May 15, 1934. R. E. WALLACE 1,959,044

ELECTROOPTICAL SYSTEM

Filed Jan. 3, 1930

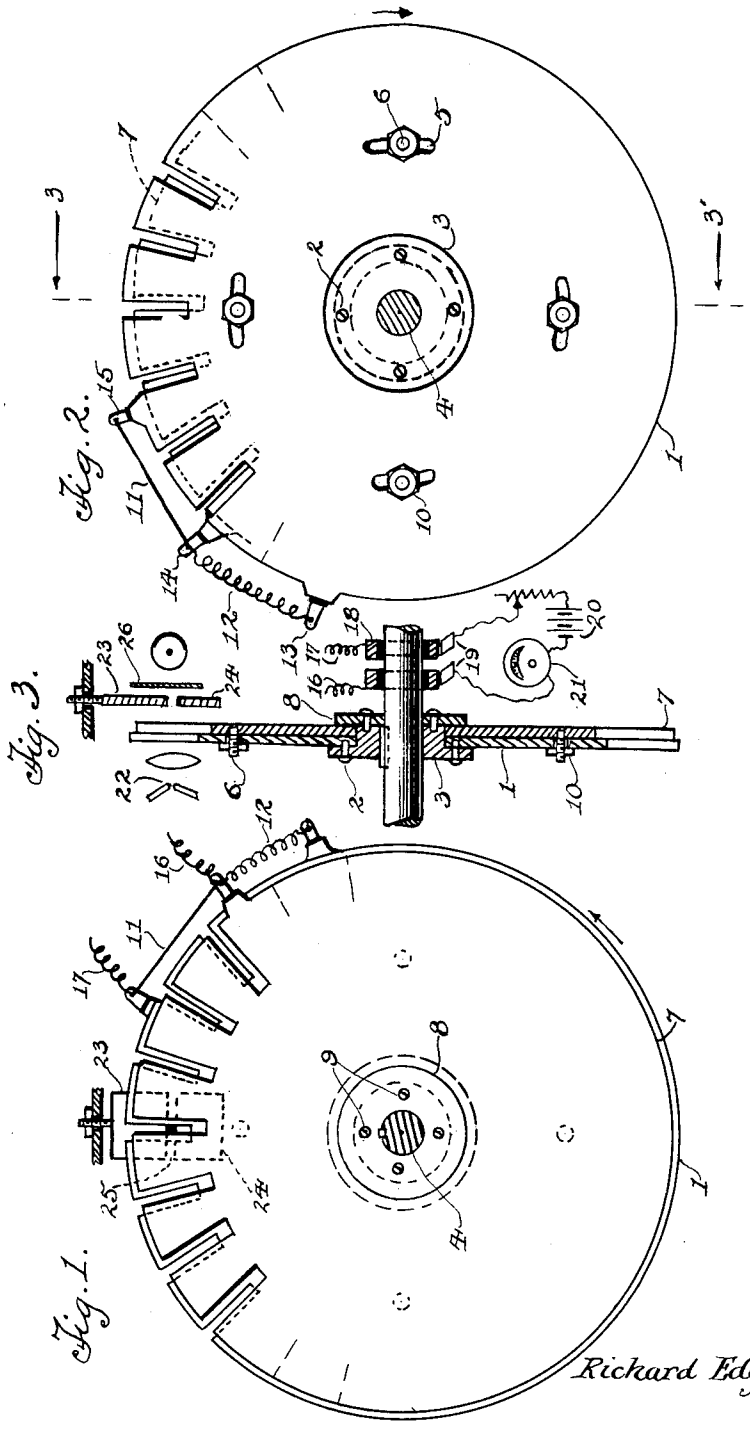


Fig. 1.

Fig. 2.

Fig. 3.

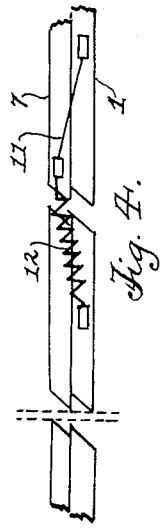


Fig. 4.

