1029ZH

Send to: NANCHAHAL, NEHA
PIERCE LAW CENTER
2 WHITE ST
CONCORD, NH 03301-4176

Time of Request: Wednesday, August 01, 2007 11:49:06 EST
Client ID/Project Name:
Number of Lines: 213
Job Number: 1862:40502040

Research Information

Service: Terms and Connectors Search
Print Request: Current Document: 53
Source: Utility, Design and Plant Patents
Search Terms: inventor(robert /2 rines)

53 of 81 DOCUMENTS

UNITED STATES PATENT AND TRADEMARK OFFICE GRANTED PATENT

2611894

Link to Claims Section

September 23, 1952

Thermoelectric system for remote object images

INVENTOR: HARVEY RINES ROBERT

APPL-NO: 605721 (02)

FILED-DATE: July 18, 1945

GRANTED-DATE: September 23, 1952

PRIORITY: July 18, 1945 - 19450605721, United States (US)

PUB-TYPE: September 23, 1952 - Utility Patent having no previously published pre-grant publication (A)

PUB-COUNTRY: United States (US)

US-MAIN-CL: 342#179

US-ADDL-CL: 136#214, 313#110, 313#307, 313#600, 315#34, 315#157, 348#E03.012

CL: 342, 136, 313, 315, 348

SUMMARY:

-The invention will now be more fully explained in connection with the accompanying drawings, in which Pig. 1 is a diagrammatic view of-circuitsand apparatus arranged and-constructed in accordance with a preferred embodiment thereof, showing also the airplane object from which the radio waves are reflected and scattered to the receiving system; Pig. 2 is a section of a modification, upon a smaller scale, taken upon the line 2-2 of Fig. 1, looking in the direction of the arrows; and Fig. 3 is a view of a common thermocouple analogous to the form shown in Figs. 1 and 2. ...:.:".... ,.....

An electromagnetic-wave generator 4 is shown exciting a dipole 2 to .produce ultra-high-frequency microwave radio; energy, say, of 3 or 1. centimeters wave-length. A. continuous-wave or any other type of modulated-wave generator may be employed, though pulsed energy, at present, has the advantage of economical and easy highpower ultra-high-frequency generation.

: The waves, emitted by the dipole 2 may be directed by a reflector 3 upon a parabolic reflector 6. The parabolic reflector 6 is shown directing the waves toward an object, say, an airplane 9, from which they are reflected and scattered toward a receiving station. .

At the receiving station, the radio waves .thus reflected and scattered from the object 9 may be focused by an

electromagnetic dielectric lens 5, such as polystyrene, upon a bank or array 7, comprising a plurality of normally ineffective insulated radio-receiving pick-up unit antenna elements. The dielectric lens 5 may be replaced by any other type of well-known lens, mirror or other directive system for focusing the electromagnetic energy scattered and reflected from the object 9 on the bank or array 7 of antenna elements.

The pick-up elements may be in the form of thermoelectric devices operating according to the > Seebeck effect. Two such elements are illustrated in Fig. 3, constituted oftwo dissimilar metal elements and II of, say, Eureka and copper or steel. They are joined together by any well-known thermocouple solder-connecting-element 8. The elements 10-and Il are shown respectively provided with dipole segments and 31.

These dipoles will receive a transmitted electromagnetic wave, whereupon heat will be -produeed with differential effects in the elements and 11, resulting in an unidirectional thermoelectric electromotive force in electrode terminals and 41 of the respective thermocouple elements and 11. The radio frequency will be short-circuited in the dipoles and 31,, but a direct current will be caused to -travel in the conductor extensions and 41. Radio-frequency energy on the left-hand side of the junction 8, therefore, is converted into direct current -in the terminals and 41 on the other side. -mechanism is thus provided for rectifying theradio frequency energy. As described in the Admiralty Handbook of Wireless Telegraphy, 1938; section W, paragraph 6, the electromotive force is proportional to the temperature: and the -heating to the square of the radiorfrequency current.

The thermoelectric antenna, -elements : are shown arranged in the form of rows and columns, in the proximity of the focal plane of the lens 5. The first or uppermost row of the: bank, for example, is illustrated as comprising the thermocouples 10-11, 12-13, 14-15, IS-18, etc.,shown as equally spaced horizontally. The length of the segments 10-II, etc., up to the junctions 8, may be a quarter-wave lengthieach..: -The: second row from the top is shown comprising the sections 22-24, 28-29, etc. Though only a small number of antenna units is shown, in each row, this is merely for illustrative purposes, in order not to confuse the disclosure. It will be .understood that, in practice, a large number of antenna units will be employed in each row. In order to fix the ideas, for purposes of description, let that number be chosen as-180.

