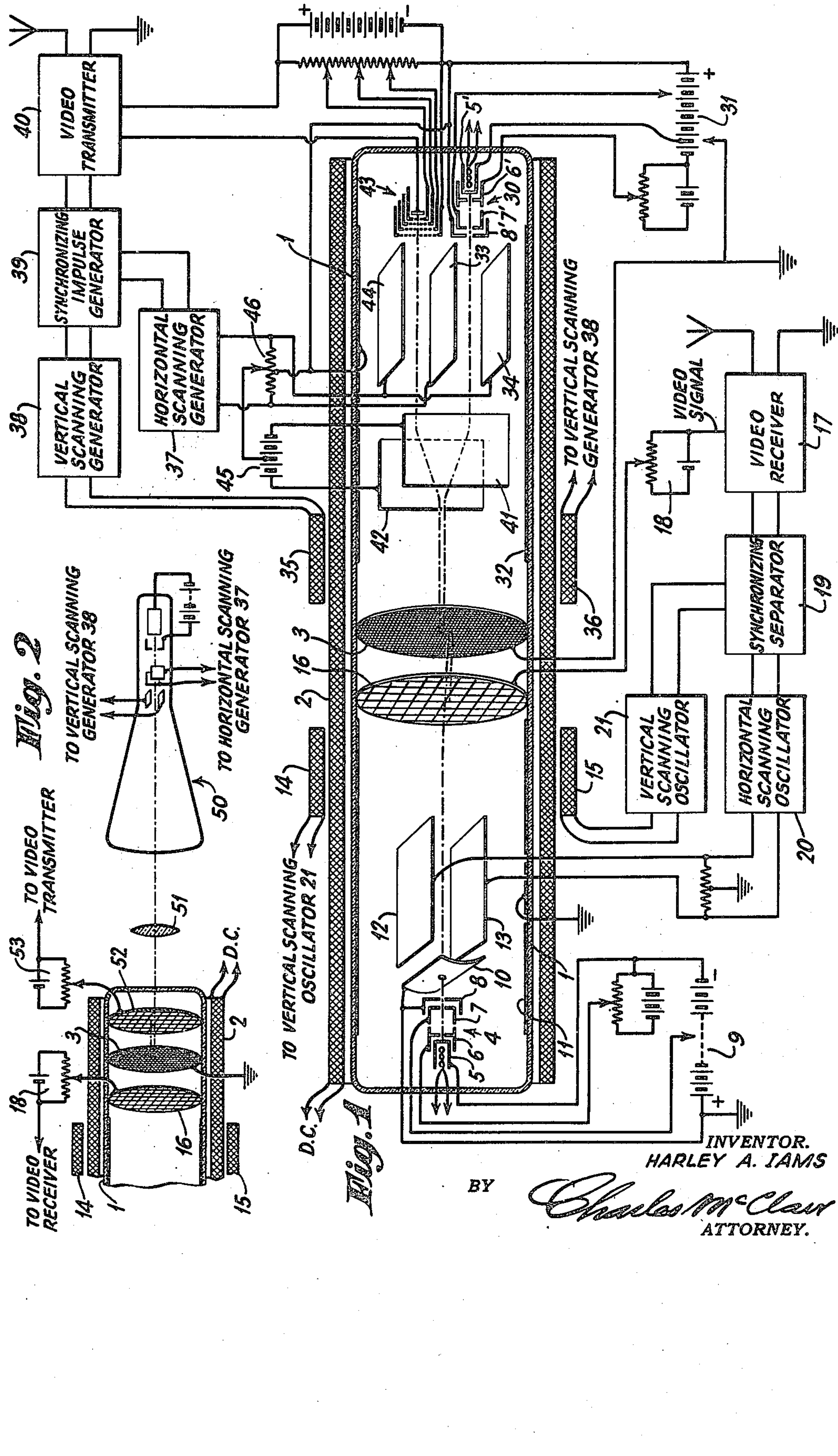
Aug. 27, 1940. H. A. IAMS 2,213,178

TELEVISION TRANSMITTING TUBE AND SYSTEM

Filed June 29, 1939



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Patented Aug. 27, 1940

2,213,178

UNITED STATES PATENT OFFICE

2,213,178

TELEVISION TRANSMITTING TUBE AND SYSTEM

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Application June 29, 1939, Serial No. 281,792

10 Claims. (Cl. 178—6.8)

My invention relates to signal converters for use in converting signals from one transmission system to another system having different standards of transmission, and particularly to tubes, methods and systems for converting transmitted television signals from one set of standards to another.

