

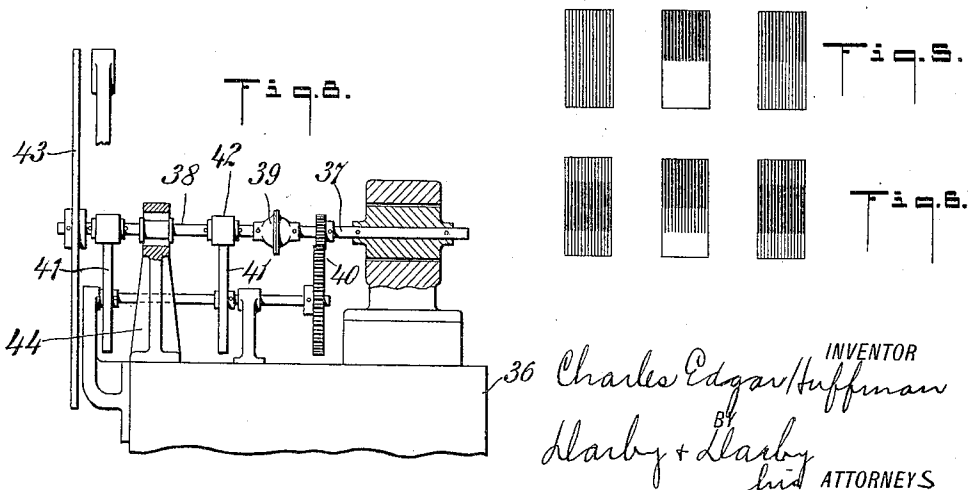
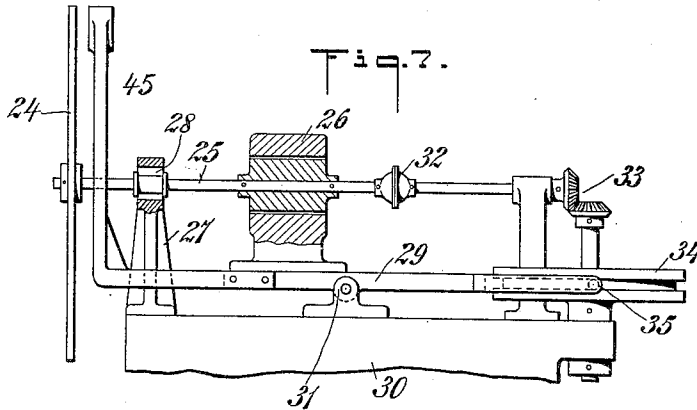
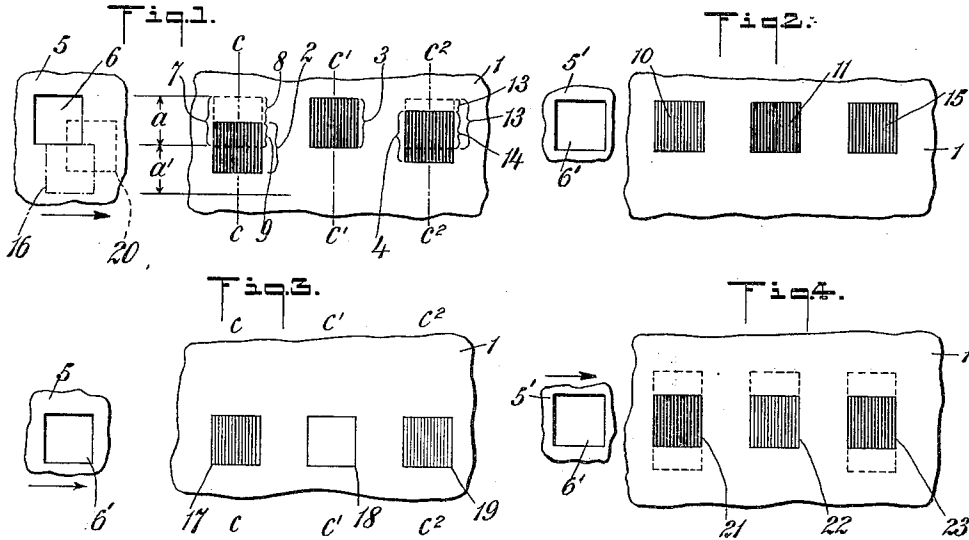
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TELEVISION METHOD AND APPARATUS

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TELEVISION METHOD AND APPARATUS

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This invention relates to television systems and with particularity to methods and means for analyzing and synthesizing elemental areas of an image or the like.

