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DIRECTION FINDER

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Fig. 1.

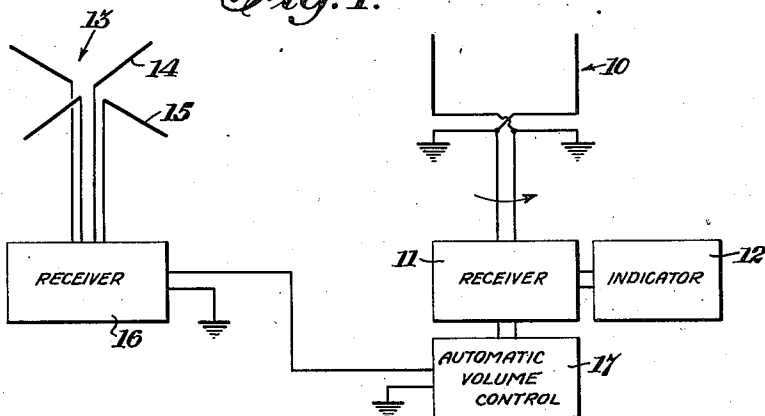
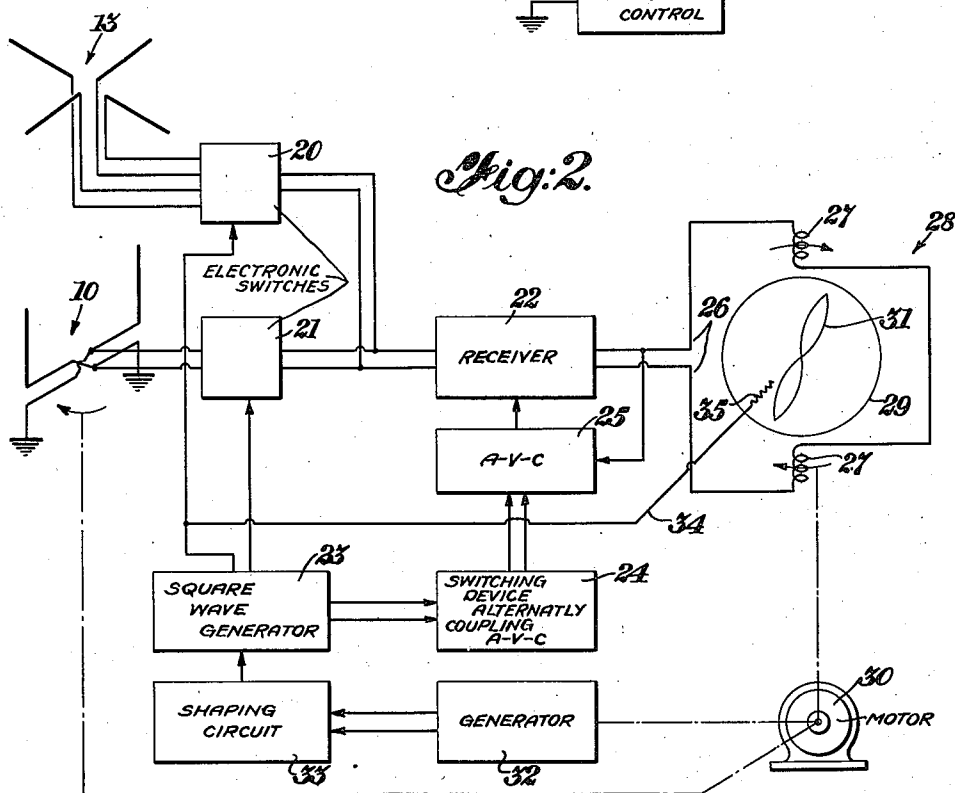


Fig. 2.



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DIRECTION FINDER

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8 Claims. (Cl. 250—11)

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This invention relates to direction finders and more particularly to direction finders operating on vertically polarized waves.

In known forms of direction finders, whether they are of the Adcock type or of the loop antenna type, errors in the direction indication occur whenever the horizontally polarized component is present at a considerable amplitude. In the past, various circuits have been designed to effect neutralization of the horizontally polarized component to avoid errors caused thereby. However, if the horizontally polarized component is very strong, these neutralizing systems do not operate to eliminate the error.

It is a principal object of my invention to provide a direction finding system in which incorrect bearings due to the presence of energy polarized in a plane other than that for which the direction finder is designed may be substantially eliminated.

It is a still further object of my invention to provide a direction finding system operated on vertically polarized waves, in which the direction finding operation of the system may be substantially discontinued in the presence of extremely strong horizontally polarized energy.