In an art such as television it is desirable to select uniform standards of operation so that all receivers may be capable of receiving signals from transmitting stations operating on a given set of standards. If, however, transmitters in various localities operate on different standards, receivers in some localities would be incapable of converting the received signals into television images. The term "standards" is here used to mean the frame and field frequencies as well as the number of scanning lines in the picture frame. The standards chosen for any particular transmitter are dependent to a great extent upon the frequency of the power supply system or systems in that locality. Thus it is desirable and almost necessary, if the cost of receivers is to be kept low, to provide field and frame frequencies of scanning equal to the power supply frequency and an exact submultiple thereof. Receivers built to operate from alternating current supply usually have some slight residual hum which either darkens or brightens part of the picture or produces a slight distortion of the frame. If the field frequency of transmission is synchronous with the power supply frequency, these effects are stationary in which case they are not nearly so noticeable to the eye as when moving rapidly across the picture. Since the power supply from different power generating stations often varies in frequency and phase, it will be necessary to convert the signals generated under one set of standards to another set of standards if program material is widely distributed to other transmitters operating from different power stations. Furthermore it is often difficult to synchronize television signals representative of scenes picked up by a portable television relay unit at the television broadcasting transmitter because in certain localities it is often impossible to tie the portable pick-up and relay unit to the power supply lines which supply power to the broadcasting transmitter so that a non-synchronous or direct current supply must be used.

It is an object of my invention to provide a system for converting communication signals, such as television signals, generated or transmitted under one set of standards to signals under another set of standards. It is another object to provide means for converting signals transmitted by one transmitter to signals of another standard and suitable for retransmission by another transmitter. It is a further object to provide a signal converter tube and system wherein the signals to be converted are effective in generating converted and corresponding signals which occupy a time period considerably different from the period of the original signals. It is a still further object to provide either a delay or an accelerating signal converter system wherein the signal frequency of the converted signals may be greater or less than the signal frequency of the original signals. It is a still further object of my invention to provide a converter tube and system wherein the signal energy to be converted may be retained by storage and only a portion of the stored energy utilized in developing the converted and corresponding signals.

In accordance with my invention I provide a method and means for converting received communication signals, such as television signals, transmitted under one set of standards into a charge pattern corresponding to the received signal which is used to generate signals under a different set of standards. More specifically in accordance with my invention I store an electrostatic replica of the signals generated by one system and use the stored replica to generate signals having another set of transmission standards without substantially altering the stored replica. Since the stored replica is not destroyed during the conversion step the converted signals may be generated at a rate greater than the rate at which the incoming signals are made into the replica. These and other objects, features and advantages of my invention will at once suggest themselves to those skilled in the art and will become apparent from the following description of my invention taken in connection with the accompanying drawing in which:

Fig. 1 is a longitudinal view partially in section of my converter tube showing its use in my converter system, and

Fig. 2 is a view of a tube suitable for use in the system shown in Fig. 1 and incorporating certain of the electrode structure shown in the tube of Fig. 1.

My invention will be described in connection with a particular use such as for converting television signals transmitted under one set of standards into signals which may be transmitted in accordance with a different set of standards. It will be observed, however, that the signals to be converted may include telegraph, voice or facsimile signals as well as others where it is desired to generate the converted signals at a frequency greater or less than the frequency with which the signals are received. Furthermore, while my system is particularly adapted to convert signals into new signals occurring at a different frequency or rate, it will be evident that the signal may be taken off the apparatus at a higher rate to obtain high speed transmission, or the order of the incoming and converted signals may be made different to obtain secrecy of transmission.

