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ELECTROOPTICAL SYSTEM

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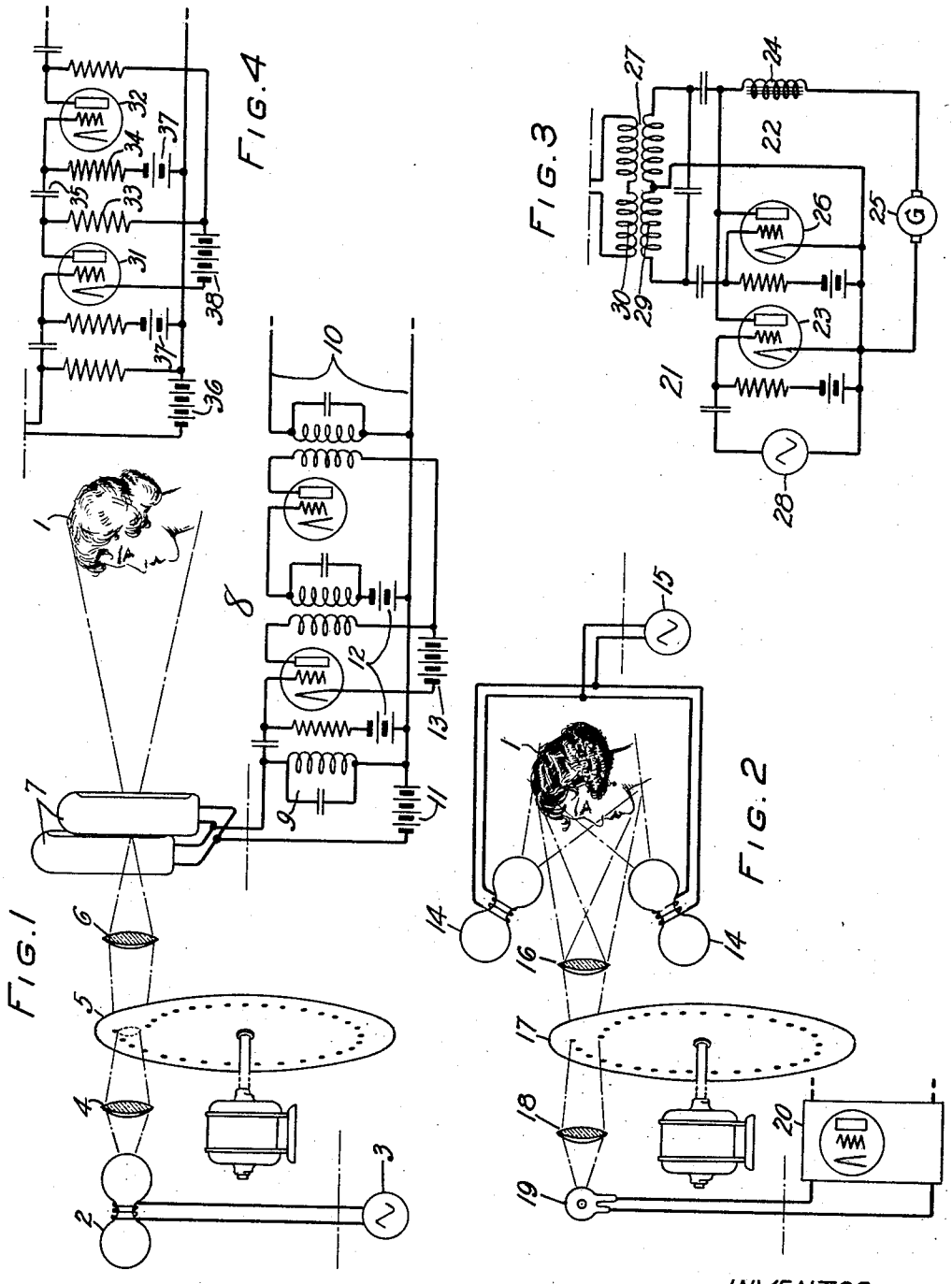

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ELECTROOPTICAL SYSTEM

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This invention relates to electro-optical systems and particularly to transmitting apparatus therefor.

The invention contemplates the production of a photoelectric current of carrier frequency modulated in accordance with the light intensities of an object to be transmitted.

It has heretofore been proposed to accomplish the result described above either by chopping the light beam at a carrier frequency rate, before or after the scanning process, or by electrically energizing the photoelectric cell with a current of carrier frequency.

Another proposal includes the use of an oscillatory current for energizing a source supplying a field or object with light, which is thereby varied in accordance with the tone values of the elemental areas of an object or field. The doubly varied light is applied to a photoelectric cell to produce current which is used to modulate a carrier wave.