The columns and rows are separated by the insulation strips I. : Though each column is shown as comprising only a few antenna units, this is again in order riot to complicate the drawings. In actual practice, the number of antenna strips in each column may be quite large, saytl80.

The direct-current sides of the thermocouples are shown disposed in a long illuminating cell such as a neon or other gas cell, directly behind the pick-up elements of the corresponding row, and extending substantially throughout the length of the row. In this case, portions of the neon-gas-discharge cells are each associated with and correspond to one of the antenna elements, energization of which by the received radio-frequency energy will produce a likeness on the array of cells corresponding to the energy received by the corresponding antenna elements.

Each of these cells may be hermetically, sealed, .. and may contain a suitable gas, such as neon, to constitute a gas cell. A screen 50, disposed at the rear faces of the cells, may be constituted of darkened transparent material to serve as a suitable weak filter. If neon is the gas employed, the filter preferably should be orange-colored.

Electrodes are shown mounted at the ends of the/cells to provide initial striking voltages for the gas cells. An initial glow may be produced in ,the top cell 23 by impressing a low directcurrent r potential upon the electrode 20, compared to that of the electrode 19.

,An;initial glow may. similarly be produced in ithe second cell 33 by impressing: a low direetcurrent:potential upon the electrode 26, as compared with ,the potential impressed upon the electrode 25; and so on for other correspondingly positioned electrodes. The pairs of. electrodes are shown connected in parallel across a, battery 2 7 for permanently impressing these directTCurrent striking potentials. A glow discharge., will thus be established through the .various ;gasTdischarge neon cells between the said electrodes.

The thermoelectric antennar-section units will, of course,, all receive the, reflected or scattered radio waves through ,the lens 5 simultaneously. There will be focused on each antenna, section a radio-frequency voltage corresponding to the scattering frpm a corresponding area of the objects.

The pick-up elements will thus .receive different field strengths of reflected or scattered radio.: energy, corresponding to the amount of energy reflected or scattered from the various parts; of the object 9 and converged upon the array::0f .pick-up, elements: by the lens 5. A go radio-energy picture, of the: object 9 is thus recorded i upon ;the; array, specific elemental ;areas of;:which will correspond to specific elemental areas of the object 9, and this specificrelementalarea;correspondence will: be preserved by reason gg of&the fact that: there is no discharge between .the;dthermo-electric-couple antenna elements. Byrmeans of .the present invention, this radioenergy ipicture may be converted into a faithful visible picture. The present invention, however, is :to be contrasted with prior-art proposals .for converting radio energy into a visual indication by. causing radio-receiving elements to produce radio-frequency discharges between one another, thereby; destroying, such specific-elemental-area Correspondence and distorting any possible visiblerlikeness.

: :,The received radio energy, by the Seebeck effect, will produce corresponding direct-current voltages continuously to disturb or modify; the normal Delation between the electrodes 19--20, 25+T-26,;etc.; of the gas cells in which they are disposed. The glow through the various portions: of the neon cells will become correspondingly modified in accordance -with" the-/ directcurrent voltage produced from the radio-frequency energy received by the corresponding antenna elements.

By suitable design, it is possible to operate on a portion of the characteristic of the neon cell such that a nearly linear relationship shall exist between the direct-current excitation and the illumination or glow intensity of the neon cells, within the range of operation. :.The radio distribution received by each thermo-couple radio-receiving element may therefore be converted, according to the present invention, into a. corresponding light distribution. To fix the ideas, consider the cell 23, for example, where a direct-current potential is established by the battery 2T between the electrodes 19 and 20. This causes ionization of the neon and a slight orange glow .between the electrodes 19 and 20. The impressing of radio-frequency energy on the dipole 10-11, converted into direct-current voltage by ,the thermocouple thereof, will cause the part of the neon cell associated with the conductor extension electrodes and 41 on the other side of the thermocouple (0-II to glow with an additional modifying orange glow the intensity of which bears a fixed relation to the amount of radio-frequency energy.

Unlike the before-mentioned, prior-art-systems, there will be little or no interference between the glows in the cells behind-adjacent antenna sections, because:the gas-glowor-discharge boundaries between the direct-current side of the antenna sections, such as those between the electrodes and 4I, are rather sharply defined, and only direct-current voltages are present in the gas. The discharges are at Bright angles to the background discharge in the cells, as between the electrodes 19 and 20. The slightly darkened aspect produced by the orangecolored filter will help to keep-the daylight off the gas, thus preventing affecting the: ignition characteristics. The weak orange filtering;action serves also to help produce the additional orange glow in respose to: the radio-frequency signals, filtering out the background of the orange directcurrent glow, and thus helping to produce.on:the bank of neon cells the visible image of the object 9, as impressed, in radio-frequency form, on the antenna sections.

