

Aug. 13, 1940.

I. L. MAGUIRE
TELEVISION SYSTEM

2,211,066

Filed Nov. 16, 1938

3 Sheets-Sheet 1

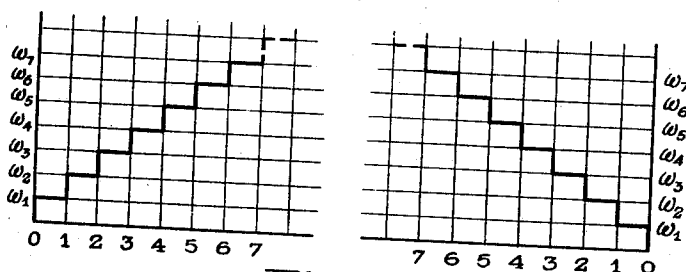


Fig. 1.

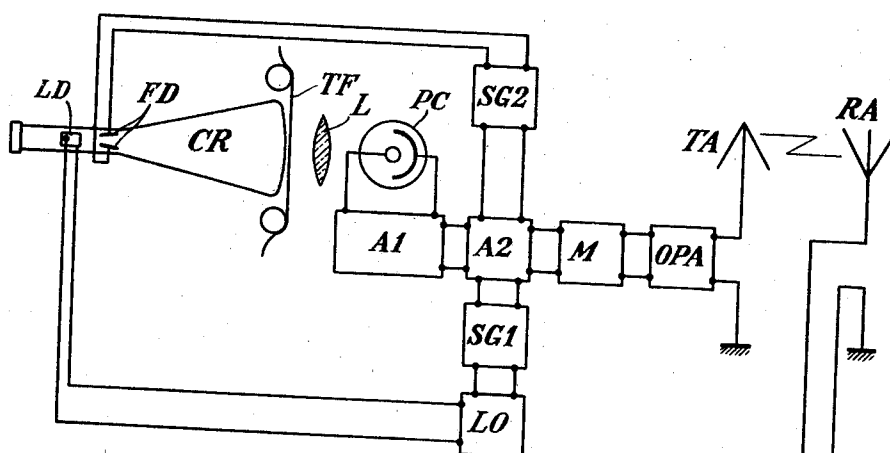
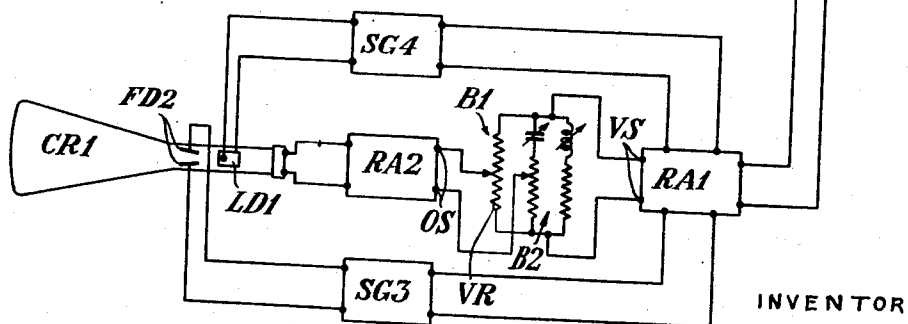


Fig. 2.



