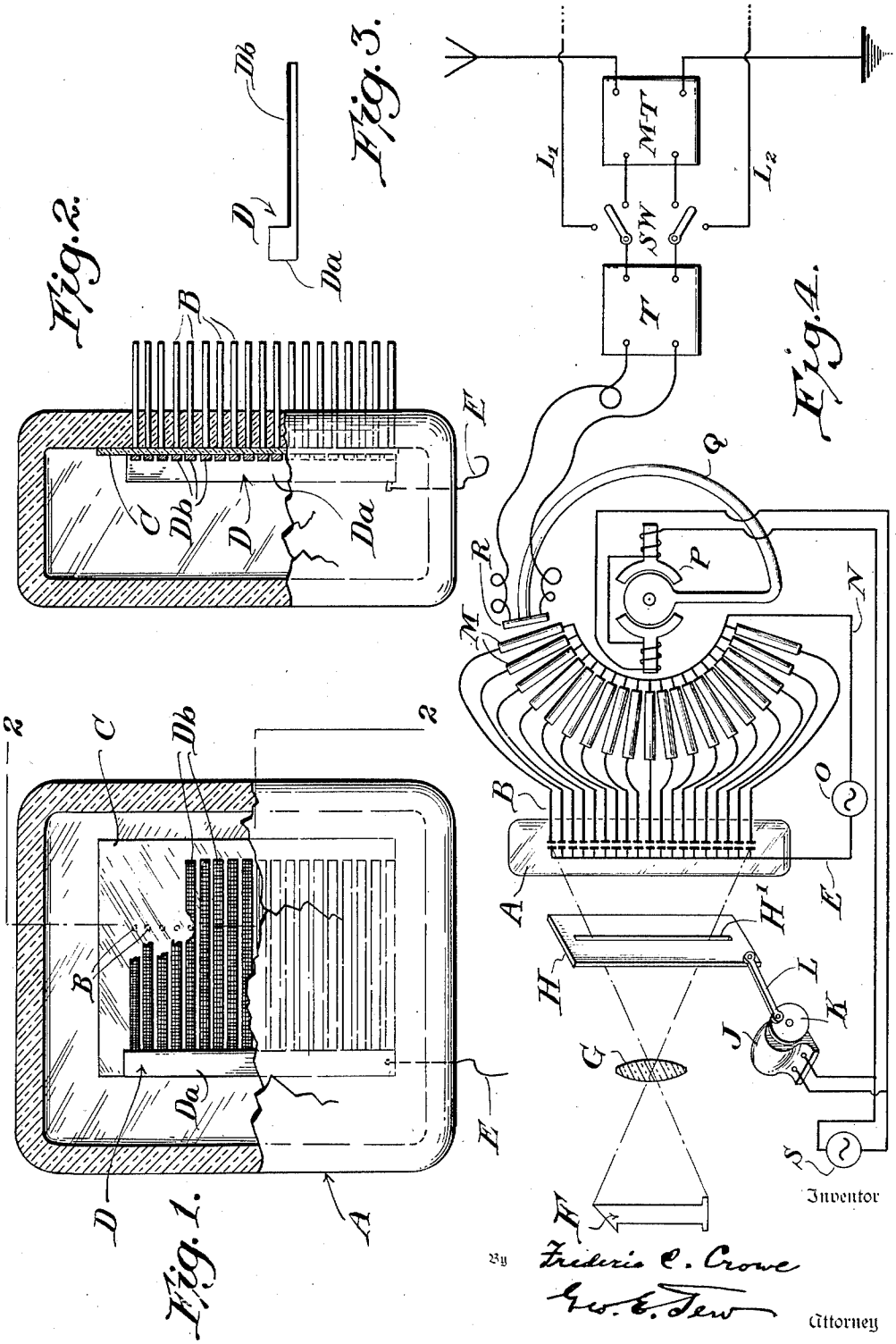
June 10, 1930. F. C. CROWE 1,762,470

PICTURE TRANSMISSION SYSTEM

Filed March 25, 1929 2 Sheets-Sheet 1

