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Visual reproduction of distant objects

INVENTOR: RINES ROBERT H

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SUMMARY:

The present invention relates to electric systems, and more particularly to radio-receiving systems that, while having more general fields of usefulness, are especially adapted for use in television.

An object of the invention is to provide a new and improved radio-receiving system.

Another object is to provide a new and improved television system.

Another object is to provide a novel combined radioand-television system.

Another object of the present invention is to provide a new and improved radio-locator system for both detecting the presence of a body and rendering it visible.

Other and further objects will be explained hereinafter and will be more particularly pointed out in the appended claims.

The invention will now be more fully explained in connection with the accompanying drawings, in which Fig. 1 is a diagrammatic view of circuits and apparatus arranged and constructed in accordance with a preferred embodiment thereof; Fig. 2 is a view of a modification; and Fig. 3 is a diagram showing an airplane object from which radio waves are reflected and scattered to the receiving system of Fig. 1.

An electromagnetic-wave generator 4 is shown exciting a dipole 2 to produce ultra-high-frequency pulsed-radio energy, say, of 3 or 1.5 centimeters microwave wavelength. A continuous-wave or any other type of modulated-wave generator may be employed, but pulsed energy, at present, has the advantage of economical and easy high-power 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 8, 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 8 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 systems for focusing the electromagnetic energy scattered and reflected from the object 8 on the bank or array 7 of pick-up elements.

The pick-up elements of the bank or array 7 are shown as metal strips or other conducting antenna sections, separated by insulation strips to prevent radio interference and interaction between the antenna sections, and 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 is illustrated as comprising the sections 10, 12, 14, 16, etc shown as equally spaced horizontally. The second row from the top is shown comprising the sections 18, 20, 22. etc. The third or next-lower row is shown comprising the sections 24, 26, etc and so on for the remaining rows of pick-up elements. Though only a small number of pick-up 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 pick-up units will be employed in each row, say, 180.

The sections 10, 18, 24, etc are arranged in the first or left-hand column. The sections 12, 20, 26, etc are disposed in the second column from the left. The se tions 14, 22, etc are disposed in the third column from Patented DL 7.

sysof large close-range objects for a three-centimeter wave, assuming an eight-inch-display cathode-ray-tube screen!

The pick-up units will, of course, all receive the resimultaneously. There will be focused on each pick-up unit of radio energy, corresponding to the amount of energy reflected or scattered from the various parts of the object 8 and converged upon the array 7 of pick-up elements by the lens 5. A radio-energy picture of the object 8, as will presently be explained, is thus recorded upon the array, specific elemental areas of which will correspond to specific elemental areas of the object 8. By means of the present invention, this radio-energy picture may be converted into a visible picture 123. According to the preferred embodiment of the invention, the visible picture 123 is caused to appear upon the fluorescent viewing screen 106 of a display cathode-ray oscilloscope tube 90. Though the tube 90, and also the hereinafterdescribed cathode-ray-oscilloscope-like member 89, are.

shown operating on the electrostatic principle, magnetic deflection or a combination of magnetic and electrostatic forces may be employed. The invention provides a means for producing upon the screen 106 images corresponding to the radio-frequency energy received by the pick-up elements.

Provision is made for first rendering the normally ineffective pick-up units 10, 12, 14, 16, etc of the first row successively effective momentarily in the display circuits; for then rendering the pick-up units 18, 20, 22, etc of the second row successively effective momentarily in the display circuit; for then rendering the pickup units 24, 26, etc of the third row successively effective momentarily; and so on.

A preferred way of effecting this result is with the aid of a novel electron-operated energy-scanning apparatus that, for the particular preferred radio-energy purposes described herein, comprises a plurality of insulated energy-storing devices shown as charging condensers and small rectifiers, equal in number to the number of pickup sections. The rectifiers may be uranium-oxide or silicon beads, and serve respectively, to rectify the energy received by the respective

pick-up units. The charging condensers and the rectifiers are connected to the pick-up sections by conductors, which should be extremely short transmission lines, preferably no more than 3 or 4 wavelengths long, and all the conductors should be of substantially the same electrical length. The sections 10, 12, 14, 16, 18 and 24, for example, are shown connected by conductors 11, 15, 19, 23, 27 and 31, respectively, to rectifiers 13, 17, 21, 25, 29 and 33.

