

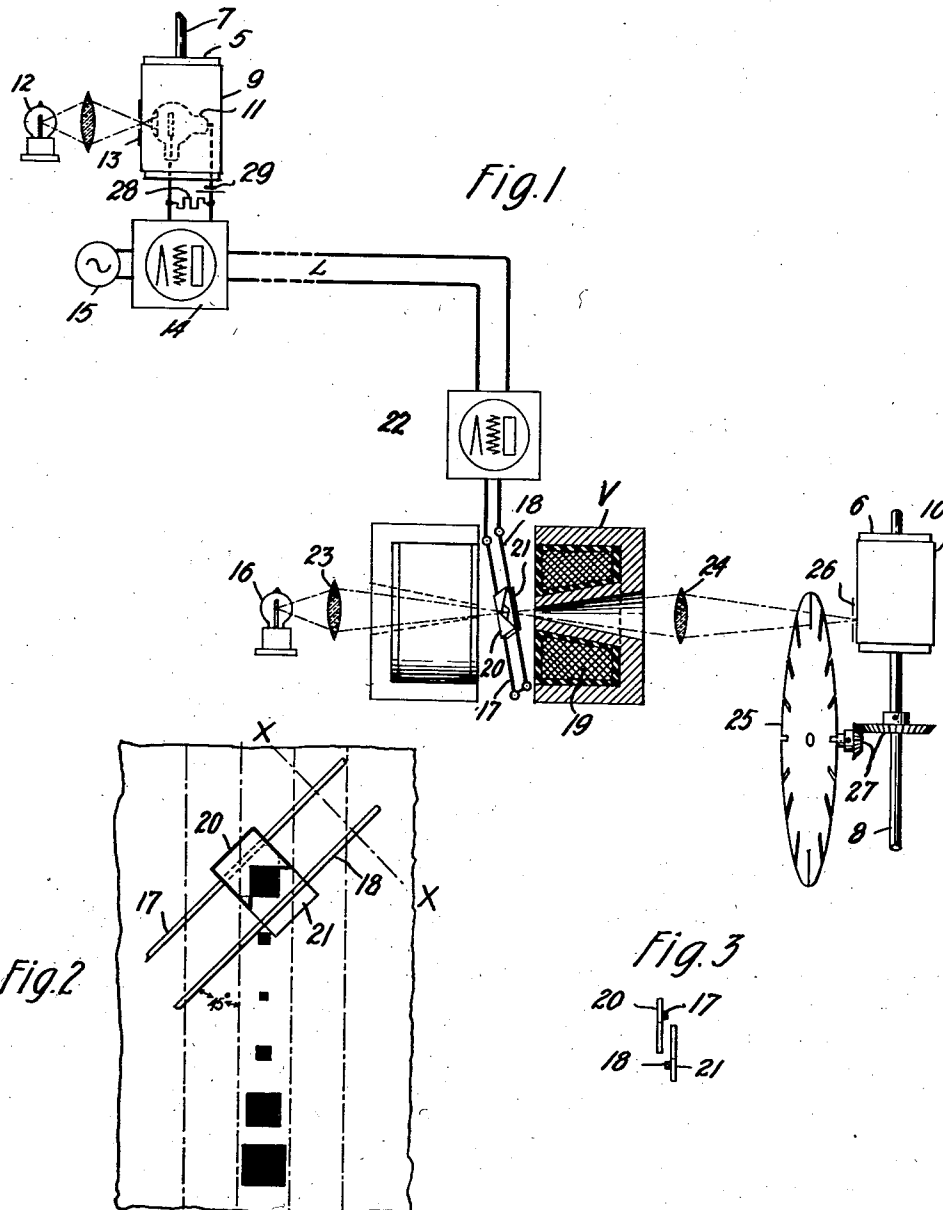
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H. E. IVES

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TRANSMISSION OF PICTURES BY ELECTRICITY

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Inventor:
Herbert E. Ives
by Edward A. Ives

UNITED STATES PATENT OFFICE.

HERBERT E. IVES, OF MONTCLAIR, NEW JERSEY, ASSIGNOR TO WESTERN ELECTRIC COMPANY, INCORPORATED, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

TRANSMISSION OF PICTURES BY ELECTRICITY.

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This invention relates to the transmission of pictures by electricity and more particularly to the reproduction of a picture in the form of a dot image.

5 In the reproduction of a picture from an electric current which varies in accordance with the light characteristics of the original, the picture may be built up of line traces of varying density, of lines of uniform density and varying width, or of dots of various sizes. Pictures reproduced in the last mentioned manner are similar in appearance to the ordinary half tone pictures so well known in the printing art. Such pictures have a much less objectionable grain than do pictures consisting of parallel lines or strips and so are somewhat preferable from the standpoint of appearance. A possibly even greater advantage of the dot picture is that it may be used to print directly upon the copper or zinc used by the photo-engraver to make a typographic printing plate. Such use permits the elimination of several copying operations which have heretofore been necessary with electrically transmitted pictures.