Heretofore various methods have been devised for analyzing and synthesizing the successive elemental areas of an image, picture, or object to be transmitted, but all these prior art methods are open to the objection that an analyzing device of finite dimensions must be employed with corresponding lack of detail. For example, in one type of analyzing mechanism there is provided a rotating element provided with scanning perforations which are made as small as is consistent with the amount of light necessary to be transmitted therethrough. Likewise, the synthesizing elements, because of their relatively large size, are unable to reproduce the characteristics of the elemental areas of the image without, what may be termed, an averaging effect. For example, in those systems wherein the object or image is scanned in successive linear elements, while it is desirable to produce a response corresponding to an infinitely small area of the image or object, the size of the scanning or reproducing element, such as the disc perforation, merely produces a response which is the average of a great number of infinitely small areas. Accordingly, it is an object of the present invention to enable the usual scanning apparatus to be operated in such a manner that the effects of extremely fine analysis are produced. In achieving the above noted object it is proposed, in accordance with the invention, to depart from the usual manner of scanning, and to provide means whereby the scanning is accomplished by traversing the image or picture in overlapping lines.

A feature of the invention resides in the method of scanning whereby a scanning element of comparatively large size is used and produces results corresponding to a much smaller scanning element.

Another feature of the invention resides in a method of scanning whereby one traverse of the scanning device produces effects corresponding to a linear element, and another traverse of the scanning device produces a

response corresponding to a set of overlapping adjacent linear elements.

Another feature pertains to a method of scanning wherein a strip of the image or object is scanned first through a central portion thereof and then through edge portions overlapping said central portion.

A further feature relates to a method of scanning wherein each scanning element is caused to traverse the image or object in successive parallel lines and each scanning element is subjected to a motion perpendicular to the direction of scanning.

Another feature pertains to the means for effecting the scanning of an image or object in overlapping parallel linear elements.

A still further feature pertains to the means for effecting the reproduction of pictures or images at a distance with a greater degree of faithfulness and detail than has heretofore been found practical in existing scanning devices.

Other features and advantages of the invention not specifically enumerated will be apparent after a consideration of the following detailed description and the appended claims.

While the invention will be disclosed hereinafter as applied to one well known type of scanning device it will be understood that any other equivalent type of scanning means may be employed and only sufficient portions of a television system are shown as will enable a clear understanding to be obtained of the manner of practicing the invention.

Fig. 1 of the drawing represents successive steps in the method of scanning according to the invention;

Figs. 2, 3 and 4 represent the successive steps in the method of reproduction according to the invention;

Fig. 5 illustrates one manner of means for carrying out the method illustrated in Figs. 1 to 4;

Fig. 6 shows another manner of means for practicing the inventive method; and

Figs. 7 and 8 illustrate a mechanism for effecting the overlap scanning.

