

Oct. 23, 1923.

1,471,357

S. RUBEN

ELECTRICAL IMPULSE INDICATOR

Original Filed March 15, 1922

2 Sheets-Sheet 1

Fig. 1.

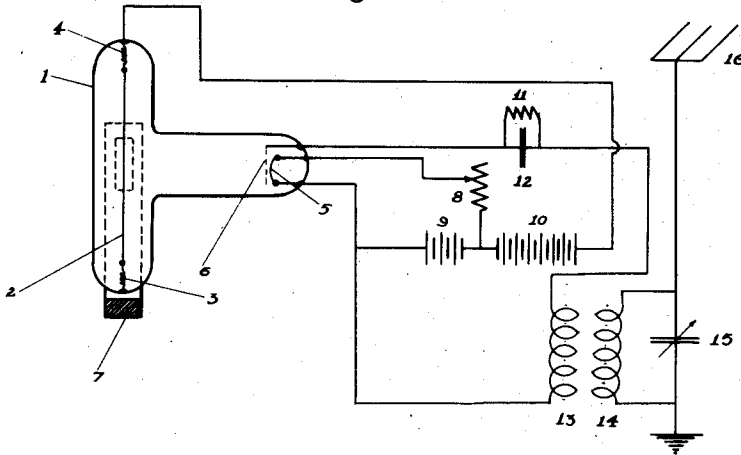


Fig. 2.

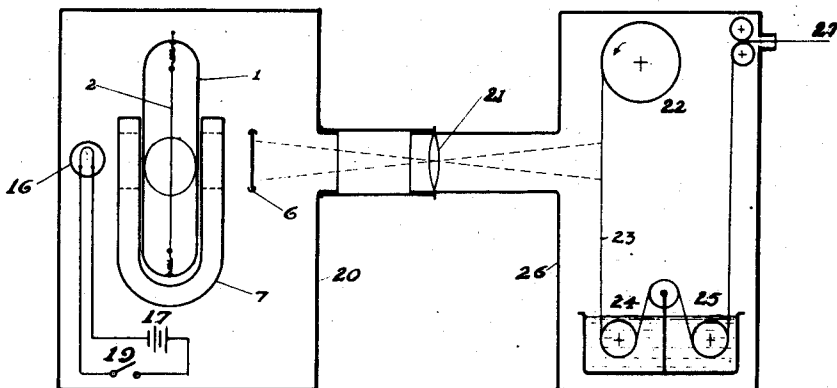
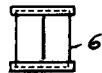


Fig. 3.



Samuel Ruben
INVENTOR

BY *Sam Ruben*

ATTORNEY

Oct. 23, 1923.

1,471,357

S. RUBEN

ELECTRICAL IMPULSE INDICATOR

Original Filed March 15, 1922 2 Sheets-Sheet 2

Fig. 4.

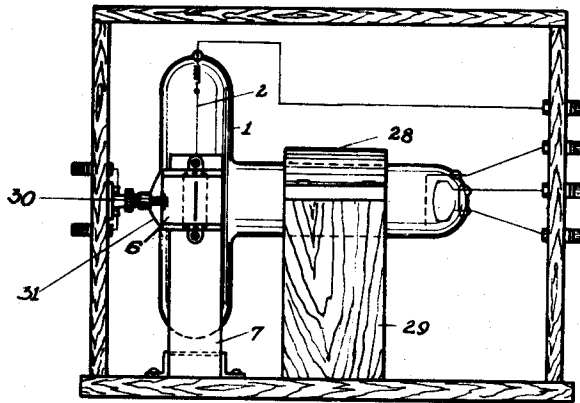
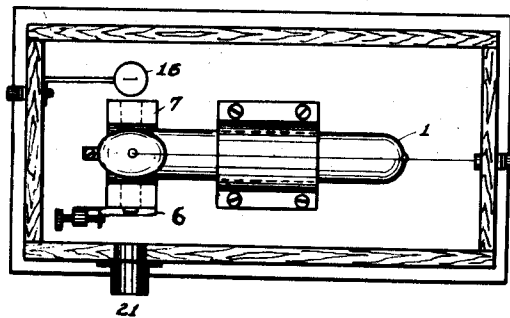


Fig. 5.



Samuel Ruben

INVENTOR

BY *Len Robbins*

ATTORNEY

Patented Oct. 23, 1923.

1,471,357

UNITED STATES PATENT OFFICE.

SAMUEL RUBEN, OF NEW YORK, N. Y.

ELECTRICAL IMPULSE INDICATOR.

Application filed March 15, 1923, Serial No. 543,895. Renewed March 19, 1923.