An object of this invention is the reproduction of pictures in the form of dot images in a novel and effective manner.

30 In one embodiment of the invention, an electromagnetic light valve is actuated by current which is modified in accordance with the light characteristics of the picture to be transmitted. The light valve consists of two movable members suspended in a magnetic field, in such a manner that current there-through will cause relative movement thereof. Opaque plates each with a V-shaped edge are mounted on the wires so that the resultant opening is a square whose size varies with the motion of the wires. The wires are mounted at an angle of 45 degrees to the direction of the trace on the record blank. Intermittent exposure at proper intervals in order to form dots is effected by a rotating sector disc.

45 The novel features which are characteristic of this invention are set forth with particularity in the appended claims. The invention, both as to its organization and method of operation, together with other objects and advantages will be understood from the following description, having reference to the accompanying drawing. It will be noted that some of the features of the

invention are useful in other fields than that of picture transmission as will appear hereinafter.

Fig. 1 illustrates schematically a system for the transmission of pictures by electricity according to this invention including an arrangement for reproducing the picture in the form of a dot image.

Fig. 2 is an enlarged section of one form of a developed record showing the relation of the exposed areas to the opaque shields and movable shields.

Fig. 3 is a partial cross-section along the line X—X of Fig. 2 showing the relative positions of the opaque shields and movable wires.

Referring now to Fig. 1, two rotating drums 5 and 6 are mounted on shafts 7 and 8, which are caused to rotate in any suitable manner. As the drums rotate, they are caused to move axially with respect to the shaft. The drum 5 is transparent and has mounted thereon a transparency 9 of the picture which is to be transmitted. Mounted upon the drum 6 is a record blank 10 such as a sensitive photographic paper or film. Located within the transparent drum 5 is a photo-electric cell 11, an electrical characteristic of which is affected by the amount of light received from a source 12 through an aperture in screen 13. The amount of light reaching the photo-electric cell 11 is determined by the tone value of the elemental area of transparency 9 which is opposite the aperture in screen 13 at any given time. The circuit of the photo-electric cell 11 is connected to a modulating device 14, whereby carrier waves from source 15 are modulated and transmitted to the transmission line L. The modulating device 14 may consist of electron discharge devices as indicated. A suitable arrangement for synchronously rotating the drums 5 and 6 and modulating the carrier waves in accordance with picture currents from the photo-electric cell 11 is disclosed in the copending application of M. B. Long Serial No. 681,847, filed December 18, 1923.

At the reproducing station, a light valve V controls the amount of light which may pass from a source 16 to effect exposure of the light sensitive record blank 10. The light valve V is similar in general arrangement to the light valve disclosed in a copending application of E. C. Wentz Serial

No. 635,886, filed May 1, 1923. It consists of two wires 17 and 18 suspended in a magnetic field which is produced by a coil 19. Mounted on the wire 17 is an opaque shield 20 and on the wire 18 an opaque shield 21, each of which has a V-shaped notch in one edge. The shape and relative location of the wires and shields are shown more clearly in Figs. 2 and 3.

Under the action of current from the line L, (which current may be translated in any suitable manner in the electrical apparatus indicated in block 22) the wires are caused to move relatively to each other. The result of such movement is the formation of a square aperture between the opaque shields varying in size in accordance with the strength of the actuating current. The translating action which takes place within the block 22 may be a demodulating action as disclosed in the Long application supra, or it may be a simple amplification of the modulated carrier waves. In any event, the adjustment of the movable wires is such that the aperture is either at its maximum opening or entirely closed when no carrier waves are being received from the line L.

The shields are illuminated by light from the light source 16 which is concentrated by condensing lens 23. The projection lens 24 then forms an image of the aperture between the opaque shields on the record blank whenever a slit in the sectored disc 25 permits the passage of light through an aperture in the screen 26. The sectored disc 25 is rotated at a speed proportional to that of the drum 6 and at such a speed that any desired number of exposures per linear inch of trace may be effected. For a good grade of reproduction, this speed would be such that 50 or 60 exposures per linear inch of trace would be made. The sectored disc may be driven by means of the gears 27 as shown.

It is to be noted that the movable wires and the sectored disc in Fig. 1 are shown in perspective for the purpose of clearness and simplicity.

The size of the exposed area on the sensitive record blank 10 is determined by the size of the aperture between the opaque shields 20 and 21 which in turn is a function of the current flowing in the conductors 17 and 18.

Fig. 2 in addition to showing the movable wires and opaque screens shows a section of the developed surface of the record blank 10. This showing is of course greatly enlarged. The paths between the vertical dot-dash lines indicate the trace of the light beam as the drum 6 rotates. The record is in the form of squares of varying size depending upon the relative positions of the movable wires 17 and 18. The axes of the wires 17 and 18 are located at an angle of 45 degrees to the direction of the trace of the

record, as shown, so that the sides of the dots will be parallel or at right angles to the direction of the trace. Other arrangements may of course be used if desired.

