

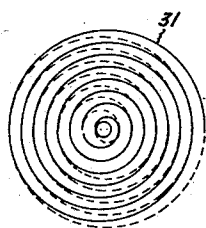
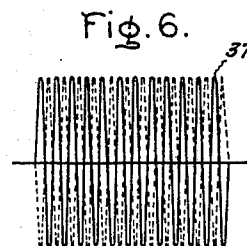
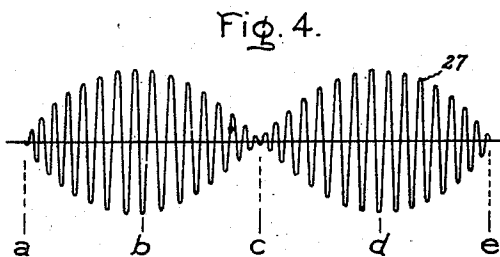
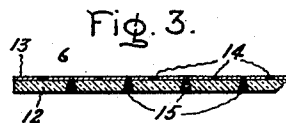
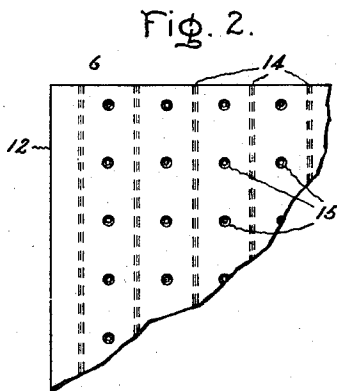
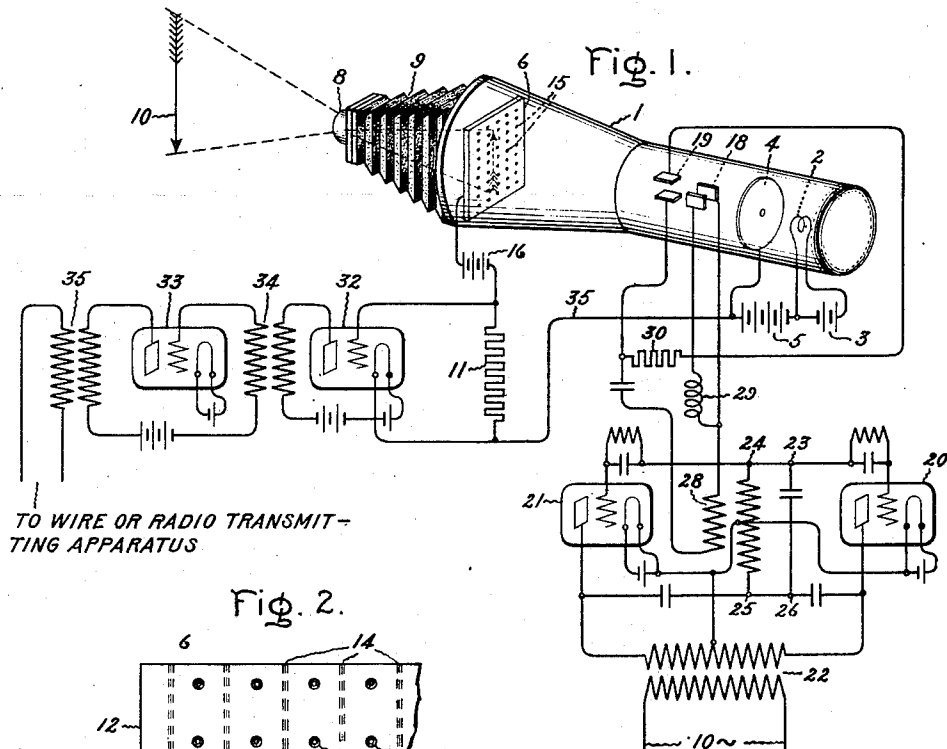
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C. A. SABBABH

1,747,988

TRANSMISSION OF PICTURES AND VIEWS

Filed May 27, 1925



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UNITED STATES PATENT OFFICE

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TRANSMISSION OF PICTURES AND VIEWS

Application filed May 27, 1925. Serial No. 33,271.

My invention relates to the electrical transmission of pictures and views. An object of my invention is the provision of improved method and means for the rapid transmission of still pictures and views and for the transmission of moving pictures and views. A further object of my invention is to provide apparatus for this purpose which shall have no moving material parts and which is thereby free from inertia effects.

In accordance with my invention I project an image of the picture or view to be transmitted on a plate of photo-resistance material, that is, a material whose resistance varies in accordance with the intensity of light falling upon it. On one face of this plate are a large number of small conductors forming a grid. A cathode ray which is directed toward the opposite face of this plate and which is caused rapidly to scan the plate is connected in circuit with the grid and a suitable amplifying means. The return current of electrons is thereby proportional at any instant to the resistance of the small area of the resistance plate engaged by the cathode ray at that instant. The amplified current is adapted to be transmitted by wire or radio to a distant receiving station.

