May 1, 1934. H. P. DONLE 1,957,101

TELEVISION METHOD AND APPARATUS

Filed July 11, 1931

Fig. 1.

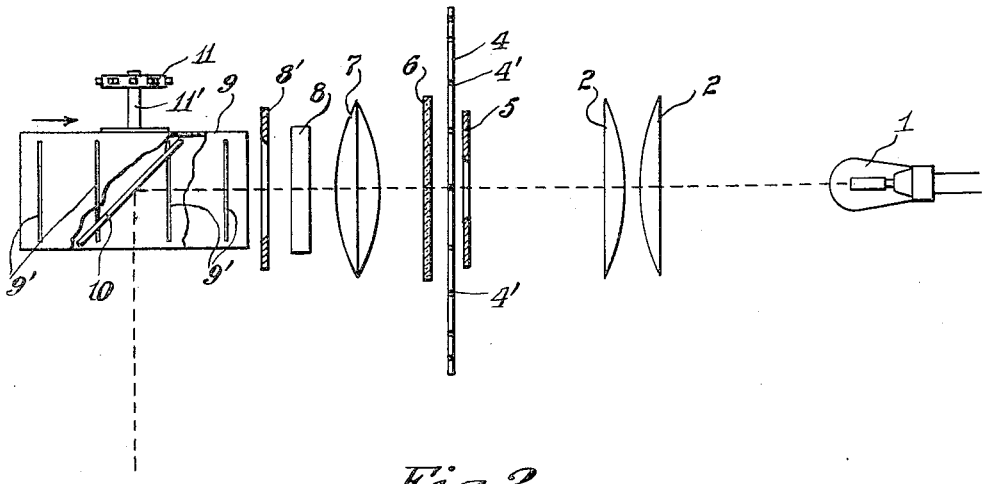
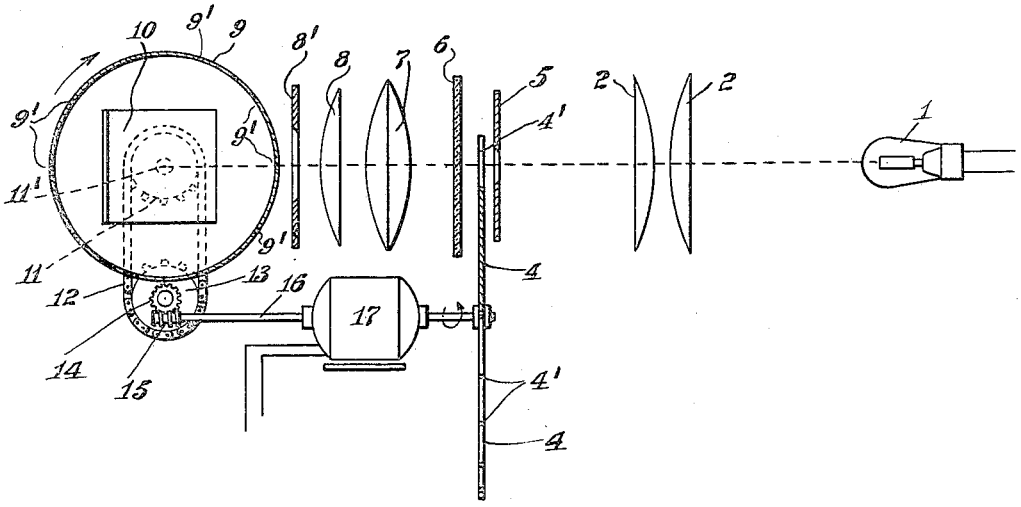


Fig. 2.



Harold P. Donle
INVENTOR.

BY
ATTORNEY

Patented May 1, 1934 1,957,101

UNITED STATES PATENT OFFICE

1,957,101

TELEVISION METHOD AND APPARATUS

Harold P. Donle, Meriden, Conn., assignor to Radio Inventions, Inc., New York, N. Y., a corporation of New York

Application July 11, 1931, Serial No. 550,117

7 Claims. (Cl. 178—6)

This invention relates to a method and apparatus for the transmission of optical images by electrical means over either physical or radio channels of communication.

This invention includes a method and means for operating upon optical rays by means of a plurality of scanning members and a diffusing screen to secure a wider angle of effective field of vision than has been previously possible.

More particularly, this invention increases the divergence of light rays in the output of television scanner by scanning the rays in one direction to form a partially scanned secondary image upon a screen, and then scanning this image in the other direction.

One object of my invention is to allow the viewing of television images over a wide solid angle and at varying distances from the apparatus.

Another object of this invention is to render it easier to secure precise scanning action with apparatus whose manufacture shall require no machining operations of a high degree of precision, and which therefore shall be less costly than in the case of apparatus of the usual form which does require such precision machining operations in its manufacture.

An additional object of this invention is to allow the apparatus proper to remain stationary while the field of view moves over a wide angle, without objectionable distortion being thereby introduced.

