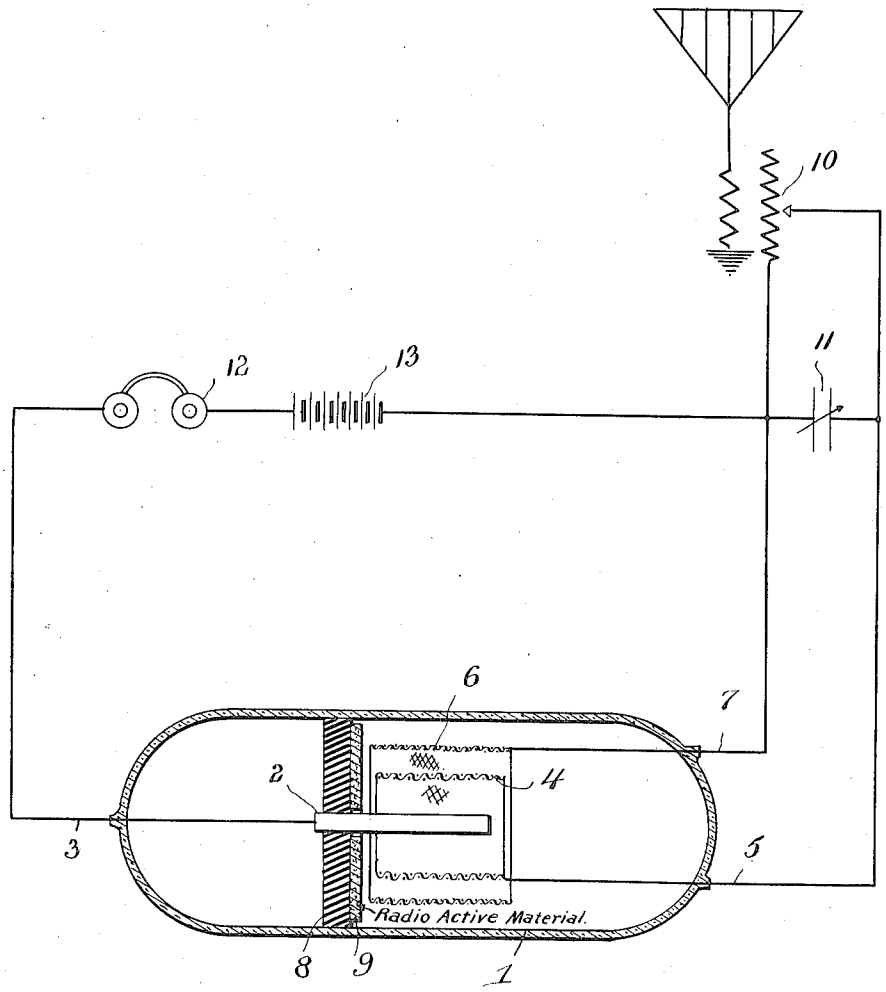
C. D. AINSWORTH.

ELECTRIC WAVE DETECTOR.

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1,145,735.

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ELECTRIC-WAVE DETECTOR.

1,145,735. Specification of Letters Patent. Patented July 6, 1915.

Application filed June 13, 1913. Serial No. 773,517.

To all whom it may concern:

Be it known that I, CHESTER D. AINSWORTH, a citizen of the United States, residing at Worcester, in the county of Worcester and State of Massachusetts, have invented new and useful Improvements in Electric-Wave Detectors, of which the following is a specification.

This invention relates to improvements in instruments for detecting electric waves or oscillations.

It is a well established fact that certain elements, and also the mechanical compounds of such elements, possess the property of emitting radiations similar in character to the familiar Röntgen or X-rays, resembling such rays in their penetrating power, photographic action, and action upon electrified gases. Such elements are uranium, thorium, radium and actinium, these elements being termed radioactive to denote this property.

Results obtained by prolonged observations and experiments on uranium and its compounds bring out the facts that the power of radiation belongs to the element itself and not to the substances associated with it; that the radiations are emitted spontaneously and unaided by outside agencies and that this power of radiation does not deteriorate with time.

In carrying out the present invention, it is my purpose to employ these radiations for the rectification of alternating currents, and consequently, the detecting of electric waves or oscillations, particularly for use in radio-telegraphy. It will be understood, however, that the use of such radiations elsewhere and for analogous purposes may be brought about. These radiations produce numerous advantages in radio-telegraphy in replacing the ionizing element now employed in the so-called audion and valve detectors.

It has long been known that gases, which under normal conditions are nearly perfect insulators of electricity, when in a state of ionization and under the influence of an electric field become conductors of electricity, permitting a unidirectional flow of current. In radio-telegraphy, this principle is employed in the so-called audion and valve detectors, ionization of the rarefied gas inclosed in a glass bulb being produced thermally, an incandescent filament being the ionizing element. Such detectors, however, although they are the most sensitive yet devised, have many defects. In the first place, this type of detector is fragile, being inclosed in a thin glass bulb so that the filament may, at all times, be readily observed. Again, while in operation they require a continuous current supply in view of the fact that the filament must always be incandescent to produce ionization. Furthermore, this current supply must be carefully regulated and constant, otherwise overheating will greatly shorten the filament's naturally short life, and lastly, it may be stated that instruments of this class, being fragile and requiring careful and intelligent manipulation, are not practical in this art.

Among the many advantages, that a detector of the audion or valve type in which a suitable radioactive substance, for instance, uranium, is made the ionizing element, will possess over other detectors of this type, are: First, such a detector can be made practically unbreakable. Second, no adjustment will be required owing to the fact that the detector will be permanently adjusted in the process of manufacture. Third, a separate source of energy for the detector will not be required for the reason that the ionizing radiations emitted by all radioactive substances are spontaneous, and fourth, such a detector may be used continuously without operating expense for an indefinite time.