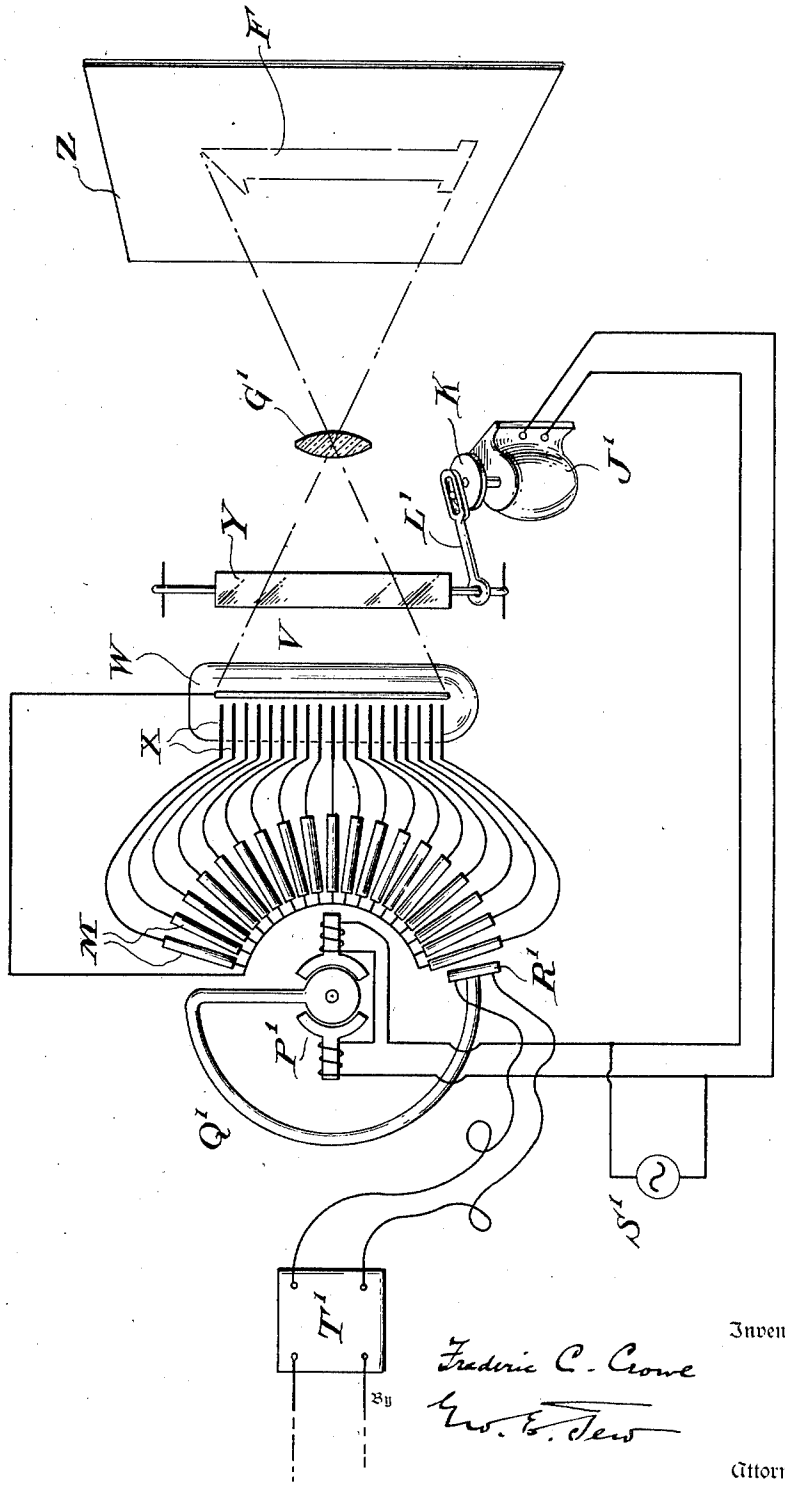


June 10, 1930. F. C. CROWE 1,762,470

PICTURE TRANSMISSION SYSTEM

Filed March 25, 1929 2 Sheets-Sheet 2

Fig. 5.