A further object of my invention is to secure a smooth field or image background, free from lines, by the employment of accurate rectangular virtual apertures.

Another object is to secure fine details in the image by the employment of rectangular scanning apertures whose height is greater than their width or vice versa, and which pass the maximum amount of light for a given amount of detail, in accordance with the general principles set forth in my co-pending application Ser. No. 433,670.

A still further object of my invention is to allow the construction of television apparatus in a more compact form than hitherto common, in comparison with the size of the picture produced thereby.

Television apparatus as commonly employed has had for one limitation the fact that the angle of satisfactory vision has been very narrow, in many cases as low as five degrees. Consequently the observers have had to assume a position within comparatively narrow limits, and only a few persons have been able at any one instant to view a given image.

Another limitation of certain apparatus constructed in accord with the prior art has been that it has been necessary that the observers of the reproduced image be at a certain distance from the apparatus, which distance has had to fall within comparatively narrow limits for satisfactory viewing of the image. This feature also has limited the number of observers who could simultaneously be served by a single television apparatus.

The present invention overcomes the foregoing limitations of the narrow angle of view and of limited distances from the scanning apparatus by the employment of certain optical principles in connection with the scanning and projecting apparatus employed in the television apparatus.

The following figures illustrate the construction of a television receiver embodying the principles of my invention.

Fig. 1 is a plan view of the apparatus, showing the parts thereof essential to illustrate my invention, and diagrammatically showing the path of the light rays therethrough.

Fig. 2 shows an elevation of the apparatus of Fig. 1, including also certain mechanical features not shown in Fig. 1.

Referring now to Fig. 1, at 1 there is indicated a light source which may be of any suitable type such as a neon glow tube. Its electrodes may be of the flat plate type or the structure may be of the concentrated glow type as here shown. At a convenient distance from this light source are located lenses 2, of any optical type which can serve to collect and preferably render convergent the light from the source, such as the usual condenser system of lenses. These lenses also serve to focus the rays upon a screen 6 formed of a translucent material such as ground glass or the like. Next in the path of the light rays is a light stop 5, serving to delimit the image cast upon a screen 6 to that of a single complete area equivalent to that of a single complete image view.

Scanning disc 4, provided with radial slits 4', rotates through the path of the rays before they impinge upon the screen 6, thus causing the image produced thereupon to be already scanned in one dimension, and to consist of a real image in the form of apparent bands of light varying in strength according to the degree of luminosity of the elemental areas into which the complete image from the light source is divided in one dimension.

The real image which is produced upon screen 6 is preferably smaller than the final image seen by the observer, and the rays diverging there-

from are collected by lens 7, which may be a spherical lens of any convenient character, and emerge therefrom in such wise as to cover the width of lens 8, which may be a cylindrical type, used in accordance with the principles disclosed in my co-pending application Ser. No. 474,088 entitled "Television scanning system" to compensate for the non-rectangularity of the scanning elemental areas produced by the radial slits of scanning disc 4. Either or both of these lenses may be omitted without changing the essential character of this invention, or they may be combined into a single optical lens by means well known in the optical art.

Stop screen 8' may be employed at this point in the passage of the rays in order that only one complete image in both dimensions shall be visible beyond the same.

A slitted drum 9, whose slits 9' are parallel to the axis thereof, rotates across the path of the rays in a direction perpendicular to that in which the slitted disc 4 rotates. This combination of a drum and disc for scanning purposes is substantially in accordance with the principles disclosed in my co-pending application Ser. No. 425,785 entitled "Television apparatus and method", and secures the advantages, inter alia, of compact, light weight mechanisms and low driving energy requirements.

At 10 is indicated a stationary mirror located within the drum, preferably at a 45° angle, which affords one convenient method of projecting the field of vision without the drum.

Since the light rays impinging upon this mirror are divergent in character, the field of view will cover a wide angle. The exact extent of this angle will depend upon the values of the distances, lenses, and other elements of the optical system employed.

Referring now in addition to Fig. 2, the essential details of one method of mechanical drive for this type of reproducer will be apparent. Sprocket wheel 11 upon a common shaft 11' with the drum 9 is rotated by chain 12 from sprocket 13, which is rotated by pinion 14 driven in turn by worm 15. Shaft 16 bears towards one end the worm 15, and towards the opposite end the scanning disc 4. This main driving shaft receives its motive power from any suitable driving means, such as the motor indicated at 17. This motor is operated substantially synchronously with the scanning device at the other extremity of the television communication channel, by any means well known in the art.

Framing of the image may be accomplished by any of several methods such as momentarily slowing the motor 17 for field framing and shifting the phase of current in the motor for line framing, or interposing a clutch between the motor and worm 15 for field framing and rotating the frame of motor 17 for line framing, by combinations of these systems or by other suitable methods.

While not confining myself to any particular sizes for the parts of my invention the following values have been found convenient.