Separate neon tubes may, however, be employed, with separate cathodes, connected to the respective radio-receiving elements. A uniform background may,,be attained in this manner. The picture of the object 9 would be; visible on the neon cells themselves, if such separate cells were employed. Instead of the direct-current ignition potential from the battery 27 moreover, a striking radio-frequency voltage, suitably attenuated, may be applied to the cells from the transmitter 4. The neon cells may, furthermore, be supplied with control-grid electrodes and anodes, omitted from the drawings, for the sake of simplicity. If the radio-frequency, signals should be weak, they may be enhanced by means of amplifiers "between the antennas and the neon cells. A radio-frequency shield 51 of any suitable material, such as meshr Wire may be interposed between the cells and the pick-up elements 10-II, etc., to lessen the likelihood of interference effects of the radio energy and the electrodes and elements in the cells.

A likeness corresponding: to the radio energy received by the radio-receiving array 7 of antennae will thus be electromagnetically produced on the screen of; the gas-discharge;neon,cells, This likeness will be a distinct, definite sharp visible image of the distant object. The definition of the likeness depends merely upon the size of the thermoelectric elements and their number. The greater the number of the elements, and the smaller their size, the more sharp will be the definition. rows and columns of antenna sections of dipole dimensions will yield good definition for large close-range objects, particularly for a three-centimeter wave, assuming an eight-foot screen 50.

Although the invention has been described in connection with antennae arranged in rows and columns, it will be understood that this is not essential, for other arrangements are also possible. Antennae arranged along concentric circles covering the field, or a continuous spiral; will also serve.

Further modifications will occur to persons skilled in the art, and all such are considered to fall within the spirit and scope of the invention, as defined in the appended claims.

ENGLISH-CLAIMS:
Return to Top of Patent

What is claimed is:

1. An electric system having, in combination, means for receiving radio waves, gas-discharge means, and thermoelectric-couple means controlled iri accordance with the thermoelectric operation of the thermoelectric-couple means for producing on the gas-discharge means directcurrent glow discharges defining a likeness corresponding to the energy distribution received by the radio-receiving means.

2. An electric system having, in combination, a plurality of thermoelectric-couple radio-wave receiving elements, gas-discharge means having portions each corresponding to one of the elements, and means controlled in accordance with the thermoelectric operation of the radio-wave receiving elements for energizing the said portions of the gas-discharge means in accordance with the thermoelectricity in each of the elements resulting from energy received by each of the elements to produce a likeness corresponding to the energy received by each of the elements.

3. An electric system having, in combination, thermoelectric-couple means for receiving radio waves from an object, gas-discharge means, and means operable in accordance with the thermoelectric operation of the thermoelectric means 5g and responsive to the thermoelectricity in the thermoelectric-couple means and controlled by the received radio waves for producing on the gas-discharge means a likeness of the object.

4. An electric system having, in combination, a plurality of thermoelectric-couple radio-wave receiving elements, gas-discharge means having portions each corresponding to one of the elements, means for striking glow through the gasdischarge means, and means for modifying the glow of the said portions of the gas-discharge means in accordance with the thermoelectricity in each of the elements resulting from the radiofrequency energy received by each of the elements.

.,&; An electric system having, in combination, a plurality of radio-wave receiving elements, electrode means, means for producing a glow discharge between the electrode means, and means for modifying the glow discharge between the electrode means with direct-current glow discharges in accordance with the energy received by each of the elements.

7. An electric system having, in combination, a thermoelectric couple comprising two elements of dissimilar metals for receiving radio waves and an electrode connected to each of the elements, the elements having dimensions resonant to the radio waves, and gas-discharge means responsive to the energy produced in the electrodes by the received radio waves for producing a visual indication of the received radio waves.

8. An electric system having, in combination, a plurality of radio-wave receiving-and-rectifying elements for

receiving and rectifying radio waves from an object, gas-discharge means, and means connecting the elements and the gasdischarge means for producing rectified directcurrent discharges in the gas-discharge means, thereby to produce a likeness of the object.; 9. An electric system having, in combination, a plurality of thermoelectric-couple elements -for receiving and rectifying radio waves from an object, gas-discharge means, and means corinecting the elements and the gas-discharge means for producing rectified direct-current discharges in the gas-discharge means, thereby to produce a likeness of the object.

10. An electric system having, in combination, a plurality of thermoelectric-couple elements for receiving and rectifying radio waves "from an object, each thermoelectric-couple element corresponding to an elemental portion of the object from which it receives the radio waves, and gasdischarge means responsive to the rectified energy produced in the thermoelectric-couple elements by the radio waves from the corresponding elemental portions of the object for producing elemental portions of a likeness of the object corresponding to the radio waves received and rectified by the corresponding elements. :

12. An electric system having, in combination, thermoelectric-couple means comprising two elements of dissimilar metals having a common junction, means for focusing radio waves from an object upon the thermoelectric-couple means, and gas-discharge means connected to the common junction and responsive to the thermoelectricity in the thermoelectric couple means for producing a likeness of the object.

