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ELECTRONIC RECEIVER FOR DISK TRANSMITTERS

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Fig. 1.

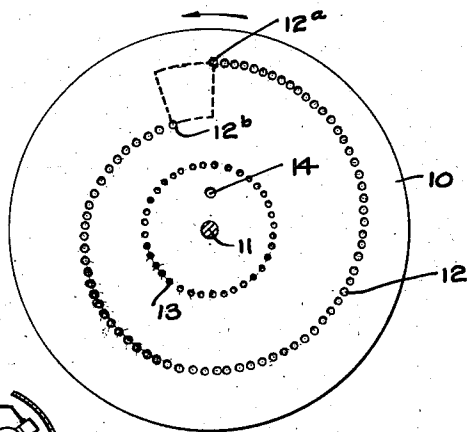


Fig. 2.

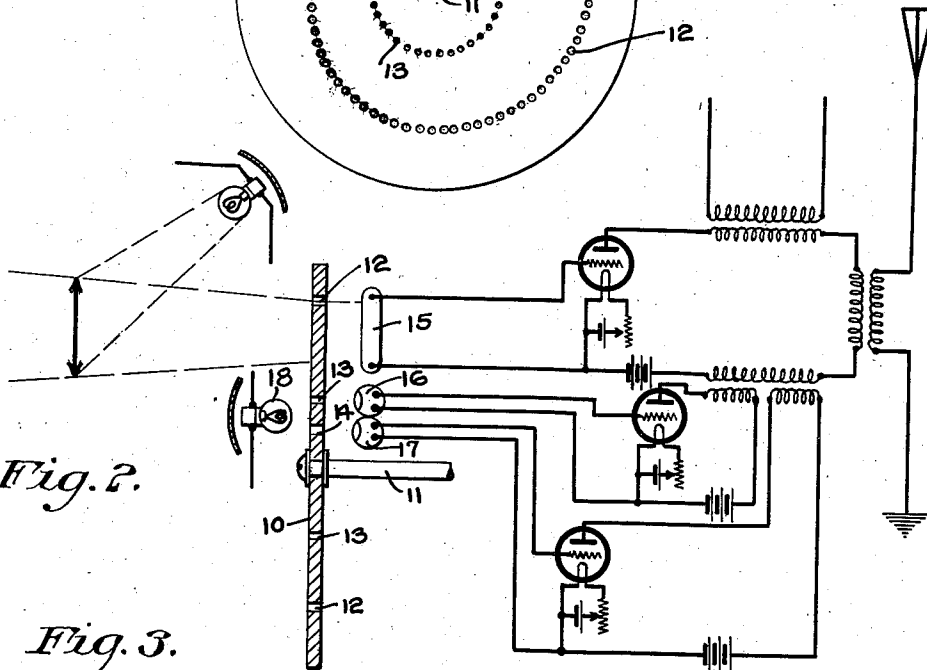
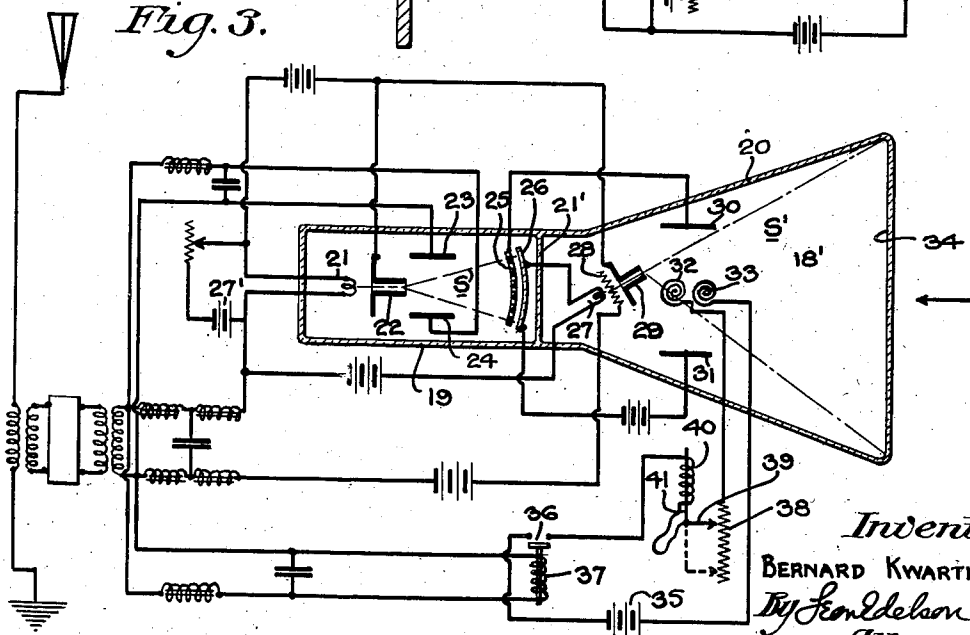