In accordance with a preferred embodiment of the present invention, the light source is energized by a current of carrier frequency to provide illumination for a field or object to be scanned at a transmitting station. The light radiations, varying at carrier frequency and also in accordance with the tone values of elemental areas of the field or object, are then applied to a photoelectric cell, which is thereby controlled to produce a carrier frequency current modulated in amplitude in accordance with the tone values of the field.

An object of the invention is to control the production of photoelectric currents by radiations from a prime source of light which varies at a carrier frequency rate and also as the tone values of an object or field to be transmitted.

A feature of the invention relates to the provision of a light source, energized by current of carrier frequency for illuminating an object to be transmitted, as a means to control the production of photoelectric currents.

A more detailed description of the invention follows and is illustrated in the attached drawing, in which

Fig. 1 illustrates a television transmitter in which the object is scanned by a spot of light;

Fig. 2 is similar to Fig. 1, but the object is flood lighted;

Fig. 3 illustrates a system for supplying current to the illuminating source, and

Fig. 4 shows an amplifier which may be used with the system of Fig. 3.

In Figure 1, the subject 1 to be transmitted is illuminated by a lighting device 2, supplied with current by a high frequency current source 3.

The subject may be a human being, either still or moving or a scene including still or animated objects. The device 2 may be any lamp adapted to produce light radiations fluctuating at high frequency when supplied with current from the source 3. An induction lamp of the type disclosed in U. S. Patent 966,204 Aug. 2, 1910 to Hewitt is suitable for this purpose. High frequency current may be supplied from any well known source, a vacuum tube oscillating system constitutes such a source.

The light source 2 is imaged by a lens 4 upon the scanning disc 5, provided with a series of apertures arranged in a spiral line. The light radiations, passing through the perforations of the disc 5, are concentrated by a lens 6 into an intense spot of light.

As disclosed in U. S. application Serial No. 227,649 filed October 21, 1927 by F. Gray, the disc 5 operates to cause the spot of light to transverse successive parallel lines of the subject 1. The disc is driven at a rate of speed such that the subject is completely scanned a number of times per second, corresponding to the persistence of vision.

The light reflected from the subject 1 is applied to and serves to activate the photoelectric cells 7. Current is supplied to the space path within the photoelectric cells 7 by the source 11, herein shown by way of example as a battery. Since the light produced by the lamp 2 fluctuates in intensity in step with the current supplied by the source 3 and is further caused to vary as the tone values of elemental areas of the subject 1, the photoelectric cells 7 will be activated to produce a

high frequency current having its amplitude modulated in accordance with the varying tones of the subject.

The modulated high frequency current is supplied to the input electrodes of an amplifier 8, herein shown as a two-stage amplifier including space discharge tubes. The filaments of the tubes, included in amplifier 8, are heated by any suitable source, (not shown), grid biasing potential is supplied by the tubes by the sources 12 and space current is supplied thereto by the source 13.

Obviously the amplifier 8 may include amplifying devices of any type. The only requirement is that they repeat the modulated wave without distortion. Again, one or any number of stages may be used. The input circuit of each stage of the amplifier includes a loop circuit tuned to the frequency of the impressed wave whereby the photoelectrically produced amplitude modulated high frequency wave is selectively amplified. After being amplified to the required degree, the modulated wave is supplied to a transmission circuit 10, which may be associated with an antenna or a line.

The system of Fig. 2 differs from that of Fig. 1, mainly in that the subject 1 is illuminated by flood lights. In other words, the subject is completely illuminated at all times. For this purpose two induction lamps 14 are used. These lamps are supplied with current by the high frequency source 15.

The lens 16 serves to image the subject 1 upon the scanning disc 17, provided with a spiral row of apertures. The disc 17 is driven at a rate of seed such that the subject is completely scanned a number of times per second, corresponding to the persistence of vision. The light passing through the spiral of apertures is concentrated by the lens 18 upon the photoelectric cell system 19, which may include any desired number of cells.

The photoelectric cell system 19 is controlled to produce a carrier wave, modulated in amplitude by image currents corresponding to tone values of the elemental areas of the subject 1. As in the system of Fig. 1, the carrier modulated wave is amplified in the amplifier indication by 20 and supplied to a transmission circuit.

In general induction lamps require the use of an energizing current of such high frequency that it cannot be efficiently transmitted to a remote receiving station over a line.