The conductor 11, for example, connects the section 10, through the rectifier 13, to a condenser plate 28; the conductor connects the section 12, through the rectifier 17, to a condenser plate 30; the conductor 19 connects the section 14, through the rectifier 21, to a condenser plate 32; the conductor 23 connects the section 16, through the rectifier 25, to a condenser plate 34; the conductor 27 connects the section 18, through the rectifier 29, to a condenser plate 36; the conductor 31 connects the section 24, through the rectifier 33, to a condenser plate 42; and so on.

The condenser plates are shown arranged in an insulating-disc bank or array 9 of rows and columns to correspond to the bank or array 7 of rows and columns, respectively, of the pick-up sections. The first or uppermost row comprises the equally spaced condenser plates 28, 30, 32, 34, etc corresponding to the pick-up antenna sections 10, 12, 14, 16, etc of the first row of antenna sections. The second row from the top comprises the equally spaced condenser plates 36, 38, 40, etc corrego spending to the antenna sections 18, 20, 22, etc of the second row of pick-up units. The third row comprises the equally spaced condenser plates 42, 44, etc corresponding to the third row of sections 24, 26, etc -and so on. The first column of condenser plates 23, 36, 42, etc corresponds similarly to the first column of sections 10, 18, 24, etc. The second column of condenser plates 30, 38, 44, etc corresponds to the second-column -of sections 12, 20, 26, etc. The third .column of condenser plates 32, 40, etc corresponds to the third column of sections 14, 22, etc and so on.

The condenser plates 28, 30, 32, 34, etc of the first row are shown respectively cooperating with condenser plates 35, 37, 39, 41, etc that are all connected to a grounded condenser strip 43. Condensers are thus provided, one plate of which is connected -to the strip 43, and the other plates of which are connected, through the respective rectifiers, to the sections 10, 12, 14, 16, etc.

The condenser plates 36, 38, 40, etc of the second row are similarly shown respectively cooperating with condenser plates 45, 47, 49, etc that are all connected to::another grounded condenser strip 51. The condenser plates 42, 44, etc of the third TOW are similarly shown cooperating with condenser plates 53, 55, etc that are all connected to a third grounded condenser-strip 57, and so on.

The condenser plates of the respective .condensers are all preferably separated by the same distance. The condensers may conveniently have either large or small capacitance, varying, say, from micro-microfarads to farads, depending upon the type of antenna receiving circuits used.

The same result may, of course, be attained in other ways than through the use of the rectifiers. One such way is to connect the antennae 10, 12, 14, etc directly to the condenser plates 28, 30, 32, 34, etc. The co densers must now, however, have a small value of capacitance, in order to present a relatively high impedance to the radio-frequency energy. For 3-centimeter waves, capacitances of the order of 1Q-15 farads would be adethe short leads 11, IS, 19, 23, 27, 31, etc should 10 technique.

be connected by ultra-high frequency chokes, not shown, to prevent interaction. These chokes will not permit the passage of current from one metal pidc-up section to the adjacently disposed metal pick-up section during the hereinafter-described discharge or short-circuiting of -:j quency pulse for the period between successive radio the condensers, since the time of the discharge or shortcircuiting of each metal section is very short.

The condenser plates and strips may be embedded in the insulating disc 9, at the screen end of the cathoderay-oscilloscope-like member89, provided with a vacuum-tube electron-gun part 58, comprising, a cathode 95, -a control-grid electrode 93 and an anode 97. Electrons emitted from the cathode ;95 will become enabled, in response to proper stimulation of the grid 93, to pass by the grid 93 to the anode 97 of the tube 58 of the me her 89. The electrons will continue to travel in a stream from the anode 97,between & pair of vertically disposed deflector plates 99 and 101,

of which the plate 99 is shown grounded, arid between a pair of horizontally disposed deflector plates 103 and 105, of which the plate 105 is shown grounded, to impinge finally on the disc 9 of the member 89. \A horizontal-sweep-time base, applied, as hereinafter more fully explained, to the vertically disposed deflector plates: 99 and 101, will cause the:electron stream from the cathode to: become d fleeted horizontally, and a vertical-sweep-time base, applied to the horizontally disposed deflector plates 103 and 105 will cause the electron stream to become defleeted vertically.