Fig. 3.



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ELECTRONIC RECEIVER FOR DISK
TRANSMITTERS

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3 Claims. (Cl. 178-6)

This invention relates to the transmission of pictures, motion pictures or direct vision for facsimile reproduction at a distance and more particularly to an improved apparatus for and method of transmitting and reproducing the same.

It is among the objects of the present invention to provide a television system in which images, in the form of pictures and the like, are transmitted by means of a mechanical transmitter, such as the type employing a perforated disk, and are received by means of a cathode ray receiver. Heretofore and prior to this invention no attempt has been made to my knowledge to combine a mechanical transmitter and an electronic receiver in order to obtain the advantages which are inherent in such types of transmitters and receivers.

Those skilled in the art to which this invention appertains realize that television is faced with two most imperative requirements, one of which is to increase the size of the facsimile reproduction of the transmitted image and the other to increase the detail and at the same time decrease the distortion of the reproduced image. It is known that by increasing the diameter of the disk employed in the mechanical systems of television, larger received images may be obtained. However, for a reasonable size of image the diameter of the receiving disk would necessarily be too great to be safely or conveniently used in the home. It is also known that by reducing the size of the apertures in the disk and increasing the number thereof, a greater amount of detail is obtainable in the received image but this also requires the use of a disk the diameter of which is objectionably great.

For transmitting purposes the objections against the use of a scanning disk are more readily overcome because in the transmitting station the size of the disk presents no real difficulty. For receiving purposes the cathode ray tube offers the desired solution and it only remains to devise some arrangement whereby the cathode ray tube, as a receiver, may be synchronized with the revolving scanning disk, as a transmitter. This I have accomplished by means of the present invention and as will be set forth in greater detail hereinafter.

Other objects of the invention will appear more fully hereinafter.

The invention consists substantially in the combination, construction, location and relative arrangement of parts, all as will appear more fully hereinafter, as shown in the accompanying drawing and as finally pointed out in the appended claims. For the purpose of more particularly ex-

plaining the principles of the present invention, I have described in the following specification the application of my invention to that type of television transmitter which employs a revolving apertured disk for scanning the subject to be televised. It will be understood however that this invention is not at all limited to such a specific application inasmuch as it is equally applicable to any and all of the present known types of mechanical transmitters, such as the drum scanner, the mirror drum, etc.

In the accompanying drawing:—

Figure 1 is an elevational view of a scanning disk employed in connection with the present invention;

Figure 2 is a diagrammatic view of a transmitter arranged for operation in accordance with this invention; and

Figure 3 is a diagrammatic view of a cathode ray receiver for use with the transmitter of Figure 2.

Referring now to the drawing and more particularly to Figures 1 and 2 thereof, it will be seen that the television system embodying the principles of the present invention utilizes a mechanical transmitter of the type employing a perforated scanning disk 10. This disk is suitably mounted upon a rotatable shaft 11 to which rotation is imparted of a suitable speed by a motor (not shown). As appears most clearly in Figure 1 the disk 10 is provided with a suitable number of apertures 12 arranged in a spiral. While the number of these apertures may be varied within certain limits, I believe best average results are obtained through the use of seventy-two holes with the disk making twenty revolutions per second. This is equivalent to 1440 scanning lines per second or a signal frequency of 1440.