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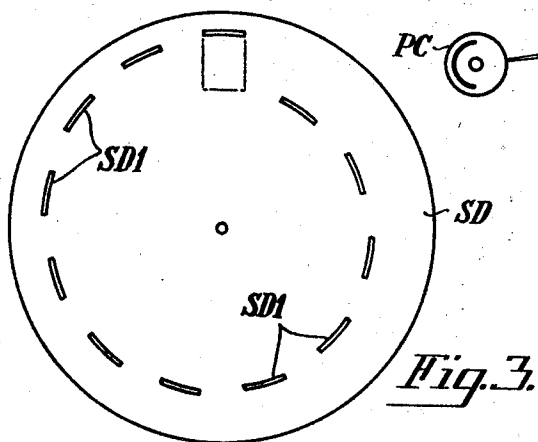
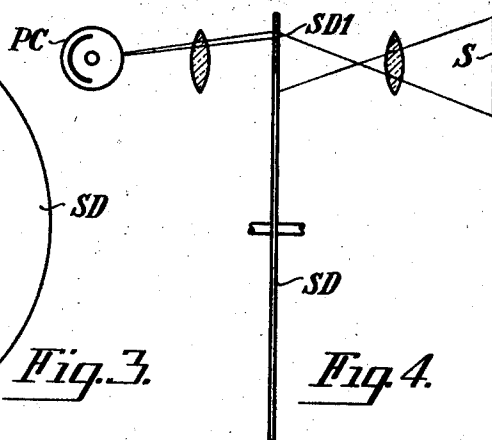
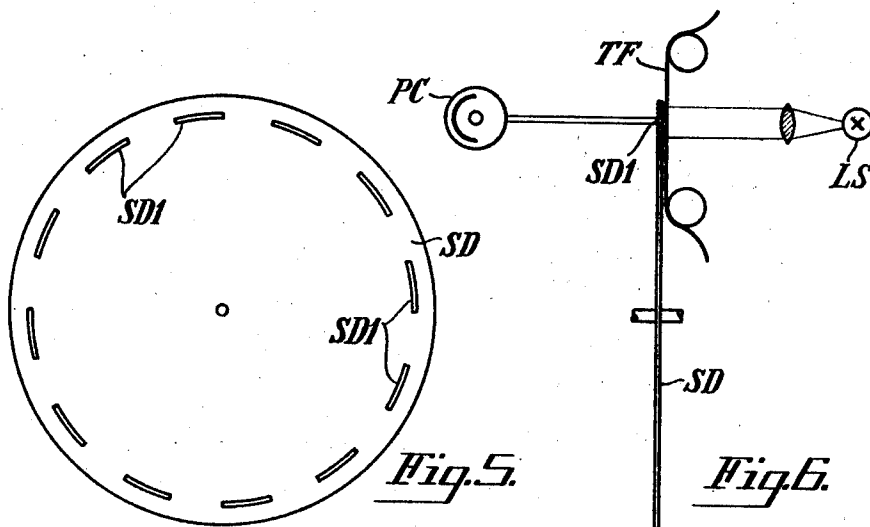
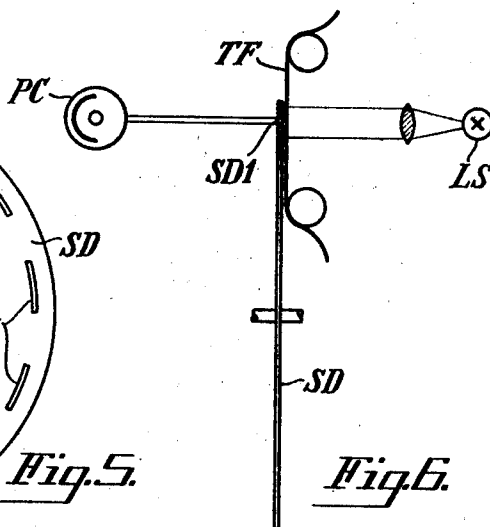
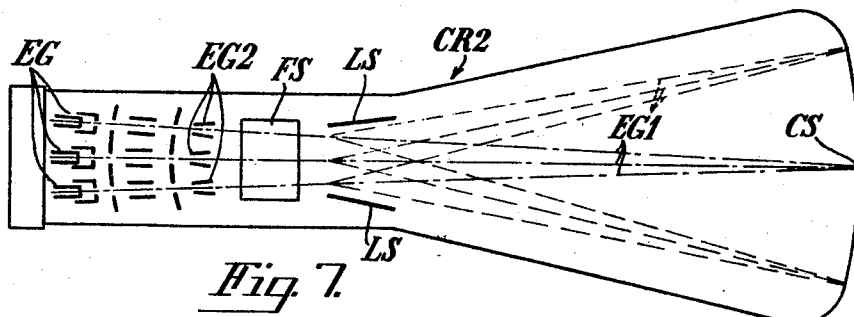
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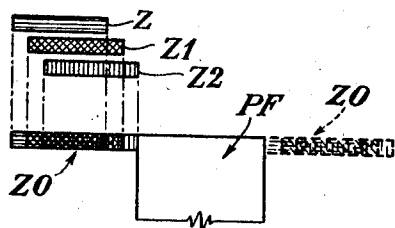


Fig. 8.

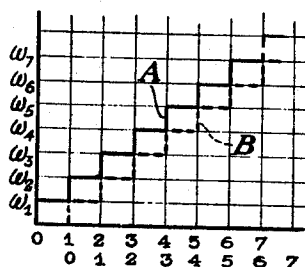


Fig. 9.

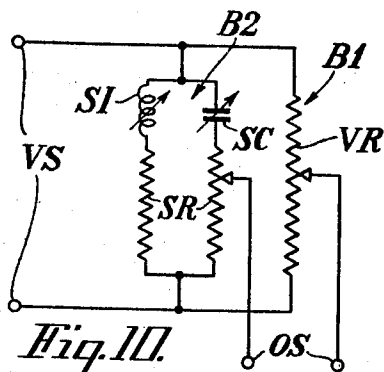


Fig. 10.

