

April 14, 1936.

J. H. O. HARRIES

2,037,577

TELEVISION METHOD AND APPARATUS

Filed Dec. 1, 1930

2 Sheets-Sheet 1

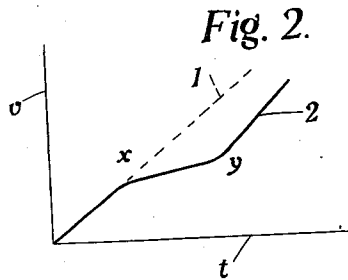
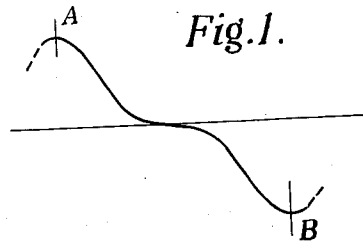


Fig. 3.

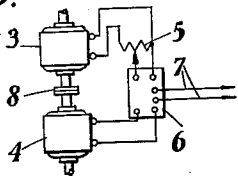


Fig. 4.

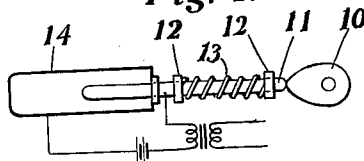


Fig. 5.

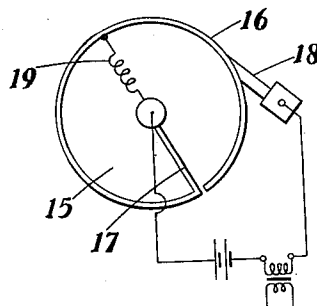
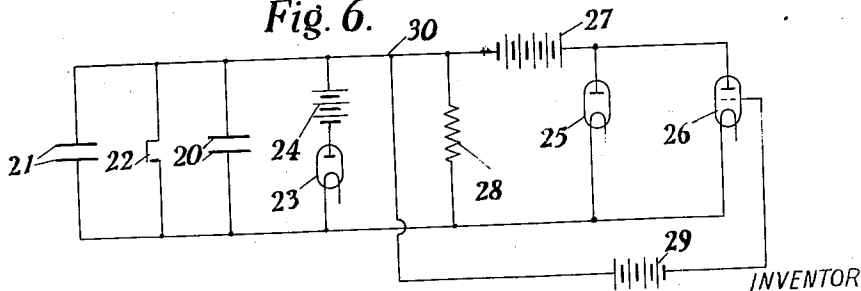


Fig. 6.