To all whom it may concern:

Be it known that I, SAMUEL RUBEN, citizen of the United States, and resident of New York city, in the county of New York and State of New York, have invented certain new and useful Electrical Impulse Indicators, of which the following is a specification.

This invention relates to a means of indicating electrical impulses. It relates particularly to a means for indicating such electrical impulses as radio, cable and telegraph signals where high speed is desirable. Coupled with a photographically recording apparatus, such as used in oscillographic work, it furnishes a means of indicating and recording such impulses at extremely high speeds. Its object is to provide a means for sharply indicating electrical impulses at high speed.

By this means, use is made of the vibrations of the anode in a vacuum tube, controlled by electrical impulses, such as radio signals, etc.

In accordance with this invention a flexible anode in a vacuum tube apparatus is so mounted that it will physically respond to variations in intensity of the cathode discharge upon it, the discharge being modulated by any suitable means, such as the commonly used wire grid, placed in its path. The anode is located, preferably in an external magnetic field, so as to obstruct the path of light from its source to a narrow opening through which it can pass, such as an opening in a metal plate or a line etched in a carbon coated surface on a glass plate.

In order to afford a full understanding of the principles of the invention, one embodiment thereof in a specially desirable practical form is illustrated in the accompanying drawings, and is hereinafter described in detail for the sake of a concrete illustrative example; but it is to be understood that the invention is not limited to this particular arrangement.

In the drawings referred to,

Fig. 1 is a more or less diagrammatic representation of a vacuum tube device constructed in accordance with the present invention, illustrating the employment of the novel device in a radio signalling system.

Fig. 2 represents the vacuum tube device as a unit in a photographic system in an enclosed chamber, the end view of the tube be-

ing shown, the anode being interposed between the source of light and the opening through which the light rays pass to the sensitive element of the photographic device.

Fig. 3 shows the slotted plate between the anode and the photographic recording device.

Fig. 4 represents a side view of the vacuum tube in the enclosed chamber.

Fig. 5 represents a top view of the tube in the chamber.

Referring first more particularly to Fig. 1, 1 is an evacuated glass tube or bulb in which are suitably mounted the electron emission element or cathode, 5, 2, the anode or responsive element and the grid 6. The anode is suspended between springs 3 and 4, and 7 is the permanent magnet around a section of the tube.

The anode is under the influence of the magnetic field and is free to vibrate therein. The magnet may also be an electro-magnet. The usual components of a radio receiving circuit are represented by 11, 12, 13, 14, 15 and 16. The source of energy for heating the cathode is battery, 9, the energy being regulated by the variable resistance 8. The source of potential for discharging the electrons to the anode is represented by 10.

In Fig. 2 the source of light energy, 16, is supplied by battery, 17, controlled by switch 19. The magnet, 7, is cut away in both arms so that the light may pass to the opening in plate 6, the narrow opening being so adjusted in position that the anode will normally obstruct the passage of light from its source, 16, to lense, 21. The source of light, the vacuum tube, its magnet and the slotted plate are mounted in a suitable housing from which external light is excluded.

To record the light rays passing through the opening according to the electrical impulses impressed upon the grid, a photographic apparatus is provided, similar to that now commonly used in oscillographic work. A strip of light sensitive material 23, is passed before the opening, through which the light is admitted according to the anode vibrations. The strip then travels under rollers 24 and 25, through suitable chemical solutions in which the photographic imprints are fixed, and then out at opening 27.

Fig. 3 shows the plate 6, having a narrow opening therein, through which the light rays pass from the source, 16, to the sensitive strip.

In Fig. 4 the vacuum tube 1, is suitably mounted on a support 29, and strapped by band 28, in a light-proof chamber. The magnet is 7, and 6 is the slotted plate laterally adjustable by screw 30, on holder 31. The tube elements, the cathode, grid and anode, are connected with their respective terminals.

Fig. 5 shows another view of the vacuum tube mounted in the chamber, 16 representing the source of light and 21 the lense in an enclosed passage through which the light travels from the opening in plate 6, on to the sensitive strip 23.

In operation, when the cathode 5, is heated by battery 9, through resistance 8, and the potential 10, is applied between the cathode and the anode, a current is discharged through the vacuous space to the responsive wire anode 2.

Variations in the impact of the kinetic energy of the electron stream from the cathode to the anode, cause deflections or vibrations of the latter. The expenditure of the kinetic energy of the cathode stream upon the anode has a resultant pressure and temperature effect thereupon. The magnetic field set up by the cathode discharge current through the anode, assists in deflecting the anode. The magnetic field of the anode reacts with the external magnetic field and moves the anode in a direction at right angles thereto. Thus, any change in intensity in the cathode discharge current, as by its modulation by the variation in grid potential, is reflected by a deflection of the anode. The external magnetic field may be omitted; but it is of advantage when very high speed is desired. As then arranged, the anode response is only to the effects of cathode discharge impact upon it, due to pressure and temperature effects, the latter causing expansion and consequent deflection of the anode.