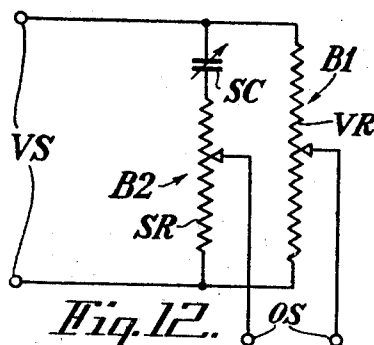


Fig. 12.

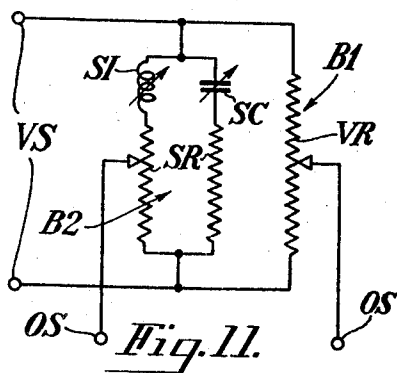


Fig. 11.

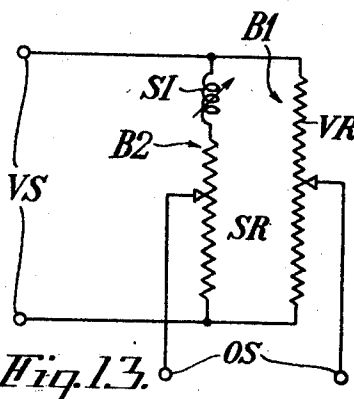


Fig. 13.

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UNITED STATES PATENT OFFICE

2,211,066

TELEVISION SYSTEM

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AustraliaApplication November 16, 1938, Serial No. 240,824
In Australia December 3, 1937

7 Claims. (Cl. 178—6)

This invention relates to cathode ray and mechanical methods of scanning in television systems, and it has been devised to simplify difficulties which arise in photocell response, amplifiers and the like in both transmission and reception. In particular the present invention provides for reduction of transmission frequency with increased degree of definition of a facsimile to thereby simplify difficulties of transmission reception and amplification of signals.

According to present day practice, for photocells other than the mosaic type, the light emitted by each picture point actuates the photocell during the time taken for a scanning spot to traverse one of said points and the response of gas filled types of photocell to this light is proportional to the time during which the light is incident upon it. Thus the greater the definition of the picture, the smaller is the response of the photocell for a given brilliance of the individual picture points. Further, the picture points of the facsimile are recreated during the time taken to scan corresponding points of the picture and the apparent brightness to the eye of the recreated picture points of the facsimile depends, for a given source of light, upon the time taken for the scanning spot to traverse the picture point. Further, the photocell response depends upon the total amount of light flux emitted by the scanning spot and since the light of the scanning spot utilised for the recreation of the picture points of the facsimile is more or less uniform and of a size equivalent to that of a picture point, it follows that no definite detail of the picture or facsimile which is smaller in size than a scanning spot, can be recreated. The frequency of the video signal is proportional to the ratio of the area of the picture frame to the area of the scanning spot and to the number of picture frames scanned in a given time and thus the frequency of the video signal is proportional to the definition of the picture and the greater the definition the higher the video signal frequency.

The present invention has for its objects the improvement of definition in the facsimile reconstructed at the receiver and reduction of the video signal frequency, and according to this invention the first mentioned object is attained by modulation of the light for the creation of facsimiles by means of a signal which is derived from the difference in effects of two similar signals which differ in phase and which are generated from a video signal which is derived from the progressive individual scanning of zones of the

subject to be transmitted which are successively scanned in serial order. By this means the definition of the facsimile is rendered independent of the video signal frequency with resultant increase in the definition of the facsimile.

Reduction of transmission frequency is attained by a scanning method comprising the successive scanning of zones of the subject to be transmitted, said zones being equivalently proportioned and dimensioned to comprise a group of picture points whereby the individual picture points recreated in the facsimile at the receiver may be appreciably smaller in area than the zones scanned at the transmitter. The relative dimensions of said group of picture points and individual picture points are determined by the size of the zone scanned at the transmitter and the difference in phase provided and utilized as above described at the receiver.

Preferably the dimensions of each zone above-mentioned are equivalently proportioned to a single line of the picture frame at the transmitter.