Inventor

Frederic C. Crowe

By

Attorney

Patented June 10, 1930

1,762,470

UNITED STATES PATENT OFFICE

FREDERIC C. CROWE, OF ERIE, PENNSYLVANIA, ASSIGNOR OF TWO-THIRDS TO S. H. CAULEY AND C. L. CAULEY, BOTH OF ERIE, PENNSYLVANIA

PICTURE-TRANSMISSION SYSTEM

Application filed March 25, 1929. Serial No. 349,754.

This invention relates to a system for the transmission of still and moving pictures by wire or radio.

The invention further relates to a novel type of light-sensitive element.

An object of the invention is to devise a system of picture transmission employing the novel light-sensitive element which I have invented.

A further object is to devise a picture transmission system employing a novel scanning arrangement.

My invention also involves a novel current modulating system and method at the transmitting station, and at the receiving station a novel light-modulating and distributing arrangement.

My invention is illustrated in the accompanying drawings in which:

Figure 1 is a front view, partly in section, of the novel light-sensitive cell employed in my system;

Figure 2 is a view of Figure 1 taken along the line 2—2;

Figure 3 is an end view of one of the elements of Figure 1;

Figure 4 is a diagrammatic sketch of the arrangement at the transmitting station; and

Figure 5 is a diagrammatic sketch of the arrangement at the receiving station.

Referring to Figure 1, the light-sensitive cell employed in my system comprises a glass envelope A from which the air and gas has been exhausted in the back of which are sealed a number of fine wires B of square cross-section (see Figure 2). Wires B are arranged in a straight line extending from near the top of the cell to near the bottom, the wires being arranged close together, but insulated from each other. The ends of wires B are smoothed off even with the glass on the inside of the envelope. The wires are preferably square in cross-section and of very small dimension, for example, 40 gauge. A strip of mica is cemented to the back of envelope A over the ends of wire B. Supported on top of mica strip C is a comb like element D, which comprises a stiff back member D^a and a plurality of thin tooth members D^b formed integral with the back. The comb member may be made from brass, and the teeth are of very thin gauge. The comb element D is arranged so that each tooth of the comb is opposite and overlies the end of one of the wires B. A wire E is connected to the comb element D and is brought out of the envelope as one terminal of the cell. The exposed sides of the teeth of the comb are coated a dull black by any suitable process. Each wire B and the corresponding tooth of comb D constitute a small condenser. One terminal of all the condensers are connected together through the back of the comb element.

The action of the light sensitive cell is as follows: When light falls on the blackened side of the teeth of the comb element, each tooth is pressed against the mica with a tensity proportional to the amount of light falling upon it. If the light is strong, the tooth is pressed heavily against the mica, and the capacity is decreased. If the light ray is weak, the tooth will be pressed lightly and the capacity will be correspondingly greater.

In Figure 4, I have diagrammatically shown the apparatus employed at the transmitting station. A indicates the light sensitive cell shown in Figures 1 to 3. F is a picture or subject to be transmitted. G is a lens for forming an image of the picture upon the light-sensitive surface of the cell A. H is an opaque screen interposed between the lens G and the cell A to cut off all of the picture except a narrow strip which passes through the slot H′. It will be understood that the arrangement of the lens G is such that the image of the subject F comes within the boundary of the light-sensitive area of the cell A. A motor J is provided for the purpose of oscillating the screen H across the path of the light rays at right angles to the slot H′. This is accomplished through the disc K and connecting link L pivoted eccentrically thereto; however, it is obvious that any other suitable means may be employed. Each of the wires B of the cell A is connected to one of a series of annular coils M arranged on the arc of a circle. The remaining terminals of the coils M are connected together and