Richard Edgar Wallace
Inventor

By his Attorneys
Darby & Darby

Patented May 15, 1934

1,959,044

UNITED STATES PATENT OFFICE

1,959,044

ELECTROOPTICAL SYSTEM

Richard Edgar Wallace, New York, N. Y., assignor, by mesne assignments, to Radio Corporation of America, a corporation of Delaware

Application January 3, 1930, Serial No. 418,201

13 Claims. (Cl. 178—6)

This invention relates to electro-optical systems and apparatus, and with particularity to analyzing methods and means as employed in television and like systems.

The invention has for its principal object to provide a novel analyzing or scanning device for television, picture transmission or similar systems.

In the usual type of scanner employed in television systems the image, object or visual representation to be scanned is analyzed in successive parallel linear elements of elemental width. Thus in the Nipkow disc scanner the disc is provided with a plurality of perforations of elemental size, and the scanning beam which passes through each perforation is of fixed light boundary. It has been found that for various reasons it is highly desirable to be able to vary the size of the scanning beam or light spot, particularly while the scanning device is in operation.

Accordingly it is another object of the present invention to provide an analyzing device or scanner whereby the size of the elemental areas scanned, or the light boundary of the scanning spot may be varied while the apparatus is in motion.

Another object of the invention is to provide a scanner or analyzing mechanism for television, picture transmission, or similar systems wherein the size and shape of the scanning apertures may be varied.

Another object of the invention is to provide a scanner wherein the size of the scanning elements or apertures may be controlled with a higher degree of accuracy than is attainable with prior art scanners wherein the scanning perforations are made by a drilling or punching process.

A feature of the invention relates to a television scanner in the form of a disc having slots cut or punched in the periphery thereof.

Another feature of the invention relates to a television scanner comprising a pair of rotating discs having cooperating slots cut in the periphery thereof whereby the size of the scanning spot may be accurately varied while the discs are in rotation.

A further feature of the invention relates to a pair of scanning discs having means for varying their relative angular positions while in rotation whereby the width of the scanning spot may be varied while the discs are in rotation, together with an adjustable aperture plate for controlling the height of the scanning spot, and enabling a motion picture film to be scanned in straight transverse linear elements.

A further feature of the invention relates to the means for accurately measuring and indicating the size of a scanning perforation in a television scanning device without stopping the rotation of the device. As a result of this latter feature the scanner may be accurately adjusted while in operation to give the optimum effects as regards speed of scanning and size of scanning spot.

A still further feature of the invention is concerned with a scanning device wherein the scanning perforations may be accurately varied from a minimum to a maximum while the device is in operation.

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

While the invention will be described as applied to one known form of television scanner, it will be understood that the invention is not limited thereto but is capable of embodiment in other types of scanners as will be apparent to those familiar with the television art.

Fig. 1 of the drawing shows a front view in elevation of a scanning device according to the invention;

Fig. 2 shows a rear view of the device shown in Fig. 1;

Fig. 3 is a sectional view taken along the line 3—3 of Fig. 2; and

Fig. 4 is a detailed plan view of a portion of the scanning device of Figs. 1 and 2 to show the knife-edge formation of the scanning slots.

Referring more particularly to Figs. 1, 2 and 3, the numeral 1 represents a disc of thin material preferably, although not necessarily, of a light metal such as aluminum. Disc 1 is fastened as by screws or bolts 2, to a hub 3 which is keyed to the shaft 4 for rotation therewith. Disc 1 is provided with a plurality of arcuate slots 5 which register with corresponding threaded pins 6 attached to a second disc 7. Disc 7 is provided with a large cutout central portion and is adapted to fit over the hub 2 for rotation thereabout. A circular washer 8 is fastened by screws 9 to the end of hub 3 to prevent relative lateral movement between the discs 1 and 7 while they are rotating. When the discs have been adjusted to the proper relative angular positions, as hereinafter described, they may be locked in this adjusted position by means of suitable locking nuts 10.