The before-described distance between the condenser plates may be made of value necessary to give the before-mentioned capacity, and the anode 97 maybe adjusted so that this distance shall be substantially equal to the width of the electron stream, in order that the .electron stream may fill "the gap or region. between: these condenser plates, thereby to discharge the .condensers.

The rows of condensers may be positioned, along the successive paths of the electron stream, as the electron stream successively sweeps out the successive, rows of the array on the disc 9.

It is not essential that-the condenser-plates be .embedded in the disc 9. They, may be.ordinary condensers, connected in parallel with rows and cqlumns of pinpoint electrodes (not shown) that are so. embedded, arid separated from each other by the said "distance in order that the electron stream of the member 89 may fill the gap between them. The electron stream will then electrically bridge the pin-point electrodes of each pair, to cause the discharge of the -corresponding condenser.

The antenna sections of the array 7, and either the condensers in the disc 9, or the pairs of pin-point electrades (not shown), will thus correspond to one another. A condenser is provided corresponding to each pick-up unit, and corresponding condensers or pairs of pin-point electrodes and pick-up antenna sections may occupy corresponding positions.

Radio-frequency voltages received through the lens upon .the .antenna sections of the array 7, in the .system of Fig. 1, are thus rectified, and there are built up across the corresponding condensers rectified-direct-current condenser-charging voltages that are proportional to the strengths of the radio-frequency voltages received by the corresponding antenna sections. As the electron stream produced from the cathode 95, in response to appropriate horizontal sweep-time-base voltages applied to the vertically disposed deflector plates 99 and :101 of the cathode-ray-tube-like member 89, travels across between the condenser plates, jor ;the pairs of pin-point electrodes, in the disc 9, these built-up /charges upon the condensers become successively discharged into a grounded preferably linear amplifier 79, by way of a conductor ?8. If desired, the amplifier 79 may be replaced by a bank of linear amplifiers, one corresponding to each of the antenna sections, and .connected to the respective charging condensers.

The output of the amplifier 79 will obviously vary, at .successive anstants, in accordance with the discharge of the successive condensers, and this discharge is a measure of the strength of the radio energy received by ?5 the corresponding pick-up elements.

A pulse generator, which may, if desired, be the same pulse generator :4, may:be employed to tngger a honzontal-time.base-sweep circuit 63 and a vertical-sweep .circuit :69,: according.to conventional and well-known television The pulse generator 4 .may feed, through If attenuator:,and rectifier 1,-to an oscillator or any sim-

ar or equivalent television circuit. One such circuit is ;shown as a pulse-recurrence-frequency multiplier 65, for -applying many;pulses corresponding to. each r-adio-frepulses, to trigger the horizontal-sweep circuit 63. A horizontal-time-base sweep will thereby be:produced be-

tween the vertically disposed deflector plates,99 and 101, occurring as many tunes, say, between successive radiofrequency: transmissions, as there, are rows of pick-up ante-nnae. The pulse generator 4 may also feed, through attenuator and rectifier:!, to trigger the vertical-sweep circuit,69, once corresponding to every radio-frequency transmission. .One vertical sweep will then occur between 55-the horizontally disposed plates 103, 105, during the -Periods between successive radio-pulse transmissions, corresponding to as many horizontal sweeps as there are i rows;

of .antennae, causing each of the horizontal sweeps ft to .appear at successively lower levels on the oscilloscopeswe?P faces.

If the circuit comprises an oscillator, the oscillations j niay be:employed to:trigger the horizontal sweep. The period of: the oscillations which, as before explained, is much less an me duration of a radio pulse, corre-

Go ponds to the time of discharge-of one row of the con-

densers: in the disc.9, in- response to energization of one row of the antenna sections of the array 7. If, as pre-

viously mentioned, continuous-wave radio transmission is employed, the vertical sweep circuit 69 may be trig-

Sered to i Produce one -vertical sweep corresponding to a? m.anv horizontal sweeps from the horizontal-sweep -circuit ,63 as there are rows ,of antenna: sections.

