June 18, 1929. H. E. IVES ET AL 1,717,782

ELECTROOPTICAL TRANSMISSION

Filed June 22, 1927

FIG. 1.

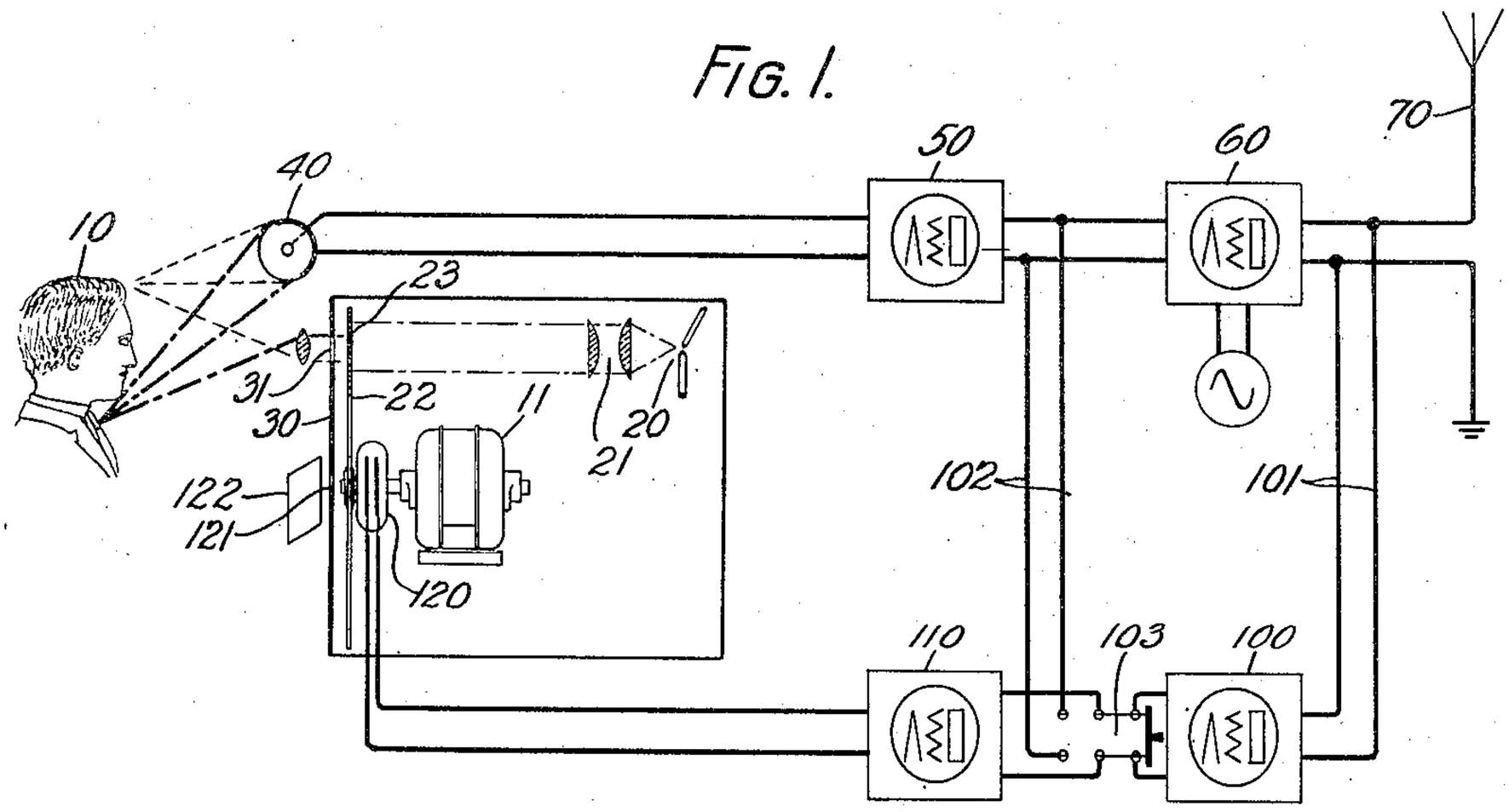
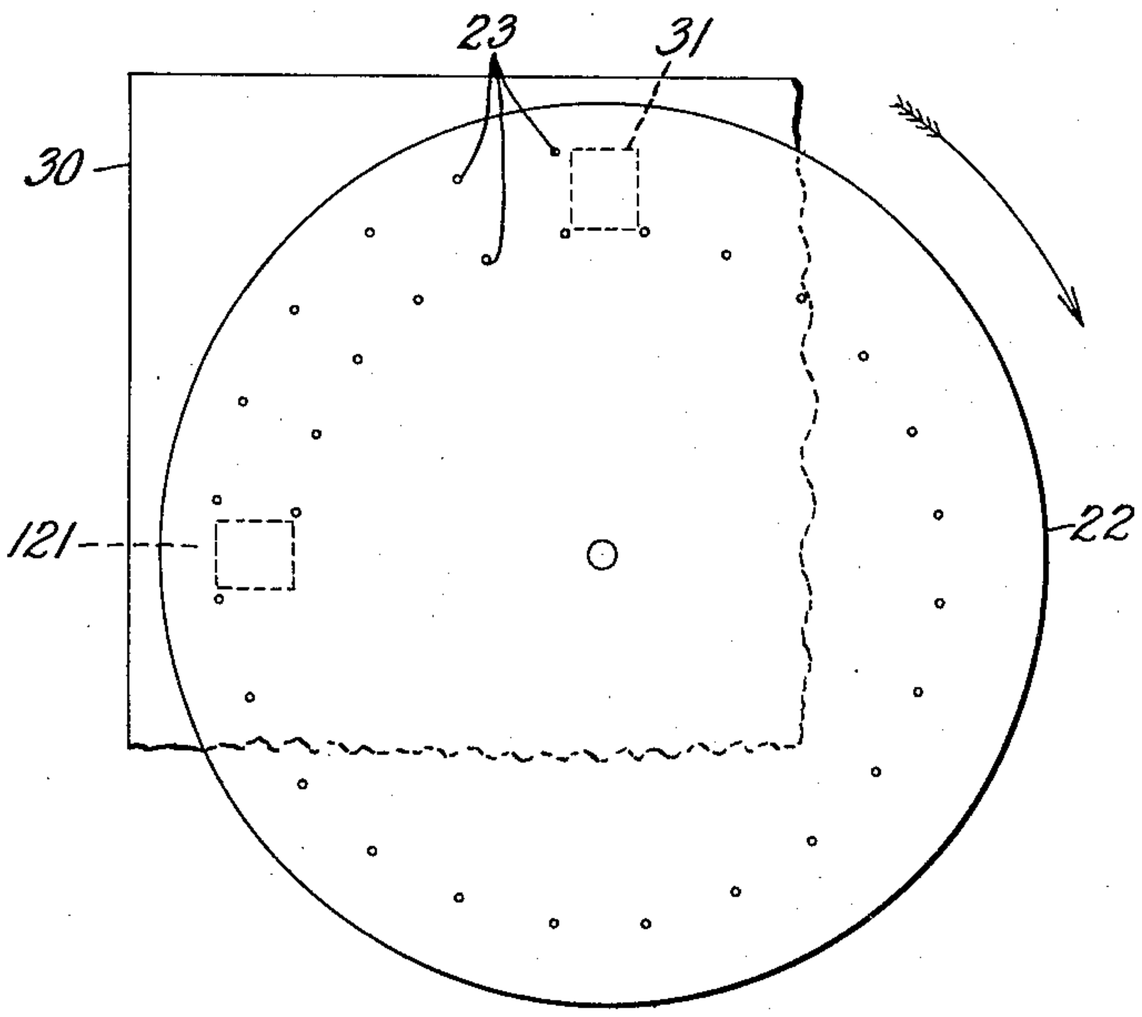