In the scanning operation at the transmitter each picture point within a zone of scanning is presented to the photo-cell for a period of time equivalent to that occupied in the scanning of the complete zone, and thus the response of the photocell per picture point is increased. This advantage is obtained by progressively revealing each zone to the photocell until maximum disclosure is reached, following which the zone is progressively concealed to zero before commencement of the scanning of the next zone.

The scanning of the picture may be effected by known means such as a cathode ray beam focussed on a photosensitive mosaic, but the image of the beam in lieu of being a spot is a zone or rectangular shaped area equivalent in proportions to a line of the picture, and in scanning, the beam image is caused to traverse the picture frame along the lines of the picture so as first to progressively reveal the picture points and then to progressively conceal said points.

Alternatively in lieu of the image of the cathode ray beam being focussed to a zone of the proportions of a line of the picture, the image of the cathode ray beam may be focussed to a spot as usual and the beam oscillated at high frequency to cause the spot to traverse backwards and forwards along a line and by superimposing a suitable sweep movement to this oscillatory movement of the cathode ray beam the scanning zone produced by the oscillatory movement of the spot is caused to advance across the picture frame

in the same manner and with the same equivalent effect as when the cathode ray beam image was focussed to a line and the line was caused to advance across the picture frame and further, this scanning zone so produced by the oscillatory movement of the spot can be caused to fly back quickly as in known methods of spot scanning with cathode ray tubes.

Alternatively a scanning disc may be employed in which a series of arcuate slots is arranged, said slots preferably being equivalently proportioned to a line of picture frame and angularly spaced so that each slot progressively reveals a line of the picture to a photocell and then progressively conceals the line from the photocell before the next succeeding slot commences to reveal the next succeeding line zone.

The method of integrating and differentiating the effects obtained in scanning by the methods of this invention will be understood from the following analysis:

Assume that there are n picture points per zone of the picture, and assume for identification purposes that the points are numbered 1, 2, 3, etc. starting from the end of the zone when the first picture point is disclosed to the photocell. Assume that the time taken to fully disclose the zone is nt seconds and that the time taken to traverse a picture point from one end of the picture point to the other is

$$\frac{nt}{n} = t$$

seconds. Assume that the light flux emitted by the picture points 1, 2, 3, etc. in t seconds is W_1 , W_2 , W_3 , etc. respectively. The amplitude of the photocell currents at any instant is proportional to the light which is incident at this instant upon the cell so that at the respective instants that the number of picture points 1 or 2 or 3 etc. are simultaneously disclosed, the amplitude of the photocell currents is proportional to

$$W_1, (W_1 + W_2), (W_1 + W_2 + W_3),$$

etc. respectively.

The suppositional graph marked Fig. 1 in the drawings accompanying this specification shows the variations in amplitude of the photocell current with time of scanning a zone of the picture. The abscissae shows the number of picture point revealed at any instant, and the ordinates show amplitude of the photocell current when the zone discloses 1 or 2 or 3 or more etc., picture points to the photocell.

The video signal current is equivalent to the photocell currents and the amplitude of the photocell currents and the video signal currents at any instant is thus proportional to the integrated effect of the picture points which at that instant are incident upon the photocell.

At the receiver the effects of the video signal are differentiated to obtain an effect which is proportional to the rate of change in amplitude of the video signal. This instantaneous rate of change in amplitude of the video signal corresponds to the change in amplitude of the photocell currents due to the disclosure at that instant of a picture point to the photocell. Thus the effects so obtained correspond to the individual effects of the picture points disclosed to the photocell. When these effects are utilised for the modulation of the light at the receiver they enable the picture points of the facsimile to be recreated.

Referring to the drawings accompanying this specification, Fig. 1 as previously mentioned is a

graph showing variations in amplitude of photocell current with time of scanning a picture zone.

Fig. 2 shows a circuit arrangement for transmitter and receiver equipment organised to incorporate an embodiment of the invention in which scanning operations are performed by a cathode ray method.

Fig. 3 shows a mechanical scanning disc devised for use at a transmitter shown diagrammatically in Fig. 4, while—

Figs. 5 and 6 are views, similar to Figs. 3 and 4, of a modified mechanical scanning arrangement.

Fig. 7 is a schematic lay-out of a cathode ray tube arranged for optical creation of facsimiles within the scope of the present invention.

Fig. 8 is a diagrammatic representation of the operation of the triple beam produced by the cathode ray tube shown in Fig. 7.

Fig. 9 is a graph showing two curves plotted in the manner of the curve in Fig. 1 and illustrating difference in amplitude of duplicate signals differing in phase relationship.