Means is provided, controlled by -the -discharge of e condensers, for-producing, upon the screen-106 of the dlsPla7 oscilloscope ;90, images corresponding - to the radio-frequency energy-received by .the correspondm pick-up antenna elements. Successively disposed areas- of the fluorescent-screen 106, that correspond to -the similarly disposed antenna elements,-are-energized by an electron stream in the oscilloscope to illuminate them. This electron stream is synchronized to travel -with the electron stream of the cathode-ray-tube-ljke member-89. The horizontal sweep circuit 63 is connected to the horizontal-deflector plate . ;-of the oscilliscope- by a conductor 67, and to the horizontal deflector plate 101 of the oscilloscope-like member 89 by the conductor 67 and a conductor 124. The verticalsweep circuit 69 is connected to the vertical-deflector plate 102 of the oscilloscope by a conductor 71,and to the vertical-deflector plate 103 of the oscilloscope-like member 89 by the conductor 71 and a conductor 146.

The amplifier 79 is connected by conductors 84 and 86, to the phase-inverter and amplifier stage or stages 81 which, in turn, is connected, by conductors and 87, te the control-grid electrode 92 and the cathode the vacuum-tube electron-gun part 88 of the oscilloscope 90. The condensers become thus successively connected, through the amplifier 79 and the phase-inverter 81, to the control electrode 92. Electrons emitted from the cathode 94 will become enabled, in response to the action of the amplifier 79 and the phase-inverter 81, to pass by the grid 92, to the anode 96 of the tube 88 of the oscilloscope tube 90. The electrons will continue to travel in a stream from the anode 96, between the pair of vertically disposed oscilloscope deflector plates and 100, of which the plate 98 is shown grounded, and between the pair of horizontally disposed oscilloscope deflector plates 102 and 104, of which the plate 104 is shown grounded, to impinge finally on the fluorescent viewing screen 106 of the oscilloscope 90. The horizontal-sweep-time base applied to the vertically disposed deflector plates 98 and will cause the electron stream from the cathode 94 to become deflected horizontally, and the vertical-sweep-time base, applied to the horizontally disposed deflector plates 102 and 104, will cause the electron stream to become deflected vertically, in synchronism with the horizontal and vertical sweeps discharging the condensers in the disc 99 of the scope-like member 89.

The magnitude of the voltage fed into the amplifier from the condensers will depend upon the intensity of the radio-frequency voltage received from the object 8 through the lens 5 by the corresponding antenna sections.

This is because the sections are successively rendered effective by the discharging of the corresponding condensers by the electron stream of the member 89. The output of the amplifier 79 will therefore vary, at suecessive instants, in accordance with the potential upon the successive receiving antenna sections.

energizing positive voltages are thus produced from the amplifier 79 on the control electrode 92 of the tube part 88 of the cathode-ray tube 90, of magnitude proportional to the radio-frequency energy received by the corresponding antenna sections. This will render the tube effective to permit the passage of the electrons in quantities dependent upon the radio-frequency energy impinging on the particular antenna section, to the anode 96, and between the pairs of vertically disposed deflecting plates 98, 100 and horizontally disposed deflecting plates 102, 104, to the viewing screen 106.

After each simultaneous horizontal sweep of both the scope and the oscilloscope-like member 89 has been completed, a successively larger voltage will be applied to the horizontally disposed deflector plates 103, and 102, 104, respectively, by the vertical sweep circuit.

After the last such horizontal sweep, the voltage between the horizontally disposed plates 103, 105 and 102, 104 will become restored to zero. The next horizontal sweep, therefore, will start again at the first or top row.

Successively disposed areas of the screen 106 of the oscilloscope will therefore correspond to the similarly disposed condensers in the disc 9 of the oscilloscopelike member 89, and to similarly disposed antenna sections. Each spot along a particular horizontal sweep, therefore, will become brightened on the screen 106 according to the amount of radio energy received by the corresponding pick-up element, and fed, by way of the amplifier 79 and the phase-inverting-and-amplifying circuit 81, to the control electrode 92 of the tube 88 of the cathode-ray oscilloscope to render the tube effective to produce a likeness upon the screen 106.