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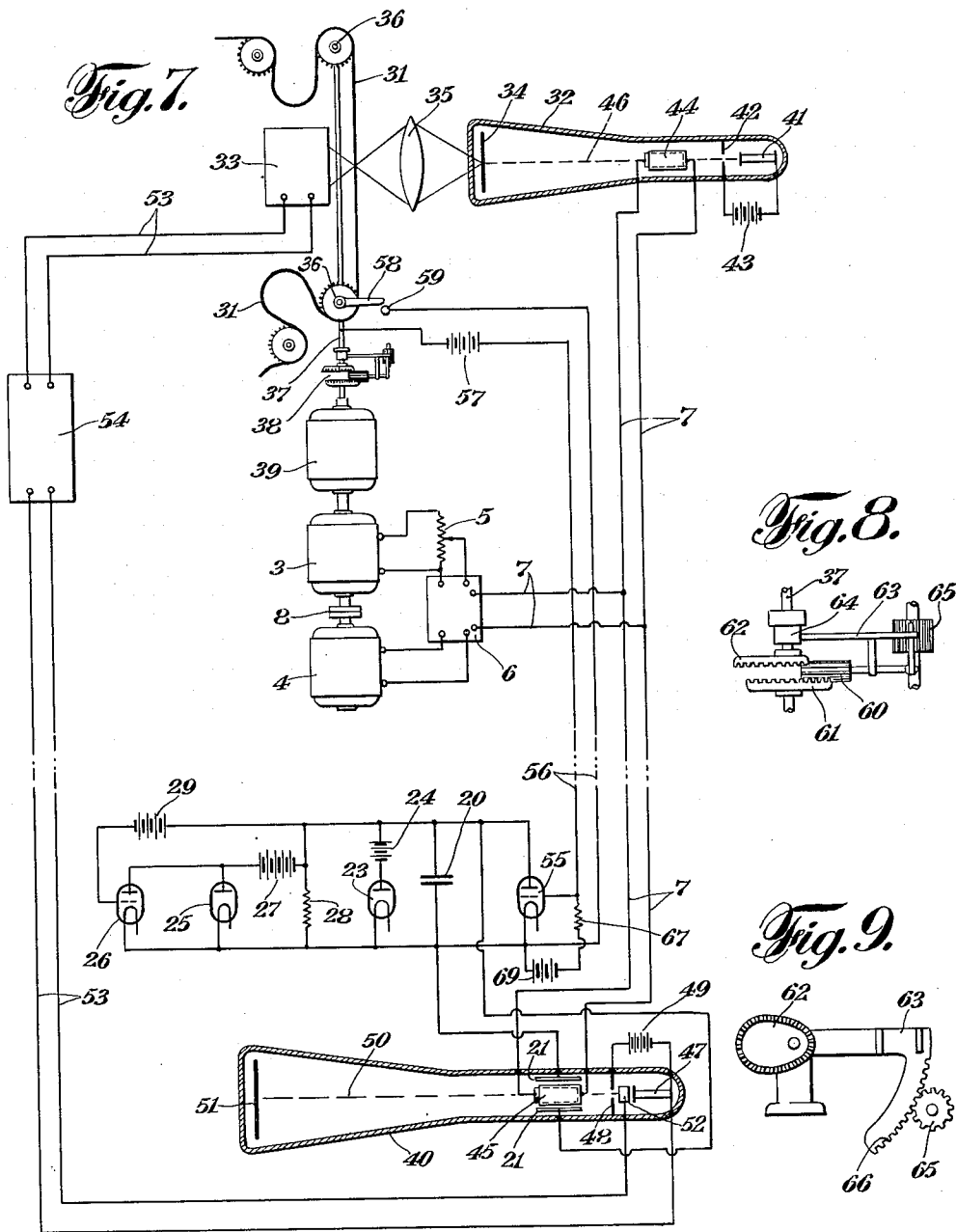
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TELEVISION METHOD AND APPARATUS

Filed Dec. 1, 1930

2 Sheets-Sheet 2



INVENTOR

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UNITED STATES PATENT OFFICE

2,037,577

TELEVISION METHOD AND APPARATUS

John Henry Owen Harries, Frinton-on-Sea,
EnglandApplication December 1, 1930, Serial No. 499,322
In Great Britain June 16, 1930

18 Claims. (Cl. 178—6)

The invention relates in general to the transmission and reproduction of pictures, scenes, views, images and the like by television and is concerned more particularly with forms of television apparatus in which a scanning point or beam is moved over the picture proportionally to electrical or electrically controlled scanning forces.

It is known that the definition of, and therefore the size of a picture transmitted by television is proportional to the scanning speed and to the width of the band of frequencies transmitted. Both the scanning speed and the band width are seriously limited by practical requirements and therefore it is exceedingly difficult to transmit any but very small pictures.

It may be shown that, because the human eye has only a very small point of distinct vision in the total field of view, in a picture only the centre of interest need be very highly defined. The rest of the picture need only be of lower definition without detriment to the representation of the object portrayed.

The object of the present invention is to provide a method and means whereby such an unevenly defined picture may be employed in television, thus economizing the total amount of detail which need be transmitted and enabling a larger picture to be used than would otherwise be possible.