It is a still further object of my invention to provide a system wherein horizontally polarized energy will serve to substantially block the receiving equipment when this horizontally polarized energy exceeds in amplitude the vertically polarized energy.

According to a feature of my invention, I provide a direction finder antenna operating to receive vertically polarized electromagnetic waves and apply the output of this direction finding antenna to an indicator. Cooperating with the vertical antenna arrangement, I provide an antenna which is most strongly responsive to horizontally polarized energy. This antenna is coupled to a receiver which detects the received energy and applies the detected energy to the direction finding receiver to bias the receiver to cut-off when the energy at the output of the horizontal receiver is substantially at the level of the vertically polarized received energy. In one embodiment of my invention, the provision of two separate receivers is avoided by providing suitable switching means for alternately applying energy from the vertical and the horizontal antenna to the receiver, and providing an automatic volume control circuit in the receiver responsive to the energy received on the horizontal antenna for blocking the receiver should this energy exceed that received on the vertical antenna. In

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this system, suitable switching control arrangements are provided to assure proper synchronization of the receiver switching to the volume control leads.

A better understanding of my invention may be had from the particular description thereof made with reference to the accompanying drawing, in which

Figure 1 illustrates a simple form of receiver, in accordance with my invention; and

Fig. 2 illustrates another embodiment of a receiver incorporating the features of my invention.

Turning to Fig. 1 first, 10 represents a vertical antenna of the Adcock type, preferably similar to the type shown in my copending application, Serial No. 445,468, filed June 2, 1942, which is rotatable for direction finding purposes. In place of a rotatable antenna, a fixed structure with rotatable goniometer may be used. Antenna 10 is coupled to receiver 11 in the output of which is provided an indicator 12. This receiver may be of conventional type, and the indicator may constitute any known form of meter or cathode ray indicator as desired. Antenna 10 is composed of vertical elements and responds more strongly to vertically polarized energy, than to horizontally polarized energy. Associated with the circuit is provided antenna 13, comprising two dipoles 14 and 15, arranged at right angles to one another and in a horizontal plane. Antennae 14 and 15 are coupled to provide a 90° phase difference, so that antenna 13 operates substantially as an omni-directional antenna for receiving horizontally polarized energy. Antenna 13 is coupled to receiver 16, which serves to amplify and detect the received horizontally polarized energy, and apply the detected output to automatic volume control device 17 of the receiver 11. The automatic volume control circuit is preferably adjusted so that when the applied energy from antenna 13 is substantially equal to or greater than that received on antenna 10, it will serve completely to block receiver 11.

With this arrangement, indicator 12 will not provide any indication when the horizontally polarized energy is present in such magnitude as to render indications of direction substantially useless. However, the system will provide direction indications at all times when the energy received is of such a nature that it can be usefully applied.

In Figure 2, is shown an arrangement in which a single receiver may be used instead of separate receivers for the vertically and horizontally polarized energy. In this arrangement, energy

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from the horizontal antenna is applied to electronic switch 20 and from the vertical antenna to electronic switch 21. Switches 20 and 21 are operated to alternately apply energy to a receiver 22. A square wave generator 23 is provided to control electronic switches 20 and 21. The square wave generator may be of the well known multi-vibrator type and is preferably adjusted to a frequency above that necessary for persistence of vision. This generator may, for example, operate at a frequency of from 50 to 1,000 cycles.

Square wave generator 23 also operates a second switching device 24 which serves to switch the receiver circuits in timed relationship with the antenna switching, so that only energy from the horizontal antenna, is applied to an AVC circuit 25. The switching device 24 may be similar to the electronic switches 20, 21, or may be of any desired form. For example, the switching device may constitute merely bias control elements for applying control voltages from generator 23 alternately to separate tubes in the output of receiver 22. The AVC circuit 25 is adjusted so that it will respond to block receiver 22 when the energy from the horizontal antenna is sufficiently high to render directional indications substantially meaningless. The AVC circuit is also provided with a known form of time constant control means, such as resistance-condenser circuits, adjusted so that the time constant of this circuit exceeds the period of the square wave from generator 23. Thus, the AVC circuit, once it has operated, will maintain the receiver blocked until such time as the received energy from the horizontal antenna drops to a value lower than that received on the vertical antenna.

The energy from the vertical antenna passes from receiver 22 over output leads 26 to the deflecting coils 27 of a cathode ray oscillograph 28. Coils 27 are rotated about the envelope 29 of tube 28 by a motor 30. Motor 30 may also serve to rotate the directive vertical antenna so that a direction indicating pattern 31 is produced on the screen of the cathode ray tube. Preferably, motor 30 also operates a generator 32, the output energy of which is applied over a shaping circuit 33 to square wave generator 23, so that the square waves used for switching are timed with the rotation of the deflecting circuit.

