May 2, 1933. S. RUBEN 1,907,124

TELEPHOTOGRAPHIC SYSTEM

Filed Dec. 31, 1929

Fig. 1.

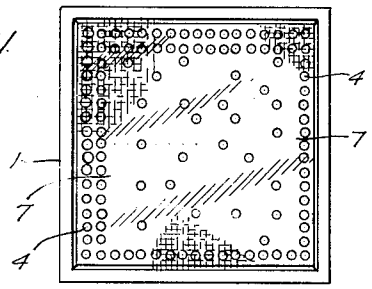


Fig. 2.

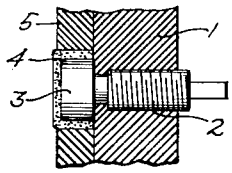
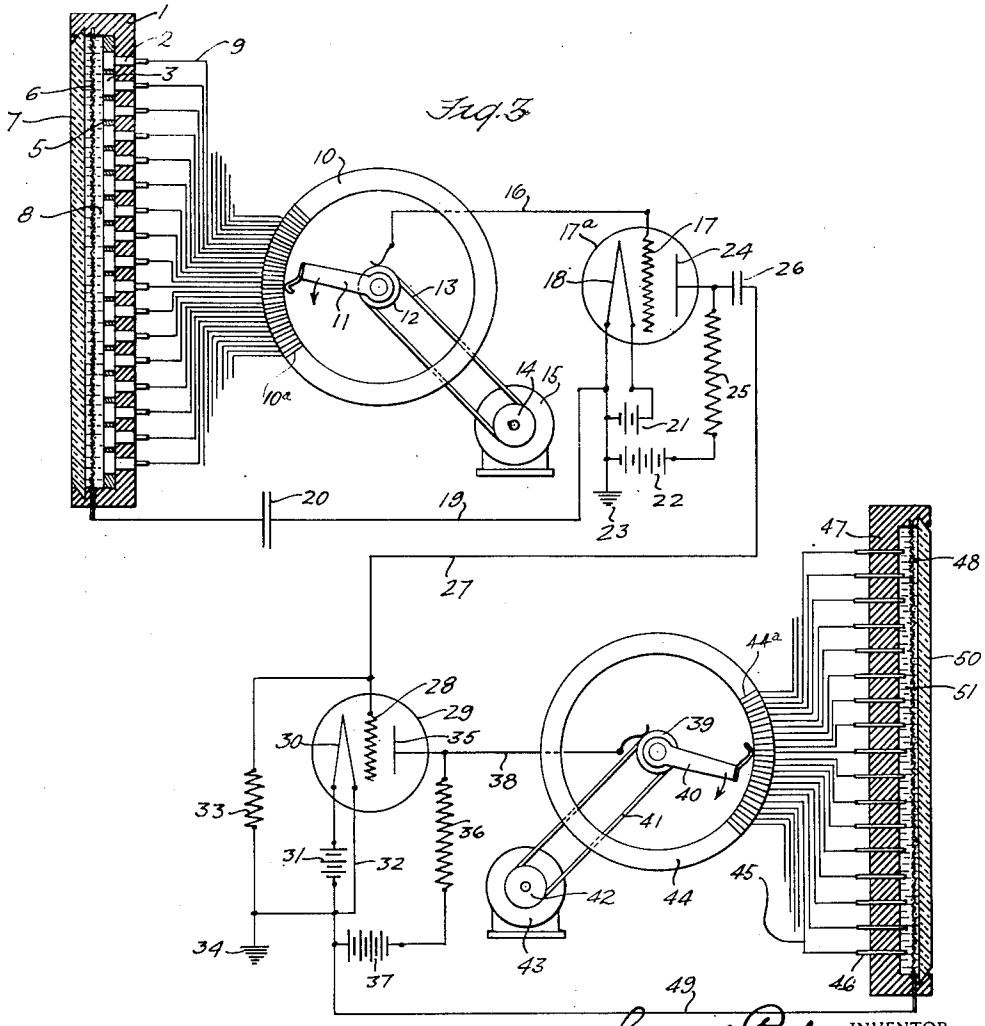


Fig. 3.



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UNITED STATES PATENT OFFICE

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TELEPHOTOGRAPHIC SYSTEM

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This invention relates to a system adaptable for wired or wireless telephotographic and television transmission and reception; it relates specifically to such a system in which photo-voltic cells are utilized.

The object of the invention is to provide such a system which is simple and practically instantaneous in operation. Other objects will be apparent from the disclosure.

Heretofore in the art, various mechanical devices such as scanning discs have been employed to obtain from an image, the necessary distribution of light to be translated into electrical oscillations and reproduced by another scanning disc synchronized with the transmitter disc. Much difficulty has been experienced when motion of the image was affected and when reflected and unfocused light from the image to be transmitted was desired.

By means of my invention, the reflected light from the image to be transmitted is allowed to be directly applied to a large photocell, preferably of the contact potential type which has its photosensitive surface divided and selectively connected to a segment type contact device so that individual contact can be made with every photo-sensitive part in any desired arrangement.