When motive power is applied to the shaft 4 the disc 7 is driven through the intermediary of

the disc 1 and for this purpose it is preferred to provide a frictional drag between the contacting faces of the discs, so that as the disc 1 rotates it tends to drive the disc 7. The purpose of this frictional drag will be clear from the ensuing description. From the foregoing description it will be apparent that when the locking nuts 10 are loosened the disc 7 is capable of limited angular rotative movement with respect to the disc 1, the extent of this relative movement of the discs is controlled by a spring 12 and a taut wire 11. Spring 12 has one end attached to an insulated lug 15 formed or affixed to the disc 1, the other end of the spring being attached to a similar insulated lug 14 formed on disc 7. Similarly wire 11 has one end attached to the lug 14 and the other end attached to a similar lug 13 on disc 1. The ends of wire 11 are connected by conductors 16, 17 to a pair of sliprings 18, which are connected through the brushes 19 to a source of heating current represented as a battery in Fig. 3, but it will be understood that any other current source may be employed. Connected in circuit with the battery 20 and the wire 11 is an indicating device 21 which may take the form of an ammeter or similar instrument to indicate the strength of current flowing through the wire 11. It will be obvious that the wire 11 will vary in length in correspondence with the current flowing therethrough and consequently it is preferred to employ a wire which has a high co-efficient of linear expansion such as ordinarily employed in hot-wire ammeters or voltmeters.

As shown in the drawing each disc has its edge provided with notches, and while these notches are shown as extending only part way around each of the discs, it will be understood that the complete circumference of each disc is notched. The notches may be formed by any convenient method such as cutting, or preferably milling, so that the edges of each notch are tapered to a knife-edge as indicated in Fig. 4. It will be understood that the number of notches in each disc is determined by the number of linear elements that are to be scanned per unit area of the image or visual representation. Thus if the representation is to be scanned in 48 linear elements per unit area then each disc is provided with 48 notches.

It will be clear from an inspection of the drawing that the effective width of the light beam which can pass through the edges of the discs from source 22 is determined by the relative angular positions of the discs, which is in turn controlled by the current flowing through wire 11. The length of wire 11 is so chosen that when the locking nuts 10 are loose, and assuming the discs to be rotating in the directions shown, and no current is flowing through wire 11, there is no over-lapping of the notches and each pin 6 is in engagement with one end of the associated slot 5. Under this condition the light from source 22 is prevented from passing through the edges of the discs or it has its minimum width. When it is desired to increase the width of the beam passing through the discs current from the source 20 is passed through wire 11 which thereupon elongates and permits the spring 12 to retard the disc 7 relatively to the disc 1 until the cooperating notches over-lap to the required extent. It will be understood of course that during this adjustment the disc 7 is being driven by disc 1 through the frictional engagement hereinabove described, but the spring 12 is so designed that when the nuts 10 are loose spring 12 can overcome this frictional engagement and move disc 7 with respect to disc 1 until the wire 11 is again taut. It is preferred to provide the device 21 with an additional scale which is calibrated to read in degree of overlap of the notches so that the operator may notice immediately from an inspection of the device 21 the extent of overlap and consequently the width of the scanning beam.

It is obvious that the shape of the scanning beam which passes through the disc edges from the source 22 is determined by the depth of the slots, which of course may be made as short as required. However, in order further to be able to control the shape and dimensions of the scanning beam there is provided an adjustable aperture plate between the light source 22 and the discs. This aperture plate is preferably made in two sections 23, 24 which are mounted in any suitable frame whereby they may be adjusted vertically as a unit. It is also preferred to provide means whereby the sections 23, 24 may be independently adjusted so as to vary the width of the aperture 25.

The object to be scanned, such as a motion picture film 26, is positioned on the opposite side of the discs from the light source 22. Consequently as the discs rotate the film or other object is scanned across a linear elemental strip by a moving light spot whose width is determined by the extent of overlap of the disc notches, and whose height is determined by the separation of the aperture plate sections 23, 24.

In the case of a motion picture film it is highly desirable to scan it in successive linear elements transversely of the film. In the ordinary method of scanning such a film, employing a rotating disc with fixed perforations, the film is scanned transversely in curved linear elements, while with the arrangement disclosed in the drawing the transverse linear elements are straight.

The method of adjusting the mechanism is substantially as follows. The locking nuts 10 are first loosened and with the discs stationary current is passed through the wire 11 to provide the proper extent of overlap between the disc notches, this being indicated on the calibrated scale on device 21. The aperture 25 is then adjusted to the proper opening, whereupon the discs are locked in adjusted position by means of the nuts 10 and are then ready for scanning. If for any reason it should be desirable to change the shape or size of the scanning spot while the discs are in motion, the locking nuts 10 are previously left loose and the operator can change the width of the scanning spot merely by varying the current through wire 11. Thus the operator may instantly change the size and shape of the scanning spot while at the same time observing the effects on the television pick-up device. This feature is of the highest practical importance in experimental work and provides an accurate and speedy method of controlling the relation between scanning speed and the size of the scanning spot.