Referring in general to the system and device shown in Fig. 1, the incoming signals are stored in or on a suitable target which, for converting television signals, has the property of retaining the signals in a space relationship or charge pattern determined by the areas of light and shade from which the incoming signals are generated. In the apparatus, to be more fully described below, the incoming signals are stored in a two-sided target or mosaic electrode by scanning one surface of the mosaic electrode with a high velocity electron beam which is deflected according to the standards of the incoming signals. The high velocity beam generates a constant quantity of secondary electrons which are collected or rejected by the elemental areas of the mosaic in accordance with the signal to be converted. The beam current which may be of the order of magnitude of one microampere or more is not modulated by the incoming signals, but the electrostatic field near the surface of the mosaic electrode which is scanned is varied and the potential of each successive point on the surface of the mosaic is determined by the electric field adjacent the mosaic at the instant the beam strikes the mosaic electrode and thus the charge pattern is formed on the scanned surface. Modulation of the beam current would be contrary to the teaching of my invention because it would be impossible to vary the charge replica unless it were completely neutralized after each frame period. With such an arrangement the advantages of converting to different standards could not be obtained. Further in accordance with this modification of my invention, a strong magnetic field perpendicular to the mosaic electrode is provided for the purpose of preventing redistribution of secondary electrons over the surface of the electrode which might otherwise cause the potential of the charge at elemental areas of the mosaic to drift after the instant of scanning. Thus in accordance with my invention I provide a replica of the original signals or in the case of television signals a replica of the original scene which may be in terms of a charge pattern on a mosaic electrode, essentially the same as the pattern of charges existing in the pick-up tube used to view the original scene and generate the picture signals. The charge pattern existing on the mosaic electrode is now scanned by means other than the electron beam deflected according to the standards of the incoming signals to insure that the charge corresponding to a given part of the picture does not change until it is replaced or supplemented by a charge representing a part of the next picture. This other scanning means, in accordance with the modification shown in Fig. 1, may include another electron beam or "take-off" beam which may be deflected in accordance with another set of standards. In the modification illustrated in Fig. 1 the take-off beam is preferably of low velocity and of low current density so that this beam does not destroy the charge distribution on the mosaic electrode.

Referring more particularly to my signal converting tube and system shown in Fig. 1, the tube comprises an elongated evacuated envelope 1 enclosed by a magnetic focusing coil 2 over substantially its entire length. A target or mosaic electrode 3 of the two-sided type such as that described by Hickok, U. S. Patent 2,047,369, is positioned within the envelope transverse to its longitudinal axis and substantially at its midsection and is connected to ground. The mosaic electrode 3 as used in the modification of my invention shown in Fig. 1 need not be of the photosensitive type but at least one side should have high secondary electron emitting properties. To the right of the mosaic electrode 3 and exposed to the side having the high secondary electron emitting properties, I provide an electron gun 4 which generates and directs an electron beam toward the mosaic electrode 3. The electron gun 4 is of a conventional type and comprises a cathode 5 from which an electron stream may be drawn, a control electrode 6 connected to the usual biasing battery so that the intensity of the electron stream may be controlled and regulated, and a first anode 7 maintained positive with respect to the cathode 5. The electron stream leaving the first anode 7 is accelerated and at the same time may be focused into an electron scanning beam directed upon the right-hand side of the mosaic electrode 3 by a second anode 8 and by an axial magnetic field having lines of force extending from the gun to the mosaic electrode. The first anode 7 and the second anode 8 are maintained at the desired positive potentials with respect to the cathode 5 by a battery or other potential source 9. The negative potential applied to the cathode 5 is preferably high being approximately 1000 volts. Also comprising a part of the electron gun 4 is an apertured electron collecting electrode 10 and a conductive wall coating 11 which are connected to the second anode 8 and to ground. Between the electron gun and the mosaic electrode I provide means for deflecting the electron beam in two mutually perpendicular directions over the secondary electron emitting surface of the mosaic electrode 3. The horizontal scanning is accomplished by the combined electrostatic field generated between the plates 12 and 13 and a magnetic field generated by the coil 2, which field is parallel to the longitudinal axis between the electron gun and the mosaic electrode 3, perpendicular to the extended surface of the mosaic electrode and which preferably extends over the entire length of the tube. The combination electrostatic and magnetic field produces a deflection of the beam in the region of the deflection plates 12 and 13 in a plane parallel to the plates to produce line scanning of the mosaic electrode. Vertical or frame scanning is accomplished by the use of deflection coils 14 and 15. While I have shown two coils for this purpose, it is obvious that a single coil or a further set of electrostatic plates perpendicular to the planes of the plates 12 and 13 might be used. Between the deflection means associated with the electron gun 4 and the mosaic electrode 3 I provide a wire mesh input signal electrode 16 which has a bounded area substantially equal to or greater than that of the mosaic electrode 3, and through which the beam passes to the mosaic electrode.

