Feb. 4, 1930. F. GRAY 1,745,756

ELECTRICAL PICTURE TRANSMISSION RECEIVING SYSTEM

Filed Aug. 2, 1926

Fig. 1

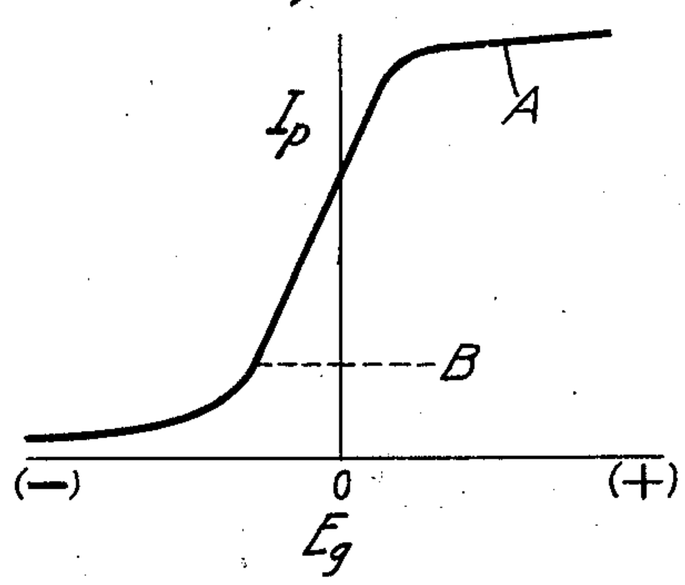


Fig. 2

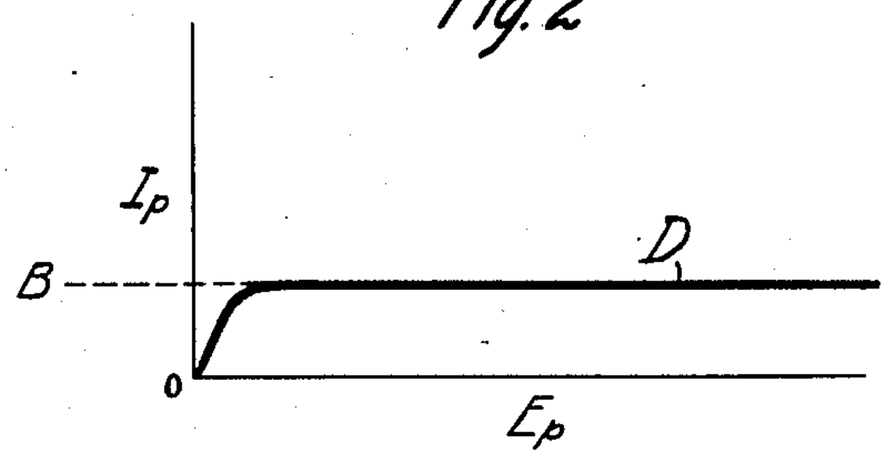
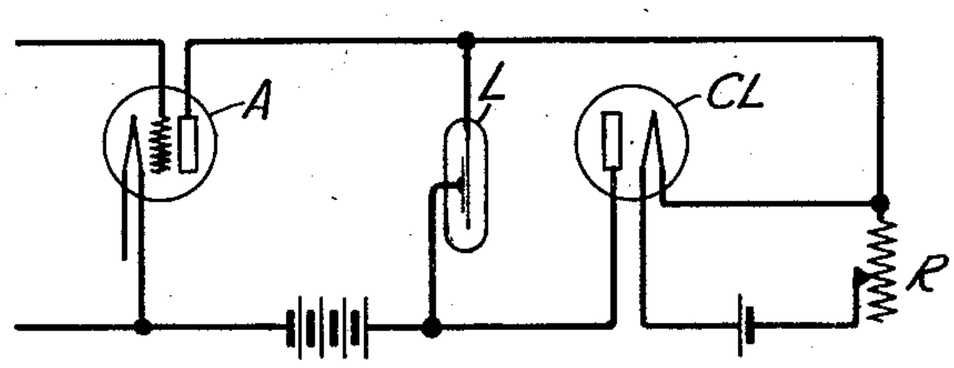


Fig. 3



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UNITED STATES PATENT OFFICE

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ELECTRICAL PICTURE-TRANSMISSION RECEIVING SYSTEM

Application filed August 2, 1926. Serial No. 126,505.

This invention relates to signal receiving systems and more particularly receiving arrangements suitable for picture transmission and television systems.

The general object of this invention is the elimination of distortion in signal receiving systems; while a specific object is the elimination of distortion in the receiving apparatus of electrical picture transmission systems employing an electron discharge device for the energization of the reproducing light source.