to one side of a high frequency oscillator O by wire N, and the other side of the oscillator O is connected to the cell A by wire E. An oscillating motor P is provided with a semi-circular arm Q mounted on its rotor, and carries at its free end a search coil R which is small enough to enter the central opening of the coils M. The oscillating motor P and the motor J may be operated from the same source of alternating current S, it being understood that the speed of operation may be adjusted by fixing the number of poles on each other, or by employing intermediate gear trains. Search coil R is connected to any suitable amplifying device T, the output of which may be either connected to lines L^1 and L^2 or to a radio modulator and transmitter M—T by means of switch element SW. The modulator-transmitter is of usual construction.

Operation of Figure 4 is as follows: Only a narrow strip of the image of the object F is impressed upon the cell A. Current flowing through each small condenser of cell A, and therefore, through corresponding coils M, will be determined by the intensity of the light falling upon each tooth of the comb. Pick-up coil R is oscillated in and out of coils M periodically, thereby coupling the amplifier T with each coil in succession. There will be induced in pick-up coil R successive currents corresponding in magnitude to the currents flowing in the coils M. The rate of oscillation of the pick-up coil R is such that while the coil R is moving from one end of the series to the other, the screen H is moving a distance equal to the width of the slot H′. The varying currents induced in pick-up coil R are amplified by amplifier T and transmitted to the receiving station either over lines L^1 and L^2, or radiated to the station by means of modulator-transmitter M—T. For television operation, it will be necessary for the pick-up coil R to oscillate in and out of the coils M many times per second, and screen H should also oscillate at the usual rate to produce continuity of vision. For example, if the screen H moves back and forth at a rate of 15 times a second, and the slot H′, is .003 inches wide, then an image one inch square would require $\left(\frac{1000}{3}\times 15\right)$ in and out movemets of coil R per second.

In Figure 5, I have shown a circuit diagram of the arrangement employed at the receiving station. In this figure, elements corresponding to like elements in Figure 4 are indicated by similar reference characters. T′ is an amplifier for amplifying the currents received from the transmitting station. The output of this amplifier is connected to a distributor coil R′ mounted on the end of semi-circular arm Q′ of motor P′, and arranged to oscillate in and out of annular coils M′. The common connection to coils M′ is connected to an elongated electrode V, and in spaced relation thereto, are mounted a series of auxiliary electrodes X corresponding in number to coils M and to the teeth in cell A at the transmitting station. Each electrode X is connected to a coil M. A mirror Y, pivoted about a vertical axis, is arranged to receive the light from the lamp W and reflect the same onto a projecting lens G′ and onto a screen Z. A motor J′ is provided for oscillating mirror Y through a limited angle about its pivoted axis by means of disc K′ and lever L′. It is understood that any other suitable means may be employed for oscillating mirror Y. Motors P′ and J′ may be operated from the same source of alternating current S′ if desired.

Operation of Fig. 5 is as follows: It will be understood that the operation of mirror Y is synchronized with the operation of screen H at the transmitting station by any suitable and well-known synchronizing system. It will also be understood that oscillating motor P′ is synchronized with oscillating motor P at the transmitting station. As distributor coil R′ moves into energy relation with the coils M′, proportional currents are induced in these coils and produce light discharges between corresponding electrodes X and the electrode V. These light discharges will correspond in intensity to the currents carried by distributor coil R′. If the light pulses produced by the lens W were permitted to pass directly through the lens G′ onto screen Z, they would all fall in the same straight line and would not reproduce the image. However, the rays first strike the mirror Y and are reflected from there through the lens G′ onto the screen Z, and due to the oscillating action of the mirror Y the light pulses are distributed at right angles to the line of light elements in proper relation to reproduce the image F′ corresponding to the object F at the transmitting station.

In the annexed claims it will be understood that the word "picture" is employed to indicate either a photograph, and object, or any subject to be transmitted.

It will be understood that the accompanying drawing is not draw to scale, but the thicknesses of the elements forming the light-sensitive cell are greatly exaggerated.