To each row of antenna sections, therefore, there corresponds, on the face 9 of the oscilloscope-like member 89, a horizontal electron stream that discharges the horizontal row of charged condensers. To each row of go will be understood that this is not essential, for other antenna sections, moreover, there corresponds, on the oscilloscope screen 106, a horizontal electron stream that is graded in intensity, due to the application of signal voltages, from successive antenna sections of the row, on the oscilloscope control-grid electrode 92. This intensity is distributed in synchronism with the corresponding state of charge of the corresponding condensers on the disc 9 of the scope-like member 89. This provides for successive horizontal time bases on the screen, and the successive areas of the screen 106 are thus illuminated in synchronism with the effective reception of the radio energy by the corresponding pick-up antenna sections.

To each successive row of antenna sections, moreover, there corresponds a successively lowered level of operaof 10 tion of the electron stream on the screen 106 of the oscilloscope, corresponding to the measured voltage applied at that instant by the vertical sweep circuit 69.

The sweeps of the two electron streams of the members 89 and 90 are thus synchronized, to produce intensity modulation on the oscilloscope screen 106, corresponding to the radio-frequency distribution on the antenna sections of the bank 7. The radio waves received successively by the antenna units along the suecessive rows and columns will thus become converted into successive portions of the visual likeness .123, along correspondingly disposed rows and columns thereof, along the successive time bases. The visual picture 123 of the aircraft object 8 on the oscilloscope screen 106 will accordingly correspond to the radio-frequency picture on the array 7 of pick-up elements which, in turn, corresponds to the actual object 8.

If the rectifiers 13. 17, etc are not used, as previously suggested, but radio-frequency voltages are applied directly to the condenser plates 28, 30, 32, 34, . 36, 38, 40, . 42, 44, . etc then slight modifications may be incorporated as follows: the amplifier 79 and its input should be tuned to the radio-frequency energy that will be fed thereto during the scanning of the condenser, and the phase-inverter-and-amplifying stage or stages 81 should be followed by a rectifier (not shown), and then applied to the control grid 92 of the cathode-ray oscilloscope 90.

Instead of the conducting antenna sections of the array 7, other types of conventional nltra-high-frequency antenna units may be employed such, for example, as the hollow-pipe valve-guides illustrated in Fig.

2. Square-cross-sectional wave-guides are there shown, designated by the same reference numerals as the cor-

Successive responding conducting antenna sections of Fig. 1, but agumented by 100. Each wave-guide is provided with a pick-up loop that is connected, through the corresponding rectifier, to the corresponding condenser. Thus, the wave-guide is provided with a pick-up 111 that is connected by the conductor 11, through the rectifier 13, to the condenser 28, 35; the wave-guide 112 is provided with a pick-up loop that is connected by the conductor 15, through the rectifier 17, with the condenser 30, 37; the wave-guide 114 is provided with a pick-up loop 119 that is connected by

the conductor 19, through the rectifier 21, with the condenser 32, 39; and so on. The operation is substantially the same as before described, with the condensers connected to feed the amplifier 79, except that there is less need for feedtransmission lines and, therefore, less attenuation of the high-frequency energy. The wave-guides will, of course, have dimensions suitable for receiving the desired wave which, as before stated, may have a length of 3 or 1.5 centimeters.

Assuming that the size of the object 8 is known, the position of the lens 5 to produce a sharp electromagnetic image on the array 7 of dipoles, coupled with the size of the visual image 123, may be used to deduce range, by simple geometrical optics. If, for example, the object seen is a fighter, or a bomber plane, the size of the image, divided by the known size of the fighter or bomber, will be proportional to the ratio between the distance of the lens 5 from the bank 7 of antennae, adjusted to obtain clear vision, divided by the distance of the object 8. The range of the object 8 may also easily be obtained by monitoring the pulse emission and reflection, if radio pulses are used, on a separate oscilloscope, according to common practice.

Although the invention has been described in connection with antennae arranged in rows and columns, it arrangements are also possible. Antennae arranged along concentric circles covering the field, or a continuous spiral, will also serve, though the oscilloscope arrangement would, of course, be correspondingly modified. In the case of the concentric circles and the spiral, the antennae would be rendered effective in two-dimensional order, as in the ease of the rows and columns before descfibed; The antennae disposed along one of the circles, for example, Would first be rendered effective, then those aldng the next circle, and so on.

