

Feb. 6, 1934.

D. S. DE AMICIS

1,945,968

TELEVISION SYSTEM AND APPARATUS

Original Filed June 27, 1929

2 Sheets-Sheet 1

Fig. 1

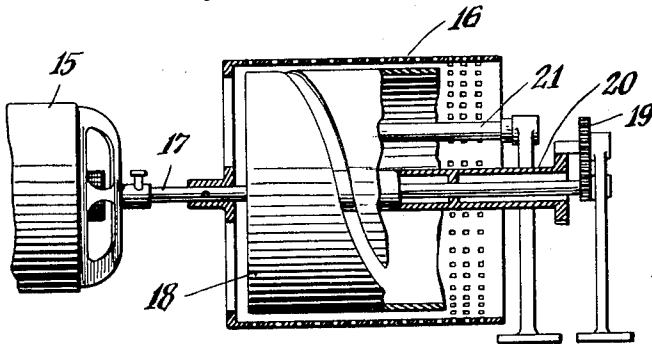


Fig. 2

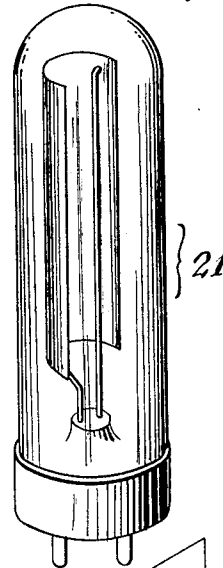


Fig. 6

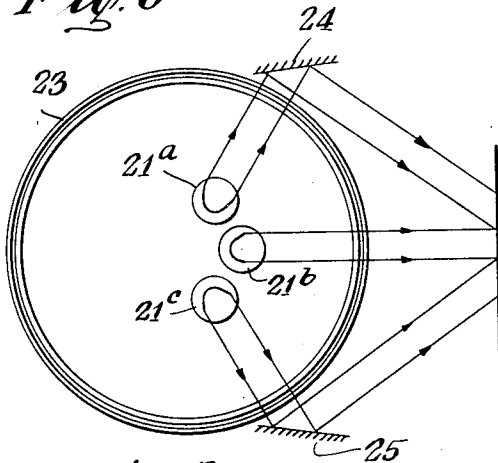


Fig. 7

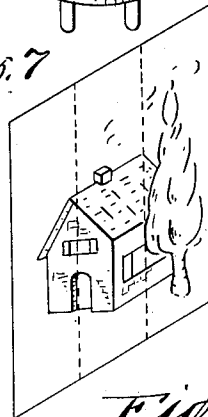


Fig. 3

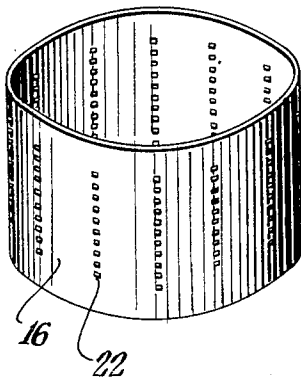


Fig. 4

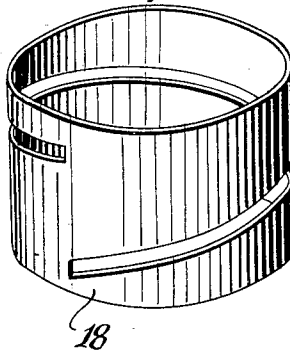
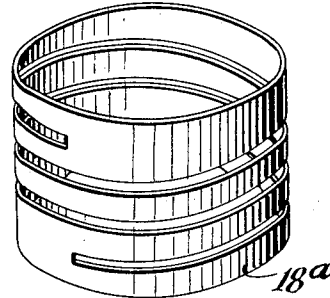