In accordance with the invention the electrical or electrically controlled scanning forces (hereinafter referred to as scanning forces) are arranged to have a suitable amplitude/time wave form so that the picture is scanned more slowly, and therefore is greater in detail over the center of interest than elsewhere. For this purpose the speed of the scanning beam may be reduced as herein described in passing over that part of the picture which it is desired to emphasize or conversely in case it is desired to transmit pictures from a moving film the speed of the film relative to the scanning beam may be reduced when the beam is passing over that part of the picture which it is desired to emphasize, (the operative part of the wave being arranged to be the most useful portion).

Referring to the accompanying drawings in which like reference numerals refer to like parts:

Fig. 1 illustrates an example of wave shape useful in employing the invention.

Fig. 2 illustrates an additional wave form for the purpose.

Fig. 3 illustrates one form of apparatus for producing the desired wave forms.

Figs. 4 and 5 illustrate other forms of apparatus for the purpose.

Fig. 6 illustrates another form of apparatus for the purpose in which the desired wave form may be produced by variations in the scanning force itself.

Fig. 7 illustrates diagrammatically one form of circuit in which the invention may be employed for television.

Figs. 8 and 9 illustrate details of the apparatus shown in Fig. 7.

As an example of the kind of wave form required, consider the case of the scanning forces in a cathode ray system. Two such forces are usually required, one rapidly oscillating to move the jet, say 500 times a second to produce the strips of the picture; and another slow "framing" deflection at right angles to the above to produce the required number of pictures per second.

It will be understood that the centre of interest will usually be at about the centre of the picture, where the point or beam normally rests when the scanning current is at zero amplitude.

Concerning the above-mentioned rapidly oscillating wave, if this is of sinusoidal form, as is usual in the operation of a cathode ray system, the current rate of change with time, and therefore the rate of scanning, will be at its greatest at zero current. Therefore the picture will be scanned at the fastest rate in the middle. But the rate is required to be at the least here.

The present invention may however employ a wave for example, of the form

$$y = (a \sin w) - \left(\frac{a}{3} \sin 3w \right) \quad 35$$

The wave is plotted in Fig. 1 of the accompanying drawings, the operating part being between A and B.

The comparatively slow framing deflection is frequently arranged to be linear with time so as to spread the scanning lines evenly and so give an evenly defined picture. But in order to give a greater definition over the centre of interest lying about the middle of the picture, in accordance with the present invention, the time rate of change of the scanning forces must again be less over the centre of interest than elsewhere. In Fig. 2 curve 1 represents the usual linear relation between the scanning force v , with the time t , and curve 2 represents the non-linear effect desired in accordance with the invention.

The desired wave form may be generated by a plurality of coupled generators, each delivering a component of the desired complex wave, which

would appear in a circuit to which the components are fed. The relative characteristics of the individual components may be varied by suitable adjustments to the generators or to the coupling between the generators. The generators may themselves be driven by a motor to act as a motor generator convertor. In Fig. 3 this is illustrated as applied to two alternators 3, 4, and a potentiometer 5 controls the relative strength of the components, which are combined in the electrical coupling device 6, and the resulting complex current appears in the output wires 7. The alternators are mechanically coupled as indicated at 8, to preserve the desired phase difference between them. Thus, to produce the wave form shown in Fig. 1, alternator 3 would produce a current $i_1 = a \sin w$, and alternator 4 would produce a current

$$i_2 = \frac{a}{3} \sin 3w$$

and the two alternators would be coupled in anti-phase to produce the desired resultant current

$$i_3 = a \sin w = \frac{a}{3} \sin 3w$$

As an alternative the desired wave may be derived from a periodic variation of the circuit constants, e. g., resistance or capacity.

In Fig. 4 a cam 10, is rotated at a constant speed by any suitable means; one end of a follower or rod 11, slidably mounted in brackets 12, is held in contact with the cam profile by a spring 13, and on the opposite end of the follower 11, is a contact which slides over a resistance 14. The terminals of the external circuit are connected to one end of the resistance 14, and to the follower contact respectively. As the cam 10 rotates the contact slides over the resistance 14, and causes a periodic variation of the resistance in the external circuit. The cam profile is of such a shape as to cause the resistance and therefore the current in the external circuit to vary periodically as shown by the curve Fig. 1.