Referring more particularly to Fig. 1 the numeral 1 represents a highly magnified por-

tion of a picture, image, or object, the characteristics of which are to be transmitted and reproduced at a distance and the numerals 2, 3, 4 represent elemental areas of the magnified portion 1. Solely for the purpose of explanation it will be assumed that the elemental areas 2, 3 and 4 are of the same shade characteristics, for example black, and that the remaining area of the magnified portion 1 is white. In the case of a film it will be clear that the elemental areas 2, 3 and 4 will then correspond to maximum opaque portions and the remaining area will be of maximum transparency. Associated in the well known manner with the image to be transmitted is a scanning or analyzing apparatus, a section of which is represented schematically in Fig. 1 of the drawing by the numeral 5. In order to simplify the explanation of the invention a single scanning element 6 is shown. This scanning element may be a lens such as disclosed in United States Patent No. 1,679,086 to C. F. Jenkins, granted January 2, 1925. It will be assumed that the scanning element 6 traverses the image 1 in the direction of the arrow and for the purpose of simplifying the explanation it will be assumed that the image is divided into linear elements having a width a corresponding to the size of the scanning element 6. Accordingly when the center of the scanning element 6 is in registry with the center line c of the elemental area 7 of the image 1 the photo-electric cell or other light sensitive device is energized by the average amount of light passing through the element 6 which, in the example shown in Fig. 1, is an average of the white portion 8 and the black portion 9.

In other words, the light sensitive device is energized as if the area 7 were a light gray characteristic. Accordingly, the reproducing integrating element 6' corresponding to the transmitter scanning element 6 and moving in synchronism therewith, causes to be produced a light spot which is neither black nor white, but rather an average as illustrated by the light gray spot 10 in Fig. 2. As the analyzing element 6 at the transmitter comes into registry with the center line c' of the black elemental area 3 there is produced in the light sensitive device a response which corresponds to the true overall characteristic of the elemental area 3. Consequently, the reproducing mechanism is enabled to produce a light spot which is of the true characteristic as represented by the elemental spot 11 of Fig. 2. For example, if the elemental area 3 of the image is totally black as above assumed then no light reaches the light sensitive device and, consequently, a corresponding black spot 11 is reproduced at the receiving station. As the center of the scanning element 6 is brought into registry with the center line c^2 of the elemental area 12 of the image there is produced a response

which is the average of the white portion 13 and the black portion 14. Inasmuch as the portion 14 predominates, the light sensitive device produces a response which is neither black nor white, but rather a mixture such as dark gray, depending upon the relative proportions of the areas 13 and 14. Consequently, the reproducing mechanism instead of producing a spot having two sharply demarcated portions of white and black produces a spot which is rather of a dark gray characteristic, as represented by the numeral 15 of Fig. 2. After the first linear element of the image 1 is scanned as above described the scanning element 6 traverse the image across the next adjacent linear element a' as represented by the dot dash square 16. When the center of the element 6 is again brought into registry with the center line c the light sensitive device responds to a light value which is, in the example assumed in Fig. 1, a mixture of half black and half white. Consequently the reproducing element produces a light gray spot as represented by the numeral 17 of Fig. 3. In other words, instead of producing a spot which is composed of two sharply defined sections of black and white there is produced a single spot of a light gray characteristic. As the transmitting element 6 is next brought into registry with the center line c' the area of the image 1 being completely white the light sensitive cell is enabled to produce a true response. Likewise, the reproducing element 6' produces a light spot which is white as represented by the numeral 18 of Fig. 3. As the scanning element 6 is next moved into registry with the center line c^2 there is produced a response which corresponds to a mixture of a small black area and a much larger white area. In other words, the light sensitive device responds to the area under consideration as if the same were a very light gray characteristic. Consequently, the reproducing mechanism likewise produces a light spot which is of a very light gray characteristic as represented by numeral 19 of Fig. 3.

The above described method of scanning is that usually employed in existing television systems whereby the image to be transmitted is scanned in adjacent non-overlapping linear elements, and in the case of the image 1, the reproduction would be as shown in Fig. 5. In accordance with this invention instead of scanning the image in discreet adjacent linear elements it is proposed, in addition, to rescan the edges of the adjacent linear elements. In other words, considering the image portion 1 of Fig. 1 the usual method of scanning would be as above described, namely to scan the linear elements a , then the linear element a' and so on for each succeeding linear element. In accordance with this invention the linear element a is first scanned, then the linear element a' as above