In the accompanying drawing, the figure is a diagrammatic view of an electric wave detector constructed in accordance with my present invention, and circuit connections therefor.

In the present instance, I have shown my improved detector as comprising a cylindrical glass bulb 1 in which is disposed concentrically of the axis thereof a tubular anode 2 having fastened thereto one terminal of a conductor 3 sealed through one end of the bulb.

The numeral 4 indicates a neutral electrode of woven wire disposed concentrically of the tubular anode 1 and having connected thereto one terminal of a conductor 5 sealed through the opposite end of the bulb. A cylindrical cathode 6 surrounds the electrode 4 and is disposed concentrically thereof and appropriately spaced apart therefrom, such cathode being preferably formed

of woven wire of a mesh finer than that of the electrode 4. Leading from the cathode 6 and sealed through the end of the bulb 1 with the conductor 5 is a conductor 7.

Arranged within the bulb 1 adjacent to one end thereof is a transversely disposed disk 8 composed of suitable insulating material and having the center line thereof coaxial with the longitudinal center line of the bulb and the similar lines of the anode 2, neutral electrode 4 and cathode 6. A suitable form of radioactive substance is indicated at 9 and may be either in the form of a suitable chemical compound deposited upon one face of the disk 8, or in the form of the metallic element itself mechanically secured to the disk.

In the present instance, the conductors 7 and 5 of the cathode and neutral electrode respectively are connected to the terminals of the secondary winding of a tuning transformer 10, while bridged across the terminals of the secondary winding of such transformer is a variable condenser 11, the conductor 3 of the anode 2 including in series receivers 12 and a source of energy such, for instance, as an electric battery 13 and having the free terminal thereof tapped onto the conductor 7 of the cathode.

In practice, radiations are emitted by the radioactive substance 9 on the face of the disk 8 in proximity to the anode and cathode and neutral electrode and thereby ionize the rarefied air within the bulb in the vicinity of the various electrodes which air, being under the influence of the electric field produced by the battery 13 between the anode 2 and the cathode 6 permits a unidirectional flow of current.

In the present instance, the anode 2 is connected with the positive terminal of the battery, while the neutral electrode 4 and cathode 6 are negative so that the current generated by the battery 13 will tend to flow from the anode 2 to the electrodes 4 and 6. Under normal conditions, that is, when the transformer 10 is not excited, the rarefied gas within the tube 1 is in a state of ionization produced by the radiation from the radio-active substance 9, while the voltage of the battery 10 is such that the potential between the positive electrode 2 and the negative electrodes 4 and 6 is lower than the potential necessary to break down the electrical resistance of the ionized gas between such electrodes. Upon the induction of high frequency current in the secondary winding of the transformer 10, the current flows from one terminal of the secondary, through the battery 13, receivers 12, conductor 3, anode 2, through the ionized gas to the negative electrode 4, thence back to the remaining terminal of the secondary winding of the transformer by way of the conductor 5. Thus, the battery voltage is increased sufficiently to break down the resistance of the ionized gas, thereby producing a sound in the receiver 12. When the induced current falls to the zero period of the cycle, the resistance of the gas is restored and the battery current interrupted and during the second half cycle of the induced current, the current flows from one terminal of the secondary winding of the transformer, through the conductor 5, electrode 4, through the ionized gas to the electrode 6 and then back to the other terminal of the secondary winding by way of the conductor 7. When the induced current passes from the neutral electrode 4 to the cathode 6, the resistance of the ionized gas is broken down thereby enabling the battery current to flow as before and produce a sound in the receiver. As soon as the high frequency currents are induced in the secondary winding of the tuning transformer, the above cycle of operations is repeated, so that the signals represented by the electro magnetic wave passing through the primary of the transformer may be translated at the receivers.

While I have herein shown and described one particular form of apparatus for carrying my invention into effect, I wish it to be understood that I do not limit myself to the details of construction herein described and delineated, as modification and variation may be made within the scope of the claims and without departing from the spirit of the invention.

I claim:

1. An electric wave detector comprising an anode, a cathode and a neutral electrode disposed in a rarefied atmosphere, a receiving circuit including all of said electrodes, and a radioactive substance disposed in proximity to said electrodes.

2. An electric wave detector comprising an anode, a cathode and a neutral electrode disposed in a rarefied atmosphere, a receiving circuit including all of said electrodes, a radioactive substance disposed in proximity to said electrodes, and means for intensifying the current in said receiving circuit.

3. An electric wave detector comprising an anode, a cathode disposed concentrically of said anode, and a neutral electrode disposed concentrically of said cathode and all of said electrodes being disposed in a rarefied atmosphere, a receiving circuit including said electrodes, and a radioactive substance in proximity to said electrodes.

4. An electric wave detector comprising a bulb having the air therein rarefied, an anode within said bulb coaxial with the longitudinal axis thereof, a cathode disposed concentrically of said anode, a neutral electrode arranged concentrically of said cathode, a receiving circuit including all of said electrodes, and a radioactive substance within said bulb in proximity to said electrodes.

5. An electric wave detector comprising a bulb having the air therein rarefied, an anode within said bulb coaxial with the longitudinal axis thereof, a cathode disposed concentrically of said anode, a neutral electrode arranged concentrically of said cathode, a receiving circuit including all of said electrodes, a radioactive substance within said bulb in proximity to said electrodes, and means for intensifying the current in said receiving circuit.

In testimony whereof I affix my signature in presence of two witnesses.

CHESTER DREW AINSWORTH.

Witnesses:
FRANCIS P. MCKEON,
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