In addition to the apertures 12, the disk 10 is provided with a circle of apertures 13, the total number of which is 36 or half the number of apertures 12. As appears quite clearly in Figure 1, the circle of apertures 13 is well within the spiral of the scanning apertures 12. The disk 10 is also provided with a single aperture 14 disposed within the inner circle of apertures 13. Preferably, the single aperture 14 is of larger diameter than either the apertures 12 or 13. With the disk 10 making 20 revolutions per second, it will be apparent that the apertures 13 will provide a frequency of 20×36 or 720, while the aperture 14 will provide a frequency of 20×1 or 20. It will be understood of course that these frequencies are merely exemplary and may be varied as deemed expedient by changing either or both the number

of apertures 12 and 13 employed or the speed of revolution of the disk.

Referring now to Figure 2 it will be observed that the subject to be scanned is positioned in front of the disk 10 so that the light rays reflected therefrom are projected through the scanning apertures 12. Immediately to the rear of the disk is a light responsive element 15, such as a photo-electric cell, this element being so positioned that it is successively influenced by the light passing through each of the several apertures during the rotation of the disk. The photo-electric cell is included in a suitable amplifying circuit and converts the light fluctuations into corresponding electrical variations which are superimposed upon and so modulate the usual carrier wave employed in the transmission of electrical signals or impulses either by wire or radio. It is the signals or impulses thus established by the photo-electric cell 15 that are transmitted for subsequent reception at a remote point and there translated back into corresponding light variations to produce the facsimiles of the transmitted subject.

Also disposed immediately behind the scanning disk are a pair of photo-electric cells 16 and 17. In front of the disk and adapted to project light through the apertures 13 and 14 is a source of constant light 18. The cell 16 is thus influenced 36 times for each revolution of the disk or 720 times per second. The cell 17 is influenced once per disk revolution or 20 times per second. The cells 16 and 17 therefore respectively produce signals having frequencies of 720 and 20, which frequencies are also superimposed upon and so modulate the carrier wave. The transmitter thus transmits a carrier wave which is modulated not only by the scanning signals of 1440 frequency but also by the auxiliary signals of 720 and 20 frequencies, respectively. The purpose of latter frequencies and the necessity for creating them will be apparent hereinafter.

At this point it is important to note that the disk 10 is designed to rotate in one direction only, in this instance, in a counter-clockwise direction. This means of course that each of the scanning apertures 12 scans the subject along a single line and always in the same direction. The uppermost line is that obtained by the aperture 12^a while the lowermost is that obtained by the aperture 12^b. These facts are important and must be taken into consideration when it is realized that in a cathode ray tube the electron beam oscillates from side to side.

Referring now to Figure 3, it will be observed that the receiver therein shown is of the cathode ray or electronic type. This receiver, designated generally by the reference numeral 18', comprises a pair of tube members 19 and 20 separated by a partition 21'. While I prefer to construct these members 19 and 20 as an integral unit as shown, it is to be understood that they may be constructed as independent units the circuits only of which may be electrically connected together.

The member 19 of my receiver is a tube of the Braun type and includes a thermionic cathode 21, an anode 22, and a pair of plates 23 and 24 for deflecting the electron stream in a horizontal plane. At the rear end of the member 19 is a perforated metallic plate 25 preferably in the form of a screen, and an imperforate plate 26. These plates 25 and 26 are each of arcuate shape horizontally of the tube and are spaced a slight distance apart with the perforated plate 25 disposed within the imperforate plate 26. It will also be observed that the plates 25 and 26 are arranged

with their opposite ends terminating short of the opposed side walls of the member 19.

The thermionic cathode 21 is energized in any suitable manner, as by a source of potential 27' to produce the electron stream S, which latter passes through the tubular anode 22 and toward the plates 25 and 26. The stream S not only contacts the perforated plate 25 but also passes there-through for contact with the plate 26. The oscillatory movement of the stream S is controlled by the electrostatic field established between the plates 23 and 24, these plates being energized by the signals of 720 frequency which were produced by the transmitter (by light rays from source 18 passing through apertures 13 and so influencing photo-electric cell 16—see Figure 2).