The modulating element which electrically controls the position of the anode, being connected to the receiver circuit, will, as the potential impulses are received from that circuit, vary the cathode or electron discharge according to the electrical impulse characteristics impressed upon it. Therefore, as the position of the anode in the path of the light from its source to the opening, is governed by such signal pulsations, they determine the amount and characteristics of light reaching the sensitive strip. The light may be concentrated, or its path may be changed, if desired, by reflecting surfaces.

In this way, a means is had of receiving electrical signals at extremely high speeds, due to the characteristics of the vacuum tube and the highly responsive vibrating anode element.

For the photographic device, any other light responsive element, such as a silenium

or photoelectric cell can be substituted; and, if desired, any suitable electrical device actuated thereby.

At low speeds and high intensities the light flashes through the opening can be satisfactorily noted by the eye.

What I claim is:

1. An apparatus of the character described comprising, in combination, a source of light, a vacuum tube apparatus comprising a vibratory anode and means for affecting the character of the vibrations thereof, and indicating means responsive to the vibrations of said anode.

2. An apparatus of the character described comprising, in combination, a source of light, a vacuum tube apparatus comprising a vibratory anode and means for affecting the vibrations thereof, said anode being located in the path and controlling the amount and the character of light from said source passing through an opening of restricted area.

3. An apparatus of the character described comprising, in combination, a source of light, a vacuum tube apparatus comprising a vibratory anode and means for affecting the vibrations thereof, said anode being located in the path and controlling the amount and the character of light from said source passing through an opening of restricted area, and indicating means, responsive to changes in the amount and the character of light passing through said opening.

4. An apparatus of the character described comprising, in combination, a source of light, a vacuum tube apparatus comprising a vibratory anode and means for affecting the vibrations thereof, said anode being located in the path and controlling the amount and the character of light from said source passing through an opening of restricted area, and recording means responsive to changes in the amount and character of light passing through said opening.

5. An apparatus of the character described comprising, in combination, a source of light, an external magnetic field and a vacuum tube apparatus comprising a vibratory anode and means for affecting the vibrations thereof, said anode being located in said magnetic field and in the path and controlling the amount and character of light from said source passing through an opening of restricted area.

6. An apparatus for indicating electrical impulses comprising a chamber, a source of light, a plate having an opening therein of restricted area, through which light, directed from said source, can pass, and a vacuum tube apparatus comprising a cathode, a modulating element and a vibratory anode capable of vibrating in response to variations in the cathode to anode discharge, and

located in the path and controlling the amount and character of light from said source to said opening.

7. An apparatus for indicating electrical impulses comprising a chamber, a source of light, a plate having an opening therein of restricted area, through which light directed from said source, can pass, and a vacuum tube apparatus comprising a cathode, a modulating element and a vibratory anode capable of vibrating in response to variations in the cathode to anode discharge, and located in the path and controlling the amount and character of light from said source to said opening, said anode being located also in an external magnetic field.

8. An apparatus for indicating electrical impulses comprising a chamber, a source of light, a plate having an opening therein of restricted area, through which light directed from said source can pass, and a vacuum tube apparatus comprising a cathode, a modulating element and a vibratory anode capable of vibrating in response to variations in the cathode to anode discharge, and located in the path and controlling the amount and character of light passing from said source to said opening, and an element responsive to light passing through said opening.

9. An apparatus for indicating electrical

impulses comprising a chamber, a source of light, a plate having an opening therein of restricted area, through which light from said source, can pass, and a vacuum tube apparatus comprising a cathode, a modulating element and a vibratory anode capable of vibrating in response to variations in the cathode to anode discharge, and located in the path and controlling the amount and character of light passing from said source to said opening, in combination with a means for photographically recording the variations in the amount and character of light passing through said opening.

10. An apparatus for indicating electrical impulses comprising a chamber, a source of light, a plate having an opening therein of restricted area, through which light from said source, can pass, a vacuum tube apparatus comprising a cathode, a modulating element and a wire anode capable of vibrating in response to variations in the cathode to anode discharge, and located in the path and controlling the amount and character of light passing from said source to said opening, and means for adjusting the position of said opening.

Signed at New York city, in the county of New York and State of New York this 6th day of March A. D. 1922.

SAMUEL RUBEN.