July 29, 1941. L. G. STEWART ET AL 2,250,730

ELECTRICAL REPRODUCING APPARATUS

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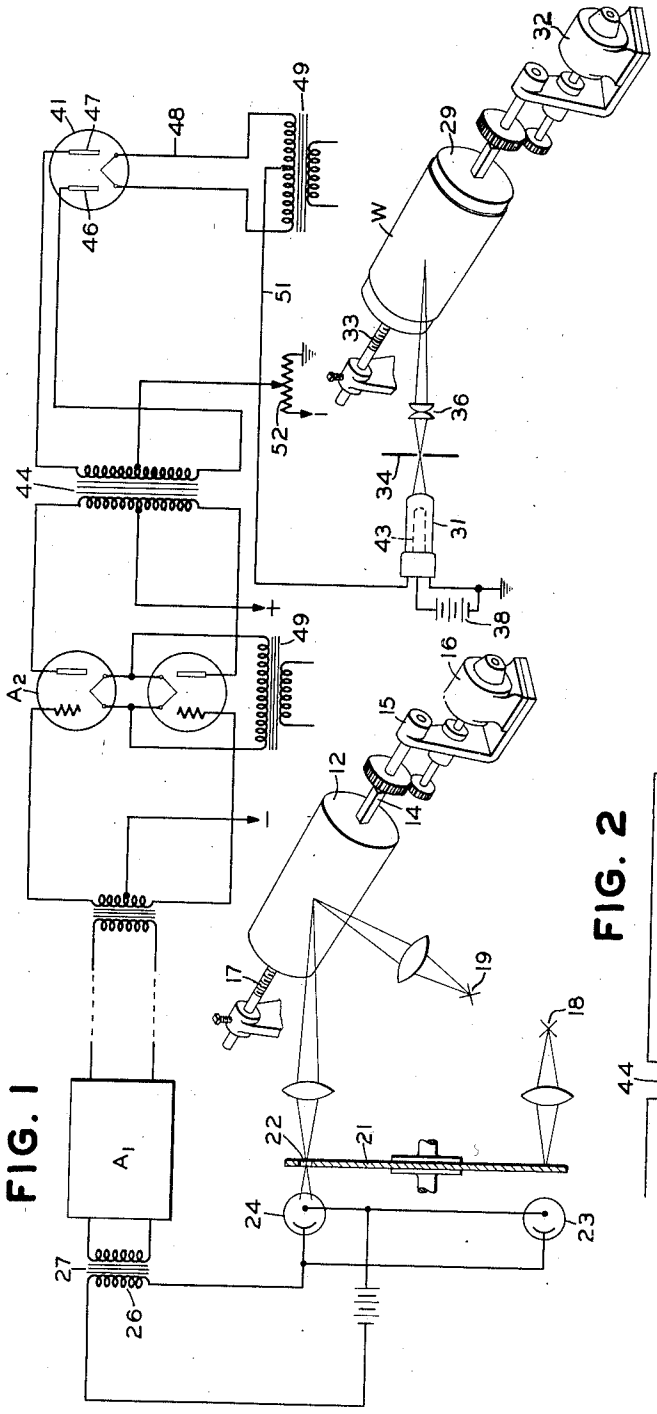


FIG. 1

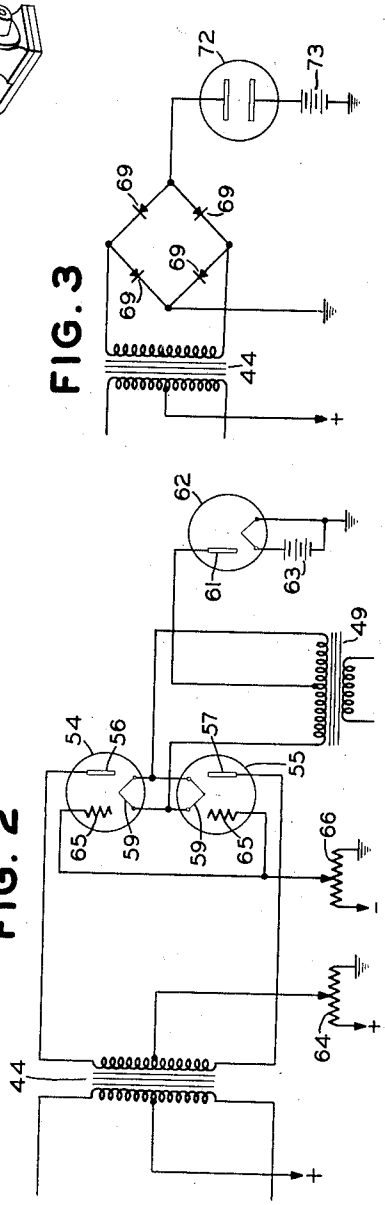


FIG. 2

FIG. 3

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ELECTRICAL REPRODUCING APPARATUS

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Application September 11, 1937, Serial No. 163,424

6 Claims. (Cl. 178—7.4)

The present invention relates to means for electrically reproducing or recording pictures, messages or other subject matter, and more particularly to a novel means for supplying a recording or television reproducing lamp, tube, or the like, with components of signal voltages and a biasing or striking voltage, enabling the lamp or tube to record transmitted subject matter or to reproduce an image thereof as in television.