Figs. 10, 11, 12 and 13 are circuit diagrams illustrating different networks for obtaining phase differences between duplicate signals.

As before stated the essential characteristic of the invention resides in utilizing the difference in effects of two similar signals, which differ in phase and are generated from a single video signal produced at the transmitter, to modulate the light used for creating facsimiles at the receiver, and consequently it will be convenient first to refer to the group of figures of drawings marked Figs. 10 to 13 inclusive illustrating phasing methods.

In each figure of the group (Figs. 10 to 13) the received single video signal is applied at VS being the input terminals of the network, one branch B1 consisting of a potential dividing resistance VR and the second branch B2 which may be arranged as a constant impedance comprising resistance and capacity and inductance at SR, SC, and S1 respectively, or it may be arranged as a reactance comprising a capacity and resistance SC and SR respectively.

In Figs. 10 and 12 the output from branch B2 is taken from the capacity leg and in Figs. 11 and 13 from the inductance leg.

The arrangements shown in Figs. 10 to 13 each provide a duplicate of the video signal in each of the branches B1, B2 and by adjustment of the capacity and/or inductance in the latter branch the current therein can be caused to lead or lag behind that in branch B1 to set up the required phase difference at the output terminals at OS, which terminals bear similar reference characters in Fig. 2 and are connected to the amplifier at RA2 in that figure. Resistance VR may conveniently constitute the grid leak resistance of the input tube of amplifier RA2.

Referring now to Fig. 2, the subject to be televised is indicated as a travelling film at TF and is scanned by the cathode ray generated by cathode ray tube CR.

Reduction of video signal frequency in accordance with the invention and to obtain the advantages of low frequency transmission is attained by so scanning zones successively, each zone being equivalent to a line of the subject, that each zone is progressively revealed to the photocell until maximum disclosure is reached following which the zone is progressively concealed to zero before scanning commences of the next succeeding zone. By this method the amplitude of the photocell currents at any instant

is equivalent to the sum of the picture points revealed to the photocell at the same instant.

Scanning means for carrying out the scanning method stated may consist of conventional cathode ray tube apparatus or mechanical scanning devices such as a Nipkow type of disc having its scanning apertures dimensioned as hereinafter described.

In utilizing cathode ray scanning means, the image of the beam is focussed to a rectangular area equivalent in proportions to one line of the subject and the beam is caused to sweep along the line to progressively reveal and conceal the line as before stated. In lieu of focussing the said image of the beam to a rectangular area, it may be focussed to a spot as usual and the beam oscillated at high frequency along a path equivalent to a line of the subject and a sweep movement is imparted to said path to effect said progressive revelation and concealment.

Referring now in detail to Fig. 2, the scanning at the transmitter is performed by the cathode ray methods above described by the cathode ray tube CR, the resultant beams being directed by a lens L to the photocell at PC. The photocell currents are led to the coupled amplifier units at A1 and A2 thence to modulator unit at M where the output current from the latter is superimposed upon a carrier frequency and the modulated carrier frequency is applied to the transmitting aerial at TA via oscillator-power amplifier OPA. The line sweep oscillator is indicated at LO and the line sweep-synchronising signal generator at SG1 and these are connected to the deflecting plates at LD of the cathode ray tube CR, while the frame deflecting plates FD of the latter are connected to the frame sweep-synchronising signal generator SG2.

At the receiver the pick-up at RA of the incoming low frequency impulses from TA are received and amplified at RA1 and then applied to a phasing network (comprising branches B1 and B2) for the purposes previously described and as ascertained by reference to Figs. 10 to 13 inclusive.

The output from the phasing network terminals OS is applied to the amplifier RA2 and thence to the cathode ray modulating electrode of the cathode ray tube at CR1. The line sweep potentials are applied to the deflecting plates at LD1 and the frame sweep potential to the deflecting plates at FD1. The synchronising signals are applied from RA1 to SG3 and SG4.

Referring to Figs. 3 to 6 inclusive depicting means for mechanical scanning as an alternative to the cathode ray tube scanning methods described, in Fig. 3 is shown a scanning disc SD having scanning apertures SD1, arranged in a single spiral path. Each of said scanning apertures SD1 is proportioned so as to be equivalent in shape to one line of the picture frame and said apertures are spaced apart a distance, at least equivalent to the length of said line. The scanning disc SD is shown in Fig. 4 associated with its related photocell PC and subject at S.

In Fig. 5, showing an alternative arrangement of the scanning apertures SD1 in Fig. 3, the scanning apertures are disposed in a circular path in the scanning disc SD for scanning a continuously travelling film TF as shown in Fig. 6 in juxtaposition with an associated photocell PC and light source at LS.