Referring to the drawing, Fig. 1 is a diagrammatic representation of one form of apparatus involving my invention; Fig. 2 is a fragmentary detail of the receiving plate greatly enlarged; Fig. 3 is a cross section of the plate shown in Fig. 2; Fig. 4 shows one form of wave used for moving the cathode ray; Fig. 5 shows the spiral path which the cathode ray is caused to take, and Fig. 6 shows a modified form of wave.

In Fig. 1 I have shown diagrammatically a cathode tube 1 having at one end the filament 2 which is adapted to be heated by the battery 3. In front of the filament 2 is the anode 4 connected with the filament through the battery 5 and having a small opening therein through which the cathode ray is directed toward the plate 6 arranged in the tube at the opposite end thereof. A suitable lens 8 is shown connected by a bellows 9 with the tube so that it may be adjusted to produce a

sharp image on the plate 6 of the picture or view represented by the arrow 10.

The plate 6, a fragment of which is shown in elevation and section respectively on a greatly enlarged scale in Figs. 2 and 3, comprises a glass plate 12 having on its rear side a thin layer or film 13 of a substance whose resistance changes greatly with the degree of illumination thereof, such for example as thallium sulphate or molybdenite which is fused on the glass. The film has a polished surface on which are metallic lines 14. These lines are spaced preferably not over one hundredth of an inch and for greater sharpness of the picture or view transmitted may be more closely spaced, for example, one two-hundredths of an inch. Between the metallic lines 14, the glass plate 12 has rows of holes filled with silver or other suitable metal forming conducting plugs 15 extending through the glass plate whereby numerous conducting paths are provided between the film and the opposite side of the glass plate which is the side facing the cathode 2. The metallic lines 14 are joined together and are connected by battery 16, resistance 11 and conductor 35 with battery 5 and cathode 2.

Within the tube 1 and arranged on opposite sides of the path of the cathode ray at a point preferably adjacent the anode are two pairs of spaced parallel plates 18 and 19, the one pair being placed at right angles to the other. As is well understood by those skilled in the art, if charges are given to these pairs of plates the cathode ray which passes between the plates will be distorted or bent and that by suitably varying the charges on the two pairs of plates relative to each other the ray can be made to follow any desired path. If the picture or view to be transmitted is still, movement of the ray in scanning the image need only have such speed that the movement of the corresponding spot of light in the receiver may not be detected by the eye of the observer. For the transmission of a moving picture or view the ray should scan the entire image at least sixteen to twenty times per second to prevent the effect of flickering of the transmitted picture.

Various methods may be employed for

varying the field between the plates 18 and the plates 19 to cause the ray to cover the image on the plate 6 with the desired speed. One arrangement whereby the plates 18 and 19 may be energized in a manner to cause the ray to travel in spirals such as shown in Fig. 5 at the desired rate is shown diagrammatically in Fig. 1. A well known form of self-rectifying circuit is employed comprising the two pliotrons 20 and 21. When the rectifying circuit is fed by the transformer 22 connected for example to a ten cycle source of alternating current, the current in the oscillation circuit 23, 24, 25, 26 may be of the form represented by 27 in Fig. 4, the high frequency oscillations being modulated by the ten cycle current. A winding 28 in inductive relation to the oscillation circuit is connected in circuit with an inductance 29 and resistance 30. One pair of plates, for example plates 18, is connected across the inductance 29, the other pair of plates is connected across the resistance 30. By this arrangement the currents traversing the two pairs of plates are substantially in quadrature with each other and each has the form illustrated by Fig. 4. The resulting effect upon the cathode ray is to cause it to trace upon the plate 6 spiral paths such as illustrated for example by 31 in Fig. 5. Every small unit area of the image on the plate is thus covered many times per second by the ray. At this point of the description it is desired to point out that the drawing is purely diagrammatic in character and that no attempt has been made therein to show the various parts in their true or relative proportions. Likewise in the diagrams forming Figs. 4 and 5, as well as Fig. 6 to to be described hereinafter, the high frequency wave and the resulting pitch of the spiral 31 are not illustrative of actual conditions but rather have been shown having such values as is found most convenient in illustrating the idea.

The current impulses traversing the resistance 11 as a result of the cathode ray scanning the image on plate 6 may be transmitted to a distant station either by wire or by radio. Two amplifying pliotrons 32 and 33 are shown connected together by the transformer 34, the grid and filament of the first pliotron being connected with the resistance 11 and the plate of the second pliotron being connected through the transformer 35 with a suitable wire or radio transmitting apparatus not shown.