Fig. 5



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2 Sheets-Sheet. 2

Fig. 10

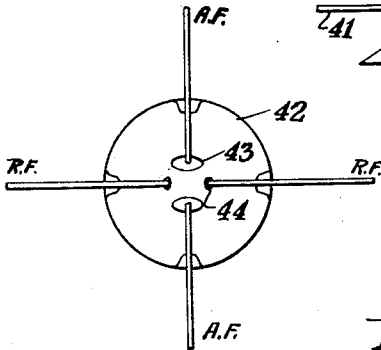
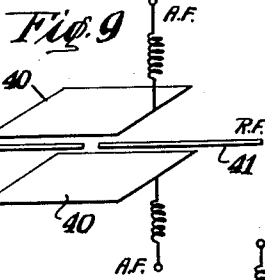
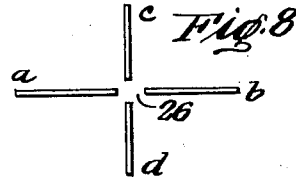


Fig. 11

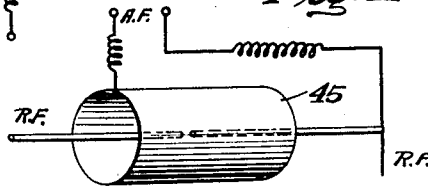


Fig. 12

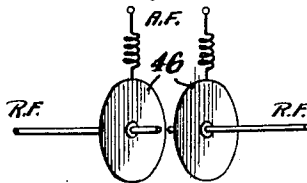


Fig. 13

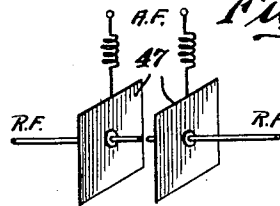


Fig. 14

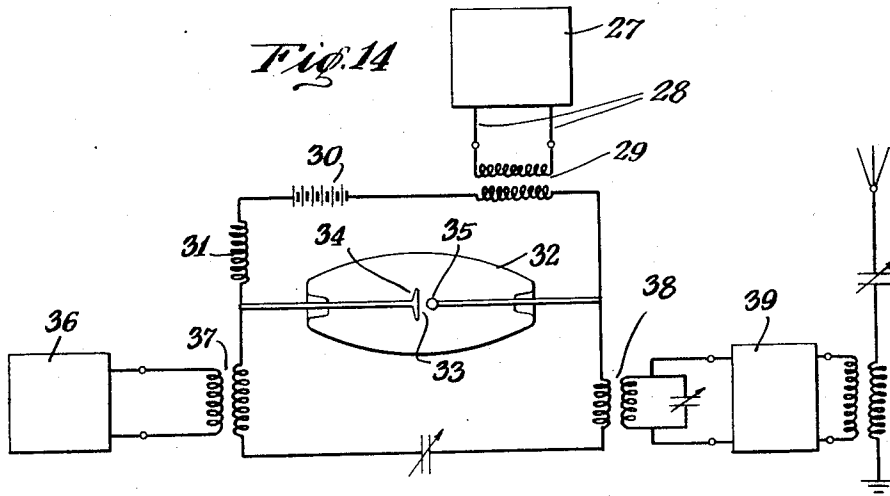
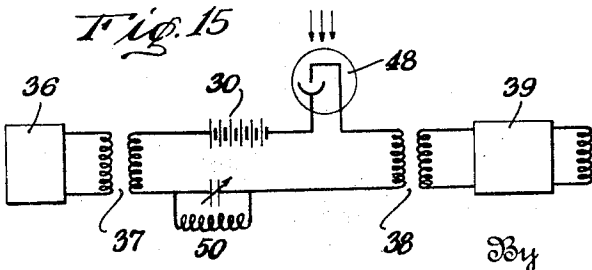


Fig. 15



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UNITED STATES PATENT OFFICE

1,945,968

TELEVISION SYSTEM AND APPARATUS

Domenic Sicari de Amicis, Jersey City, N. J.

Original application June 27, 1929, Serial No. 374,053. Divided and this application August 30, 1930. Serial No. 477,847

4 Claims. (Cl. 178—6)

This invention relates to television and more particularly to methods of and means for transmitting images and electrical phenomena with greater definiteness and efficiency.