In a desirable form of the system, the photo cell comprises an insulating container having insulated photo-sensitive contacts composed of copper screws or rivets, the heads of which have been converted into a dense and integrally formed layer of cuprous oxide in a manner described in my Patent #1,694,189 and further described in my various co-pending applications.

Amplifier means are employed and the receiver or optical reproducer comprises an insulating cell containing aluminum magnesium alloy wires which glow when a potential is applied, the wires being selectively connected to the input circuit so as to correspond with the position of the photocell contacts and reproduce by virtue of the intensity of its glow, the corresponding light intensity falling on the cell from the image.

The described apparatus and system are based on the following:

That if an electrode of cuprous oxide be exposed to light radiation, its contact potential in relation to the electrolyte in which it is immersed and in respect to the cooperating electrode will change and a potential will be generated. The current flow in the cell output circuit is only of a transient character because of the capacitance connection of cell to amplifier, this connection having been described in a prior and co-pending application, and is of fundamental necessity in order to prevent any deterioration of cell due to electrolytic or chemical effects.

The other important factor, in this system, is that if an aluminum or aluminum alloy wire, preferably composed of 90% aluminum and 10% magnesium, is placed in an electrolyte and connected as the anode, it will glow if the voltage is in the order of 200 volts, due to the oxygen layer on its surface. The intensity of glow will vary with the impressed potential. As this glow has no appreciable lag or heat factor, it is of use as a reproducing device. Further intensification of the glow can be had by adding a slight percentage of fluorscene which converts any of the invisible short wave radiations to visible radiations.

In order to afford a better understanding of this invention, reference is made to the following description in which a desirable form of the system is described and to the drawing in which

Fig. 1 illustrates the photocell construction;

Fig. 2 shows one of the photosensitive contacts and

Fig. 3 shows the complete system for transmission and reception.

Referring to Fig. 1 specifically. (1) is a bakelite container having a glass window front (7) and a metal gauze electrode in back of it. On the back of the bakelite container are mounted many photosensitive contacts (4) which are insulated from each other and are separated from each other and the metal gauze electrode which is located between the tops of the contacts and the glass window or in between the contacts.

The space inside the cell is filled with an electrolyte.

In Fig. 2 is shown the head of a copper rivet (3). The top surface (4) has been converted into an integrally formed layer of cuprous oxide by heating in an oxidizing atmosphere to 1000° C. This formation is necessary in order to avoid the necessity of formation by chemical means as by reaction with a solution. The cuprous oxide layer (4) when formed of a sufficient thickness is cleaned in hydrochloric acid to remove any cupric oxide formed and is further cleaned in nitric acid to further clean it and leave a smooth ruby red surface of pure cuprous oxide. In order to render the surface sensitive to rapid changes of light intensity, the cuprous oxide surface is etched by placing it for several hours in a 1% solution of sulphuric acid. (5) shows insulation between the contacts. The shank (2) of the photosensitive electrode extends through the bakelite container (1).

In Fig. 3: (8) illustrates the electrolyte with which the container is filled and consists of a mixture of acetic acid and cobalt chloride, this mixture having been found to give a long life without chemical effects; (5) is the insulation between the contacts; (9) represents the lead wires connecting the contacts to a selector switch (10). This switch is composed of a number of insulated segments (10*a*) which are individually connected to the photosensitive contacts with which the rotary contactor (11) makes contact. The rotary contactor is driven by a synchronous motor (15) by means of pulleys (12) and (14) and driving belt (13). Lead (16) contacts the rotary contactor with the vacuum tube grid element (17) which modulates the plate current flow between the electron emitter (18) and plate (24). Connected with the gauze electrode (6) is condenser (20) which allows a capacitance or electrostatic connection of the photocell to the amplifier input circuit and therefore prevents a dark current flow which would tend to cause electrolytic effects. In the circuit of plate (24) is a resistance element (25); (21) and (22) are sources of potential for their respective circuits; (26) is a coupling condenser for electrostatically connecting the transmitter amplifier tube (17*a*) with the receiver amplifier circuit in which (28) is the grid electrode, (35) is the plate element and (30) the electron emission or cathode element; (36) is a resistance in the plate circuit; (31) and (37) are the sources of potential for their respective circuits; (44*a*) represents the segments of rotary selector switch (44); (40) is the rotary contactor which makes intermittent contact with the insulated metal segments; (39) and (42) are pulleys and (41) the driving belt by which contactor (40) is driven by synchronous motor (43); (47) is a bakelite container, similar in structure to the transmitter container (1), except that instead of having photosensitive contacts forced through it, aluminum magnesium alloy rivets (46) are distributed over the entire back surface. These are insulated from each other by the bakelite spacing between them. Screen or gauze electrode (48) is connected to the negative terminal of battery (37) which is of 250 volts. Electrolyte (51) is a solution of amonium phosphate which fills the container and (50) is glass plate which is cemented on front of the bakelite container to make a water tight and transparent side. Container (47) may be adapted to have a refill plug and a small hole in the top as a gas vent.