The signals to be converted to signals having a different set of standards are, for purposes of explanations, received by a conventional video receiver 17 which separates the video signals from the synchronizing signals and applies the video signals to the input signal electrode 16 through the variable bias source 18. The synchronizing signals received by the video receiver 17 are separated into their horizontal and vertical components by the synchronizing separator 19 and applied to the horizontal and vertical scanning oscillators 20 and 21 to drive the deflection plates 12 and 13 and the deflection coils 14 and 15.

In operation the signals to be converted are applied to the grid-like input signal electrode 16 which is in the path of and is traversed by the high velocity beam from the gun 4. These signals vary the ability of this electrode 16 to collect the secondary electrons which are produced on the mosaic when scanned with the high velocity beam. If a positive charge is desired on any element or elements of the mosaic the electrode 16 is made positive at the instant of scanning the element or elements so that the secondary electrons are collected from the element or elements. However, if it is desired to neutralize a positive charge on the mosaic the electrode 16 is made negative at the instant of scanning so that secondary electrons are returned to the scanned element or elements, thereby neutralizing the positive charge impressed on the elements by the loss of secondaries under beam bombardment. Redistribution of secondary electrons from one area of the mosaic to another is prevented by the longitudinal magnetic field generated by the coil 2, thereby preventing loss in resolution and picture detail. I have previously mentioned that intensity modulation of the beam from the gun 4 is not feasible. It will now be appreciated that if the beam were intensity modulated it would be impossible to decrease the charge on the mosaic unless the charge were removed by the take-off beam. Removal of the charge by the take-off beam would prevent the attainment of the principal objects of my invention because it would then be impossible to convert the signals at a different frequency or rate, this ability to convert signals at a different rate and under wide variations in transmission standards being one of the principal advantages of my system.

At the opposite end of the tube from the electron gun 4 and to the left of the mosaic electrode 3 I provide a second electron gun 30 having a cathode 5', a control grid 6' and first and second anodes 7' and 8'. The two guns may be of identical construction except that the electron gun 30 is displaced from the longitudinal axis of the envelope 1. The electrodes of the gun 30 are supplied with operating potentials by a battery or potential source 31 in a manner similar to that by which the elements of the gun 4 are supplied except that the cathode 5' is operated at or near ground potential. The potential of the battery or source 31 may be varied over wide limits but I prefer to use a relatively low voltage such as approximately 100 volts on the second anode 8'. The inner wall of the envelope 1 between the mosaic electrode 3 and the gun 30 is preferably provided with a conductive coating 32 which is maintained at the same potential as the anode 8'. Between the gun 30 and the mosaic electrode I provide means for sweeping the beam over the mosaic electrode in two mutually perpendicular directions. The beam may be swept in a horizontal direction by deflection plates 33 and 34 which are symmetrically positioned with respect to the undeflected path of the beam from the gun 30. Vertical deflection of the beam is provided by a magnetic field generated by the coils 35 and 36 in a manner similar to the deflection produced by the coils 14 and 15 for the electron beam from the gun 4. The plates 33 and 34 are supplied with horizontal scanning potentials by the horizontal scanning generator 37 and the deflection coils 35 and 36 are supplied with vertical deflection currents by the vertical scanning generator 38 which are operated at a frequency determined by the desired set of standards under which the converted signals are to be transmitted. As shown in Fig. 1, there are no synchronizing control connections between the scanning oscillators 20—21 and the scanning generators 37—38, the scanning frequencies of the low velocity beam being generated independently of the high velocity beam scanning. These scanning generators 37 and 38 likewise supply impulses to a synchronizing impulse generator 39 which supplies synchronizing impulses to the video transmitter 40 which transmits the converted signals under the new or different set of transmission standards. The electron gun 30 is preferably displaced from the longitudinal axis of the tube to permit the collection of beam electrons not reaching the target and I, therefore, provide means for lifting the electron beam, preferably after it has been deflected by the combined electrostatic and magnetic fields generated by the plates 33—34 and the coil 2. The beam lifting means comprises the "lifter" plates 41 and 42 which are so energized that the path of the beam after passing through these lifter plates is in a plane parallel with but displaced from the plane of deflection between the plates 33—34. The electron beam from the gun 30 approaches the mosaic electrode 3 with a velocity approaching zero since the cathode 5' of the gun 30 is at or near ground potential and the foundation of the mosaic electrode 3 is at ground potential. Depending upon the intensity of the electrostatic charge on the various areas of the mosaic electrode the electrons of the beam from the gun 30 will be collected by or will be repelled from the surface of the mosaic electrode facing the electron gun 30. These electrons will follow the path of the electrons approaching the mosaic electrode until they enter the field of the lifter plates, whereupon because of the combined electrostatic and magnetic field these electrons will be lifted again by the plates 41—42.