In the arrangement illustrated in Fig. 5, a disc 15 is steadily rotated by any convenient means, and a resistance wire or strip 16, is arranged around its edge; one end 17 of said wire being connected to the external circuit, the other end is free. An electrode 18, rubs on the wire, and is connected to the other terminal of the external circuit. The resistance 19 is connected between the external circuit, where the end 17 of the wire 16 joins it, and the middle point of the wire 16. As the disc 15 revolves it will be realized that a periodic variation of the circuit resistance between the end 17 of wire 16 and the electrode 18, will take place; further, the resistance 19 will act as a shunt and will cause the total circuit resistance to drop when the electrode 18 passes over or near its point of junction with the wire 16.

It is evident that the resulting resistance and therefore current variation in the external circuit will be of the type of curve 2 shown in Fig. 2. The arrangement shown in Figs. 4 and 5 may advantageously be used together to respectively produce co-operating scanning forces having the wave forms illustrated in Figs. 1 and 2. In such case, the cam 10 and disk 15 may be driven by a common prime mover.

Very many variations of these arrangements will suggest themselves to those skilled in the art.

A further series of arrangements will consist

of devices wherein the circuit constants change with different magnitudes of the scanning forces; in this manner a sine wave, or transient force, may be made to produce the desired wave form.

One example consists of a pair of triode valves in push-pull amplifier arrangement. The valve grids are biased so that the lower values of a sine wave impressed on the grids are partially suppressed, the peaks being reproduced normally, resulting in an output wave form similar to Fig. 1.

A second example is where a series of devices (e. g. diode or triode valves or other relaying devices) are biased so as to come into operation in shunt or series in a circuit at different values of the input volts, hence varying the current output wave form, either by their varying load on the circuit or by switching in or out additional apparatus, e. g., capacities, etc.

The operation of mechanical relays may be delayed in order to act at the right instant by means of oil dash-pot apparatus or the like.

In Fig. 6, the present invention is applied to a known form of apparatus wherein the potential across the plates of a condenser, which is charged through a constant current device, is utilized to give the deflecting force to a cathode ray tube.

The condenser 20 has in parallel therewith the deflecting plates 21 of the cathode ray tube, and a relay operated short circuiting switch 22, and a diode valve 23 biased by a battery 24. In series with all these devices, and in series with a diode 25 and triode 26 (which are in parallel with each other) is a battery 27. Resistance 28 is merely to provide a path for the D. C. plate current to diode 25 and triode 26 when the relay switch 22 is open. The grid of triode 26 is connected to a biasing battery 29 and the other terminal of said battery is connected to the top of the condenser 20 at 30. The apparatus described may be employed in a television system when periodic impulses are used as the scanning force for framing purposes, said periodic impulses being caused to momentarily close the switch 22 between the transmission of successive pictures. The operation of this circuit is as follows:—

On the condenser 20 being periodically short circuited it is discharged. When the switch 22 is opened the said condenser 20 commences to charge up from battery 27 through the diode 25, which is arranged to pass a constant current. The diode 23 and triode 26 are respectively biased so that they do not operate at the initial values of the rising voltage across the condenser 20 as it commences charging up.

From known theory this voltage rises linearly with time due to the constancy of the charging current. This condition holds until the voltage reaches the value x on the curve in Fig. 2, (where v may represent the voltage across the condenser 20, and t , time as before,) when the voltage on the plate of diode 23 is sufficient to overcome the effect of the biasing battery 24, and the diode 23 becomes conducting to an extent which increases over a short interval of time. During this time a portion of the current from battery 27 is deflected from the condenser 20, and the voltage across this condenser 20 does not increase as rapidly as heretofore. This effect is shown in Fig. 2 over the part of the curve between x and y . At y the voltage across the condenser 20 and on the grid of the triode 26 becomes sufficient to overcome the effect of the bias battery 29, and the plate circuit of the triode 26 commences to conduct, thus increasing the charging current

and causing the curve in Fig. 2, to bend upwards until the condenser is again short circuited and discharged by switch 22, when the cycle of operations again continues. The result is therefore the production of the desired curve as in Fig. 2.

