

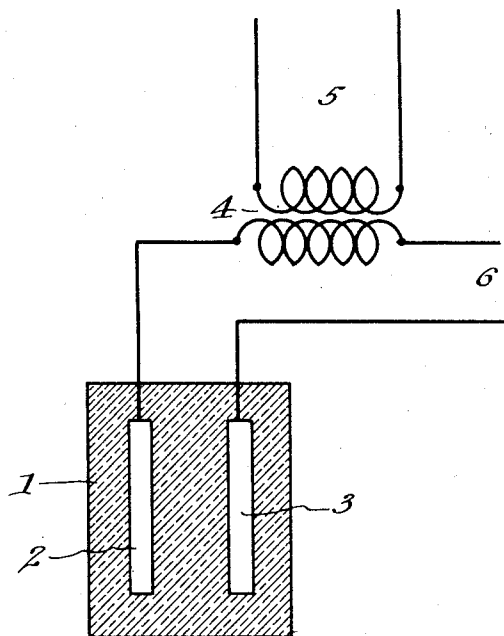
Feb. 28, 1933.

R. A. FESSENDEN

1,899,026

MEANS FOR MODULATING ELECTRICAL ENERGY BY LIGHT IMPULSES

Original Filed Aug. 21, 1922



Inventor

Reginald A. Fessenden

384

Lawrence B. ...

Attorney

UNITED STATES PATENT OFFICE

REGINALD A. FESSENDEN, OF CHESTNUT HILL, MASSACHUSETTS

MEANS FOR MODULATING ELECTRICAL ENERGY BY LIGHT IMPULSES

Original application filed August 21, 1922, Serial No. 583,271. Divided and this application filed January 8, 1927. Serial No. 159,949.

My invention relates to the transmission and reception of energy by high frequency impulses, and more particularly to the transmission of images by short electric waves, more particularly to the transmission of vision by short electric waves by wire or wireless, and still more especially to radio telescopes.

The object of the invention is to improve the efficiency of such transmission, and to disclose methods and apparatus adapted to accomplish the same, and to eliminate the effective disturbing impulses, and more particularly to the means of modulating by light (visual or ultra or infra visible) the transmitted electric energy used for producing the images at the receiving end.

Figure 1 shows means adapted for carrying out my invention.

The transmission of images by wire is well known, and descriptions will be found in the "Scientific American" and other papers in the decade 1880-1890 of the successful transmission of such pictures by Grey (by his telautograph and by other methods) and by Bain (by his electro-chemical method), between New York and Boston and Chicago, etc., and such pictures were transmitted wirelessly by applicant, using the Grey telautograph, between Brant Rock and Plymouth, in 1907 and 1908, by the methods shown in U. S. Patent No. 1,015,881, December 19, 1906.

The transmission time of the above methods was measured in minutes or fractions of a minute, and consequently, they were entirely incapable of transmitting vision, i. e. acting as a telescope, since, to produce the effect of vision, ten images, or even more, must be transmitted and reproduced per second.

Means for accomplishing this were described by applicant in U. S. Patent No. 1,015,881, December 19, 1906, above referred to, but while practicable, the apparatus was complicated and costly, and had other commercial disadvantages.

Applicant discovered from his work done on the subject of the radio telescope, in the

years 1901-1910, that there were two fundamental difficulties to be overcome.

The first was a suitable modulator at the receiving end for controlling the light there, so as to form there the visual image.

The second was a suitable light modulated device at the transmitting end for modulating the optical view into electrical impulses for transmission.

A suitable form of light modulated device was invented, and is disclosed in U. S. Patent No. 1,133,435, February 9, 1914, and tests, giving the sensibility of same as fourteen hundred (1,400) times that of previous photo-electric effect cells, and demonstrating the entire absence of lag or fatigue in response, will be found in an article by Professor Crewe in the "Physical Review" for December 1926.

Another suitable form is applicant's hot wire barretter type, described in the parent application, of which this is a division, i. e., Serial No. 583,271, filed August 21, 1922, in which are also described other types which have formed, or will form, the subject matter of other divisional applications, or have been already patented.

