Feb. 21, 1933. C. A. CULVER 1,898,080

PICTURE TRANSMISSION

Filed May 1, 1929

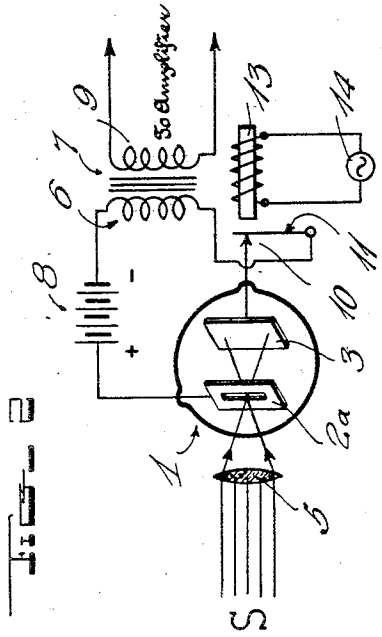


FIG. 2

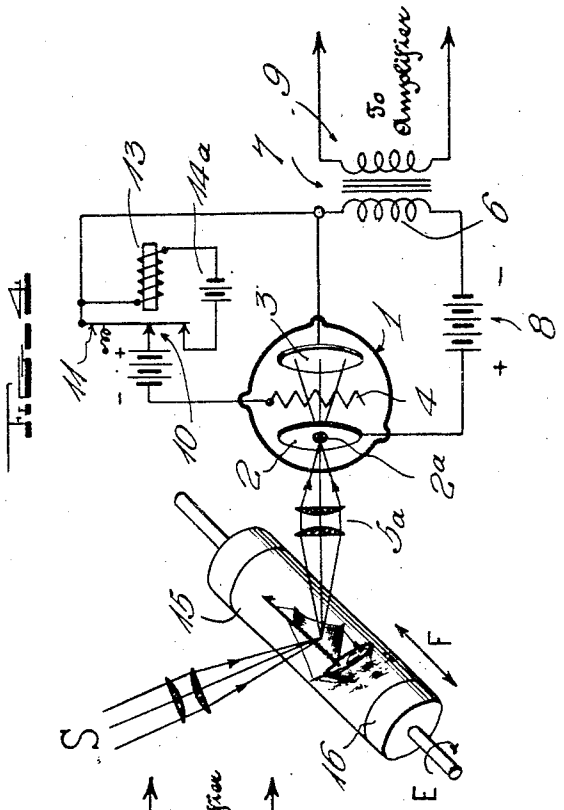


FIG. 4

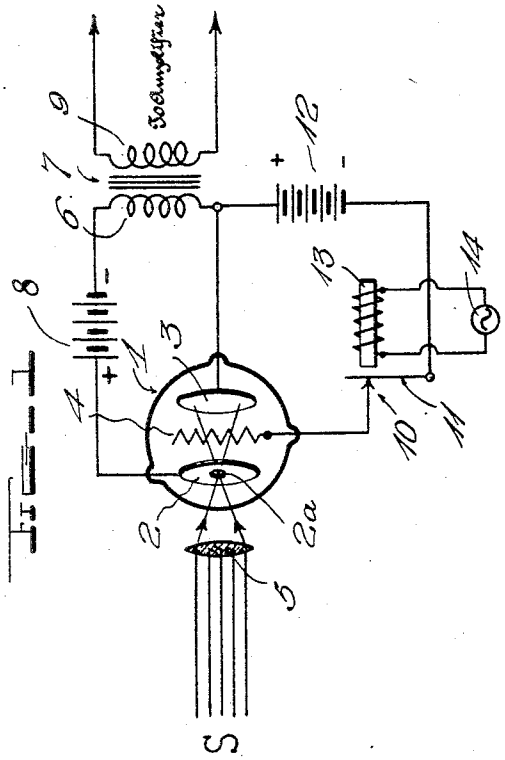


FIG. 1

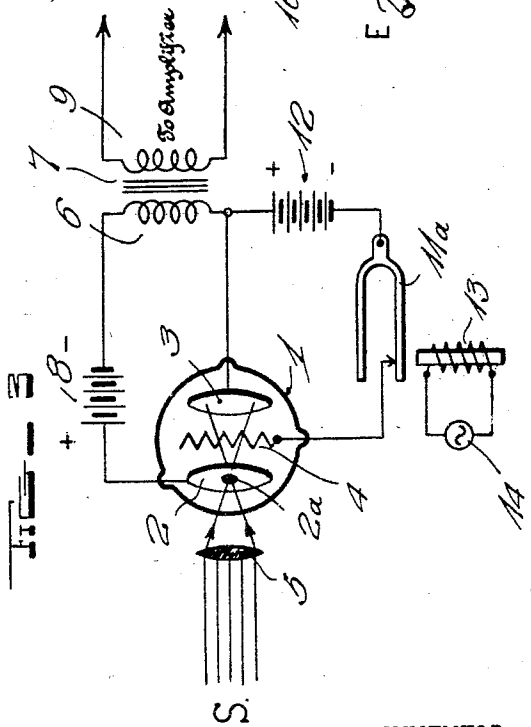


FIG. 3

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Patented Feb. 21, 1933 1,898,080

UNITED STATES PATENT OFFICE

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PICTURE TRANSMISSION

Application filed May 1, 1929. Serial No. 359,692.