A triode with the grid suitably biased and connected to point 30 may be substituted for the diode 23. The increasing current through this triode after the point *y*, on the curve, (Fig. 2) will partially counteract the effect of the triode 26 in raising the curve, and must be allowed for in design.

The same general principle of employing differently biased tubes, as explained here, may be employed to change the time rate of change of an input wave over part of its curve.

By altering the scanning wave form from either the transmitter or the receiver, (by means of known remote control devices) the position of the highly defined part of the image may be moved over the remainder of the image. For instance, in the apparatus illustrated in Fig. 3, the relative (mechanical) phase and excitation of the two alternators may be varied, or in the apparatus shown in Fig. 4 the cam may be altered or adjusted.

For the better understanding of the invention an example of one application of the present invention to a cathode ray television system is diagrammatically illustrated in Figs. 7, 8 and 9.

In Fig. 7 a cinematograph film 31 is fed past a cathode ray scanner 32 and photo-electric cell 33. Scanner 32 includes a cathode 41 and anode 42 connected in series with a battery 43 in the usual manner to produce a jet of cathode rays 46, which impinge on the fluorescent screen 34. Light rays from the consequent light spot on the fluorescent screen 34 are focussed by lens 35 onto the film 31. The film is moved past the cell 33 and scanner 32 by means of the sprockets 36 which are both mechanically coupled to shaft 37. Shaft 37 is driven through a gear mechanism 38 by a prime mover 39. The prime mover 39 also drives the generators 3, 4 which supply scanning currents to the circuit 7, as previously illustrated in Fig. 3. Circuit 7 is connected to the deflecting plates 44 of the transmitting scanner 32, and also to the corresponding plates 45 of a receiving cathode ray scanner 40.

The receiving scanner 40 consists of a cathode 47 and anode 48 in series with a battery 49 in the usual manner to produce a jet of cathode rays 50, which impinge on the fluorescent viewing screen 51. The jet 50 is deflectable by potentials applied to the plates 21 and 45. The intensity of the light spot produced on the viewing screen 51 by the impact of the jet 50 is controlled, also in known manner, by the potentials applied to the electrode 52.

The picture currents from the photo-electric cell 33 are transmitted through lines 53 and amplifier 54 to the cathode 47 of the receiving scanner 40 and to the control electrode 52 therein.

Plates 21 of the receiving scanner 40 are connected across the condenser 20. Condenser 20 is discharged and charged up once for every picture transmitted from the film 31 by means of the apparatus 23, 24, 25, 26, 27, 28, 29 (as illustrated previously in Fig. 6), the triode valve 55 being arranged to act as the short circuiting switch 22 shown in Fig. 6.

The lines 56 and battery 57 are connected to switch arm 58 and contact 59. Switch arm 58 is fastened to sprocket 36 so that contact is made to 59 between the transmission of each picture

on the film 31. A high resistance 67 and battery 69 maintain the grid of the triode 55 at a sufficiently negative potential to make the plate circuit virtually non-conducting when contact 58, 59 is open.

The gear mechanism 38 is shown in greater detail in Figs. 8 and 9.

In Fig. 8 the pinion 60 is in mesh with a gear wheel 61 rotated at a constant speed by the prime mover 39 (in Fig. 7) said pinion 60 also engaging teeth in an eccentrically mounted gear wheel 62, mounted on the shaft 37.

It will be seen from the drawings (Fig. 9) that the configuration of the gear wheel 62 is such that though the peripheral speed of said gear wheel 62 is constant, the speed of rotation of the shaft 37 will vary in accordance with the configuration of the gear wheel 62.