FIG. 2.

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# UNITED STATES PATENT OFFICE.

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## ELECTROOPTICAL TRANSMISSION.

Application filed June 22, 1927. Serial No. 200,618.

This invention relates to electro-optical transmission and more particularly to an arrangement for monitoring television transmission.

In electrically transmitting images of moving objects or pictures to distant stations it is important to monitor or check the image current at the transmitting station to determine whether this current is being so generated and impressed upon a transmission channel as to produce an accurate picture of the object whose image is being produced. Obviously this can be determined by using at the transmitting station apparatus similar to that employed at the receiving station, but this invention accomplishes the same result by a much simpler and more direct arrangement. The monitoring is accomplished by using a part of the image current to energize a receiving lamp associated with the scanning disc of the transmitting apparatus in substantially the same manner as in the regular receiving apparatus. Upon viewing this lamp through the scanning disc in the usual manner an image of the object may be seen which enables the operator to tell whether the adjustments of the circuit up to the point of where the monitoring current is taken off, are correct.

A more detailed description of the invention follows and is illustrated in the accompanying drawing.

Fig. 1 is a schematic representation of the essential elements of a transmitting station selected for illustrating this invention.

Fig. 2 is a drawing of the scanning disc showing particularly the annular displacement of the monitoring field of view with respect to the main scanning field used in transmission and the arrangement of the spirally positioned apertures in the disc.

Referring to Fig. 1, the scanning apparatus at the transmitting station includes a powerful light source 20 whose light is directed by means of the lenses 21 upon the scanning area of the scanning disc 22. The path of the scanning light from the light source is through one of the apertures 23 in the scanning disc, the apertured screen 30 whose opening 31 is so dimensioned that light coming from only one aperture in the scanning disc 22 can at any instant pass, and a lens 32, to the object 10 whose image is transmitted. The scanning disc 22 is rotated at a substantially uniform speed by the driving motor element 11. As the scanning disc is rotated it causes a small beam of intense light passing successively through its apertures to scan in a series of parallel paths the object whose image is transmitted and reflected light from each elemental area of the object 10 so illuminated is successively impressed upon one or more light sensitive translating devices 40. Further details of such a scanning and light translating arrangement are shown in the copending application of Frank Gray, Serial No. 181,538, filed April 6, 1927.

The photoelectric or image current generated in the light sensitive cell or cells 40 is amplified by the amplifier 50 and impressed upon any suitable transmission system such as the modulator 60 and the antenna 70. While a radio channel is here shown, any other suitable channel such as a physical circuit may be used. As heretofore stated a part of the signal current is employed for monitoring and this may be taken off from the outgoing circuit at one or more points, though in most cases it would be preferable to monitor with current which has passed through all of the transmitting apparatus and just before being impressed upon the transmission channel. The circuit 101 taps the outgoing circuit where the signal is impressed upon the radio channel and a small part of the signal current is fed into the detector 100. The output current from the detector after passing the switch 103 is amplified by the amplifier 110 and the amplified current is impressed upon a glow discharge receiving lamp 120. The light emitted by the glow discharge lamp so connected varies in accordance with the variations of the signal current impressed upon the transmission channel. As heretofore mentioned the signal current used for monitoring may be taken from another point such as at the output of the amplifier 50. The circuit 102 connected at this point leads through the switch 103 to the amplifier 110 thus causing the glow discharge receiving lamp 120 to be energized by signal current taken from the output of the amplifier 50 when the switch 103 is thrown to the left. The switch 103 facilitates monitoring at more than one point but connects the monitoring circuit with the signal circuit at only one point at a time.

The monitoring receiving glow discharge

lamp 120 is associated with the transmitting apparatus, being placed behind the scanning disc 22 which is used in scanning the object whose image is being transmitted. This lamp and its viewing arrangement must be positioned so as not to interfere with the use of the disc for transmitting. This is accomplished by an angular displacement of the two positions which may be any convenient amount such as 90° to 180° apart. As shown in the drawing the displacement is 90°. An apertured screen 30 containing an opening 121 is positioned in front of the scanning disc 22 and the receiving lamp 120 to limit the field of view to a area such that light may pass to the observer through only one of the apertures 23 in the scanning disc at any instant. The produced image may be viewed directly through the opening 120 bounding the viewing field or at one side if a deflecting member such as a mirror or prism 122 is placed in front of the aperture thus avoiding any interference by the observer with the object in front which is being scanned. The produced image appearing through the aperture 121 is turned by an amount proportional to the angular displacement between the transmitting and the image producing position on the scanning disc. This may be optically compensated by a suitable arrangement of mirrors or prisms so that the produced image may be viewed in its normal position.