My invention relates to picture transmission and more particularly to facsimile transmission of pictures, printed matter and the like by means of physical circuits or space radio.

An object of my invention is to provide a means and method for facsimile picture transmission employing a constant uninterrupted source of luminous energy.

Another object of my invention is to provide a picture transmission system wherein the sensitivity of the photoelectric cell employed is increased.

A further object of my invention is to provide a picture transmission system wherein the mechanism employed is greatly simplified by the elimination of moving scanning mechanism usually required in picture transmission systems.

Other and further objects of my invention are to provide adequate circuit arrangements for improving systems for the transmission of facsimile pictures, a better understanding of which can be had from the specification following and from the accompanying drawing, wherein:

Figures 1 and 2 show the improvements in picture transmission of my invention employing two different types of photoelectric cells respectively; Fig. 3 shows a modification of my invention; and Fig. 4 is a diagrammatic illustration showing a modification of my invention and a typical system for facsimile picture transmission.

Practically all systems for the transmission of pictures employ a common element known as a photoelectric cell. The operation of such a cell depends upon the amount of luminous energy incident thereon. Such a photoelectric cell is responsive to variations in the intensity of the luminous energy, in that the electronic emission of the light sensitive surface of the cell is directly proportional to the intensity of the luminous energy incident thereon.

Fig. 1 of the accompanying drawing shows a photoelectric cell 1 having an anode 2, cathode 3 and control electrode 4. Anode 2 has an aperture 2*a* for admitting the rays of luminous energy from lens 5 and source S. Cathode 3 has a coating of suitable light sensitive electron emitting substance whereby electrons are discharged to the anode 2. Control electrode 4, positioned in the path of the electrons, exerts a marked influence on the electronic current. As the space current between anode 2 and cathode 3 is varied in direct proportion to the intensity of luminous energy through aperture 2*a*, the current in primary winding 6 of transformer 7 is varied in direct proportion to the intensity of the luminous energy from source S. The variations are, however, very slow and amplification of the energy is not possible. To make possible the amplification of such current variations, I introduce an interrupter in the photoelectric cell circuit. In the present figure the interrupter comprises contact 10, armature 11, electromagnet 13 and source 14. Armature 11 and contact 10 are adapted to interrupt the control electrode circuit of photoelectric cell 1. A source of biasing potential 12 is connected in series with the control electrode cathode circuit.

Source 14 comprises any suitable source of alternating or pulsating current having any desired frequency. The vibration of armature 11 interrupts the supply of biasing potential to control electrode 4 and hence interrupts the current in the anode circuit. This interruption of the current in the primary 6 of transformer 7 will induce an electromotive force in secondary winding 9 of transformer 7 and the electromotive force will be proportional to the intensity of the energy upon electrode 3. These electrical impulses, when amplified and transmitted to the receiving apparatus, constitute the "dot pattern" which goes to make up the picture at the receiving station. The characteristics of photoelectric cell 1 and the potential of source 12 are preferably so chosen that the space current between anode 2 and cathode 3 will be reduced to substantially zero when the control electrode circuit is completed.

Fig. 2 of the accompanying drawing shows a modification of my invention. The design of the photoelectric cell 1 shown in all figures of the accompanying drawing, is fully described in my copending application Serial

No. 303,068, filed August 30, 1928, entitled "Photoelectric device". Like reference characters are employed in the drawing. Photoelectric cell 1 is here shown as of the two electrode type employing only an anode 2 and cathode 3. The anode-cathode circuit is periodically interrupted by opening the circuit 10—11. While this arrangement is satisfactory to produce the necessary current impulses, the control for most purposes does not equal the control obtainable by the arrangement shown in Fig. 1. The current at maximum in this circuit is very small and therefore the energy required to interrupt the circuit may be proportionally small.