The lifter plates 41 and 42 are supplied with a constant direct current potential by a battery or potential source 45 and have superposed thereon a portion of the horizontal deflecting components from the generator 37. The horizontal components may be applied to the lifter plates 41 and 42 by connecting a resistor 46 across the horizontal scanning generator leads to the plates 33 and 34, the center point of which is tied to the coating 32 and provided with an adjustable tap connected to the midpoint of the potential source 45. The purpose for tying the center point of the resistor 46 to the coating 32 and the lifter plates 41 and 42 to the horizontal scanning generator is to maintain the mean potential of the lifter plates near the potential of the coating 32 and to maintain a constant accelerating field gradient between the lifter plates for all positions of the beam through the lifter plates as determined by the scanning produced by the plates 33—34.

The electrons from the gun 30 which do not reach the left side of the mosaic electrode return to an electron multiplier 43 which is preferably displaced from the longitudinal axis of the tube by an amount equal to the displacement of the gun 30 but on the opposite side of the axis. Since it is desirable to have all of the electrons returning from the left-hand side of the mosaic electrode collected over a relatively small area, an additional deflecting plate 44 is provided parallel to the plate 33 so that these plates are substantially equidistant from the longitudinal axis between the multiplier 43 and the mosaic electrode 3. The electron multiplier 43 may take any desired form and may be a four stage secondary electron multiplier as shown in the drawing. This multiplier 43 functions as an output signal multiplier for the converted signals and the output electrode of the multiplier is connected to the input of the video transmitter 40, where the signals may be combined with the synchronizing impulses and transmitted in the conventional manner.

While I prefer to derive the converted signal from the mosaic electrode by the use of a low velocity electron beam, I may produce the converted signal by light spot scanning as shown in connection with Fig. 2. Referring to Fig. 2 wherein the structure similar to that of Fig. 1 is similarly referenced and the portion of the tube to the left of the mosaic electrode which is not shown is identical to the structure of Fig. 1, I provide means to scan the mosaic electrode 3 with a rapidly moving light beam which is scanned over the mosaic electrode 3 in accordance with the standards under which the converted signals are to be transmitted. In the case of light spot scanning I prefer to make the exposed surface of the elemental areas of the double-sided mosaic electrode 3 light sensitive. Thus if the plugs or elements of the mosaic electrode are of silver, I oxidize and photosensitize the surface of these plugs exposed on the right-hand side of the electrode such as by coating the oxidized surface with caesium. To provide light spot scanning of the mosaic electrode 3, I provide a cathode ray tube 50 which is provided with an electron gun and a fluorescent screen with means for deflecting the electron beam from the gun over the screen in accordance with the standards under which the converted signals are to be transmitted. The tube 50 should have a fluorescent screen having a very short phosphorescent time lag although if the converted signals are to be transmitted under a system using relatively few scanning lines, the cathode ray tube 50 may be replaced with a conventional scanning disk and suitable light source. Intermediate the cathode ray tube 50 and the envelope 1 I provide an optical focusing lens 51 for the purpose of focusing the light generated by the cathode ray tube 50 upon the mosaic electrode 3. For the purpose of collecting photoelectrons liberated from the right-hand surface of the mosaic electrode, I provide a collector electrode 52 which may be of similar construction to that of the modulator electrode 16.