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:
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What is claimed is:

1. An electric system having, in combination, a plurality of radio-receiving wave-guide elements, a plurality of antennae associated with the wave-guide elements, a plurality of condensers, one corresponding to each of the antennae, means for charging each condenser from the energy of the corresponding antenna, means for suecessively discharging the condensers; and means controlled by the discharge of each condenser for producing a likeness corresponding to the energy received by the corresponding element.

2. An electric system having, in combination a cathode-ray-tube-like member having an electron-strearn-producing means and a screen; a plurality of energy-storing means supported by the screen and each provided with a pair of oppositely disposed electrodes separated from one another, and means for causing the electron stream to fill the separated regions between the electrodes, thereby to discharge the energy storing means.

3. An electric system having, in combination, a plurality of radio-receiving elements, a plurality of electrical charging elements, rectifying means, means confleeting the charging elements to the receiving elements through the rectifying means to energize the charging elements from the energy of the receiving elements, means for successively discharging the charging elements, and means controlled by the discharge of each charging element for producing a likeness corresponding to the energy received by the corresponding receiving element.

4. An electric system having, in combination, a plurality Of radio-receiving elements, a plurality of electrical charging elements, one corresponding to each Of the radio-receiying elements, a plurality of rectifiers, one Corresponding to each of the electrical charging elements, means connecting the charging elements to the respective receiving elements through the respective rectifiers to energize the charging elements from the energy of the corresponding receiving elements, means for suecessively discharging the charging elements, and means Controlled by

the discharge of each charging element for 50 1,699,270 producing a likeness corresponding to the energy receiyed by the corresponding receiving element.

5. An electric system having, in combination, a twodimensional array of wave-guide radio-receiving elements arranged in rows and columns for receiving radio waves 55 2,219,113 from an object, a two-dimensional array of electrical charging elements arranged in rows and columns, one corresponding to each of the receiving elements, means for charging each charging element from the energy of the corresponding receiving element, means for scan- 60 2,306,272 -ning the charging elements in two-dimensional order along the rows and columns thereof successively to discharge the charging elements in two-dimensional order along the successive rows and columns, a normally ineffective electric circuit for producing a likeness corresponding to the radio energy received by the receiving elements from the object, means for connecting the charging elements to the circuit, and means controlled in synchronism with the successive discharges of the charging elements for rendering the circuit successively effecfive through the connecting means to produce successive portions of the likeness of the object in two-dimensionalorder along rows and columns corresponding to the rows and columns of the charging elements synchronously with the reception of the radio energy front the object by the corresponding receiving element.

6. An electric system having, in combination, a twodimensional array of wave-guide radio-receiving elements for receiving radio waves from an object, a two-dimensional array of electrical Charging elements, one corresponding to each of the receiving elements, means for charging each charging element from the energy of the corresponding receiving element, means for sending an electron stream to the charging elements in twodimensional order successively to discharge the charging elements in two-dimensional order, an amplifier for amplfyirig the discharges of me charging elements, means for Connecting the charging elements to the amplifier, an oscilloscope having a screen successively disposed areas of which correspond to the successively disposed f eceiving elements in two-dimensional order and means for producing an electron stream impinging on the screen, and means connected to the amplifier for controlling the operation of the oscilloscope electron stream in synchronism with the operation of the discharging electron stream to produce successive portions of a likeness of the object along the said areas of the screen in two-dimensional order synchronously with the reception of the radio energy from the object by the receiving elements corresponding to the said areas.

7. An electric system as claimed in claim 2 and in which there is provided radio-frequency means for energizing the energy-storing means.

8. An electric system as claimed in claim 2 and in which there is provided radio-frequency antenna means for energizing the energy-storing means.

9. An electric system as claimed in claim 2 and in which there is provided radio-frequency wave-guide means for energizing the energy-storing means.

10. An electric system as claimed in claim 2 and in which there are provided radio-frequency means, rectifying means, and means for energizing the energy-storing means from the radio-frequency means through the rectifying means.

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