Reference will now be made to Figs. 7 and 8 for the purpose of further describing the alter-

native arrangement for creation of facsimiles at the receiver in which the phasing effect before-mentioned is provided by utilizing a cathode ray tube providing a differentially illuminated zone equivalent to a line of the picture frame.

Referring particularly to Fig. 8 three illuminated zones are indicated at Z, Z1, and Z2, one of said zones Z1 being assumed as illuminated to double the brilliance of each of the zones Z and Z2.

The zones Z, Z1, Z2 are superimposed with overlap as indicated generally at ZO and, so related, are swept across the picture frame PF to effect the progressive revelation and concealment of a line of picture frame.

Fig. 7 depicts a cathode ray tube CR2 arranged to create the zones Z, Z1, Z2 related and functioning as above described.

The tube CR2 is shown provided with three electron guns EG directed towards a common focal point on the screen at CS. The rays EG1 emanating from the guns EG are oscillated at high frequency by the deflecting plates LS to illuminate superimposed overlapped zones equivalent to Z, Z1, Z2 on the screen at CS. The deflecting plates at LS also effect the line sweep motion and deflecting plates FS effect the frame sweep motion of the zone ZO. The deflecting plates EG2 are utilized to relatively locate the overlapped zones Z, Z1 and Z2.

From the foregoing it will be evident that if three zones are relatively illuminated as above set forth and the light of the brightest zone Z1 is positively modulated whilst the light of each of zones Z, Z2 is negatively modulated (i. e. the light of the zone Z1 is modulated to increase in brightness, while the light of the zones Z, Z2 is modulated for decrease in brilliance) and if said zones are superimposed so that the first disclosed picture point of each zone is a picture point out of phase in the order shown by the following formula for W_1, W_2, W_3 etc., then the light of the zones becomes differentiated due to the effects of persistence of vision so that the mind is rendered conscious of the creation of the picture points 1, 2, 3 etc. If the zones are scanned and located at the receiver in a manner corresponding to the scanning of the zones at the transmitter then a facsimile will be created.

At the receiver differentiation of the effects of the video signal may be obtained electrically or optically.

Assume that it is desired to effect the differentiation electrically.

The amplitude of the video signals, up to the time of disclosing the zone at the transmitter to its maximum extent to the photocell, at the instant of scanning picture points 1, 2, 3, etc. is proportional to $W_1, (W_1+W_2), (W_1+W_2+W_3)$ etc., respectively (see Fig. 2). Assume that a network is employed at the receiver in which there are two branches through each of which flows a signal current which is proportional to the video signal current. In one of the branches of this network the current lags behind that of the other branch by the time taken to scan a picture point, thus at the time of scanning the picture points 1, 2, 3, 4 etc. the currents in one branch have amplitudes proportional to $W_1, (W_1+W_2), (W_1+W_2+W_3), (W_1+W_2+W_3+W_4) + \text{etc.}$, and at the time corresponding to these values of currents the amplitude of the currents flowing in the other branch are 0, $W_1, (W_1+W_2), (W_1+W_2+W_3) + \text{etc.}$ The instantaneous differ-

ence in potential between the potentials across these branches at the time of scanning picture points 1, 2, 3, 4, etc. is thus proportional to: $W_1=0-W_1$, $(W_1+W_2)-(W_1)=W_2$; $(W_1+W_2+W_3)-(W_1+W_2)=W_3$; $(W_1+W_2+W_3+W_4)-(W_1+W_2+W_3)=W_4$ etc.

These results are illustrated by the difference in amplitude of the two curves marked A and B in the graph shown in Fig. 9 of the accompanying drawings. These curves are plotted according to the assumptions made for plotting the graph shown in Fig. 1. Curves A and B are identical but are plotted so as to be out of phase by one picture point. The top row of figures along the abscissa corresponds to the total number of picture points simultaneously disclosed for curve A and correspondingly the bottom row of figures along the abscissa applies to curve B of the curves shown in Fig. 9. Each curve is hereinafter called the modulating signal.

The amplitude of the modulating signal, obtained by taking the difference in potential of the currents flowing in the two branches of the network at the time of scanning the picture points 1, 2, 3 etc., is thus proportional to W_1, W_2, W_3 etc. This signal is thus equivalent to the signal generated by scanning the picture point by point in accordance with the usual method of picture scanning at the present time. Thus, if a known type of scanning device such as the cathode ray tube is used as a receiver and its beam is modulated by the modulating signal and the focussed spot of the cathode ray is moved to correspond with the movements of the scanning zone at the transmitter and so that the focussed spot at the receiver corresponds in location with the leading end of the scanning zone at the transmitter then the facsimile will be created to correspond with the picture scanned at the transmitter.