In operation of the structure shown in Fig. 2 the signals to be converted are applied to and stored by the mosaic electrode 3 as described in connection with Fig. 1. A light beam is generated by the cathode ray tube 50 and focused upon the mosaic electrode 3 to liberate photoelectrons which are collected by the collector 52 and applied to the video transmitter 40 through a bias source 53 which controls the potential on the electrode 52 with respect to ground, this potential being adjusted to be slightly positive with respect to ground. The intensity of the light spot which scans the mosaic electrode 3 is maintained at a relatively low value so that photoelectrons liberated from the mosaic electrode 3 inappreciably change the charge stored thereon in accordance with the signals to be converted. In this manner the charge replica representative of the signals to be converted is maintained substantially unaltered irrespective of the speed or rate at which the signals are converted to the new system of standards. For this reason it is possible to generate new signals without destroying the charge replica thereby enabling the generation of the recreated signals in a time sequence indeterminate with respect to the time sequence of the signals to be converted.

It will be evident from the foregoing description of my invention that I have provided means which are effective in generating new signals representative of greater or less time period than that occupied by the original signals inasmuch as I can store the signals to be converted and generate new signals without destroying the charge replica of the original signals. My invention is therefore distinguished over the prior art which utilizes a high velocity intensity modulated beam for storing the signals on a mosaic electrode and a high velocity beam for taking off the new signals, thereby not only destroying the charge replica but rendering it impossible to transmit the converted signals at a rate different from that at which the original signals were generated.

While I have indicated the preferred embodiments of my invention of which I am now aware and also have indicated only a few specific applications for which my invention may be employed, it will be apparent that I have provided a system and method of converting signals transmitted under one set of standards to signals embodying another set of standards which is by no means limited to the exact forms illustrated or the use indicated. Thus, I may create a charge replica of the signals to be converted by apparatus other than that disclosed which nevertheless operates in accordance with my method and utilizes the charge replica for generating new signals by method steps not limited to the specific structure described. Furthermore, it will be apparent that my invention is not limited to the exact forms illustrated or the use indicated but that many variations may be made therein without departing from the scope of my invention as set forth in the appended claims.

I claim:

1. A signal converter tube and system for converting signals transmitted under one set of standards to signals representative of another set of standards comprising a tube having a charge storage electrode, means on opposite sides of said electrode for generating unmodulated beams of radiant energy and directing each of said beams toward said electrode, one of said means comprising an electron gun for generating an unmodulated beam of high velocity electrons, means to deflect said beam of electrons over said electrode in two mutually perpendicular directions, an electron collecting electrode coextensive with and closely adjacent said charge storage electrode and between said electron gun and said charge storage electrode, a source of signal potential representative of the signals to be converted connected between said charge storage

electrode and said collecting electrode to vary the electron collecting ability of said collecting electrode in accordance with the signal to be converted, and to establish electrostatic charges representative of the signals to be converted on said mosaic electrode, means to direct and scan the unmodulated beam of radiant energy from the other of said means over said charge storage electrode without destroying the said charges representative of the signals to be converted to form an electron stream modulated in intensity in accordance with said charges, and means to collect the modulated electron stream to produce current pulses representative of the converted signals.

2. A signal converter system for converting signals representative of one set of transmission standards into signals to be transmitted under another set of standards including a tube comprising a charge storage electrode, an unmodulated electron gun to generate and direct a beam of constant intensity on said electrode to generate on the surface of said electrode secondary electron emission, and an electron collecting electrode coextensive with and closely adjacent said charge storage electrode and between said gun and said charge storage electrode to collect and reject secondary electrons from said charge storage electrode in accordance with signals to be converted and establish on said storage electrode an electrostatic image representative of the signals to be converted, a source of signaling energy connected between said collecting electrode and said charge storage electrode, means to scan the electron beam of constant intensity from said unmodulated electron gun over said charge storage electrode, means associated with said source of signaling energy and connected to said scanning means to deflect the beam in accordance with the transmission standards of the signals to be converted, means on the opposite side of said storage electrode from said electron gun for converting the signals applied between said storage electrode and said collector electrode, said means comprising a source of electrons and an anode to form the electrons from said source into a concentrated beam of low velocity electrons, means to direct and scan said beam of electrons over said charge storage electrode to modulate said beam in accordance with the electrostatic image representative of the signals to be converted without destroying the electrostatic image, an independent source of scanning energy connected to the scanning means, a second collecting electrode to collect the beam electrons not reaching said storage electrode, and an output circuit connected to said second collector to utilize the converted signals in accordance with the standards of retransmission.