In accordance with the invention in its preferred form, received signals representing pictures or other subject matter are applied to the anodes of a full wave rectifier which is connected in circuit with the glow tube to be used. The source of biasing voltage which may be of a value suitable to maintain the glow discharge within the tube is also included in circuit with the rectifier and the tube.

Accordingly, an important object of the invention is to provide means embodying a rectifier for applying signals representing pictures or other subject matter to a glow lamp or tube.

Still another object of the invention is to provide novel means for obtaining a signal controlled illumination variation in the tube or lamp which is within the range of contrast of the recording medium used.

A further object of the invention is to provide a novel arrangement of apparatus for feeding signal currents to a glow lamp or tube employing a space discharge tube or tubes having the grid or grids thereof maintained at a fixed potential by a constant but adjustable biasing voltage.

The foregoing and more specific objects will appear in the following complete disclosure of the invention in its several aspects. Referring to the drawing:

Fig. 1 is a diagrammatic presentation of the invention as embodied in a facsimile telegraph system;

Fig. 2 is a diagrammatic showing of a modification of the invention; and

Fig. 3 is a diagrammatic showing of another modification of the invention.

Referring to Fig. 1 of the drawing, there is shown a transmitter similar to that described in the application of R. J. Wise et al. Ser. No. 110,760, filed November 13, 1936, comprising a rotatable copyholder or cylinder 12 slidably supported by a driving shaft 14, which is journaled in a suitable manner in a bearing 15 forming a part of the transmitter framework and driven by a motor 16. The cylinder 12 moves axially along the threaded shaft 17 as it is rotated by the shaft 14. Transmission is effected by the apparatus illustrated in Fig. 1 in the manner described in the Wise et al. application above referred to. Briefly, the optical pickup device comprises two independent sources of illumination 18 and 19 and a rotary shutter or light chopper 21 having openings 22 adjacent its periphery to interrupt light rays from the sources 18 and 19, which are incident on the photocells 23 and 24 alternately if a positive picture is to be reproduced or recorded by the present invention. It will be understood that the light rays from the sources 18 and 19 may be simultaneously incident on the photocells whereby to record a negative at the receiver. In this case the source 18 can be of low intensity or it may be omitted.

The picture modulated signal may be derived by modulating a separately generated oscillating current with the picture signals obtained directly from the photocell 24 in which case the light chopper 21 may be omitted. The methods of obtaining picture signals referred to above form no part of the present invention and the scanning arrangement of the receiver which is briefly to be described is also well known. The transmitting apparatus and the receiving apparatus may include transmitting and receiving amplifiers A1 and A2 respectively which are interconnected by an available communication link or channel L.

The receiver illustrated by the right hand side of Fig. 1 shows an arrangement for obtaining a scanning movement between a web or blank *w* carried on the periphery of the recording cylinder 29 and a glow lamp or tube 31. The cylinder 29 is of substantially the same diameter as the transmitter cylinder 12 and is rotated in synchronism therewith in any suitable manner as by means of an alternating current synchronous motor 32 or other kind of motor which is kept in step with the driving motor 16 at the transmitter by any known method of obtaining synchronism. The threaded shaft 33 advances the drum 29 axially as it rotates so that the desired peripheral area thereof will be covered by the fluctuating beam of light from the tube 31 which passes through an aperture 34 and is imaged by a lens system 36 on the surface of the photo-sensitive blank *w*.

The tube 31 which may be any type of glow lamp or tube is indicated as being of the hot cathode type having a filament heated from the power source 38. A full wave rectifier of any type, illustrated as comprising the tube 41, serves

to feed signals derived from the amplifier A2 to the anode 43 of the tube 31. The amplifier A2 is of conventional design as shown and its output circuit includes the primary of a push-pull transformer 44. The secondary of this push-pull transformer is connected to the anodes 46 and 47 and to the cathode 48 of the rectifier tube. The rectifier cathode is heated from a transformer 49, the primary of which is connected to a suitable source of heating current. The mid-point of the secondary of the transformer 49 is in communication with the anode 43 of the tube 31 over a conductor 51. The cathode of the tube 31 is effectively connected to the anodes of the rectifier tube 41, the connection including the biasing source 52 for the glow lamp.

In operation of the facsimile system described, signals derived from the transmitter and received over the communication channel L are amplified in the amplifier A2 in the usual manner and are applied to the anodes 46 and 47 of the full wave rectifier. The half waves of the incoming signals are rectified and applied to the anode 43 of the tube 31 so as to vary the illumination emitted from the tube in accordance with the received signals. The source 52 illustrated as a potentiometer, provides for applying an adjustable positive bias on the anode 43 of the glow tube so that this tube in the absence of signals is just above its striking potential.