The form herein described and claimed is based upon applicant's discovering that substantially all transparent bodies have their specific inductive capacities changed when light falls upon them. This variation of specific inductive capacity may be used to modulate the transmission circuit in manners well known to those skilled in the art. See, for example, U. S. Patent 706,747. The effect is small, but is readily amplified, and condensers so made will themselves act as amplifiers if a high frequency current be impressed upon them.

In Figure 1, 1 is the dielectric which may, for example, be selenium melted and flowed around the condenser electrodes 2, 3, which may consist of short pieces of copper wire of small diameter, for example, one-half inch long and size No. 22 B. & S. gage. The method of making such selenium cells is well known in the art, and they may have been used as condensers, although applicant is not aware of any such prior use. 6 is the electri-

cal circuit attached to the condenser electrodes 2, 3. As is well known in the art of electrical engineering, when the circuit 6 is connected to a source of continuous current, e. g., a dry cell, a small current will flow from one electrode 2 to the other electrode 3, through the selenium, due to the fact that like all dielectrics selenium does not have an infinite ohmic resistance, and when light falls on the selenium, this ohmic resistance is decreased and the amount of current flowing is considerably increased. Such cells are well known in the art as selenium cells, and have been used for many purposes in other arts, for example, those of picture transmission, though on account of their lag they have never, so far as is known to applicant, been shown to be capable of the use in the art of television, unless a considerable number of such selenium cells are used, as shown, for example, in applicant's pioneer patent on television (U. S. Patent 1,015,881, Dec. 19, 1906).

A new property of the selenium cell, discovered by applicant, forms the basis of the present invention, i. e., that there is another and additional effect of enormously greater magnitude which occurs when in place of, or in addition to, a continuous current source, a source of very high frequency currents, for example, fifty thousand (50,000) per second, or upwards, is applied to the circuit 6.

When this is done, the flow of current in the circuit 6 depends mainly upon the dielectric capacity of the selenium cell acting as a condenser, and when light is thrown on the selenium cell, a change in the current takes place which is, as a rule, enormously greater than that which takes place when a continuous current source is used, in fact thousands of times greater, and in addition, a matter of fundamental and much greater importance, there is no lag in the action of the light, the action taking place in one-hundred thousandths of a second, and less.

This action is utilized by connecting a transformer 4, as shown in the circuit 6, the terminals 5 of the secondary of the transformer leading to the transmission circuit.

This form of device, I have found to be very suitable if used at the sending end of television apparatus, though it has many other uses, for example, in any place where instantaneous or large modulation of electrical energy is desired. It may, of course, be used with other apparatus, such as amplifiers, etc., as is well known in the art.

When it is desired to regulate or modify the action of different colors of lights, the selenium (or other dielectric), may be stained by any suitable staining material. For example, if it is desired to observe an aeroplane or ship at night, or in fog, the selenium may be stained with lamp-black, or a dark red stain, or may be heated until it turns dark red or

brown, in which case, the heat rays from the engine of the aeroplane or from the smokestack of the ship, will effect the cell and show up on the reproducing screen, as described in the parent application, Serial No. 583,271, filed August 21, 1922.

What I claim is:

1. As a modulator of electrical energy by the action of light, a translucent-condenser and a source of high frequency currents in operative relation to the terminals of said condenser, whereby on variation in the amount of light falling on said condenser, the electrical energy flowing in the high frequency electric circuit is modulated in accordance therewith, and means for modifying the effect of various portions of the light spectrum by staining said selenium.

2. A means for modulating electrical energy by the action of light waves, (including ultra and infra visible light) and comprising a selenium cell and a source of continuously generated high frequency electrical impulses in operative relation thereto, and means for modifying the effect of various portions of the light spectrum by staining said selenium.

3. As a modulator of electrical energy by the action of light, a translucent condenser and a source of high frequency currents in operative relation to the terminals of said condenser, whereby, on variation in the amount of light falling on said condenser, the electrical energy flowing in the high frequency electric circuit is modulated in accordance therewith, and means for modifying the effect of various portions of the light spectrum by staining said translucent condenser.

In testimony whereof, I have hereunto set my hand.

REGINALD A. FESSENDEN.