5 This application is a division of my application, Serial No. 374,053, filed June 27, 1929.

The general object of the invention is to provide a system of radio communication, particularly television, in which a single wave of predetermined and constant frequency may be employed for each communication channel, the single wave being suitably controlled to carry out the objects heretofore intended to be accomplished by a band of waves.

15 In order to suitably analyze an image at a sending station, and effect concomitant composition at a receiving station, it is customary to use a plurality of waves of varying wave lengths, the different waves being utilized at different frequencies. Thus, it has heretofore been customary, for television purposes to use a carrier wave, in the radio frequency range, and a signal wave, generally in the audio frequency range, the combination necessitating a band of waves ranging to 100 kilocycles. This is due to the system of transmission and modulation employed, the modulation of the carrier wave by the signal and its subsequent amplification resulting in an output which is a function of the characteristic of the tube.

20 Applicant proposes to provide a new system of wave transmission and modulation by utilizing a single wave of desired frequency, whose modifications in form and character will be carried on by varying the resistance of a gap between electrodes in an ionization tube serving a circuit therefor.

25 A feature of the invention therefore resides in the provision of a tube employing one or more pairs of electrodes positioned with respect to a gap, whose resistance is varied responsive to change in the character of a circuit served by some of said electrodes. Thus, for example, an ionization tube may be employed in combination with an audio frequency amplifier, the resistance of a gap between electrodes in the tube being varied responsive to changes in wave form characteristics of the audio frequency signal. By utilizing a master oscillator, or the like, producing a constant frequency wave, changes in form of the wave may be effected by employing the resistance of said gap to vary the E. M. F. of the constant characteristic wave. A radio frequency amplifier has its output correspondingly varied and hence is enabled to transmit a single wave

of constant frequency whose resultant form has the same effect as the sum of the audio frequency and radio frequency sinusoidal component waves now have, except that applicant eliminates the side bands encountered in the present system. 60

Another object of the invention is to provide an improved method and apparatus for analyzing or scanning an image at a sending station and composing said image at a receiving station.

In order to more effectively analyze the image and obtain a better defined beam upon the light-sensitive, photo-electric cell employed to respond, in the usual manner, to variations in the intensity of the different portions of the image, applicant employs an electric glow lamp of the ionization type. This lamp has a pair of electrodes either of which may serve as the negative side, and in which the concentration of the ionization current is effected to increase the luminosity. To better obtain a concentrated beam, one of the electrodes is formed as a reflector having a surface of circular, hyperbolic, parabolic, or other conformation. 65 70 75

By using a plurality of such glow lamps, alone or in combination with reflecting means, applicant is enabled to produce an image composed of various sections, each of which is formed by an individual glow lamp of the plurality used. 80

In order to obtain an image of great clarity, whose features are individually distinct and sharp, it is highly desirable to analyze the image into a great number of small parts, and this applicant accomplishes by utilizing a scanning means adapted to contain any number of analyzing openings. 85 90

A further feature of the invention therefore resides in the use of a rotary drum having a plurality of helices thereon containing openings, each preferably square in form. By utilizing squares a complete image is formed, not equally obtainable by the use of round holes. In scanning an image it is, for best performance, necessary to expose but a single opening at a time. Applicant therefore provides a distributing drum in combination with the analyzing drum for assuring exposure of a single opening at a time, and enabling maximum speed of rotation without diffusion of light before different openings. Where a great number of helices are provided with an analyzing drum, it is desirable at times to utilize a number of distributing drums in order to obtain maximum scanning efficiency. 95 100 105

Other objects and features, making for efficiency, economy and dispatch, in the art of television, will be apparent from the following 110

description read in connection with the accompanying drawings, in which:

Fig. 1 represents a fragmentary view, partly in section, of a scanning and distributing drum suitably mounted in association with one another;