Fig. 3 illustrates an apparatus 21 for producing current, which may be used to energize induction lamps so that they produce light radiations varying at a frequency which may be efficiently transmitted over a line. Hence by substituting this source for that shown at 3 or 15, the systems of Fig. 1 or 2 may be made available for use with a transmission line.

The apparatus of Fig. 3 comprises a space discharge oscillator 22 and a modulator tube 23, the output circuits of which are supplied with space current from a source 25 in parallel through a constant frequency choke coil 24.

The oscillator 22 is of the type disclosed in U. S. Patent 1,356,763 issued October 26, 1920 to Hartley. It includes a tube 26 having a filament, a grid, and an anode associated with a tuned circuit 27, which serves in general to determine the frequency of the oscillations generated. These may be of high frequency suitable for energizing an induction lamp. The input circuit of the modulator 23 is supplied with a current of line carrier frequency by a source 28.

The above described system operates in the manner disclosed in U. S. Patent 1,442,147, issued January 16, 1923 to Heising, to combine the line carrier current supplied by the source 28 with the high frequency oscillations generated by the oscillator 22. This system will operate to produce, in the plate circuit of the oscillator, a current of line carrier frequency, a current of high frequency and two sidebands having frequencies respectively equal to the sum and the difference of the carrier and high frequencies.

By substituting the source 21 for the source 3 or 15 of Figs. 1 and 2 respectively, the induction lamps will be energized to produce light radiations fluctuating in accordance with the different frequency currents supplied to it. After being used to scan the subject, the light produced by the induction lamps is supplied to the photoelectric cells, which are thereby caused to produce, among other components, a current of line carrier frequency modulated in amplitude in accordance with the tone values of the elemental areas of the subject. These, are amplified and supplied to transmission circuit.

A simple arrangement for amplifying the image current modulated line carrier wave supplied by the photoelectric cell system is shown in Fig. 4. This amplifier comprises resistance coupled space discharge tubes, the constants of the circuit being so chosen that it operates more efficiently as an amplifier of the components of line carrier frequency than the components of high frequency.

As illustrated, the amplifier consists of two space discharge tubes 31 and 32 intercoupled by resistances 33 and 34, respectively, in shunt to the output electrodes of one tube and the input electrodes of the succeeding tube. The lead connecting the upper terminals of the resistances 33 and 34 includes a series condenser 35. The photoelectric cell system may be included in or coupled to the input circuit of the tube 31. A battery 36 supplies space current to the photoelectric cells. The filaments of tubes 31 and 32 are supplied with heating current from any suit-

able source, not shown. Biasing potentials are supplied to the grids of the tubes by the batteries 37 and current is supplied to the space paths within the tubes by the source 38, herein shown as a battery.

Obviously the amplifier circuits could be tuned to the line carrier frequency, i. e. either the input or output circuit or both could be provided with a tuned circuit. In this case the amplifier would selectively amplify the line carrier wave while the high frequency wave would be sharply attenuated.

As a matter of fact the system of Fig. 3 provides a means for simultaneously producing a high frequency carrier wave and a line frequency carrier wave each modulated by the tone values of the subject to be transmitted. It therefore provides a means whereby currents modulated by the same image variations may be simultaneously supplied for transmission over a radio link and over a transmission line.

What is claimed is:

1. A transmitter for an electro-optical system comprising an induction lamp, means for energizing said lamp with composite current including components of high and line carrier frequencies, a light sensitive device, and means for controlling by elemental areas of a subject to be transmitted the light supplied from said source to said sensitive device.

2. A transmitter for an electro-optical system comprising an induction lamp, a source for supplying said lamp with energizing current of high frequency modulated with a current of line carrier frequency, a light sensitive device, and means for controlling, by elemental areas of a subject to be transmitted, the light supplied by said lamp to said sensitive device to cause the production of a line carrier wave modulated in accordance with said elemental areas.

3. An electro-optical apparatus comprising an induction lamp, a source supplying said lamp with energizing current simultaneously varying at different frequencies, a light sensitive device, and means for controlling, by elemental areas of a subject, the light supplied by said lamp to said light sensitive device.

4. An electro-optical apparatus comprising an induction lamp, a source supplying current simultaneously varying at high and line carrier frequencies, a light sensitive device, and means for controlling, by elemental areas of a subject, the light supplied by said lamp to said light sensitive device.

5. An electro-optical system comprising an induction lamp, a source supplying said lamp with energizing current having components of different frequencies each of which is of constant amplitude, a light sensitive device, and means for controlling, by elemental areas of a subject, the light supplied by said lamp to said light sensitive device.

In witness whereof, I hereunto subscribe my name this 22 day of January, 1930.

FRANK GRAY.