modulation of purely mechanical kind in a rotating modulator. This may be inductive or capacitive. Its one part, for instance its stator part, then may be fed with the unmodulated oscillation, and its other part, in the chosen

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example its rotor part, may be kept in rotation with a number of turns, corresponding to the desired surging frequency, in the chosen example thus a frequency in the order of magnitude of 300 cycles per second. From the rotor winding by means of sliprings or by means of an inductive or capacitive transformer, the modulated signal is received. This may thereafter, eventually after amplification, be fed to the antenna system which has to transmit the covering field.

In the attached drawing one form of execution of the invention is shown, which is further described below. FIG. 1 shows the known prior art arrangement, whereas FIG. 2 shows the same arrangement, modified in accordance with the present invention. FIG. 3 shows an arrangement which replaces that part of FIG. 2 surrounded by a dashed line so that the arrangement according to FIG. 2 may function with a capacitive transformer instead of with an inductive transformer.

In FIG. 1, 26 is a control oscillator, creating the radio frequency to be transmitted by the speaking radio beacon. The control oscillator feeds two amplifiers 29, 30, which also function as amplitude modulators. For this purpose the amplifiers and modulators 29, 30 are combined with a bearing indication sound machine 31, so that the transmitted signals are modulated with the bearing indications which may for instance be composed by the spoken sound for the English words "two," "four," "six" and so on for indicating of 20°, 40°, 60° bearing and so on. The antennae 32 and 33 therefore transmit by means of their characteristic lobes 10 and 11 this statement about the bearing. It should be observed, that the characteristic lobes of the antennae 32, 33 are very narrow and approach the form, which one has within this field of technology called "cigar characteristic form."

Further, however, also a phase modulator or a frequency modulator 34 is fed with the oscillation from the control oscillator 26. The phase modulator obtains its modulation frequency from a modulation frequency generator 35, which may for instance be arranged in such a way that the frequency is of audible order of magnitude, for instance 300 cycles a second. The oscillation phase-modulated in this way is fed to an amplitude modulator and an output amplifier 37 in such a form, that it is frequency or eventually phase modulated around a mean frequency, coinciding with the carrier wave frequency from the antennae 32 and 33. The audio-frequency oscillation to be used for the carrier signal is created in an audio frequency generator which may for instance consist of a tooth wheel generator 38, and is modulated in the amplitude modulator and output amplifier 37 on the frequency or phase modulated oscillation from the amplifier and modulator 34, the signal thereafter being fed to the antenna system 39, which is arranged to transmit a field with the two directional characteristic lobes 16 and 17, respectively.

It is now obvious that the antennae 32 and 33 will transmit a signal modulated with the bearing statement on the carrier wave, used for the speaking radio beacon. Simultaneously the antenna 39 is transmitting a covering field with a mean frequency equal to that of the carrier wave just mentioned, but this covering field will be frequency modulated, and this composed oscillation further is amplitude modulated with the audio frequency oscillation derived from the audio frequency generator 38.

There would, however, be a lot of advantages to gain if one could instead of arranging a frequency or phase modulation in the phase modulator 34 with a super-modulated signal, derived from the modulation frequency generator 35, continuously change the frequency of the transferred signal in the phase modulator 34 by such a small amount, that thereby a surging tone will be obtained

on the receiver side between the signals radiated from the antenna systems 32, 33 and 39, respectively. This surging tone, however, should for the reasons mentioned above be of a constant tone height. For this purpose, in the arrangement comprised by the present invention, a rotating transformer is used in a way, which is evident from FIG. 2.

In FIGURE 2 parts corresponding to those of those of FIGURE 1 and which have the same function as they, have been indicated by the same reference numerals. It is immediately seen that no change has been made in such parts, which create the signal transmitted through the antenna systems 32 and 33. On the other hand, the creation of the signal transmitted through the antenna 39 will take place in another way.

The crystal controlled radio frequency oscillation received from the oscillator 26 thus is fed to a division point 40 from which extends a stator winding 41, whereas the other branch leads to the other stator winding 43 of the rotating transformer over a phase displacement filter 42. The rotor winding 45 is connected to the output amplifier and amplitude modulator 37 in the same way as in the arrangement according to FIG. 1.