While specific apparatus and arrangements thereof have been disclosed herein, it will be understood that the invention is not limited thereto, but that various changes may be made without departing from the spirit and scope of the invention.

What is claimed is:

1. In combination, a television scanning member having a plurality of separate scanning openings, one for each linear element of the picture to be scanned, a second member having open-

ings of equal area to those in the first mentioned scanning member, a spring coupling between said scanning member normally acting to maintain the openings of the one in complete register with those of the other, and means to relatively displace said scanning members against the action of said spring to vary the effective area of the combined openings.

2. In a television scanning means, a light source, a light sensitive element to be influenced by a beam from said source, and a movable scanning device interposed between said source and element said device including a pair of disks having apertures of equal dimensions, one of said disks being mounted for positive rotation and the other frictionally rotated therefrom, a spring operating to normally maintain said disks in position for their apertures to register with each other, and means to adjustably displace the frictionally driven disk relatively to the positively driven disk against the action of said spring.

3. In a television scanning device, a rotatably mounted disk having apertures of uniform dimensions, a second disk having apertures of equal dimensions with those of the first disk, said second disk mounted to be rotated frictionally by the first disk, a wire connecting said disks and normally operating to maintain corresponding apertures of the two disks in complete register with each other, and controllable means to vary the length of said wire to adjustably displace the frictionally driven disk rotatively with reference to the first named disk.

4. In a television scanning device, a rotatably mounted disk having apertures of uniform dimensions, a second disk having apertures of equal dimensions with those of the first disk, said second disk mounted to be rotated frictionally by the first disk, a wire connecting said disks and normally operating to maintain corresponding apertures of the two disks in complete register with each other, and means to supply a heating current to said wire to adjustably displace the frictionally driven disk relatively.

5. Television scanning mechanism including a positively rotated disk having scanning slots, a second disk having scanning slots of equal dimensions with those of the first disk, said second disk being mounted to be rotated frictionally by and at equal speed with the first disk, a spring connection between said disks to maintain yieldingly said disks with their respective slots in definite relation to each other, and means to cause said spring to rotatively displace one of said disks relatively to the other to vary the relation of the slots.

6. Television scanning mechanism including a positively rotated disk having scanning slots, a second disk having scanning slots of equal dimensions with those of the first disk, said second disk being mounted to be rotated frictionally by and at equal speed with the first disk, a spring connection between said disks to maintain yieldingly said disks with their respective slots in definite relation to each other and means to adjustably control said spring to rotatively displace the frictionally driven disk.

7. Television scanning means according to claim 5 wherein the slots in the disks are formed in the edges of the disks and are of equal dimensions.

8. Television scanning means according to claim 5 wherein the slots are of equal dimensions of rectangular shape, and disposed in substantially radial relation with respect to the disks.

9. Television scanning mechanism including a positively rotated disk having scanning slots, a second disk having scanning slots of equal dimensions with those of the first disk, said second disk being mounted to be rotated frictionally by and at equal speed with the first disk, a spring connection between said disks to maintain yieldingly said disks with their respective slots in definite relation to each other, a wire also connecting said disks, and means to heat said wire to permit the spring to rotatively displace one of said disks.

10. Scanning mechanism for television apparatus including a pair of disks mounted to rotate together at equal speeds in the same direction, means for positively rotating one of said disks, the other of said disks being rotated frictionally by the positively rotated disk, said disks having scanning slots in their edges, said slots being of equal dimensions and of rectangular contour, substantially radially disposed in the disks and means for adjusting the relative angular positions of said disks, comprising a wire extending in the direction of rotation of said disks and connecting the one to the other, means for maintaining said wire under tension and means for heating said wire to vary its length.

11. Scanning mechanism according to claim 37 in which the variations in effective length of the wire is controlled without releasing its tension.

12. In a scanning apparatus for television systems, a pair of disks frictionally engaging each other, one of said disks being positively rotated, said disks having scanning slots of rectangular contour radially disposed and of equal area, a wire extending in the direction of rotation of said disks and connecting the one to the other, a spring to maintain said wire taut and controllable means for heating said wire.

13. Scanning mechanism according to claim 12 in which the slots in the disks are provided with knife edges.

RICHARD EDGAR WALLACE.