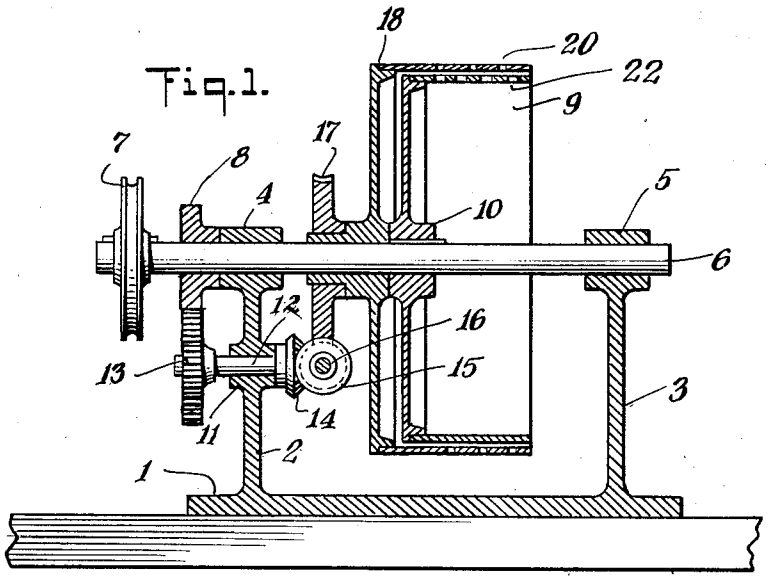
June 19, 1934. R. M. ZIMBER 1,963,255

SCANNING DEVICE

Filed Oct. 28, 1929

Fig. 1.



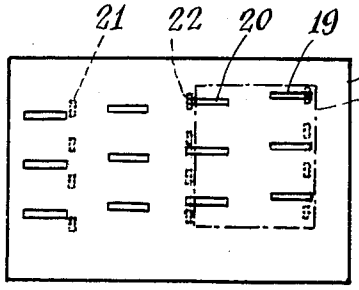


Fig. 2.

Fig. 3.

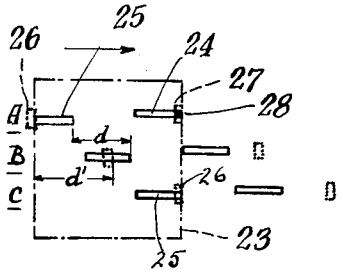


Fig. 4.

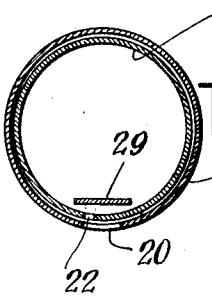


Fig. 5.

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SCANNING DEVICE

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Application October 28, 1929, Serial No. 402,918

6 Claims. (Cl. 178—6)

This invention relates to electro-optical systems and with particularity to methods and means for scanning in television or like systems.

Heretofore various means have been devised for analyzing and synthesizing an image, or other visual representation, employing rotating discs. For example, the Nipkow disc employs a series of perforations arranged in the path of a single turn spiral, however, this type of scanner is open to the objection that the scanning field is limited by the pitch of the spiral.

In order to increase the scanning field it has been proposed to employ a first disc having the perforations arranged in a plurality of convolutions and another disc rotating in front of the first disc to act as a shutter in rendering each convolution of the first disc successively effective. This arrangement is open, however, to serious objections. The disc having the convolutions of perforations must be very large in order to provide a reasonably large picture field. Furthermore, the perforations in successive convolutions being at different distances from the center of rotation, the picture cannot be reproduced with uniform results, since the edges of the picture will taper toward the common center of the discs. In addition, because of this tapering effect, if the picture is to be reproduced with uniformity throughout its area, the perforations near the edge of the disc must be larger than those near the center, requiring a very expensive and tedious machining process in making the discs.

To overcome certain of the disadvantages of the latter system it has been proposed to employ a drum having slots in the wall thereof, and a perforated shutter disc having a plurality of convolutions of perforations. This last system likewise possesses serious disadvantages, which it is the purpose of the present invention to overcome. One of the main disadvantages is that the disc must rotate in a plane which is tangential to the periphery of the drum. Consequently the disc in moving across the picture field produces a foreshortening effect in the light beam. Thus, considering the tangential point of relation between the drum and disc, the disc perforations are of the same width as the disc slots. However, as the drum rotates, because of the thickness of the wall, it tends to cut off part of the light so that the effective cross section of the reproducing light beam is different at the edges of the picture from the cross section at the center of the picture. Also, the disc must be mounted on a separate shaft, usually at right angles to the drum shaft, requiring a highly accurate adjustment between the disc and drum.