Fig. 2 is a perspective view of an ionization glow lamp adapted to be used in combination with scanning equipment, such as that shown in Fig. 1;

Fig. 3 is a perspective view of a scanning or composing drum, for convenience called a scanning drum;

Figs. 4 and 5 illustrate distributing drums adapted to be used with a scanning drum;

Fig. 6 represents a plurality of glow lamps within a drum, adapted to transmit, and receive for composition, sections of an image;

Fig. 7 illustrates an image, the dotted lines indicating the sections, each of which may be served by an individual glow lamp and a portion of a drum;

Fig. 8 is a diagrammatic illustration of a plurality of electrodes adapted to be used in an ionization tube designed to carry out applicant's method of wave transmission and control;

Figs. 9 to 13 illustrate different ensembles of electrodes constituting variations of the arrangement shown in Fig. 8, and

Figs. 14 and 15 are diagrammatic circuit arrangements illustrating two applications of applicant's system.

Considering the drawings, similar designations referring to similar parts, numeral 15 represents a motor adapted to drive scanning or analyzing drum 16 through shaft 17, and distributing drum 18 through gear arrangement 19 and its associated shaft 20. Ionization glow lamp 21 is suitably positioned, as illustrated, within the drum. As diagrammatically shown in Fig. 6, a plurality of glow lamps may be employed and positioned within a drum in any desired arrangement.

Referring more particularly to Figs. 3 to 5, it may be noted scanning drum 16 has a plurality of openings 22, which are preferably square in shape. A continuous line through the centers of these openings will form a plurality of helices on the surface of the drum. This is so arranged in that during the scanning operation the far edge of one opening will be in alignment with the near edge of the adjacent opening, or so arranged that each opening will scan a particular bit of an image, and the greater the number of openings provided, the greater will be the number of bits of image transmitted, and greater the definiteness of the resultant image. As may be noted in Fig. 3, applicant provides as many convolutions as is deemed desirable, or as is limited by the physical limitations of the apparatus. For practical purposes, it may be assumed that he employs n convolutions. It may be seen that if a drum of n convolutions, each convolution containing m openings, were used without the provision of means for exposing one opening at a time to the glow lamp, that diffusion of light between different openings would make proper scanning and image transmission and reception practically impossible. Applicant, therefore, provides distributing drums such as 18 and 18^a, each of which has helical openings or slots therein of a desired number of convolutions. Thus in Fig. 4, one convolution is provided, whereas in Fig. 5 three are provided. Of course, the helices of each drum cover the width

of the band of helices employed on the scanning drum. It may, therefore, be seen that by combining the scanning and distributing drums one within the other, it is readily possible to confine the light to a single opening at a time regardless of the speed at which the scanning drum is operated. If the number of openings in the scanning drum is increased, it may be necessary to use a greater number of distributing drums. This, however, is a matter of mechanics and, within the purview of this invention, it is contemplated that any number of distributing drums may be used, having different series of helical convolutions in the form of slot openings therein, adapted to be combined with a scanning drum having any number of openings, limited only by the image to be transmitted and the desired speed of operation.

In operation, if the drum in Fig. 3, for example, has n convolutions with respect to the one convolution in Fig. 4, it will rotate at a speed n times that of the drum in Fig. 4. Correspondingly, the drum of Fig. 5 will then operate at a speed three times that of the drum in Fig. 4. By suitable mechanism synchronism of motion may be accomplished so that not only will the speeds be proportional to the total lengths of the respective convolutions, but the relative positions for assuring scanning through one opening at a time in desired successive order, will be maintained throughout the operation.

It is understood of course, that any desired arrangement may be employed for projecting the image upon a light-sensitive, electric cell, and for carrying out other steps in the process, not pertinent to the invention.