In order that a single scanning disc 22 may control the light for scanning the object whose image is being transmitted and the monitoring picture being produced, the plurality of spirally arranged apertures 23 are continued for more than 360°, the amount being 360° plus the angular displacement between the two openings 31 and 121 bounding the two fields. The details of this arrangement are shown in Fig. 2. The radial length of each of the openings 31 and 121 is equal to the radial length of the spiral at a beginning and an ending aperture 360° apart along the spiral and the width of these openings is equal to the pitch distance between adjacent apertures. It is therefore obvious that only one of the apertures 23 can be in front of either of the openings 31 and 121 in the screen 30 at any instant. As the scanning operation in transmitting is performed by spirally arranged apertures in a spiral of 360° it is also necessary that the picture be produced by apertures in a spiral also of 360°, and in addition the apertures in front of each opening must not only be in synchronism but must be in phase which means that a similarly numbered aperture of the spiral associated with each of the openings must simultaneously pass before each opening. While two separate sets of spirally arranged apertures could be used, this invention shows a simpler arrangement in which the spiral use for transmitting is extended an amount equal to the displacement between the two apertures 31 and 121, or as shown in the drawing 90°, thus making the total length of the spiral 450°. The opening 121 is placed somewhat closer to the center of the disc by a distance equal to one-fourth of the radial depth of the spiral at a 360° position, than the opening 31 which is placed at a distance further from the center of the disc by a similar amount, so that the apertures 23 in the scanning disc pass before both of the openings 31 and 121 through a total angle of only 360°, through the total length of the spiral is 450° and the angular displacement of the openings is 90°.

Using the same scanning disc for both transmitting and producing a monitoring image of the object eliminates synchronizing problems such as would occur if separate receiving apparatus were used for monitoring and not only makes the operation of this monitoring very simple but also reduces the apparatus required to a minimum.

What is claimed is:

1. Television transmitting apparatus comprising scanning means for generating image current for transmission including moving means for moving a light beam into successive scanning positions, means for diverting some of said image current, and means for utilizing said diverted current to produce a local image including means for producing another moving light beam and a common driving element for timing the movements of said light beams.

2. In a television system, apparatus for the transmitting station comprising means for producing image currents for transmission including moving scanning means, and means controlled by energy derived frrom said image currents for producing monitoring images including said moving scanning means.

3. In a television system, apparatus for the transmitting station for setting up image currents for transmission comprising a source of light, light sensitive means, and a scanning disc, and means controlled by energy derived from said image currents and including said disc for producing monitoring images at said station.

4. A television scanning disc having spirally arranged apertures for more than 360° and means for simultaneously employing said spirally arranged apertures for producing image currents for transmission and for producing monitoring images.

5. In a television system, apparatus for the transmitting station comprising a source of light, light sensitive means, a scanning disc having spirally arranged apertures for more than 360°, and means associated therewith to produce at said station an image of the object.

6. Television transmitting apparatus comprising a source of light, light sensitive means, a scanning disc having spirally arranged

apertures for more than 360°, and means comprising an amplifier, and a second source of light for producing an image at the transmitting station.

7. Television transmitting apparatus for setting up image currents for transmission comprising a source of light, light sensitive means, and a scanning disc, and a neon tube controlled by energy derived from said image currents and positioned on one side of said disc to produce an image at the transmitting station.

8. In a television system, a scanning disc having spirally arranged apertures for more than 360° arranged for simultaneously scanning an object and for scanning a receiving lamp, and means for activating the said receiving lamp by and in accordance with the scanning of said object.

9. In an image producing system, apparatus for the transmitting station comprising means for producing image currents of a field of view for transmission including moving scanning means, and means controlled by energy derived from said image currents for producing monitoring images of the said field of view including said moving scanning means.

10. Television transmitting apparatus for setting up image currents of a field of view for transmission comprising a source of light, light sensitive means and a scanning disc, and a neon tube controlled by energy derived from said image currents and positioned on one side of said disc to produce an image of the said field of view at the transmitting station.

In witness whereof, we hereunto subscribe our names this 20th day of June A. D., 1927.

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