described, and the scanning element 6 is then caused to move into an intermediate position as represented by the dotted square 20. As the element 6 is moved into registry with the center line c during this intermediate scanning there is produced in the light sensitive cell a response corresponding to the totally black area 2. Consequently a true reproduction of said area 2 may be made at the receiving station. As above assumed, the area 2 is totally black and, consequently, there is produced in the corresponding special position at the reproducing station a totally black spot 21 (Fig. 4). As the element 6 is next brought into alignment with the center line c' there is produced in the light sensitive cell a response which is a mixture of black and white, and in other words, light gray, and a corresponding reproduction is obtained, as represented by the numeral 22 of Fig. 4. Similarly, as the element 6 is brought into registry with center line c'' there is produced a response corresponding to a dark gray area and there is reproduced a spot as represented by the numeral 23 of Fig. 4.

Because of the rapidity of scanning and as a result of the permanency of the visual impression there is produced in the eye what may be termed a "super imposition" of the separate triple scanings of the adjacent linear elements a , a' , and this super-imposed effect enables the image to be reproduced with the effect of a much finer detail. For example, Fig. 5 illustrates the manner in which the two adjacent linear elements of the image 1 would be reproduced in accordance with the prior art methods of scanning. Whereas by using the method of the present invention, namely an intermediate scanning, the same linear elements are reproduced in the manner shown in Fig. 6 which, it will be seen, more clearly resembles optically the characteristics of the image 1 than does the reproduction of Fig. 5. While in Fig. 6 there is produced what may be termed a "fringing effect" between the elemental areas this fringing effect will be of a more nearly uniform characteristic throughout the reproduced image and can be compensated for, or optically removed, by suitable adjustments of the amplifier or reproducing light source.

While any suitable mechanism may be employed for effecting what may be termed the overlapping or intermediate scanning step according to the invention there are illustrated in Figs. 7 and 8 of the drawing two representative mechanisms for this purpose. Referring particularly to Fig. 7 the numeral 24 represents any well known form of scanning disc which is attached to the shaft 25 of the driving motor 26. Shaft 25 passes through a standard 27 which is provided with a vertical slot 28 to permit the shaft 25 to move in a vertical direction without lateral displacement. The motor 26 is carried by a frame 28 which is mounted on a base plate 30 in suitable pivot bearings 31 whereby said frame 28 and the motor 26, together with the disc 24, may be oscillated in a vertical direction. For the purpose of effecting this oscillatory movement of the disc 24, the shaft of the motor is connected through a universal coupling 32 to a set of gears 33 which drive at the proper rate of speed a shrouded cam 34. Riding in said cam 34 is a cam follower 35 rigidly attached to an extension on the frame 29. The cam 34 is so designed that for each revolution of the shaft 25 the scanning disc 24 is displaced vertically a distance corresponding to half the width of the scanning perforations, and at each third revolution is brought back to its original position. If desired, however, the gearing may be so arranged that the disc is displaced vertically the required distance to produce the intermediate scanning after each linear element is scanned. In other words, after two linear elements have been scanned the disc is moved vertically so that the next scanning element traverses a path which is midway between that covered by the two preceding scanning elements.

In order that the optical axis of the scanning system may be maintained in the proper relation during the oscillation of the disc, it is preferable to mount said system on a bracket 45 attached to the frame 29 as shown.

Instead of oscillating the motor to produce the displacement of the scanning device an arrangement such as shown in Fig. 8 may be employed wherein the motor is rigidly fastened to the base plate 36 and has its shaft 37 coupled to the disc shaft 38 by a universal coupling 39, preferably of the Oldham type. The disc shaft 38 is provided with a bearing standard 44 similar to the standard 27 of Fig. 7. The motor shaft 37 drives through suitable gearing, represented by the numeral 40, a set of cams 41 and co-operating with said cams are followers 42 on the shaft 38. As the cams rotate the shaft 38 and the disc 43 are moved vertically the required distance. By this arrangement the disc is moved vertically in the same plane and, consequently, the optical system may be fixed to the base 36.