3. A cathode ray tube including a charge storage electrode, means including an electron gun and a secondary electron modulating electrode adjacent said storage electrode to generate an electrostatic image on said charge storage electrode representative of electrical signals to be converted into signals having different transmission standards than said first-mentioned signals, a second electron gun oppositely disposed from said storage electrode and said first-mentioned electron gun to generate and direct a beam of electrons at low velocity toward said storage electrode, a pair of oppositely disposed deflection plates along the path of the beam between said gun and said storage electrode, means to generate a uniform magnetic field parallel with the center line between said electron guns, and said target, a further pair of plates similarly positioned but normal to said first pair of plates to deflect said beam substantially at right angles to the deflection produced by said first pair of plates, and means to scan said beam in a direction perpendicular to the deflection produced by said first pair of plates, an additional deflection plate parallel with and opposite one of said first-mentioned plates to control the paths of electrons of said beam returning from said charge electrode, and means to intercept said returning electrons.

4. A system for converting signals transmitted with synchronizing impulses conforming in frequency of occurrence with a predetermined frequency to signals accompanied with synchronizing impulses of a different frequency including a cathode ray tube having oppositely disposed electron sources, means adjacent each of said sources to form electrons into a concentrated unmodulated electron beam, a charge storage electrode intermediate the two electron sources, and means to scan each of said unmodulated electron beams over said storage electrode, means including a source of potential to maintain one of said electron sources highly negative with respect to said storage electrode to accelerate and project the electrons from that electron source at high velocity on said storage electrode, means to maintain said other electron source at substantially the same potential as said storage electrode to project the other unmodulated electron beam upon said storage electrode with substantially zero velocity, an electron collecting electrode coextensive with and closely adjacent said storage electrode and in the path of the beam of high velocity, a source of signalling energy connected to said collecting electrode to vary the electron collecting ability of said collecting electrode whereby an electrostatic image representative of the signalling energy is formed on said storage electrode, a second electron collecting electrode on the side of said storage electrode impinged by the beam having substantially zero velocity to collect the electrons from said beam having substantially zero velocity not reaching said storage electrode, and a signal utilizing circuit connected between said second collecting electrode and the electron source generating the substantially zero velocity beam.

5. The method of television retransmission which comprises the steps of generating and transmitting television signals combined with vertical frame and horizontal line synchronizing impulses, receiving the transmitted television signals combined with both of the synchronizing impulses, separating the television signals from said synchronizing pulses, utilizing said signals to sequentially develop an electrostatic image of electrical charges distributed over an area in accordance with the frame and line synchronizing impulses, generating independently of said received television signals additional vertical frame and horizontal line synchronizing impulses each differing in frequency of occurrence from the corresponding vertical frame and horizontal line impulses separated from said signals, sequentially generating current impulses modulated in accordance with the charges distributed over the same said area in a time sequence determined by said generated synchronizing impulses and producing television signals from said current impulses for retransmission.

6. The method of generating television signals differing in standards of transmission from received television signals transmitted with synchronizing impulses which comprises the steps of transmitting television signals including vertical frame and horizontal line synchronizing impulses, receiving the transmitted television signals, receiving the vertical frame and horizontal line synchronizing impulses representative of the transmission rate of said signals, directly developing an original electrostatic charge image with said signals, developing independently of said received synchronizing impulses additional vertical frame and horizontal line synchronizing impulses each differing in frequency from the corresponding impulses of said received synchronizing impulses, generating current impulses modulated in accordance with the intensity of the charge of elemental areas of said original electrostatic charge image in a time sequence determined by the frequency of said developed synchronizing impulses and utilizing said current impulses for retransmission of television signals coordinated with the developed vertical frame and horizontal line synchronizing impulses.