Referring particularly to Fig. 6, glow lamps 21 are shown grouped within drum arrangement 23, and are designed to sectionally scan or compose an image. Thus lamp 21^a in combination with a mirror 24 will project one-third of an image. Lamp 21^b, as positioned, may project a center section, whereas lamp 21^c in combination with mirror 25 will project a third section. It is understood that the mechanism for transforming the beams of light include any desirable composing means synchronously operated with the analyzing means at the sending station. Such apparatus forms no part of this invention and is not illustrated. In Fig. 7 is shown a completed image, the dotted lines indicating the different sections, each of which may be formed responsive to one of a plurality of glow lamps in combination with a drum having composing openings similar to those of drum 16.

The beam of light employed in combination with scanning mechanism is usually arranged in combination with a sensitive photo-electric cell or tube, which is connected with a suitable electric circuit, the cell acting as a valve controlling a current depending upon the character of the light effecting the cell. The current accordingly varies responsive to the intensity of the light, which depends upon the degree of darkness of the particular point of the image reflected by the beam. For better transmitting this current, and in order to avoid using the wide band of waves usually employed in transmission of this character, applicant proposes to employ a new system to transmission and wave control, whereby this current, acting as a signal carrier, will be used to modulate a wave of constant frequency and certain character, which may be employed in the nature of a carrier wave. Thus, in Fig. 8, is shown diagrammatically an arrangement of

electrodes in a tube designed to carry out such a system of transmission and modulation. It may be assumed that electrodes A and B, within an ionization tube are arranged to serve the circuit whose E. M. F. varies responsive to the intensity of the light falling on the photo-electric cell. As may be noted, electrodes A and B are separated by a gap 26. As the current varies, the resistance of gap 26 between electrodes A and B will also vary. This variation corresponds to the variation in the character of the current. In other words, the resistance of the gap will vary in accordance with the variation of the composite curve representing the varying intensity of the light affecting the photo-electric cell. The electrodes C and D may be arranged within the tube, as shown in Fig. 8, and also be separated by gap 26. These electrodes may be used in a circuit of carrier current, suitably produced or impressed, and of constant curve characteristic. While this current may be represented by a constant curve in its primary character, it will necessarily be affected if subjected to the resistance of gap 26, which is a variable. The carrier current will, therefore, be modulated and in final form be represented by a single wave which is of constant frequency and whose amplitude curve reflects the variations in the signal. This is diagrammatically illustrated in the circuit drawing shown in Fig. 14. As shown, numeral 27 may represent an audio frequency amplification arrangement, and, in television, the circuit including leads 28 will carry the current, of audio frequency range, reflecting the variable current whose character is determined by the intensity of the successive beams of light falling on the photo-electric cell. Transformer 29, current source 30, coil 31, and ionization lamp 32, are included in a circuit carrying the audio frequency signal. Gap 33 between electrodes 34 and 35 provides a resistance which will vary responsive to variations in the signal. A master oscillator 36 is provided to supply a source of radio frequency current of a single frequency and constant wave character. As illustrated, this radio frequency current through transformer 37 and the circuit shown, will be modulated by the variation in resistance of gap 33, due to the variation in the character of the signalling current. Since the electrodes 34 and 35 also serve the radio frequency or carrier current circuit, the carrier wave will be varied responsive to changes in the resistance of the gap. This modulated carrier current will, in effect, be in the form of a wave of a single frequency whose amplitude varies responsive to the changes in resistance across the gap between electrodes 34, 35. Thus the output at transformer 38 will be a variable equal to the modulated form of the constant carrier wave. By means of a suitable radio frequency amplifier 39, the modulated wave may be broadcast or transmitted by wired systems, in any desired manner.

In Figure 15, a circuit arrangement similar in operating effect to that of Fig. 14, is illustrated. The parts similar to those illustrated in Fig. 14 serve similar functions. In this embodiment, photo-electric cell 48 is shown provided with a pair of electrodes (as in Fig. 2) forming a gap. The resistance of the gap will vary responsive to variations in the image to which the lamp reacts. The signal will accordingly serve to vary the E. M. F. of the constant characteristic wave constituting the carrier or radio frequency current. The system, therefore, employs a single wave

of desired character whose modulation is carried on by a change in resistance between electrodes serving a variable source. Applicant thus limits himself to a single carrier wave and produces a system based on a valve essentially distinct in its modulating effect and in its formation of a composite wave having all the characteristics of a band of waves of varying frequencies and curve characteristics.