The pinion 60 is supported by a member 63 secured to a collar loosely mounted on shaft 37, said member 63 being angularly adjustable by means of a pinion 65 engaging teeth 66 on the member 63, said pinion being rotatable for this purpose by any convenient means, or by known remote control means (not shown); so that the position of pinion 60 may be angularly adjusted in relation to gear wheels 61, 62, thus permitting the variations in speed of shaft 37 in relation to the speed of prime mover 39 to be adjusted in phase or angular relation for the purposes herein defined.

The operation of the apparatus shown in Figs. 7, 8 and 9 is as follows:—

The film 31 at the transmitter and the fluorescent viewing screen 51 at the receiver are scanned synchronously. At the transmitter the scanning movement is provided by the combination of the movement of the jet of cathode rays 46 over the fluorescent screen 34 by the potentials on the plates 44, and the movement of the film 31 by the sprockets 36 past the screen 34 in the direction at right angles to the direction of scanning by the jet 46.

At the receiver the scanning is performed by the combination of the movement of the jet 50 over the fluorescent screen 51 by the potentials on the plates 45, and the movement of the jet 50 in the direction at right angles to this movement by the potentials on the plates 21.

At the transmitting scanner the light from the point of impact of the jet 46 on the fluorescent screen 34 is focussed by means of the lens 35 onto the film 31 and, after passing through the film, impinges on and operates the photo-electric cell 33. The instantaneous value of the current given by the cell 33 is proportional to the density of the film 31 at the point being scanned at that instant, and the current from the cell 33 is transmitted by lines 53 and amplifier 54 to the control electrode 52 of the receiving scanner 40. Therefore the brightness of the spot of light on the fluorescent viewing screen 51 at any instant is proportional to the light and shade of the point of the film 31 which is being scanned at that instant. Therefore, according to the usual theory of the operation of television apparatus, images of pictures on the film 31 at the transmitter will appear on the fluorescent viewing screen 51 at the receiver, provided that both are synchronously and similarly scanned.

In the example illustrated in Fig. 7 synchronism and similarity of scanning are obtained as follows:—

Since the output of the generators 3, 4 is connected to both the plates 44 of the transmitter

scanner 32, and to the plates 45 of the receiver scanner 40, the rapid oscillation of both jets 46 and 50 must be synchronous and exactly similar in velocity at any instant, and, as previously explained, will cause the centre of interest of the picture transmitted to be scanned in greater detail than elsewhere.

Referring to the slower, or "framing", deflection of the jet 50 in the receiving scanner 40, this is provided by the non-linear charging of the condenser 20 across which the plates 21 of the scanner 40 are connected. This, as previously explained, will cause the centre of interest of the pictures to be more closely scanned than elsewhere. This condenser is discharged between the transmission of each picture on the film 31 by means of the contact arm 58 and contact 59 switching in a heavy positive bias from battery 57 onto the grid of the triode 55 thus overcoming the negative bias from battery 69, and causing the plate circuit of said triode 55 to become momentarily highly conducting and hence providing a discharge path for the condenser 20.

It is necessary that the corresponding "framing" movement of the film 31 past the scanner 32 should also be at a slower rate over the centre of interest of each picture on the film 31 than elsewhere. This is provided by the uneven velocity of drive to the sprockets 36 given by the gear mechanism 38, as explained heretofore. And thus, by operation of gear 65 the changes in film speed may be adjusted to correspond with the changes in speed of movement of the cathode ray 50 induced by change in potential of plates 21. It is obvious that any other appropriate variable speed drive may be used in place of the device 38.

Various refinements which will suggest themselves to those skilled in the art may be added without departing from the scope of the invention. As an example, the special scanning wave forms, the production of which is the object of the present invention, may be modified over a part, or only be used over part, of each picture scanned. This may be accomplished, for instance, in the case of the application shown in Fig. 7, by arranging a further series of contact arms and contacts on the prime mover or sprocket shafts, to alter the point on the potentiometer 5 to which the generator 3 is connected, or by cutting out the generator 3 altogether.