Accordingly it is one of the principal objects of the present invention to devise a system of scanning wherein the above noted and other disadvantages are overcome. It is proposed to achieve this object by providing two concentric scanning elements in the form of circular drums or cylinders one within the other and adapted to be driven at different speeds.

A feature of the invention resides in a two-drum scanner whereby the image or visual representation may be scanned in elemental areas all of uniform size.

Another feature of the invention relates to a scanning system whereby the image may be scanned in elemental areas of uniform rectangular light boundary.

A further feature resides in a television scanner employing two concentric drums or cylinders, one having relatively long, straight, rectangular slots, the other drum having sets of relatively small staggered slots, the respective slots being so arranged that they always move in the same direction, that is without one slot crossing the other in an intersecting movement.

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

Referring to the drawing—

Figure 1 shows a sectional view of a machine embodying features of the invention;

Fig. 2 is a view showing the relation between the drum slots and the picture field;

Fig. 3 shows how the picture field is covered in adjacent parallel strips;

Fig. 4 is a detailed study showing three successive positions of the slots in two adjacent linear strips;

Fig. 5 is a schematic view of one preferred manner of placing the light source within the drums.

Referring more particularly to Figure 1, numeral 1 represents a suitable supporting frame comprising the vertical standards 2 and 3, which are provided with respective bearings 4 and 5 for the main shaft 6. Shaft 6 has attached thereto a pulley 7 adapted to be driven at the proper speed from any source of motive power, such as is well known in television systems. A main driving gear 8 is keyed to shaft 6 and a drum or cylinder 9 has its hub portion 10 likewise keyed to shaft 6, so that drum 9 rotates at the same speed as shaft 6. The upright 2 is provided with a bearing 11 through which

passes the counter shaft 12. Shaft 12 at its left end is provided with a reduction gear 13 cooperating with gear 8, and at its right hand end carries a bevel gear 14 cooperating with another bevel gear 15 attached to shaft 16. Shaft 16 is provided with a worm which engages the worm gear 17. Gear 17 is attached to the hub of a drum 18 which is mounted for rotation around shaft 6, preferably in an anti-frictional manner as by ball bearings or the like. The gear train 14, 15 and 16 is so designed as to maintain proper ratio of angular speeds between the drums 9 and 18, as will be described hereinafter, this ratio being determined primarily by the number of convolutions of slots in the drum 9 and the number of convolutions of slots in the drum 18. Thus as shown in Figure 2 the outer drum 18 is provided with spaced rectangular slots 19, 20, etc. arranged in three turns or convolutions while the inner drum 9 is provided with four convolutions of slots 21, 22, etc. Consequently with such an arrangement of slots the speeds of drum 18 and drum 9 must be in the ratio of 3 to 4, as will be clear from the following descriptions given hereinafter.

As will be seen from Fig. 2 the slots 19, 20, etc. are preferably arranged on parallel circles traceable around the circumference of drum 18. Thus each slot provides a light area of relatively long and narrow dimensions the width of the slot, of course, being determined by the degree of detail required in the image, either when the device is used to scan for transmission or to integrate for reproduction. The length of the slot will be determined by the angular difference of speed between the drums. It will also be noted from Fig. 2 that the slots are staggered vertically, the staggering being preferably equal to the width of the slots. Thus each slot in drum 18 traverses a linear strip of the picture field 23 without overlapping the area covered by the next succeeding slot. Furthermore, since the slots are arranged on parallel circular paths, the picture field 21 is traversed in the form of parallel lines as shown in Fig. 3. In order further to subdivide each linear strip into the requisite element areas, the inner drum 9 is provided with a plurality of rows or convolutions of slots 21, 22, etc. as mentioned hereinabove, these slots being preferably as small as is consistent with accuracy of the machining. However, in order to simplify the machining process, the slots may be made rectangular instead of square, the distance between the successive slots 21, 22, etc. being determined by the width of the picture field 23. As will be seen from Fig. 2 slots 21, 22, etc. are arranged in vertical alignment but staggered horizontally so that all the slots traverse parallel circular paths corresponding to the circular paths traversed by the slots 19, 20, etc.