Since the movement of the wires relatively to each other is directly proportional to the current flowing therethrough, the areas of the dots are proportional to the square of the current. For example, if the current is doubled, the area of the aperture and hence of the dot will be quadrupled. This is inherent in the structure of the device. In order, therefore, that each dot may be proportional to the density or tone value of the corresponding elemental area of the transparency 9 of the picture, the picture current corresponding thereto should vary as the square root of the light intensity within the photo-electric cell 11. This condition may be obtained by any one or more of several adjustments of the apparatus elements of the circuit located between the photo-electric cell 11 and the movable wires of light valve V. Such adjustments will be obvious to those skilled in the art. One means for effecting this result, is to use resistance shunted across the circuit extending from the battery 29 and photo-electric cell 11 to the modulating device 14 the cell being one whose characteristic is such that the photo-electric current rises rapidly with voltage. This resistance should be large, the absolute value of which is dependent upon characteristics of the photo-electric cell.

It is not necessary that picture current from the photo-electric cell 11 be transmitted as modulations of a carrier wave but it may be transmitted directly to the light valve V with or without amplification as the requirements of the circuit demand. The sectored disc should preferably be placed as close as convenient to the screen 26, although other positions may be selected.

The scope of the invention is not to be limited by the specific embodiment shown in the drawing, but only by the appended claims.

What is claimed is:

1. A light valve comprising means to produce a magnetic field of uniform strength, a member having a V-shaped edge located in said field, a second member also having a V-shaped edge suspended in said magnetic field and adapted to move relatively to said first mentioned member so as to form a square aperture of varying size.

2. A light valve comprising means to produce a magnetic field of uniform strength, a pair of movable members suspended in said magnetic field and adapted to move relatively to each other, an opaque screen having a V-shaped edge mounted on each of said movable members and adapted to form a square aperture of varying size between said opaque screens.

3. In a system for the transmission of pictures by electricity, a source of picture current varying as a function of the tone values of the elemental areas of a picture to be reproduced, an electromagnetic light valve having a conductor movable under the influence of said current, an opaque screen controlled by said conductor for completely defining an aperture, and means to record the size of said aperture.

4. In a system for the transmission of pictures by electricity, a source of picture current having characteristics which are a function of the tone values of the elemental areas of a picture to be reproduced, an electromagnetic light valve having conductors movable under the influence of said current, opaque screens having V-shaped edges and controlled by said conductors for completely defining an aperture, and means to record the size of the said aperture.

5. In a system for the transmission of pictures by electricity, a source of picture current having characteristics which are a function of the tone values of the elemental areas of a picture to be reproduced, an electromagnetic light valve having conductors movable under the influence of said current, opaque screens having V-shaped edges and controlled by said conductors for completely defining an aperture, means to illuminate said aperture, a movable light sensitive record blank and a sectored disc for intermittently exposing said record blank to said illuminated aperture.

6. In a system for the transmission of pictures by electricity, a source of picture current having characteristics which are a function of the tone values of the elemental areas of a picture to be reproduced, an electromagnetic light valve having conductors movable under the influence of said current, opaque screens having V-shaped edges and controlled by said conductors for completely defining an aperture, means to illuminate said aperture, a movable light sensitive record blank and a sectored disc adapted to

successively expose elemental areas of said record blank to light from said illuminated aperture.

7. In a system for the transmission of pictures by electricity, means to produce picture currents, means under the control of said picture currents to produce a beam of light having a cross-sectional area proportional to said picture currents, means sensitive to said beam of light, and means to cause said beam of light to affect said sensitive means intermittently.

8. In an electro-optical system, a source of electric current, means actuated by current from said source to produce a beam of light having a cross-sectional area proportional to said current, means sensitive to said beam of light, and a disc acting upon said beam of light to affect said sensitive means intermittently.

9. In a system for the transmission of pictures by electricity, a picture to be transmitted, means to produce picture current, the instantaneous amplitudes of which are proportional to the square roots of the tone values of the elemental areas of the picture, and means including an electromagnetic light valve for reproducing the picture in the form of a dot image.

10. In a system for the transmission of pictures by electricity, a picture to be transmitted, means to produce picture current, the instantaneous amplitudes of which are proportional to the square roots of the tone values of the elemental areas of the picture, means including an electromagnetic light valve having conductors movable under the influence of said picture current, opaque screens having V-shaped edges and controlled by said conductors for completely defining an aperture, and light sensitive means to indicate the size of said aperture.

In witness whereof, I hereunto subscribe my name this 26 day of December, A. D. 1923.

HERBERT E. IVES.