In operation, when light radiation is applied to the transmitter coil, the contact potential of the cuprous oxide, in relation to the electrolyte and cooperating electrode changes in proportion to the intensity of light on its surface. The rotating switch makes contact with each photosensitive contact by means of the contacting segments (10*a*). The grid (17) thereby becomes intermittently charged to a potential dependent upon the intensity of light on the particular photo sensitive electrode with which contact is made. The modulation of the plate current between the cathode (18) and plate (24) causes an amplified pulsation of the input potential to be discharged through its circuit and resistance (25). This amplified impulse is transmitted through condenser (26) to grid (28) of receiver tube which further amplifies this impulse and the amplified oscillation is applied to the rotary contactor. In rotating, individual contact is made with the segments which alternately charge the aluminum alloy electrode, and due to the formation of a current blocking oxide, there is a glow at the electrode in contact with the electrolyte. The intensity of this glow increases with increased potential. The rotary selector switches at the transmitter and the receiver are operated by synchronous motors so that the glowing aluminum electrode contacted with corresponds with the photosensitive electrode contacted with and the intensity of the glow corresponds with the intensity of light on the photosensitive electrodes. Stationary or moving images can thus be accurately transmitted without lag.

While I have described and shown a wire connection between the transmitter and the receiver, it is obvious that a radio system can be used as well. In each case, the fundamental principles remain the same. Where a radio system of transmission is desired, the synchronizing system described in

my copending application #402,295 has been found adaptable.

While the liquid type photo cell is preferred, the electrolyte can be in a crystalline, paste of glacial form. The system may utilize other types of photocells than those described, in which a plurality of photosensitive elements can be used. The cell described however, is deemed preferable.

In the receiving end of the circuit, other means than the cell shown, such as suitably arranged scanning discs, prisms, etc. may be substituted for the cell shown and described.

What is claimed is:

1. In a telephotographic system, a transmitting circuit including a photoelectric cell of the contact potential type, having its photosensitive surface divided and selectively connected to a segment type contact device so that individual contact can be made with every photosensitive part, said cell having a capacitance connection to an amplifier, a receiving circuit including a cell containing an electrolyte and a plurality of film forming electrodes, said electrodes being selectively connected to the input circuit so as to approximately correspond to the sensitive contacts in the photoelectric cell and adapted to reproduce, by virtue of intensity of its glow, the corresponding light intensity falling on the photoelectric cell.

2. In combination with a television system comprising a photoelectric cell having a plurality of photo-sensitive elements, a rotary contact making means and an amplifier, a receiving circuit including a cell containing an electrolyte and a plurality of film forming electrodes, said electrodes being selectively connected to the input circuit so as to approximately correspond to the position of the photo-sensitive elements in the photoelectric cell and adapted to reproduce, by virtue of intensity of its glow, the corresponding light intensity falling on the photoelectric cell.

3. A telephotographic system comprising a transmitting circuit including a photo-voltaic cell having a multiplicity of individually photo-sensitive elements constituting one electrode thereof, said elements being selectively connected to a segment type contact device, said cell having a capacitance connection to an implifier, and a receiving circuit adapted to optically reproduce an image exposed directly or reflectively to the photo-voltaic cell in said transmitting circuit.

4. A scanning means for a telephotographic system comprising a photo-voltaic cell having a multiplicity of individually photo-sensitive elements constituting one electrode thereof, a distributor having a multiplicity of contacts and means of independently connecting each said photo-sensitive element with one of said contacts.

5. A scanning means as described in claim 4 in which the photo-sensitive elements of the photo-voltaic cell have a surface of cuprous oxide.

6. A scanning means for a telephotographic system comprising a photo-voltaic cell having a multiplicity of individually photo-sensitive elements constituting one electrode, a distributor having a multiplicity of contacts, and means connecting each said photo-sensitive element with one of said contacts independent of any other contact and independent of any other of said photo-sensitive elements, and a rotating member for making successive electrical contact with the several contacts for transmitting the electrical effect of the several photo-sensitive elements.

7. A scanning means for a telephotographic system comprising a photo-voltaic cell having a multiplicity of individually photo-sensitive elements constituting one electrode thereof, said cell having a capacitance connection to an amplifier, a distributor having a multiplicity of contacts, and means of independently connecting each said photo-sensitive element with one of said contacts.

8. In combination, a scanning circuit for a telephotographic system comprising a photo-voltaic cell having a multiplicity of individually photo-sensitive elements constituting one electrode thereof, a distributor having a multiplicity of contacts, means to independently connect each said photo-sensitive element with one of said contacts and a receiving circuit having a plurality of elements, approximately corresponding in number and position to the photo-sensitive elements in said photo-voltaic cell and adapted to visibly respond to variations in light intensity recorded by said photo-sensitive elements.

9. A telephotographic system comprising a transmitting circuit including a photo-voltaic cell having a multiplicity of individually photo-sensitive elements constituting one electrode thereof, said elements being selectively connected to a segment type contact device, means of preventing a continuous direct current flow from said cell to an amplifier connected in circuit therewith, and a receiving circuit adapted to optically reproduce an image exposed directly or reflectively to the photo-voltaic cell in said transmitting circuit.

Signed at New York in the county of New York and State of New York this 28th day of December A. D. 1929.

SAMUEL RUBEN.