In Figs. 9 to 13 are illustrated various arrangements of electrodes suitable for applicant's purpose. Thus, in Fig. 9 metallic elements 40 constitute electrodes connected to leads in the signal or audio frequency circuit, whereas electrodes 41 serve the carrier or radio frequency circuit. The enveloping tube is not illustrated, but it will be understood that the electrodes are suitably arranged within an ionization tube containing any desirable gas, such as neon or the like, or exhausted, if preferred. The electrodes are separated by a gap which serves both sets of terminals for the purposes hereinbefore outlined. In Fig. 10 the electrodes are illustrated with terminals variously formed and suitably positioned within an envelope 42. In this illustration the electrodes 43 may have terminals greater than those of electrodes 44. In Fig. 11 cylindrical terminal 45 is shown as a terminal on one side of the audio frequency circuit, the other side terminating in a common terminal serving the radio frequency arrangement as well. In Figs. 12 and 13 the terminals 46 and 47 constitute electrodes mounted on the electrodes serving the radio frequency side. It is patent that numerous arrangements may be improvised for carrying out applicant's objects. It may be noted that in all the various forms illustrated the terminals of larger area serve the audio frequency arrangement, and this is deemed preferable.

Thus, among others, the several objects of the invention as afore-stated are achieved. It will be understood, however, that numerous changes in construction and rearrangements of the parts might be resorted to without departing from the spirit of the invention as defined by the claims. For example: The structure of the cell might be altered. In conjunction with the members which provide the openings for passage of light rays, it will be appreciated that the members themselves need not necessarily be in the form of drums—although this is in certain instances preferable—and that the rows of light apertures provided in one member and the slot formed in the cooperating member will function according to the teaching of the present invention whether they be complete spirals or not. Moreover, it will be understood that the structure as shown in Fig. 1 is intended for the purposes of illustration only and that any desirable form of drive and synchronizing mechanism might be employed in lieu thereof.

Having described my invention, what I claim as new and desire to secure by Letters Patent is:

1. In a television system, a scanning or composing member having a plurality of openings therein, a plurality of light sources, reflectors associated with said sources and arranged to project the light therefrom simultaneously through the openings in said member and along diverging lines, and other reflectors arranged to receive the diverging lines of light and to reflect the light in converging lines onto the object or screen.

2. In a television system, a scanning or composing member having a plurality of openings therein, a plurality of light sources, reflectors associated with said sources and arranged to project

the light therefrom simultaneously through the openings in said member and along diverging lines, and other reflectors arranged to receive the diverging lines of light and to reflect the light in converging lines onto the object or screen so that the light from each source illuminates simultaneously a separate and distinct area of said object or screen.

3. In a television system, a scanning or composing member having a plurality of openings, a light source for projecting beams of light through said openings in said member onto an object or screen, a second light source, a reflector associated with said second source, arranged to project beams of light through the openings in said member, which beams are at a substantial angle to the beams of light from said first source, and a second reflector for receiving the beams of light from said first reflector and arranged to reflect same onto a separate portion of an object or screen than that on which the beams of light from said first source are projected.

4. In a television system, a scanning or composing member having a plurality of openings, a light source, a reflector associated with said light source for projecting a beam of light therefrom through the openings in said member, a second light source, a second reflector associated with said second source and arranged to project a beam of light through the openings in said member, which beam is at a substantial angle to the beam of light reflected by said first reflector, a third reflector for receiving the beam of light from said first reflector and reflecting same onto an object or screen, and a fourth reflector for receiving the beam of light from said second reflector and arranged to reflect same onto a separate zone of the object or screen than that on which the beam of light from said third reflector is reflected.

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