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ELECTROOPTICAL SYSTEM AND METHOD OF TRANSMISSION

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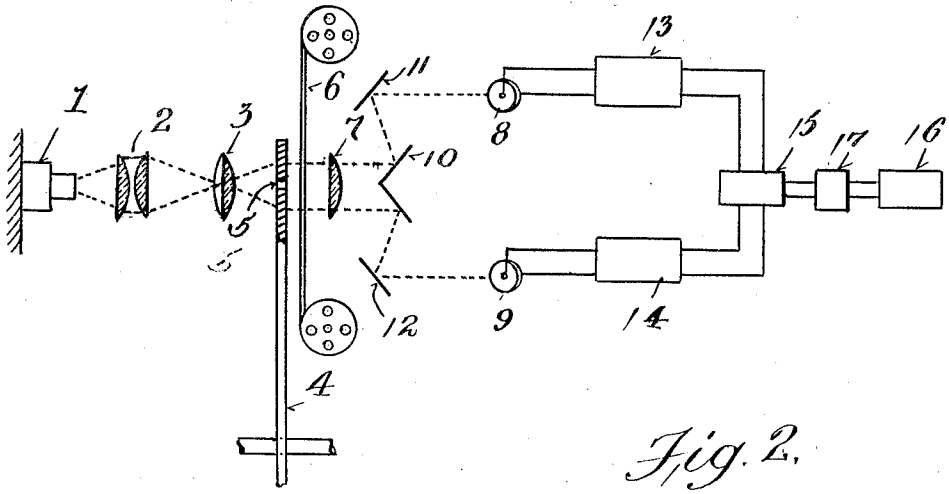


Fig. 2.

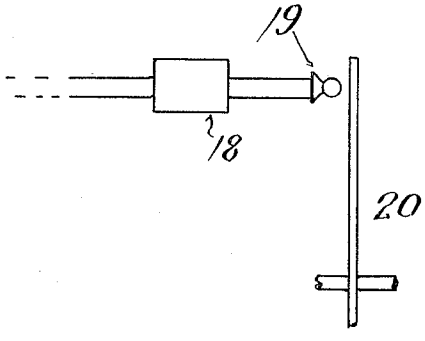


Fig. 1.

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ELECTROOPTICAL SYSTEM AND METHOD OF TRANSMISSION

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1 Claim. (Cl. 178—6)

This invention relates to electro-optical systems, and with particularity to systems for amplifying and transmitting message or signal currents having a very wide frequency spectrum.

An object of the invention is to provide a method of amplifying and transmitting message or signal currents having a wide frequency spectrum so that the several frequency components are amplified to a uniform level.

Another object is to provide novel methods and means of amplifying television signals or currents whereby a greater frequency spectrum may be transmitted, thus enabling an image or picture to be reproduced with a greater degree of faithfulness as regards the original.

In certain types of transmission systems, and particularly in television systems, in order that the original message or picture may be reproduced electro-optically with all its original detail, it is necessary to transmit currents having a frequency range extending as low as 15 cycles per second and as high as 100 kilocycles.

Inasmuch as the response of the light-sensitive device must be amplified to a certain level prior to transmission, it has been found impracticable to build a single amplifier which uniformly and efficiently amplifies the different frequency ranges required.

Accordingly, it is a feature of the present invention to provide a method of amplifying television or similar signals by separately amplifying a plurality of different frequency ranges. As a result of this arrangement each amplifier can be designed and built to amplify a respective range of frequencies with the desired efficiency.

Another feature relates to the method of controlling a plurality of separate amplifiers by a single scanning device.

Another feature relates to the method of amplifying the low frequency components corresponding to an image or visual representation to be transmitted, by optically dividing the light from each elemental area of the representation into a plurality of mutually separate channels, one channel being capable of efficiently amplifying the low frequency components and the other or other channels capable of efficiently amplifying other higher frequency components or frequency ranges.