7. The method of regenerating signals at a rate differing from that of received signals which comprises the steps of transmitting signals representative of intelligence, simultaneously transmitting signals coordinating the transmission of said signals representative of intelligence, said last-mentioned signals including at least two series of signals of different frequency, receiving signals representative of the transmitted intelligence, simultaneously receiving the two signals of different frequency coordinating the transmission of said signals representative of transmitted intelligence, developing with the signals received an original electrostatic charge image representative of the transmitted intelligence, independently producing two series of electrical impulses differing in rates of occurrence from the said two signals coordinating the transmission of said signals, sequentially analyzing the original electrostatic charge image at a rate determined by the rate of the generated electrical impulses to produce electrical impulses representative of the sequential elemental charges of said original charge image and transmitting signals representative of all of said produced electrical impulses.

8. The method of generating signals differing in standards of transmission from received signals which comprises the steps of generating and transmitting signals representative of intelligence, simultaneously generating and transmitting at least two series of signal impulses coordinating the transmission of said signals representative of intelligence, receiving the signals representative of transmitted intelligence, simultaneously receiving the two series of signal impulses coordinating the transmission of the signals received, developing with the signals received an original electrostatic charge pattern representative of the transmitted intelligence, independently producing at the point at which said signals are received electrical impulses having two components of different frequency, each component differing in rate of occurrence from the rates of the impulses coordinating the transmission of the signals received, sequentially generating different signals at a rate determined by the rates at which said electrical impulses having two components are produced by analyzing said original charge pattern without destroying said charge pattern and transmitting the sequentially generated signals under standards determined by the rates at which said electrical impulses are produced.

9. A cathode ray device including an electrostatic charge storage electrode, means including an electron gun to generate an unmodulated electron beam, means to scan said unmodulated electron beam over said storage electrode to generate secondary electrons, a secondary electron collecting electrode adjacent said storage electrode, a source of signalling energy connected between said storage electrode and said collecting electrode to vary the electron collecting ability of said collecting electrode and generate an electrostatic image of mutually isolated electrostatic charges on said charge storage electrode representative of the signals from said source of signalling energy, a second electron gun oppositely disposed from said storage electrode and said first-mentioned electron gun to generate and direct a beam of electrons at low velocity toward said storage electrode, means to generate a uniform magnetic field parallel with the center lines between said electron guns and said target and extending at least over the space between said second electron gun and said target, a pair of oppositely disposed deflection plates along the path of the beam between said second electron gun and said storage electrode to deflect in combination with said magnetic field the unmodulated electron beam from said second electron gun in a plane midway between the plates and scan said unmodulated beam in one direction over said target, means to scan said unmodulated beam from the second electron gun in a direction perpendicular to the deflection produced by said pair of plates and means adjacent said second electron gun to collect electrons of said unmodulated beam not reaching said storage electrode.

10. A device for generating television signals for retransmission comprising an elongated envelope, an electron gun adjacent one end of said envelope, an oppositely disposed target electrode, a magnetic focusing coil surrounding said envelope to generate a magnetic field having lines of force parallel with the center line between said gun and target, means comprising a first pair of deflection plates, each plate of said pair being positioned on either side of the path between said gun and target to deflect the beam over said target in a direction parallel with said plates, a pair of plates substantially perpendicular to the planes of said first pair of plates to displace the beam of electrons to a plane parallel with and displaced from the plane of deflection between said first pair of plates and to additionally displace the electrons of the beam not reaching said target to another plane parallel with and displaced from the plane of deflection between said first pair of plates, means including one of the plates of said first pair to deflect the electrons of the beam not reaching the target in an opposite direction than the deflection imparted by said first pair of plates to the electrons of the beam, electron collecting means removed from the path between said gun and target to collect the electrons returning from said target, a second electron gun on the opposite side of said target from said first-mentioned gun to generate an unmodulated electron beam, means to scan said unmodulated electron beam over the side of said target opposite the side scanned by the electron beam from said first-mentioned

gun, an electron collecting electrode closely adjacent said target and between said target and said second electron gun, a source of signal energy connected between said target and said collecting electrode to vary the electron collecting ability of said collecting electrode whereby secondary electrons liberated from said target when scanned by the electron beam from said second electron gun will be collected or rejected by said collecting electrode.

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