By this means the slow scanning of the mid section of each picture,—i. e., from one side to the other thereof or from top to bottom,—may be eliminated at the edges of said section so as to take place only at the centre of the picture, thus emphasizing the real centre of interest and subordinating the entire border.

Furthermore it will be seen that by adjusting the speed of the prime mover 39 in Fig. 7 the speed of transmission and reception of the successive pictures on the film 31 and the image frequency to be transmitted by lines 53 and amplifier 54 may be adjusted, at will, to suit the conditions under which the operation is being conducted and without disturbing the synchronous cooperation of all the operating parts.

In order to avoid the transmission of a complex synchronizing wave from the transmitter to receiver (e. g. by circuit 7, a sinusoidal wave may be employed and converted at the receiver by suitable means to the desired wave form. For instance, in Fig. 7, in cases wherein the prime mover 39 consists of a synchronizing motor, instead of circuit 7 being connected to plates

45 in the receiving scanner 40, a sinusoidal current driving the prime mover may be transmitted to the receiver and caused to drive a prime mover similar to 39 which drives generators such as 2, 4 in Fig. 3 to produce a special scanning wave identical with that in circuit 7 for application to the plates 45 of the receiving scanner 40.

In referring herein to transmission of pictures etc., I mean to refer to methods or apparatus either for the sending or receiving thereof in accordance with the invention or two systems which employ the invention both in sending and in receiving.

It will be understood that the foregoing description of circuits and devices is simply to illustrate and not to restrict my invention which may be embodied in many different forms of apparatus and circuits. I do not intend to limit my invention except as defined in the appended claims.

I claim:

1. Television apparatus comprising means for producing a scanning beam, means for producing a force in wave form, the waves of said force having a retarded rate of change adjacent zero amplitude, means for applying said force to the scanning beam to effect movement thereof across an object to be scanned to scan a portion thereof at a slower rate than that at which the remainder is scanned.

2. Television apparatus comprising means for producing a scanning beam, means for producing a force in wave form, the waves of said force having a retarded rate of change adjacent zero amplitude, means for producing another force of increasing magnitude, means for applying said forces to the scanning beam to effect movement thereof across an object to be scanned to scan a portion thereof at a slower rate than that at which the remainder is scanned.

3. Television apparatus comprising means for producing a scanning beam, means for producing a force in wave form, the waves of said force having a retarded rate of change adjacent zero amplitude, means for applying said force to the scanning beam to effect movement thereof in a path across the object to be scanned to scan a portion thereof at a slower rate than that at which the remainder of the object is scanned, and means to effect relative movement of said beam and object transversely to said path.

4. Television apparatus comprising means for producing a scanning beam, means for producing a force in wave form, the waves of said force having a retarded rate of change adjacent zero amplitude, means for applying said force to the scanning beam to effect movement thereof in a path across the object to be scanned to scan a portion thereof at a slower rate than that at which the remainder of the object is scanned, and means to effect relative movement of said beam and object transversely to said path at a periodically varying rate of speed.

5. Television apparatus which comprises means for producing a scanning beam, means for producing a wave form scanning force and applying the same to said scanning beam to effect vibration thereof along a straight path, and means for modifying said scanning forces to retard the time rate of change of position of said scanning beam over the central portion of its path.

6. Television apparatus which comprises means for producing a scanning beam, means for producing a wave form scanning force and applying

the same to said scanning beam to effect vibration thereof along a straight path, and means for modifying said scanning force to make the time rate of change of said force less over the interval of time during which the center of interest of the object is scanned than during the scanning of the remainder of the picture.

7. Television apparatus comprising means for producing a scanning beam, means for producing a wave form force approximating that given by the expression

$$y = a \sin w - \frac{a}{3} \sin 3w$$

and means for applying said force to said beam to effect vibration thereof.

8. Television apparatus comprising means for producing a scanning beam, a plurality of generators having different outputs and coupled to produce a wave form approximating that given by the expression

$$y = a \sin w - \frac{a}{3} \sin 3w$$

and means to apply said force to the scanning beam to effect vibration thereof.