Other features and advantages not specifically enumerated will be apparent after a consideration of the following descriptions and the appended claim.

Referring to the drawing;

Fig. 1 shows in schematic form one preferred embodiment of the invention;

Fig. 2 illustrates schematically a receiving station to be operated under control of the apparatus of Fig. 1.

While the invention will be described as applied to a system employing certain well known types of apparatus it will be understood that other types of apparatus may be employed, and details not necessary to a complete understanding of the invention have been omitted for the sake of clarity.

Referring to Fig. 1 the numeral 1 represents a source of light of high and constant intensity such as an arc lamp or the like. The light from source 1 is collected by the lens system 2, 3 and projected upon the scanning field of the scanning device 4. This scanning device may take the form of a disc having a series of scanning elements or apertures, one of which is indicated in the drawing by the numeral 5. These scanning apertures may be equi-distant from the axis of rotation of the disc 4, or may be arranged in the path of a spiral or spirals around the disc, as is well known in the art. Positioned on the opposite side of the disc is a picture or other visual representation to be transmitted, and represented in the drawing as a motion picture film 6. If the film 6 is to be moved in a continuous manner then it is preferred to provide a scanning disc 4 having scanning apertures equi-distant from center. On the other hand, if the film 6 is to be moved in a step-by-step fashion, then the scanning apertures are preferably arranged in spiral fashion. In effect, therefore, as the disc 4 rotates at the requisite speed the film 6 is traversed by a moving spot of light of high intensity, this spot tracing adjacent parallel elemental strips transversely across the width of the film in the well known manner. This light spot may be picked up in any well known manner either by reflection or by transmission. In the drawing it is assumed that the film 6 is of the ordinary motion picture type having different degrees of transparency from one elemental area to the next in which case the light passing through the scanning apertures is further modulated by the degrees of transparency of the successive elemental areas of the film 6. It will be understood of course that instead of transmitting the scanning beam through the transparent film the latter may take the form of a solid object in which case the moving spot may be picked up by reflection from the object.

However, for the purpose of explanation it will

be assumed that the transmission method of light pick-up is employed in which case there is situated on the opposite side of the film 6 a suitable optical system represented by the lens 7 for collecting the light that passes through the film 6 for projection upon the photo-sensitive devices 8 and 9 according to the invention. While the light which passes through lens 7 may be projected upon the cells 8 and 9 directly, it is preferred, for the sake of convenience and ease of manipulation to provide a pair of parallel light reflecting paths. Thus as indicated by the numeral 10 there is situated in the path of the light beam emerging from lens 7 a double reflector and associated with reflector 10 and symmetrically disposed laterally with respect thereto is a pair of reflecting members 11 and 12. The members 10, 11 and 12 may take the form of mirrors, reflecting prisms, or other similar device. Thus the light beam which passes through each elemental area of film 6 is divided into two paths one for energizing the photo-sensitive device 8 and the other for energizing the photo-sensitive device 9. The device 8 is coupled to an amplifier schematically represented in the drawing by the numeral 13, and similarly the device 9 is coupled to a corresponding amplifier 14. When the devices 8 and 9 take the form of photo electric cells of the usual type they are capable of responding with great sensitivity and rapidity to the light fluctuations, and consequently the curve of current variations from the cells possesses at least theoretically an infinite number of frequency components. It has been found that in order to effect reproduction with requisite faithfulness as regards the original that the low frequency components of the photo-electric currents must be amplified equally as well as the higher frequency components. It has also been found that the amplifier system must be capable of efficiently amplifying a frequency range extending as low as 15 cycles, and as high as 100 kilocycles, and even higher.