It is clear that if the horizontally polarized energy is permitted to also affect the indication pattern, a modulation effect will be produced because of the switching. In order to avoid this effect, energy is applied from square wave generator 23 over lead 34 to a control grid 35 in the cathode ray oscillograph 28, so that the electron beam is completely blacked out at the time the energy from the horizontal antenna is applied to the receiver. Thus, the pattern 31 produced on the direction finding indicator will be smooth and will at all times indicate the true direction. Whenever the energy on the horizontal antenna is of sufficiently high level to render indications meaningless, receiver 22 will be completely blocked so that no indications will be provided on the cathode ray oscillograph 28.

While I have described above specific examples illustrating a preferred embodiment of my invention, it is clear that many modifications and adaptations may be made without departing from the scope thereof. For example, it is clear that a horizontal loop antenna may be sub-

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stituted if desired for the dipole pair shown in 13. Also, other forms of vertical antenna of the dipole or monopolar type may be used in place of those shown at 10 or vertical loops may be used in some cases. Furthermore, other circuits may be readily devised for assuring the blocking of the receiver in response to the excessive amplitude of horizontally polarized energy than those particularly illustrated herein. Furthermore, if horizontally polarized energy is used for the direction determination, the vertically polarized energy may be used to cut off indications in the same manner as described above.

While I have described above the principles of my invention in connection with specific apparatus, and particular modifications thereof, it is to be clearly understood that this description is made only by way of example and not as a limitation on the scope of my invention as set forth in the objects of my invention and the accompanying claims.

What is claimed is:

1. A direction finder system comprising directive means for receiving energy polarized in a first given plane, indicator means for producing a direction indication in response to said received energy, means for receiving energy polarized in a second plane normal to said first plane, and means responsive to said energy polarized in said second plane for cutting off energy from said indicator means when received energy polarized in said second plane exceeds the received energy in said first plane.

2. A direction finder system comprising directive means for receiving vertically polarized energy, means for producing a direction indication in response to said received vertically polarized energy, means for receiving horizontally polarized energy, and means responsive to said received horizontally polarized energy for cutting off said indications at such times as said horizontally polarized energy predominates at said receivers.

3. A direction finder system comprising a directive antenna responsive primarily to vertically polarized energy, a receiver coupled to said directive antenna, a direction indicator coupled to the output of said receiver, a second antenna responsive primarily to horizontally polarized energy, a second receiver coupled to said second antenna, and connections from the output of said second receiver for rendering said first receiver unresponsive to received signals when the output of said second receiver reaches a predetermined level.

4. A direction finder system comprising a first directive antenna for receiving energy polarized in a first given plane, a second antenna for receiving energy polarized in a second plane normal to said first plane, a receiver, an indicator in the output of said receiver, an automatic volume control circuit in the receiver, and switching means for alternately applying energy from said first and second antennae to said receiver and simultaneously applying the output of said receiver alternately to said indicator and said automatic volume control circuit said automatic volume control circuit operating to block the output of said receiver in response to energy from said second antenna at a level greater than that received from said first antenna.

5. A direction finder system according to claim 4, wherein said indicator is a cathode ray oscillograph having deflecting means, further comprising means for rotating the cathode ray beam and said directive antenna in timed relation, and

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means for applying energy from said receiver to said deflecting means of said cathode ray oscillograph.

6. A direction finder system according to claim 4, wherein said indicator is a cathode ray oscillograph having deflecting means, further comprising means for rotating the cathode ray beam and said directive antenna in timed relation, means for applying energy from said receiver to said deflecting means of said cathode ray oscillograph, and means for controlling said switching means in timed relation with said rotation.

7. A direction finder system according to claim 4, wherein said indicator is a cathode ray oscillograph having deflecting means, further comprising means for rotating the cathode ray beam and said directive antenna in timed relation, means for applying energy from said receiver to said deflecting means of said cathode ray oscillograph, means for controlling said switching means in timed relation with said rotation, and means for blocking the beam of said cathode ray

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oscillograph during periods of reception from said second antenna.

8. A direction finder system comprising directive means for receiving energy polarized in a first given plane, indicator means for producing a direction indication in response to said received energy, means for receiving energy polarized in a second plane normal to said first plane, and means responsive to said energy polarized in said second plane for cutting off energy from said indicator means whenever received energy polarized in said second plane exceeds a predetermined level.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,276,119	Terman	Mar. 10, 1942