9. Television apparatus comprising means for producing a scanning beam, a plurality of generators having different outputs and coupled to produce a wave form force having a retarded rate of change adjacent zero amplitude, and means for applying said force to said beam to effect movement thereof corresponding to changes in amplitude of said force.

10. Television apparatus comprising means for producing a scanning beam, a plurality of generators having different outputs and coupled to produce a wave form force having a retarded rate of change adjacent zero amplitude, means for applying said force to said beam to effect movement thereof corresponding to changes in amplitude of said force, and means to effect relative movement of the object to be scanned and said beam transversely of the said first movement at a periodically varying rate of speed.

11. Television apparatus comprising means for producing a scanning beam, a circuit for producing a force proportional to a voltage of progressively increasing magnitude, means in said circuit responsive to variations in the magnitude of said voltage for varying the constants of the circuit to vary the rate of change of magnitude of said voltage, and means for applying said force to said scanning beam to effect movement of the same corresponding to the change in magnitude of the force.

12. Television apparatus comprising means for producing a scanning beam, a circuit for producing a force proportional to a voltage of progressively increasing magnitude, means for applying said force to said beam to effect movement thereof corresponding to changes in magnitude of the force, and thermionic devices in said circuit biased to operate at different values of said voltage for varying the rate of change of magnitude of said force.

13. Television apparatus comprising means for producing a scanning beam, a circuit for producing a force of progressively increasing magnitude,

a rotatable resistor, a contact member, means to rotate said resistor to vary the resistance of said circuit, a second resistor associated with said first resistor to retard the rate of change of resistance during a predetermined interval, means for applying the force to said scanning beam to effect movement thereof corresponding to the change in resistance of said circuit.

14. Television apparatus comprising means to produce a pair of scanning beams, means for producing a wave form force having a slower rate of change adjacent zero amplitude than elsewhere, means for applying said force to said scanning beams to effect vibration thereof along straight paths, means to advance the object to be scanned transversely to one beam at a periodically varying rate of speed, means for producing a force of progressively increasing magnitude proportional to the extent of movement of said object, and means for applying said force to the second beam to effect movement thereof normal to its vibrating movement at the same rate of movement as said object.

15. Television apparatus comprising means to produce a pair of scanning beams, means for producing a force in wave form, the waves of said force having a retarded rate of change adjacent zero amplitude, means for applying said force to said scanning beams to effect movement thereof across objects to be scanned, means to effect relative transverse movement of one beam and the objects scanned thereby at a periodically varying rate of speed, means for producing another force of increasing magnitude proportional to the relative movement between said first beam and object, and means for applying said force to the second beam to effect movement thereof normal to the movement effected by the first force.

16. The method of transmitting an image of an object by television which comprises vibrating a pair of scanning beams along straight paths, moving the object to be scanned transversely to the path of one beam, translating the resulting light various into image currents, causing these image currents to modulate the second beam, moving the path of the second beam transversely in proportion to the movement of the object, and retarding the rate of movement of the scanning beams and object during the interval of time during which the center of interest of the object is being scanned.

17. The method of scanning an object for transmission of an image thereof by television according to which a scanning force is produced in wave form, the waves of said force having a retarded rate of change adjacent zero amplitude, and is applied to a scanning beam to effect movement thereof across the object to scan the center of interest thereof at a slower rate than that at which the remainder is scanned.

18. A method of television scanning which includes causing a spot of light to traverse a subject in such a manner that the instantaneous angular velocity of the spot is a minimum at the center of the traverse, and a maximum at the extremities of the traverse.

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CERTIFICATE OF CORRECTION.

Patent No. 2,037,577.

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It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 2, first column, line 25, in the equation, strike out the equal sign second occurrence, and insert instead a minus sign; and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 19th day of May, A. D. 1936.

Leslie Frazer

[Seal)

Acting Commissioner of Patents.