The difficulty of building and handling a single amplifier capable of amplifying such a range of frequencies is so well known as to require no further comment. Indeed the difficulty in building such an amplifier is so great as to render its cost and maintenance practically prohibitive. In order to overcome these disadvantages it is proposed to employ the separate amplifiers 13 and 14 as shown in the drawing. The amplifier 13, for example being so designed as to amplify efficiently a certain range of frequencies, for example those extending from 0 to 5000, while the amplifier 14 is designed to amplify efficiently frequencies of 5000 and upward. It has been found that the amplifiers 13 and 14 for this purpose may be comparatively economically built and maintained in operation. The amplified outputs of the respective amplifiers are then led to a suitable mixing circuit represented schematically by the numeral 15, whereby the amplitudes of the amplified outputs may be conveniently proportioned and regulated as is found most desirable. The mixed outputs are then supplied to a common output circuit 16 which may take the form of any well known radio transmitter.

If desired, a common amplifier 17 may be interposed between the mixing device 15 and the transmitter. This amplifier may be of the ordinary construction, but preferably capable of amplifying a very wide frequency range with the optimum uniformity. However, as hereinabove mentioned, such an amplifier will in practice amplify one part of the frequency range with greater efficiency than another part. However, this non-uniformity of amplification may be taken care of by means of the mixing device 15. As an example, assuming that the amplifier 17 amplifies the frequency above 5000 with greater efficiency than the frequencies below 5000, this amplifier 13 which is designed efficiently to amplify the frequencies below 5000 is adjusted until the gain of the low frequency components from amplifier 17 is at the desired amplitude as compared with the higher frequency components amplified by amplifier 14.

The above described arrangement of separate amplifiers 13 and 14 has the practical advantage that the gain of a given frequency range may be rapidly and separately adjusted without altering the gain of another frequency range.

While the amplifiers 13 and 14 may take any well known form, there is preferred to employ so-called resistance coupled amplifiers and preferably also amplifiers capable of amplifying direct currents as well as pulsating or alternating currents.

While the drawing shows two separate amplifiers 13 and 14 for amplifying efficiently two ranges of frequencies, it will be understood that any greater number of amplifiers may be employed. For example, the light from each elemental area of the object or visual representation being scanned may be projected upon four separate photoelectric cells, each being connected to its respective amplifier and the amplifiers being connected to a common output circuit as hereinabove described. However, one amplifier for example, may be designed efficiently to amplify frequencies between 0 and 5 kilocycles, another amplifier between 5 and 20 kilocycles, another between 20 and 50 kilocycles, and another between 50 and 100 kilocycles, etc., in accordance with the degree of faithfulness required in reproduction.

Any well known form of television receiving mechanism may be employed for the transmitting system of Fig. 1. Thus, as shown in Fig. 2 the transmitted currents are detected and/or amplified as represented schematically by the numeral 18 and the amplified received currents are impressed upon a suitable reproducing light source 19, preferably of the neon type. The source 19, in the well known manner, is positioned adjacent to the scanning member 20, which may be similar to the member 4 at the transmitter and rotated in synchronism therewith in any convenient manner. It will be obvious, of course, that other types of scanning devices such as drums or bands may be employed in place of the disc 20.

In order that the utmost degree of faithfulness may be reached in reproduction, it may be found desirable to employ another set of amplifiers at the receiving station similar to the amplifiers 13 and 14 at the transmitting station, whereby the received currents may be employed in the proper proportions. However, separate amplifiers may be avoided at the receiving station by so proportioning the gains of the amplifiers 13 and 14 at the transmitting station that the overall output from the receiving amplifier 18 has the proper relation between the several frequency ranges. In other words, the gains of the devices 13 and 14 may be so proportioned as to provide the necessary linearity of amplification throughout the entire system.

Various other changes and modifications may

be made without departing from the spirit and scope of the invention.

What is claimed as new and useful is:

In a system of the character described the combination of a light beam having an intensity corresponding to an elemental area of a representation to be transmitted, a system of reflectors for dividing said beam into two discrete beams, a photo-sensitive device controlled by each of said discrete beams, and an amplifier for each photo-sensitive device, one amplifier having a different gain characteristic from the other, means for combining the outputs of said amplifiers, and for transmitting the combined output over a single channel to a distant receiving station.

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