Assume that it is desired to effect the differentiation optically.

At the receiver an area, equivalent in proportions to the corresponding zone at the transmitter, is uniformly illuminated by a modulated light whose brilliance is proportional to the amplitude of the photocell currents. Assume that this illuminated zone at the receiver is revealed to the eye of an observer in a manner corresponding to the revelation of the picture zones at the transmitter, i. e. at instants corresponding to the revelation of respective picture points 1, 2, 3, etc. there are revealed to the observer at the receiver corresponding respective zone points 1, 2, 3, etc. The effect upon the eye, of the light emitted at points 1, 2, 3 etc., is that due to persistence of vision and the brilliance of the points of the zone appears to the eye as being proportional to the total flux revealed per picture point of the zone during the time that the zone is scanned or revealed to its maximum extent.

Assume that the total light flux emitted by the points of the zone at the receiver during the time that the zone is revealed to the eye is 1, 2, 3, etc. where

$$\begin{aligned}(1) &= W_1 + (W_1 + W_2) + (W_1 + W_2 + W_3) + \\ &\quad - - - + (W_1 + W_2 + - - + W_n) \\ (2) &= (W_1 + W_2) + (W_1 + W_2 + W_3) + \\ &\quad - - - + (W_1 + W_2 + - - + W_n) \\ (3) &= (W_1 + W_2 + W_3) + \\ &\quad - - - + (W_1 + W_2 + - - + W_n)\end{aligned}$$

etc., and as explained previously the brightness of the points 1, 2, 3 of which the mind is rendered conscious, is proportional to the total flux

emitted and thus (1), (2), (3) is the apparent brightness of the picture points 1, 2, 3, etc.

Inspection of formulas for (1), (2), (3), etc., shows that the various quantities W_1, W_2, W_3 etc., representing the brightness of the individual picture points may be determined, thus:

$$\begin{aligned}W_1 &= (1) - (2) \\ W_2 &= (2) - (3) - W_1 = (2) - (3) - (1) - (2) = \frac{2(2) - (3) - (1)}{2} \\ W_3 &= (3) - (4) - (W_1 + W_2) = (3) - (4) - \frac{2(2) - (3) - (1)}{2} = \frac{2(3) - (4) - (2)}{2} \\ W_4 &= (4) - (5) - (W_1 + W_2 + W_3) = \frac{(4) - (5) - (3) - (4) = (4) - (5) - (3)}{(4) - (5) - (3) - (4) = (4) - (5) - (3)}\end{aligned}$$

and so on and for W_{n-1} we get

$$W_{n-1} = 2(n-1) - (n) - (n-2) \quad 15$$

Corresponding formula to the foregoing can be obtained if the mode of scanning is reversed i. e. the zone first fully progressively reveals the picture points to the photocell or the viewing screen and these picture points are then progressively concealed.

From these formula it is apparent that if three zones are uniformly illuminated so that one zone is twice as bright as the illumination of either of the other two zones and if these latter zones are illuminated to the same degree of brightness and if the light of the brightest zone is positively modulated whilst the light of the other zones is negatively modulated i. e. when the light of the brightest zone is modulated so as to increase in brightness, the light of the other two zones is modulated so as to decrease in brilliance, and if the images of the zones are superimposed so that the first disclosed picture point of each of the zones is a picture point out of phase in the order shown by the formula for W_1, W_2, W_3 etc., then the light of the zones becomes differentiated due to the effects of persistence of vision so that the mind is rendered conscious of the creation of the picture points 1, 2, 3 etc. If the zones are scanned and located at the receiver in a manner corresponding to the scanning of the zone at the transmitter then the facsimile will be created.

I claim:

1. In a television system, the method consisting of progressively and continuously scanning, in seriatum, individual zones of the subject to be transmitted, completing the scanning of one zone before commencing to scan the next zone of the series, converting the light effects from each zone into an equivalent electric signal, amplifying the latter, applying the amplified signal to a carrier frequency which is transmitted to a receiver, amplifying the received video signal, multiplying the latter with a phase difference between the multiple signals, and converting said latter signals, simultaneously in a common zone, into equivalent superimposed and overlapped fluorescently visible signals, whereby the beforementioned phase difference creates an optical effect corresponding with the light values constituting the elementary picture points present in each zone scanned at the transmitter.