Fig. 2 of the drawing shows a modification of Fig. 1 in which the full wave rectifier is replaced by a grid controlled rectifier composed of three-electrode tubes 54 and 55. The anodes 56 and 57 of these tubes are connected to the secondary of the output transformer 44 in push-pull arrangement. The cathodes 59 are heated from a filament heating transformer 49 and the anode 61 of the glow tube 62 of any desired type is connected to the midpoint of the secondary of the heating transformer 49. The power source 63 supplies heating current for the filament of the tube 62 and is grounded as shown. If the tube 62 is of the cold cathode type, its cathode will be grounded directly or connected through a positive biasing source 64 to the anodes of the rectifier. The grids 65 of the rectifier tubes are supplied with a negative biasing potential from the adjustable point of a potentiometer 66. The biasing potential for the glow discharge tube 62 is supplied in the manner described in connection with Fig. 1 from the potentiometer 64.

The arrangement disclosed by Fig. 2 provides a means for obtaining a plate voltage characteristic of the full wave rectifier such that the illumination variation in the tube 62 is within the contrast range of the recording medium. For example, if the signal swing from the line L is too great for the tone range of the recording medium to give proper contrast, the grid bias may be adjusted so that the maximum illumination of the lamp will record black and lower intensity of illumination will record proportionately lighter shades of gray. This avoids the necessity for limiting the signal range at the transmitter and therefore minimizes the effects of transmission line noise.

Fig. 3 of the drawing discloses an arrangement somewhat similar to Fig. 1 except that the full wave rectifier is composed of four copper oxide rectifiers 69 which are connected in the conventional manner to produce full wave rectification from the alternating current output of the amplifier transformer 44. The secondary of the transformer 44 is connected to conjugate points on the rectifier and the anode and the cathode of the glow discharge tube 72 illustrated as the cold cathode type, are effectively connected to the remaining pair of conjugate points of the rectifier. Biasing potential is supplied to the glow discharge tube from the source 73. The operation of the arrangement of Fig. 3 is similar to the operation of Fig. 1 described above.

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 nature of the invention will be determined from the foregoing and the scope thereof is defined in the appended claims.

We claim:

1. In combination in a facsimile receiver, a glow discharge device, an amplifier, an output transformer having its primary connected to said amplifier, a rectifier comprising two anode elements, the opposite ends of the secondary of said transformer being connected to said rectifier anodes, a connection from the cathode of said rectifier to an element of said discharge device, the remaining element of said discharge device being connected to the midpoint of said transformer secondary, said last named connection including a source of biasing potential for said device.

2. A facsimile recorder comprising a source of light, scanning means cooperating with said light source to produce a record representing transmitted copy, an amplifier, an output transformer for said amplifier embodying primary and secondary windings, a rectifier embodying cathode and anode elements, the latter being connected to said secondary, said cathode being connected to said light source in circuit with a source of biasing potential and a connection from said source to the midpoint of said secondary.

3. In a facsimile receiver, an electric lamp which produces light only when the impressed voltage has a range substantially above zero, means comprising a rectifier for impressing upon said lamp a unidirectional voltage undulating in accordance with picture signals, the said voltage having at times a value less than the voltage necessary to cause said lamp to emit light, and a source of constant voltage in series with said lamp and said rectifier for maintaining said lamp substantially at the light emitting voltage, said undulating unidirectional voltage being the sole electrical effect which varies the illumination of said lamp in accordance with received signals.

4. In combination in a facsimile receiver, a glow discharge device, a source of varying potential, a rectifier comprising a cathode, an anode and a control element, means to maintain a constant potential on said control element, said rectifier and said glow discharge device being connected in series with said source of varying potential and with a source of biasing potential for said glow discharge device.

5. In a picture transmission system, a transmitter comprising means to produce alternating current signals representing picture elements, a receiver embodying a source of light, a communication circuit interconnecting said transmitter and receiver, a recording medium, said recording medium being responsive to said light source, scanning means at said receiver to effect a scanning of said medium by said light source, a rectifier for applying received signals as an undulating unidirectional voltage to said source of light, said rectifier including means to control the characteristic of said rectifier, and means to

maintain a constant predetermined potential on said rectifier characteristic controlling means to modify the amplitude of variation of said undulating potential, whereby the light values emitted from said light source will affect said recording medium to record picture elements on said recording medium corresponding to said transmitted signals.

6. In a picture transmission system, a transmitter comprising means to produce alternating current signals representing picture elements, said signals having a wide amplitude range suitable for transmission, a receiver embodying a source of light, a communication circuit interconnecting said transmitter and receiver, a recording medium, said recording medium being responsive to said light source throughout a relatively limited range of illumination values, scanning means at said receiver to effect a scanning of said medium by said light source, a rectifier for applying received signals as an undulating unidirectional voltage to said source of light, said rectifier including means to control the characteristic of said rectifier, and means to maintain a constant predetermined potential on said rectifier characteristic controlling means to reduce the amplitude of variation of said undulating potential, whereby the range of light values emitted from said light source will be within the range of responsiveness of said recording medium to illumination variations of said light source.

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