Fig. 4 shows the manner in which the slots cooperate in traversing the picture field. The portion A of this figure illustrates the drum 18 with two slots 24 and 25, simultaneously within the picture field 23. However, due to the spacing of the slots 26, 27 in drum 9 there is only one registry of openings for the passage of light, namely that due to the intersection of slots 24 and 27 and indicated by numeral 28. As the drums are considered to be moving in the direction of the arrow, the exposed area 28 will gradually shift off the picture field and a corresponding exposed area between slots 25 and 26 will enter the picture field. Assuming that there are three convolutions of slots in drum 18, etc., and that there are four convolutions of openings in drum 9. Then the drum 18 must be driven at three-quarters of the speed of drum 9 in order that the entire picture field 23 may be covered. Thus, as shown in portion B of Fig. 6, the drum 18 is shown as having moved the angular distance D, while the drum 9 has moved an angular distance d', the ratio of angular distances d to d' being 3 to 4. Since slot 26 is moving angularly faster than slot 25, when the latter reaches the right hand end of the picture field the slot 26 as represented in portion C of Fig. 4 has likewise moved to the right hand end of slot 23 thus enabling an entire linear strip of the picture to be scanned in successive elemental areas of a uniformly square light boundary determined by the intersection of the slots in the drums.

While any well known manner of illuminating the picture field 23 may be employed, it is preferred to employ an arrangement wherein the source of illumination is in as close proximity to the inner drum as possible. Thus, as shown in Fig. 5 the numeral 29 represents a glow discharge lamp of any suitable type as usually employed in television systems, the size of the luminous area being preferably the same as that of the picture field 23 so that the rays emerge through the drums in substantially parallel lines. If desired, however, a smaller light source may be employed near the center of the drum and a suitable optical system provided between the source and the drum wall to collect the rays and project them upon the picture field area.

While the drawing shows two drums adapted to be driven at different speeds in the ratio of 3 to 4 it will be understood that the invention is not limited thereto, as any desired ratio of speed may be employed as determined by the number of convolutions of perforations in the respective discs.

Furthermore while the invention has been described in connection with a reproducing device, it will be clear that it may equally well be applied to a transmitting scanner.

What is claimed is:

1. In a television system the combination of a first slitted scanning drum, a second slitted scanning drum, the slits in one drum intersecting the slits in the other drum at right angles, the slits in each drum being arranged in a plurality of helical convolutions, and means for rotating one drum within the other in the same direction, but a different speeds about a single axis, the relative speeds of rotation being such that the entire picture field is scanned in successive elemental areas, each elemental area having a uniform rectangular light boundary.

2. Scanning means in the form of a hollow drum having a plurality of spaced narrow rectangular slits therein, the line connecting the centers of successive slits forming a multi-turn helix around the periphery of the drum, each slit having a length many times greater than the length of an elemental area of the image to be scanned, and with the length thereof disposed parallel to the drum edge, and another drum within the first mentioned drum, said other drum having a plurality of slits, the slits in the second drum being many times smaller than the slits in the first drum, and means for rotating said drums in the same direction at different speeds.

3. Scanning means comprising a hollow drum having a plurality of long narrow slits therein spaced apart equi-angularly around the drum

and in the path of a multi-turn helix, each slit having a length many times greater than the length of an elemental area of the image to be scanned, and with the length thereof disposed parallel to the drum edge, another drum within the first drum having smaller slits therein intersecting the slits in the first drum at right angles, and means for rotating said drums at different speeds in the same direction.

4. Scanning means comprising a hollow drum having a plurality of convolutions of narrow slits spaced apart equi-angularly around the drum, a second drum having a plurality of convolutions of rectangular slits also equi-angularly spaced around the second drum and intersecting at right angles the slits in the first drum, the convolutions in one drum being greater than in the other drum, and means for rotating the drums at different speeds about a single common axis, and means for rotating said drums at different speeds in the same direction.

5. Means for scanning a picture field in successive elemental areas of uniform rectangular light boundary, comprising a first drum having narrow slits therein and spaced apart angularly around the drum, a second drum also having spaced slits therein arranged in a plural-turn helix, means for rotating both said drums simultaneously across a rectangular picture field, the slits in each drum intersecting the slits in the other drum at right angles and being so arranged with relation to the speeds of the drum that the picture field is exposed to only one elemental area at a time, and means for rotating both the drums at different relative speeds in the same direction.

6. Scanning means comprising a hollow drum having a long narrow slit therein, another drum within the first drum having a short narrow slit intersecting the slit in the first drum at right angles, means for rotating both said drums about a common axis with said slits in registry across a rectangular picture field, said drums being rotated in the same direction at different relative speeds so that in traversing the picture field the narrow slit moves from one end of the long slit to the other while both the long and the narrow slit are moving in the same direction.

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