In using the apparatus, the ten cycle current supplied to the transformer 22 causes the cathode ray which is projected from the cathode 2 through the opening in the anode 4 to be deflected and to trace spirals on the plate 6, a complete spiral being traced during each of the intervals $a-b$, $b-c$, $c-d$, and $d-e$ of Fig. 4. At the same time, the image of the picture or view to be transmitted is being

projected by the lens 8 upon the plate 6. As the cathode ray, which in diameter should not be less than the distance between adjacent plugs 15 in order that the circuit shall not be interrupted, travels over the plate 6 in a spiral path as shown in Fig. 5 for example, the resistance offered to the electron stream by the film 13 varies in accordance with the brightness of each small unit area of the image upon which the ray falls. The resistance of the film 13 is relatively large but only that small portion of the film between the plug or plugs 15 upon which is falling the ray at any instant and the adjacent metallic lines 14 is included in the circuit. Thus the current through the resistance 11 is at any instant a measure of the illumination of the particular spot of the image upon which the cathode ray is falling at that instant and the resulting potential drop across the resistance after being amplified is transmitted by wire or radio means, not shown, to the receiving station.

The ray may be made narrow enough and the turns of the spiral close enough to produce a picture having the desired sharpness. The entire image is thus covered twice during each half wave of the ten cycle current. While I have used terms such as "light", "illumination" and "brightness" in speaking of the image formed upon the plate 6, I desire it to be understood that I use these terms in their broadest sense to cover not only the visible portions of the spectrum but also the invisible portions thereof since the material of the photo sensitive plate can be selected so that it will respond to visible or invisible rays.

Instead of causing the cathode ray to cover the image by tracing spirals upon the plate 6 it may be caused rapidly to sweep up and down over the plate while advancing back and forth across it, thus tracing a path after the fashion of that illustrated by the line 37 in Fig. 6. In this way the entire image is covered during each horizontal traverse of the ray. For moving the ray in this manner the self-rectifying circuit illustrated may be dispensed with and one pair of the deflecting plates may be connected to a source of sustained high frequency while the other pair of plates may be connected to a source of lower frequency which may be of the order of sixteen or twenty cycles per second or higher if desired.

By whichever method the ray is moved, it will be noted that the apparatus includes no material moving parts and hence no inertia effects have to be considered. The only moving element is the cathode ray and this is adapted to respond instantly to the deflecting force.

For receiving the picture or view thus transmitted I may use a cathode ray tube having means similar to that already de-

scribed for moving the ray and in which the voltage between anode and cathode is caused to vary in accordance with the impulses received from the transmitting station. The ray in this case may fall on a semi-transparent film of phosphorescent substance and the plate may be viewed through a suitable lens or eye piece. Synchronization of the transmitting and receiving apparatus is obtained by employing oscillation circuits 23, 24, 25 and 26 in the transmitter and the receiver having the same frequency and by slight manual variations in the constants of the circuit maintaining the exact synchronization necessary to prevent distortion of the picture.

In my Patent, No. 1,694,982, granted Dec. 11, 1928, I have disclosed a different embodiment of my invention utilizing a cathode ray for scanning purposes and have claimed in that application the broad features common to that case and the present application.

What I claim as new and desire to secure by Letters Patent of the United States, is:

1. Apparatus for the transmission of pictures and views comprising a cathode ray tube, a resistance element whose resistance varies with its illumination, means for projecting an image on the element, means for causing the cathode ray to scan the image, and circuit connections adapted to provide a return path from a plurality of small areas of said element to the cathode of said tube.

2. Apparatus for the transmission of pictures and views comprising a cathode ray tube, a light-sensitive resistance element therein having a plurality of conductors on one face thereof, means for projecting an image on said face, means for directing the cathode ray toward said element and for moving the same over the element, and circuit connections between the source of said ray and said conductors.

3. Apparatus for the transmission of pictures and views comprising a cathode ray tube, a plate therein having on one face a film whose resistance varies in accordance with the illumination thereof, means for projecting on the film an image of the picture or view to be transmitted, a plurality of spaced conductors on the film, a plurality of spaced conductors extending through the plate to the opposite face thereof, means for causing the cathode ray to sweep over said opposite face and circuit connections between the cathode and the spaced conductors on the film.

4. In apparatus for the transmission of pictures and views, a plate having on one face thereof light sensitive resistance material, a conductive grid on the resistance material, a plurality of conductors extending through the plate and arranged intermediate the elements of the grid and source of electrons interconnected with said grid.

5. In apparatus for the transmission of pictures and views, a plate having on one face thereof thallium sulphate, a conductive grid on the thallium sulphate and a plurality of conductors extending through the plate and arranged intermediate the elements of the grid.

In witness whereof, I have hereunto set my hand this 26th day of May, 1925.

CAMILLE A. SABBAAH.