I claim:

1. In a picture transmission system, a plurality of light responsive elements arranged to form a light-sensitive area, means for projecting an image of a picture upon said light sensitive surface, movable means interposed between said image projecting means and said sensitive area for admitting only a line of said image to said sensitive area, and means for successively associating each of the elements influenced by said image line with an output circuit.

2. In a picture transmission system, a plurality of light responsive elements arranged

to form a light-sensitive area, means for projecting an image of a picture upon said light sensitive surface, means interposed between said image projecting means and said sensitive area, for admitting only a line of said image to said sensitive area, means for successively associating each of the elements influenced by said image line with an output circuit, and means for shifting said interposed means to admit a new line of said image to the sensitive area.

3. In a picture transmission system, a light-sensitive surface made up of a plurality of parallel light-sensitive strips, each comprising an elongated light-sensitive cell, means for projecting an image of a picture upon the light-sensitive surface, a light-screen interposed between the projecting means and the sensitive surface and having a narrow slot formed therein to admit to the surface a narrow strip of the image at right angles to the long axis of the cells, and means for moving said light-screen to completely scan the image.

4. In a picture transmission system, a light-sensitive surface made up of a plurality of parallel light-sensitive strips, each comprising an elongated light-sensitive cell, means for projecting an image of a picture upon the light-sensitive surface, a light-screen interposed between the projecting means and the sensitive surface and having a narrow slot formed therein to admit to the surface a narrow strip of the image at right angles to the long axis of the cells, and means for successively associating each of said cells with an output circuit.

5. In a picture transmission system, a light-sensitive surface made up of a plurality of parallel light-sensitive strips, each comprising an elongated light-sensitive cell, means for projecting an image of a picture upon the light-sensitive surface, a light-screen interposed between the projecting means and sensitive surface and having a narrow slot formed therein to admit to the surface a narrow strip of the image at right angles to the long axis of the cells, means for moving said screen to scan said image, and means for successively associating each of said cells with an output circuit during the time the screen travels a distance equal to the width of the slot.

6. In a picture transmission system, a source of current, a plurality of light-sensitive cells connected to said source in parallel circuits, each circuit containing a primary winding, a secondary winding connected to an output circuit, and means for successively coupling said secondary winding to said primary windings.

7. In a picture transmission system, a source of current, a plurality of light-sensitive cells connected to said source in parallel circuits, each circuit containing a primary winding, a secondary winding connected to an output circuit and means for periodically coupling said secondary winding to the primary windings in succession.

8. A light-responsive system comprising an electric condenser, a source of current connected in circuit with the condenser, and means for varying the capacity of the condenser in accordance with light variations impressed thereon.

9. A light-responsive system comprising an electric condenser, a source of current in circuit with the condenser, and a blackened surface on one plate of said condenser whereby variations in light falling on said blackened plate produce corresponding current variations in said circuit.

10. In a picture transmission system, a plurality of sources of light arranged in a line, a source of varying current representing picture light-variations, means for controlling the intensity of said sources in succession in accordance with the current variations, means for forming images of said lights upon a screen, and means for shifting the images at right angles to the line of lights to their proper positions on the screen to reproduce the picture.

11. In a picture transmission system, a means for forming an image of a picture, means for analyzing the image into elementary areas, means for producing current variations in accordance with the light intensity of said areas, means for transmitting said current variations to a distant station, a plurality of sources of light at the distant station arranged in a line, means for controlling the intensity of said light sources in succession in accordance with the current variations, means for forming images of said lights upon a screen, and means for shifting the images at right angles to the line of lights to their proper positions on the screen to reproduce the transmitted picture.

12. In a picture transmission system, a plurality of electric lights arranged in a line, each light being connected in a circuit including a secondary winding, a source of varying current representing picture light-variations, a primary winding connected to said source, and means for associating said primary winding with said secondary windings in succession.

In testimony whereof, I affix my signature.

FREDERIC C. CROWE.