2. In a television system, the method consisting of progressively and continuously scanning, in seriatum, individual zones of the subject to be transmitted, completing the scanning of one zone before commencing to scan the next zone of the series, converting the light effects from each zone into an equivalent electric signal, amplifying the latter and applying the amplified signal to a carrier frequency which is transmitted to a receiver, amplifying the received video signal, duplicating the latter with a phase difference be-

tween the duplicate signals, and applying the potential of a signal due to said phase difference to modulate light used for the creation of a facsimile of the subject transmitted, whereby an optical effect is created corresponding with the light values constituting the elementary picture points present in each zone scanned at the transmitter.

3. In a television system, a transmitter comprising scanning means for continuously scanning, in seriatum, individual zones of the subject to be transmitted and completing the scanning of one zone before commencing the scanning of the next zone of the series, a photo-electric cell, means for applying the light effects from each of said zones to the photo-electric cell, means for amplifying the output from the photo-electric cell, means for applying the amplified signal to a transmissible carrier frequency, a receiver for said amplified signal comprising means for amplifying and means for multiplying the received signal, means for creating a phase difference between the multiple signals, means for simultaneously converting said multiple differentially phased signals into equivalent superimposed visible signals, and means for locating the latter signals in a common zone, whereby the before-mentioned phase difference creates an optical effect corresponding with the light values constituting the elementary picture points present in each zone scanned at the transmitter.

4. A television system, consisting of a transmitter comprising scanning means for continuously scanning, in seriatum, individual zones of the subject to be transmitted and completing the scanning of one zone before commencing the scanning of the next zone of the series, a photo-electric cell, means for applying the light effects from each of said zones to the photo-electric cell, means for amplifying the output from the photo-electric cell, means for applying the amplified signal to a transmissible carrier frequency, a receiver for said amplified signal comprising means for amplifying and means for duplicating the received signal, means for creating a phase difference between the duplicate signals, and means for applying the potential of a signal due to said phase difference to modulate light used for the creation of a facsimile of the subject transmitted, whereby an optical effect is created corresponding with the light values constituting the elementary picture points present in each zone scanned at the transmitter.

5. A television system, consisting of a transmitter comprising scanning for continuously scanning, in seriatum, individual zones of the subject to be transmitted, a photo-electric cell, means for applying the light effects from each of said zones to the photo-electric cell, means for amplifying the output from the photo-electric cell, means for applying the amplified signal to a transmissible carrier frequency, a receiver for said amplified signal comprising means for amplifying and means for duplicating the received signal, and means for creating a phase difference

between the duplicate signals, consisting of a phasing network constituted of two branches connected to the amplified output of the receiver, one of said branches comprising a potential dividing resistance and the other of said branches comprising a constant impedance or reactance, the output potential from said phasing network being applied to modulate light used for the creation of a facsimile of the subject transmitted, whereby an optical effect is created corresponding with the light values constituting the elementary picture points present in each zone scanned at the transmitter.

6. A television system, consisting of a transmitter comprising scanning means for continuously scanning, in seriatum, individual zones of the subject to be transmitted, a photo-electric cell, means for applying the light effects from each of said zones to the photo-electric cell, means for amplifying the output from the photo-electric cell, means for applying the amplified signal to a transmissible carrier frequency, a receiver for said amplified signal comprising means for amplifying and means for duplicating the received signal, means for creating a phase difference between the duplicate signals, consisting of a phasing network constituted of two branches connected to the amplified output of the receiver, one of said branches comprising a potential dividing resistance and the other of said branches comprising a constant impedance or reactance, a cathode ray tube, ray deflecting plates in said tube, means for amplifying the output from said phasing network, means for applying said amplified output potential to modulate the ray generated by said cathode ray tube, and means for applying frame sweep and line sweep potentials to said ray deflecting plates, whereby an optical effect is created corresponding with the light values constituting the elementary picture points present in each zone scanned at the transmitter.

7. In a television system, a transmitter comprising scanning means for continuously scanning, in seriatum, individual zones of the subject to be transmitted, a photo-electric cell, means for applying the light effects from each of said zones to the photo-electric cell, means for amplifying the output from the photo-electric cell, means for applying the amplified signal to a transmissible carrier frequency, a receiver for said amplified signal comprising means for amplifying and means for multiplying the received signal, consisting of a cathode ray tube comprising ray generating electrodes to each of which the received amplified signal is simultaneously applied to modulate said rays, means for deflecting said modulated rays to impart overlap or phase shift thereto, and means for applying frame sweep and line sweep to said deflected rays, whereby an optical effect is created corresponding with the light values constituting the elementary picture points present in each zone scanned at the transmitter.

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