The direction of rotation of disc 4 and drum 9 is shown as it should be for scanning progressively from left to right and from top to bottom. The length of slots 4' in disc 4 is such as to encompass in their angular rotation substantially all the light emergent from lens 2 and their width is such that screen 6 receives a strip of light of the desired width for line scanning. The length of slots 9' in drum 9 is such as to pass onto mirror 10, the full range of light emergent from lens 8, and their width is approximately equal to the quotient of their peripheral spacing divided by the number of lines per picture.

The product of the number of slots 4' in disc 4 times the speed of motor 17 in r. p. s. is equal to the product of the number of lines per picture times the number of pictures per second. Similarly, the product of the number of slots 9' in drum 9 times its speed in r. p. s., is equal to the number of pictures per second.

The length and spacing of slots 4' in disc 4 and slots 9' in drum 9 determine the size of the image as viewed directly, i. e., with lens system 7—8 removed.

The spacing of slots 9' in drum 9 in conjunction with the refraction of lens system 7—8, determine the length of slots 4' in disc 4. The ratio of length to spacing of slots 9' in conjunction with the diverging rays from 9 to 10 determine the ratio of height to width in the image.

Screen 6 and mirror 10 may each be greater in extent than is necessary to allow a single complete image, so that the image may be seen over a wide visual angle.

One advantage of my invention is the wide angle of view arising from the novel feature of the interposition of a diffusing screen 6 between scanning elements 4 and 9 which scan in two different dimensions and usually at different rates of speed.

Many variations are possible in the disposition of the parts of this invention without departing from the spirit thereof. For example the light source may be a fixed light with a valve of suitable type such as a Kerr cell modulating the optical output of the same.

All lens systems shown may be replaced by equivalent combinations, and their positions may be altered in accordance with well known optical principles.

Driving means for the scanning elements may be provided independently of one another, if they operate in synchronism with one another.

In place of the slotted drum, another radially slitted disc may be employed, and the optical correction lens 8 tilted in accordance with the principles of the above mentioned application Ser. No. 474,088, to compensate for the radial disposition of the slits in this additional disc.

The secondary image may be cast upon the translucent screen by line-scanning means other than the slitted disc shown, such as any form of moving slitted member, or a moving member of the reflecting type such as the mirror drum disclosed in my co-pending application Ser. No. 544,718 entitled "Television method and apparatus".

By the use of a supplemental lens subsequent to the mirror the output of this scanner may be projected upon a screen, instead of being viewed directly.

While this apparatus has been described as arranged for reproducing television images, it is also applicable to transmission by using a collecting lens in place of the lens of the observer's eye, and a light-sensitive cell in place of the light source.

I claim:

1. In a television apparatus, a rotating slitted member scanning an image in one direction and analyzing it into narrow bands, a discrete diffusing screen receiving the image thus partly scanned as a series of bands, a second scanning member scanning the image upon said screen in

another direction, and means for directly viewing the completely scanned image.

2. A television scanning system including a disclike rotating member, with radial slits therein and scanning an optical image in one dimension, a drum-like member rotating at a speed related to the speed of the disc member and having longitudinal slits therein, scanning the optical image in the other dimension, and a diffusing screen optically intermediate the two said scanning members so that the image formed thereupon is scanned in one dimension only as a series of substantially parallel bands.

3. In television scanning apparatus the method of securing a wide angle of vision which includes scanning an image in one dimension and producing from said scanning a real image comprising a plurality of substantially parallel bands, uniformly diffusing said parallel bands, scanning said produced real image in the other dimension and directly viewing the resultant of the two scannings.

4. A television scanner comprising a slitted scanning disc, rotating in one plane, a slitted scanning drum rotating in a perpendicular plane, a secondary image diffusing screen between the two scanners, and means for directly viewing the combined output of the two scanners said diffusing screen being physically independent of both said scanners.

5. Television scanning apparatus including a light source variable in accordance with electrical signals representing luminous elements of an object to be optically reproduced, light condensing means concentrating the optical output of said light source, means scanning said optical output in one dimension intermediate, real image forming means for displaying the partially scanned optical image in the form of substantially parallel luminous bands, light concentrating means projecting the optical output of said real image forming means, means scanning said projected output in the other dimension, and reflecting means changing the line of projection of the optical output of said last mentioned scanning means said intermediate image forming means comprising a translucent diffusing screen.

6. Television scanning apparatus including a light source variable in accordance with signals representative of luminous elements of an object to be optically reproduced, means analyzing said optical output in one dimension into narrow substantially parallel bands, real image forming means for displaying the partially scanned optical image as narrow bands of light, and means for scanning said displayed partially scanned optical image in the other dimension so as to allow direct viewing thereof, said real image forming means comprising a diffusing screen.

7. A television reproducer comprising a source of light, means for causing said light to be projected in a plane, means for moving said plane of light in a direction substantially parallel to its normal, diffusing means intersecting said moving plane of light whereby a lighted line is produced on said diffusing means, and independent means for successively viewing points along said diffused line of light.

HAROLD P. DONLE.