13. An electric system having, in combination, a plurality of first bimetal thermocouples resonant to radio waves for receiving radio waves from an object, a plurality of second bimetal thermocouples, one corresponding toj each of the first thermocouples, means for impressing i; o thermocouple the1tvoltage .bt/2ltoe;!icprrespdndingr;fiTst:"ihermoepuple,C:and iBfeans iacpntrolled .:. in Tj iaccordtace " iwith trthe tfchermoelectricity produced: in the.Becpndcthermo- ;cduplesiinsrespdnse:to thet;radioTvaves:ifeceived ;by ctheofirst thermocouples rfop (producing catlike - nesssidf :thei object icdrresponding:->to; theooradio energy received ctay ther first thermocouples;from .thcnobject.

w13i;:cAnnelectric;system having, in .combination, thermoelectric-couple means :for: re eeiving-;radio waves;, rgas dischargemeansvvmeans for producing-if--ao (background, gas; discharge through r the gasfdischarge? means;: means-controlled,:.by, the received 5radio waves; f pr mpdif ying, - theback- .groundf pf--.the:gas dischargee andmeans for filtering-put; the-;?unmpdined-Mbackgrpund: ;gas discharge..

l-5;< An electric system having, in combinatipn, thermoeleetricrcpuple-,means for receiving, radio vaVfiSr gasTdischarge means,,means for striking a? sufficient background, gas discharge through <the..gas-discharge means to pperate the gas-discharge means in; accprdance with a characteristic curve .provided rwith:,,a substantially linear portion alpng which the, intensity of illumination pf the gas-varies substantially, linearly with, the intensity: of excitation energy, and means controlled by the received radio waves and operative on the linear portion pf the characteristic curve if or modifyingthe background gas .discharge, , - 16,.: An electric:;system having in combination, a>two-dimensional array of r gas-discharge elements, and thermoelectric-couple radio-receiving means for receiving radio waves from. an object: and connected to and cpoperative with the .gas-discharge elements to prpduce a likeness pf the object.

17.; An electric system having, in combination, a-plurality :of thermoelectric-couple radio-wave receiving elements for simultaneously receiving radio wavesr from an object, illuminating means, and means for permanently electrically connecting the radio-wave receiving elements to the illuminating means cpntinuously to control the illumination of the illuminating means in accordance with the thermoelectricity produced by the received radio waves in the radip-wave receiving elements, in order to produce a likeness ofthe -object upon the illuminating means simultaneously with the reception of the radio waves by the radio-wave receiving elements.

18. An electric system having, in combinatipn, a< plurality of radio-wave receiving-and-reetif ying elements for receiving and rectifying-radiowave energy from an object, illuminating means, and means for permanently electrically

connecting the radio-wave receiving-and-reetifying elements to the illuminating means continuously tp control the illumination of the illuminating means in accordance with the rectified energy produced by the radio waves in the radio-wave receiving-and-reetif ying elements in order to .produce a likeness of the object upon the-illuminating means simultaneously with the reception ot the radip waves .by the radio-wave reeeivingand-rectifying elements.

23. An electric system, having, in combination, radio-wave receiving ..means for.-receiving-.radio waves from an pbject cpmprising-thermpelectriccpuple:means .prpvided-.with-electrical,conductors, .. gasrdischarge means,.. and, means fon.striking. a background, gas;discharge,:inV.thegas-discharge means, the electrical conductors ;extehding into the gas-discharge means to modify the background gas discharge in accordance with the radio waves received from the object :by. the. radio-wave receiving means.

- 24. An electric system having, in. cpmbinatipn, a plurality pf"thermoelectric-cpuple.l1adid,-wave receiving;, elements: for .receiving radio \vaves, means for focusing radio waves from an ;pbject upon the radio-wave receiving elements, illuminating means electrically connected to each element, means for illuminating the Illuminating means, and means controlled in accordance with the-radip waves received by the radio-wave receiving-elements for "controlling the-intensity pf illumination of the illuminating means to produce a likeness of the pbject.

ROBERT HARVEY "RINES.

LOAD-DATE: June 26, 2007

1029ZH

********** Print Completed **********

Time of Request: Wednesday, August 01, 2007 11:49:06 EST

Print Number: 1862:40502040
Number of Lines: 213
Number of Pages: 6

Send To: NANCHAHAL, NEHA
PIERCE LAW CENTER
2 WHITE ST
CONCORD, NH 03301-4176