The stream S, being a conductor, serves a dual purpose in the receiver, first, as an electrical connection between the plates 25 and 26 and second, to complete the circuit for the thermionic cathode of the receiver member 20. This member 20, which as stated above may be formed as an independent unit, includes a thermionic cathode 27, a control element 28, an anode 29, a pair of plates 30 and 31 for deflecting the electron stream S' in a horizontal plane, and a pair of coils 32 and 33 for shifting the stream S' downwardly from the position which it tends normally to maintain.

The secondary thermionic cathode 27 has one terminal thereof connected to the plate 26 while the remaining terminal is connected in circuit with the primary cathode 21. The secondary plates 30 and 31 are respectively connected to the perforated plate or grid 25 and imperforate plate 26. By proportioning the plates 25 and 26 such that the angle subtended by planes common to the opposite edges of said plates and intersecting at the anode 22 is less than the angle through which the stream S oscillates, it will be apparent that for each oscillation of the electronic stream S the electrical connection between the plates 25 and 26 will be interrupted twice. If the number of oscillations of the stream S is 720, it will be apparent that the circuit in which the deflecting plates 30 and 31 are included will have a frequency of 1440 which is equal to the scanning or image frequency established in the transmitter.

The tube or member 20 of the receiver is provided with flaring walls to provide at its outer end an enlarged screen or target 34 the surface of which is suitably treated to render it fluorescent when contacted by the electronic stream S'. It is important to note that the anode 29 of this member is inclined with respect not only to the horizontal but also with respect to the vertical. In this particular instance, the axis of the anode projects toward the upper, right hand corner of the fluorescent screen 34 when the latter is viewed in the direction of the arrow. It will thus be apparent that when the stream S' is influenced by the plates 30—31 or by the coils 32—33 it will tend to assume a position extending between said corner of the screen and the anode.

It will be remembered that in the disk transmitter the scanning is always in one direction for each line, say from right to left. In addition, the lines are obtained successively from top to bottom and never in reverse order. The cathode ray receiver must obviously operate in similar manner if successful results are to be obtained. The deflecting plates 30—31 insure obtaining horizontal deflections of the electron stream S' equal in number per second to that produced by the revolving disk. One of these deflections is ob-

tained for each interruption between the members 25 and 26 of the tube 19. In addition, each time the primary stream S leaves the plate 26 the circuit leading to the secondary cathode 27 is interrupted and the latter becomes temporarily deenergized in consequence of which the stream S' disappears only to reappear again along a line coincident with the axis of the anode 29 upon subsequent energization of the cathode 27. The stream S' thus moves horizontally always in the same direction, that is, from right to left.

In order to shift the electron stream S' downwardly in accordance with the corresponding scanning sequence at the transmitter, the coils 32 and 33 are employed. As appears quite clearly in Figure 3, these coils are located at top and bottom of the tube 20 and are included in circuit with a source of energy 35. The coils 32—33 tend normally to depress the stream S' simultaneously as the deflecting plates 30—31 cause it to shift from right to left. Included in circuit with the coils 32—33 is a normally closed switch 36 which is adapted to be opened by an electromagnet 37 when the latter is energized. This electromagnet 37 is energized at a frequency per second equal to the number of "frames" which are produced by the transmitter in a second, which in this instance is equal to 20. This "framing" frequency is produced by the aperture 14 in the transmitting disk and is supplied to the electromagnet 37.

Immediately upon energization of the electromagnet 37 the coils 32—33 are deenergized with the result that the stream S' assumes its normal position with the outer end thereof at the top of the screen. Instantly, however, under the influence of the again energized coils 32—33 the stream S' is again depressed simultaneously as it horizontally traverses the screen 34.