Fig. 3 shows another modification of the means and method of picture transmission of my invention. A mechanically vibratile element 11*a*, herein shown as a tuning fork is employed to periodically interrupt the supply of biasing potential to control electrode 4. Element 11*a* carries a contact member adapted to periodically contact with stationary contact 10 when element 11*a* is actuated by electromagnetic energy in electromagnet 13. Electromagnet 13 is energized from source 14 which may be any suitable source of alternating or automatically interrupted current. As in the arrangement shown in Fig. 1, source 12 is chosen of the proper value in view of the characteristics of photoelectric cell 1, so that the space current between anode 2 and cathode 3 will be reduced to substantially zero when the potential from source 12 is supplied control electrode 4. It is not necessary to employ a tuning fork as element 11*a*, for any suitable mechanically vibratile element may be employed.

Fig. 4 shows a further modification of the means and method for picture transmission of my invention. The essential elements of the complete picture transmission system are diagrammatically represented. The interrupter for producing the current impulses is here shown as an audio frequency buzzer. The biasing potential from source 12 is periodically supplied control electrode 4 which causes the space current between anode 2 and cathode 3 to be controlled from a given value to substantially zero. Cathode 3 is energized by the luminous energy incident thereon. The rays of luminous energy from source S are directed to a portion of the picture 15 from which they are reflected to lens 5*a*. From lens 5*a* the rays converge to aperture 2*a* from whence they diverge covering the surface of light sensitive cathode 3.

The electrons emitted from cathode 3 are proportional to the energy through aperture 2*a* which in turn is proportional to the reflection from the respective light and dark portions of picture 15. Picture 15 is usually positioned on a cylinder 16 which revolves on the axis E and is moved step by step in the direction F. Photoelectric cell 1 may be contained within cylinder 16 which has a transparent wall. The latter arrangement is employed when it is desired to transmit a negative. The arrangement shown is not intended to restrict the scope of my invention. The picture 15 may be carried by any suitable means whereby luminous energy is admitted to photoelectric cell 1 according to the relatively light and dark portions of the picture or negative.

The means and method for the transmission of pictures of my invention has many advantages. A very small amount of energy is required to obtain the desired interruption as compared to employing means for periodically interrupting the luminous energy. Interrupting the supply of luminous energy is equivalent to interrupting the filament circuit in a thermionic tube. By the means and method of my invention, a more linear photoelectric response may be obtained. This is very desirable where it is necessary to transmit pictures in a short interval of time.

I realize that many modifications of my invention are possible and it is to be understood that the embodiments of my invention are not to be limited by the foregoing specification or by the accompanying drawing but only by the scope of the appended claims.

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

1. In a picture transmission system the combination of a photoelectric cell having an anode, cathode and control electrode, an output circuit interconnecting said anode and cathode, said anode having an aperture for admitting luminous energy, said control electrode being connected to said cathode and a mechanically vibratile circuit maker and breaker for positively interrupting the control electrode-cathode circuit through predetermined time intervals for energizing or deenergizing the output circuit of said photoelectric cell during corresponding time intervals.

2. In a picture transmission system the combination of a photoelectric cell having an anode, cathode and control electrode, said cathode being energized by a source of luminous energy, an output circuit connected between said anode and cathode, a control circuit connected with said cathode and control electrode and a mechanically vibratile circuit maker and breaker for periodically interrupting said control circuit for intermittently energizing said output circuit.

3. In a picture transmission system, the combination of a photoelectric cell having an anode, cathode and control electrode, said cathode being energized by a source of luminous energy, an output circuit connected between said anode and cathode, a control circuit connected with said cathode and control electrode, a source of potential and a mechanically vibratile circuit maker and breaker for

periodically connecting said source of potential to said control electrode.

4. In a picture transmission system, the combination of a photoelectric cell having an anode, cathode and control electrode, said cathode being energized by a source of luminous energy, an output circuit connected with said anode and cathode, a control circuit connected with said cathode and control electrode, a source of direct current biasing potential, and a mechanically vibratile circuit maker and breaker for intermittently connecting said direct current source of biasing potential to said control electrode.

5. In a picture transmission system, the combination of a photoelectric cell having an anode, cathode and control electrode, said anode being energized by a source of luminous energy, an output circuit connected with said anode and cathode, a control circuit connected with said cathode and control electrode, a direct current source, and a mechanically vibratile circuit maker and breaker for successively establishing connection between said direct current source and said control electrode at a continuous audio frequency rate.

6. A transmission system comprising a photoelectric cell including a cathode, anode, and control electrode, a variable light source incident upon said cathode, an output circuit connected between said cathode and anode, a source of potential, and a mechanical circuit maker and breaker having contacts disposed in series with said control electrode for abruptly controlling the effect of said source of potential upon said control electrode between zero and a predetermined maximum potential for energizing or deenergizing said output circuit through successive predetermined time intervals.

In testimony whereof I affix my signature.

CHARLES A. CULVER.