The rotating transformer 41, 43, 45 is driven by a rotating motor 44, which keeps said rotor with its winding 45 in rotation with such a number of turns, that this will, with respect to the number of poles in the windings, correspond to the desired difference of frequency, for instance 300 cycles per second. In relation to the surrounding area, thus, a rotational field is created by the two stator windings 41, 43, rotating with a number of turns corresponding to the frequency of the oscillator 26, but due to the rotation of the rotor winding 45, this winding will receive the field with another number of turns, which will, dependent upon if the rotor is rotating in the same or the opposite direction of rotation of the field, be 300 cycles per second less or higher, respectively. In any case, the signal transferred to the output amplifier and amplitude modulator which differ from the signal, transferred to the antennae 32 and 33 by a frequency of 300 cycles per second in the chosen example.

It should be observed that with respect to the transferred carrier and mean wave frequency, respectively being of ultra high order of magnitude, there are no difficulties in the provision of the phase displacement filter 42. In its simplest and fully reliable form this phase displacement filter is only provided the way, that from the connection point 40 conduits 46, 47 of different length run to the stator windings 41, 43, respectively, of the rotating transformer, the difference in length being a quarter of a wavelength, which causes the phase difference between the oscillations in the two windings 41, 43 of 90°. Further the two windings being displaced in space by 90° electrical measure, one will according to known laws obtain a circularly rotating field in the rotating transformer.

Further it should be observed that the rotating transformer need not be an inductive transformer, even if such a one has been shown in FIG. 2 for providing a simpler description of the invention, but that one may with advantage instead of that use a capacitive rotating transformer, preferably a so called wave-length transformer, where the capacity layers are formed by wave conductors with a length adapted to the wave-length. This arrangement is shown FIG. 3. The wave conductors 43' and 43'' in this arrangement replace the coil 43, and wave conductors 41' and 41'' replace the coil 41. On the rotor part there are further applied two wave conductors 45' and 45'' which replace the coil 45. A suitable trans-

former is more fully disclosed in Patent No. 2,746,038, issued May 15, 1956.

It is commonly known within the present branch of engineering, that where two oscillations having equal frequencies are provided, two different actions will occur: Firstly there will be created a surging, which may be separated by rectification in the form of a tone of the surging frequency, which will in the chosen example be 300 cycles per second. Secondly, however, even a frequency modulation effect of the kind, which has also been called a complete phase modulation, will occur. This effect appears in the following way:

In a given moment the two oscillations from the antennae 32, 33 and 39, respectively are situated in the same phase position, that means, both of them have for instance zero value within a rising branch of a sine curve. From this moment on, however, successively a phase difference will occur, which will finally get its maximum value of 180° after the lapse of a time, which will in the chosen example of a frequency difference of 300 cycles per second occur after $\frac{1}{600}$ second. Thereafter, the phase difference will turn over to have the opposite sign and it will decrease until there is again phase equality after further $\frac{1}{600}$ second. It is evident from this, that one has by the disclosed arrangement obtained a very simple device, which is both cheaper and more reliable than the known arrangement, said arrangement producing on the receiver side the covering field tone of a constant tone height of a suitable order of magnitude as well as the desired frequency or phase modulation effect of the known arrangement.

What is claimed is:

1. A speaking radio beacon of the class described comprising a first antenna having a sharply limited directional characteristic in space for transmitting a bearing indication modulation signal, a second antenna for transmitting a covering field of a frequency differing from the frequency transmitted by the first antenna by an audible amount of cycles per second for filling out the field where the bearing indicating field is not radiated, means for modulating the covering field with an audio frequency oscillation, a common oscillator connected to said antennas, first circuit means for transferring the covering field signal to the second antenna and second circuit means for transferring the bearing indication modulation signal to the first antenna, and means including a rotating transformer connected in said first circuit means, said transformer rotating a number of turns corresponding to the intensity of a desired surging oscillation.

2. A radio beacon according to claim 1 wherein the rotating transformer is inductive.

3. A radio beacon according to claim 1 wherein the rotating transformer is capacitive.

4. A radio beacon according to claim 1 wherein a phase displacement filter is connected in a winding of the transformer, said phase displacement filter being tuned for a phase displacement of 90°.

5. A radio beacon according to claim 4 wherein the phase displacement filter is formed by a wave conductor of a length corresponding to one quarter of the wave length of the transferred signal.

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