As a receiving system for a picture transmission or television system, the invention has its preferred embodiment in an arrangement comprising a thermionic amplifier in the output circuit of which is a glow discharge lamp to emit light corresponding in amount to the light intensity variations of the picture or object scanned at the transmitter, said lamp being shunted by a thermionic vacuum tube current limiter which, when the picture or object scanned is dark, passes all of the current in the output circuit and is then saturated. The light emitting potential of the lamp is reached as soon as the smallest amount of light is reflected from the scanned picture or object. The biasing potential on the grid of the amplifier and other conditions are so chosen that the output current of the amplifier when the picture or object is dark corresponds to a point of the lowermost part of the straight portion of the I_p and E_g characteristic of the amplifier. Therefore the straight portion only of the amplifier is utilized in the production of the light variations corresponding to the light emitted by or reflected from the picture or object, care being taken that the amplifier is never overloaded.

It has heretofore been suggested that the receiving device of a picture transmission system be biased to eliminate the effect of the received current upon the receiving photographic film when the object or picture scanned at the transmitter is dark. Such a biasing method is shown in the patent to Herbert E. Ives et al., No. 1,691,071, issued Nov. 13, 1928, in which an electromagnetic light valve is mechanically adjusted so that no light passes through the valve until a definite current value is reached.

Applicant's receiving arrangement could be used, for example, in the picture transmission system disclosed in the patent to Herbert E. Ives, No. 1,648,127, issued Nov. 8, 1927, wherein it would replace the mechanical light valve arrangement of the Ives system.

A more detailed description of the invention follows and is illustrated in the accompanying drawings.

Fig. 1 is a characteristic curve of a vacuum tube amplifier circuit.

Fig. 2 is a characteristic curve of a space discharge device which upon reaching current saturation becomes substantially constant.

Fig. 3 is a schematic circuit arrangement of one embodiment of the invention, which has been selected for illustration.

Fig. 1 is a typical characteristic curve of an amplifying circuit such as that of a vacuum tube amplifier showing the characteristic A plotted between plate or output current, I_p, and grid voltage, E_g, the ordinate representing the former and the abscissa the latter. When the plate current reaches a certain value as indicated by B, the characteristic then becomes substantially linear and remains so for a considerable increase in grid voltage. If the receiving circuit into which such a device feeds contains a low resistance shunt capable of passing current up to the point B and practically no more, the other elements in the receiving circuit will not be appreciably affected by this current which corresponds to the non-linear portion of the amplifier characteristic.

Fig. 2 is a typical characteristic curve of such a shunt. The characteristic D is plotted to show plate or output current, I_p, and plate voltage, E_p. The saturation current is indicated by B. A device having this characteristic is a two-element thermionic tube having a hot filament and a receiving plate as its two electrodes. The magnitude of the current which such a device passes is controlled by the temperature of its filament. Such a thermionic tube will pass no more current than its

saturation current even though the impressed voltage is materially increased above the saturation value, and for this reason the current becomes substantially constant after the saturation point is reached.

Fig. 3 is a diagrammatic circuit arrangement showing a glow discharge receiving lamp with its associated shunting resistance and a vacuum tube amplifier energizing the circuit. The circuit comprises the vacuum tube amplifier A, the receiving lamp L, and the controlling shunt CL. The output circuit of the amplifier is connected in parallel with both the receiving lamp L and the shunting device CL. The preferred form of the shunt having a substantially fixed current carrying capacity is, as here shown, a two-element space discharge device having a heated filament. The circuit supplying the current for heating the filament contains an adjustable resistance R for controlling the current saturation point of the discharge device.

For picture reception, operation of the receiving device is confined to the linear portion of the amplifier characteristic, darkness in the object or picture being transmitted corresponding to currents up to the point B in Fig. 1. The receiving lamp L connected across the terminal amplifier could not give a representation of darkness on the receiving film, as it should for correct reproduction of the picture, unless the "dark" current were prevented from causing it to emit light. To eliminate the dark current from the lamp L, the shunting thermionic tube CL is adjusted by means of the adjustable rheostat R so that the dark current is shunted around the lamp L which results in only undistorted picture current passing through the receiving device L. The lamp L may be a gas filled lamp having two electrodes, such as a neon glow discharge lamp. Such a lamp is disclosed in Patent 1,461,360, July 10, 1923.

While the invention has been described in connection with picture reception it is applicable to other systems in which similar operating conditions are present.

The invention disclosed herein is obviously susceptible to various modifications and adaptations without departing from the scope and spirit of the invention and it is not intended to limit the invention to the specific structures herein shown and described, except as defined by the appended claims.