While the disclosures of Figs. 7 and 8 are merely representative it is to be understood that any equivalent mechanical arrangement may be employed to effect the intermediate scanning step. It is further understood while a perforated scanning disc is described, a lens, mirror, or other well known type of scanner may be employed. Furthermore while the scanning mechanism is shown as being mounted to scan in horizontal lines and to be displaced vertically it will be clear that the disc may scan in vertical lines and be

displaced horizontally, or at any other desired angle.

It will also be understood that similar scanning and reproducing mechanisms are employed at the transmitting and receiving stations respectively and that usual means are employed for maintaining synchronism.

It will also be understood that instead of oscillating the scanning element to effect the intermediate scanning, the usual scanning apparatus may be employed and the object, image or representation as well as the reproducing screen may be given the requisite oscillatory movement.

What is claimed is:

1. In a system for transmitting visual representations the method of scanning which comprises analyzing one linear element of the object or representation, separately analyzing another non-overlapping contiguous linear element, and then analyzing simultaneously overlapping portions of each of said linear elements.

2. In a system for transmitting visual representations the method which comprises analyzing the entire object or representation in a plurality of non-overlapping contiguous successive linear elements, and re-analyzing said object or representation in another plurality of linear elements displaced from said first elements.

3. The method of compensating for the integrating effects of an analyzing device of finite dimensions which comprises positioning said element in registry with one elemental area of the object or representation to be analyzed, positioning said device in registry with another non-overlapping adjacent linear element spacially distinct from said first linear element and positioning said device in registry with portions of both said first and said second elemental areas.

4. The method of compensating for the integrating effects of an analyzing device of finite dimensions which comprises positioning said element in registry with one elemental area of the object or representation to be analyzed, positioning said device in registry with another non-overlapping adjacent linear element spacially distinct from said first linear element, and positioning said device in registry with portions of both said first and said second elemental areas, and repeating the foregoing for each of the succeeding sets of elemental areas.

5. The method of scanning which comprises first analyzing adjacent contiguous non-overlapping linear elements of the image or representation and then simultaneously analyzing adjacent portions of each of said linear elements.

6. In a system for transmitting visual representations, means for analyzing adjacent contiguous non-overlapping lateral portions of an elemental strip of the object or repre-

sentation and means for causing said analyzing means separately to analyze the central portion of the strip.

7. In a system for transmitting visual representations, means for analyzing an object or image in a series of non-overlapping adjacent linear elements and means for displacing said analyzing means with relation to said object or image to cause said object or image to be analyzed in contiguous linear elements non-coincident with said first linear elements but partially overlapping the same.

8. In a system for transmitting visual representations, means for analyzing a linear element of the object or representation and for separately analyzing another non-overlapping adjacent linear element of the object or representation, and means for changing relative positions of said object and analyzing means to cause said analyzing means simultaneously to analyze portions of each of said adjacent linear elements.

9. In a system for transmitting visual representations, means for analyzing the entire object or representation in a plurality of successive non-overlapping adjacent linear elements and means for re-analyzing said object or representation in another plurality of linear elements, displaced from said first mentioned elements but partially overlapping the same.

10. In a system for transmitting visual representations, an analyzing disc, a motor for driving said disc, a universal connection between said motor and said disc, and means for regularly and recurrently moving the axis of said disc out of alignment with the motor shaft.

11. The method which comprises scanning an entire object whose image is to be transmitted in adjacent non-overlapping contiguous linear elements of elemental width, then re-scanning the entire object in another series of adjacent contiguous linear elements, all displaced with respect to the first mentioned linear elements to partially overlap the same.

12. The method of scanning an image which comprises scanning two adjacent non-overlapping linear elements in succession, then scanning a third element overlapping the first mentioned elements, and repeating the foregoing until the entire image is scanned.

In testimony whereof I have hereunto set my hand on this 23rd day of August, A. D. 1929.

CHARLES EDGAR HUFFMAN.