In order to increase the strength of the vertical deflecting coils 32—33 as the stream S' moves out of its uppermost or normal position, it may be desirable to include a variable resistance 38 in circuit with the source of energy 35. The movable contact 39 of this resistance unit is connected in series with the coil of an electromagnet 40 and is suitably carried by the movable armature 41 of the magnet. Normally, the contact 39 is in the dotted position but when the switch 36 is closed the coil 40 is energized as are the coils 32—33 in consequence of which the contact is shifted to decrease the resistance and so permit a greater current to be supplied to the coils 32—33. This arrangement is of course merely illustrative and may be varied as may be deemed advisable by those skilled in the art.

It will of course be understood that the carrier wave as modulated by the scanning or image frequency produced by the apertures 12 of the disk, the deflecting frequency produced by the apertures 13, and the "framing" frequency produced by the aperture 14, is received at the receiving station either by wire or by radio. At the receiving station, the several modulating frequencies are suitably by-passed in such manner that while the relatively high frequency signals are supplied to the horizontal deflecting plates 30—31 of the receiver and the low frequency "framing" signals are employed to control the vertical deflecting coils, the image signals are employed to variably energize the cathode ray tube 20.

It will be understood that the present invention is not limited to the particular type of transmitting system hereinbefore described and that

its general principles are applicable to other systems of television. Obviously, changes and modifications may be made from time to time without departing from the general principles and real spirit of the invention and it is intended, accordingly, to claim the same broadly as well as specifically as indicated by the appended claims.

What is claimed as new and useful is:—

1. In a television system, in combination, a transmitting apparatus including mechanical means for scanning an object by a beam of light to produce a series of light fluctuations and having operatively associated therewith light sensitive means for converting said light fluctuations into transmissible electrical signals of a frequency corresponding to said light fluctuations, said apparatus also including means for generating a second set of signals of a frequency half that of said first-mentioned signals, and means for transmitting said first and second sets of signals, an electronic receiver including primary and secondary thermionic cathodes for producing a facsimile image of said object from glow points evolved by potential impressed upon said secondary cathode, said primary cathode being suitably energized to produce a primary electronic stream the oscillation of which is controlled by said second set of transmitted signals, means for effecting the oscillation of said primary electronic stream in a substantially horizontal plane, and means for effecting a horizontal movement of the electronic stream projected from said secondary cathode, said movement being always in the same direction and at a frequency equal to that of said first set of transmitted signals.

2. In a television system, in combination, a transmitting apparatus including mechanical means for scanning an object by a beam of light to produce a series of light fluctuations and having operatively associated therewith light sensitive means for converting said light fluctuations into transmissible electrical signals of a frequency corresponding to said light fluctuations, said apparatus also including means for generating a second set of signals of a frequency half that of said first-mentioned signals, and means for transmitting said first and second sets of signals, an electronic receiver including primary and secondary thermionic cathodes, means for effecting horizontal deflection of the electronic streams emanating from each of said cathodes, and means interposed in the path of said primary electronic stream for insuring the horizontal deflection of the secondary electronic stream at a frequency equal to that of said first set of transmitted signals, said interposed means being operated to deenergize the secondary cathode at the instant when said secondary electronic stream reaches the limit of its deflection in a given direction, thereby insuring a deflection always in the same direction.

3. In a television system, in combination, a transmitting apparatus including mechanical means for scanning an object by a beam of light to produce a series of light fluctuations and having operatively associated therewith light sensitive means for converting said light fluctuations into transmissible electrical signals of a frequency corresponding to said light fluctuations, said apparatus also including means for generating a second set of signals of a frequency half that of said first-mentioned signals, and means for transmitting said first and second sets of signals, an electronic receiver including primary and sec-

ondary thermionic cathodes, each of said cathodes being adapted to produce an electronic stream, means for effecting the horizontal oscillation of the primary electronic stream, means for effect-
5 ing the horizontal deflection of the secondary electronic stream, said secondary cathode being relatively so arranged that the axis of the electronic stream normally emanating therefrom de-
fines the limit of the deflection thereof in one direction, and means for effecting the energiza-
tion of said secondary cathode only during the period that said secondary electronic stream is moving away from said aforementioned deflec-
tion limit. 5

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