What is claimed is:

1. In a signal receiving system, an electric discharge lamp having a characteristic such that the light is proportional to impressed voltage over a range of voltages extending upwards from the striking voltage, means to impress upon said lamp voltages both within and below said range, and means for causing only the voltages within said range to be utilized in the production of the signal.

2. In a signaling system, a source of voltage producing two ranges of voltage the upper of which contains the voltages essential to signaling, a glow discharge lamp connected across said source and having a striking voltage corresponding to the lowermost voltage of the upper range of voltages from said source, and current carrying means in shunt to said lamp, whereby current may flow from said source corresponding to the lower range of voltages.

3. The combination with an electric lamp which produces light only when the impressed voltage has a value substantially above zero, means for impressing a varying voltage upon said lamp which is at times below said light emitting voltage, and a shunt circuit for said lamp through which current can pass of a value below that corresponding to the light emitting voltage.

4. In a signaling system, a source of current comprising an amplifier having a current output circuit, a source of light connected in series with said output circuit, light being produced only when the voltage impressed upon said light source has a value substantially above zero, and a shunt path for current of value below that corresponding to the light producing voltage.

5. In a system for producing images of pictures or of other objects, a source of current comprising an electron discharge amplifier in which the currents in the output circuit corresponding to the various light values of the picture or other object whose image is transmitted have a range of amplitudes the lowermost of which has a value substantially above zero, a glow discharge lamp having a striking voltage corresponding to said lowermost current value, and a shunt path for said lamp which carries all the amplifier output current up to said lowermost value.

6. In a receiver for producing images of pictures or of other objects, including a vacuum tube terminal amplifier, a receiving lamp, and a space discharge device, said discharge device being connected in parallel with said receiving lamp and across the output of said terminal amplifier.

7. In a receiving circuit for producing images of pictures or of other objects, a terminal amplifier, a receiving lamp connected in the output circuit of said amplifier, a two-element thermionic tube connected in parallel with said lamp, and means for adjusting the current saturation point of said thermionic tube.

8. In combination, a vacuum tube amplifier, a receiving device and a two-element space discharge device, the two said devices being connected in parallel with each other and both connected in series with the said amplifier, and means associated with the said discharge device for adjusting its current saturation point.

9. In combination, a vacuum tube amplifier, a receiving lamp, a two-element thermionic space discharge device having an electron emitting filament and an adjusting device, said receiving lamp and said discharge device being connected in parallel with each other and both in series with the said amplifier, and said adjusting device controlling the temperature of the filament of said discharge device.

10. In combination, a receiving lamp and a two-element thermionic tube connected in parallel with said receiving lamp, and means for varying the amount of current flowing through the heating element of said thermionic tube to adjust its current carrying capacity.

11. In a system energized from a source of electrical current having a non-linear characteristic between voltage and current up to a certain point and therefrom a substantially linear characteristic over a certain range, circuit controlling means for passing current corresponding to the non-linear portion of the characteristic through one path of said circuit and the current corresponding to the linear portion of the characteristic through another path of said circuit, the former path including an element having a current saturation point at a given value and the latter path a linear characteristic.

12. A method of reproducing an image by electrical means, which comprises producing current of varying amplitude, the variation bearing a linear relation to voltage over a certain range and a non-linear relation over a different range, using the linear current to reproduce the image, and dissipating the energy of the non-linear current in such a manner as not to affect the reproduction operation.

13. In a signal receiving system, an electric discharge lamp having a characteristic such that the light is proportional to impressed voltage over a range of voltages extending upwards from the striking voltage, means to impress upon said lamp voltages both within and below said range, and means to shunt around said lamp substantially all current caused to flow by voltages below said range, the voltages within said range being alone representative of the received signals.

14. A light emitting element, a source of current for causing said element to emit light and a current limiting device in shunt to said element with respect to said source, said light emitting element, said source and said current limiting device being so adjusted that light is generated in said light emitting element when the current limiting action takes place.

15. In an electro-optical image producing system, a receiving circuit comprising an electron discharge amplifier having an output circuit, a glow discharge lamp in said output circuit, voltage generating means in said output circuit for impressing voltage on said lamp not appreciably greater than the striking voltage when no image signal voltage is received, the emission from said lamp being substantially proportional to the voltage impressed thereon above the striking voltage, and means for causing the light emitted to be substantially proportional to the impressed signal voltage representing light conditions of the elemental areas of the object whose image is being produced.

In witness whereof, I hereunto subscribe my name this 30th day of July, A. D. 1926.

FRANK GRAY.