

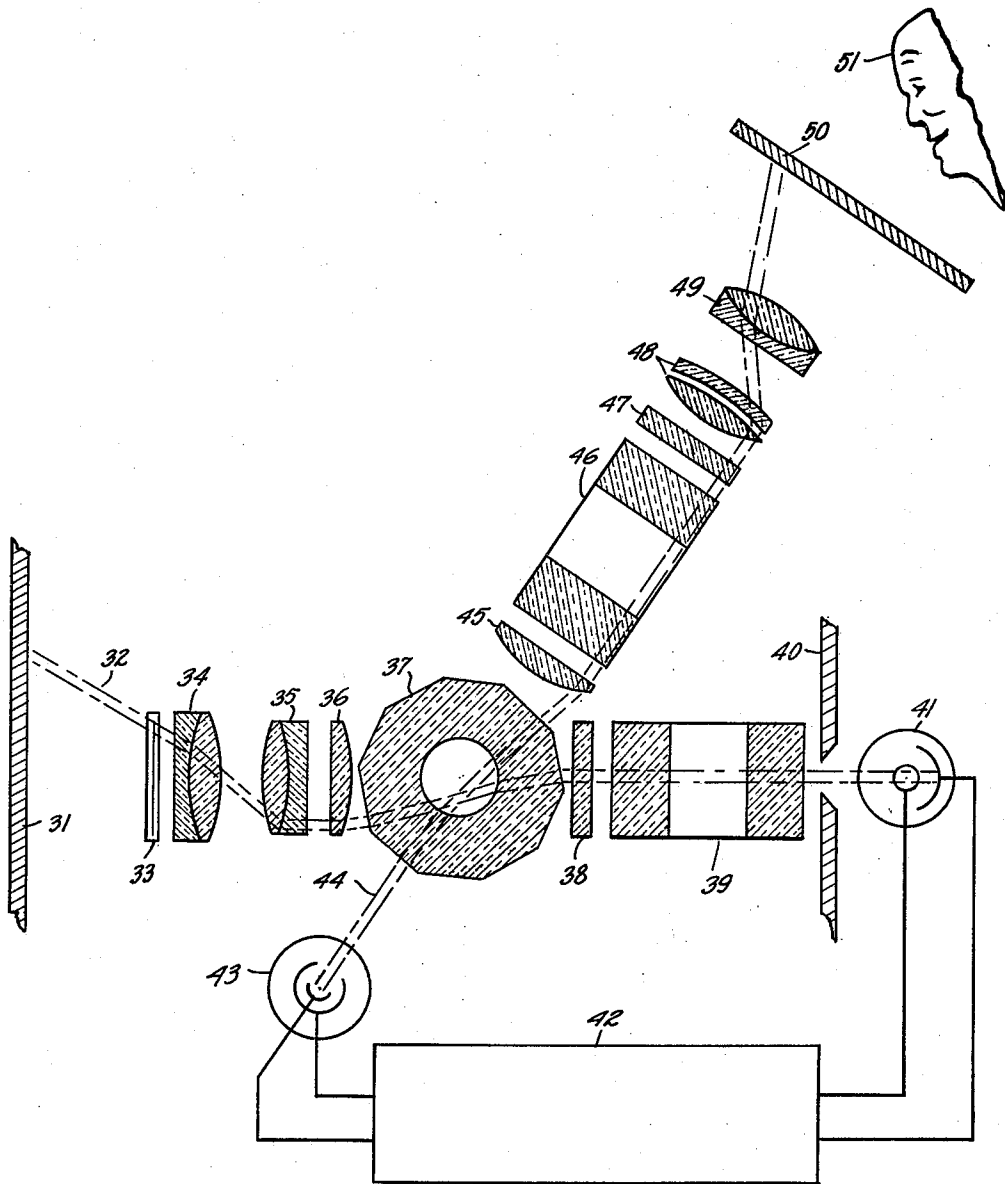
Jan. 11, 1949.

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2,458,865

INVISIBLE LIGHT TELEVISION SYSTEM

Original Filed April 15, 1944



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UNITED STATES PATENT OFFICE

2,458,865

INVISIBLE LIGHT TELEVISION SYSTEM

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Original application April 15, 1944, Serial No. 531,205. Divided and this application October 27, 1945, Serial No. 625,035

2 Claims. (Cl. 178—6)

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This application is a division of my pending application, Serial No. 531,205, filed April 15, 1944.

This invention relates to methods and means for controlling invisible and visible scanning beams in an infra-red or ultra-violet ray television system and the like wherein objects are scanned by means of infra-red or ultra-violet rays and a visible image of said object is formed upon a screen, and methods and means for mechanically interlocking the scanning devices in an apparatus which is effectively a television transmitter and receiver closely coupled thereby eliminating the necessity of costly scanner synchronizing devices.

Object scanning at the transmitter and image scanning at the receiver have both been accomplished by electronic and mechanical means. The electronic devices were efficient but expensive, while the mechanical devices proposed heretofore were inexpensive but inefficient and some were impractical.

It is a well known fact that an object which emits or reflects visible light rays is invisible to the eye if a fog or haze exists between the object and the observer, because the visible rays are diffused by the fog or haze, while the penetrating infra-red rays are not detected by the eye. Likewise, objects which emit or reflect only infra-red or ultra-violet rays are not visible to the eye.

This invention provides means for scanning a television object which emits or reflects visible light rays but is obscured by fog or haze, or a television object emitting or reflecting infra-red or ultra-violet rays and enveloped in darkness, and means for scanning a television image of said object upon a suitable screen; comprised of infra-red or ultra-violet ray detecting devices, transducers for converting the infra-red or ultra-violet scanning rays into visible light scanning rays, invisible and visible ray kineto-optical devices, etc., hereinafter described.

An object of this invention is to provide practical means for viewing an object enveloped in darkness, fog or haze.

Other objects of this invention will appear hereinafter.

The views in the drawing are entirely sectional, to facilitate illustration of the optical devices.

The drawing shows the invention as applicable to infra-red or ultra-violet television, wherein visible television images of objects which emit or reflect invisible but refractable rays are received upon a suitable viewing screen. The devices effectively comprise a transmitter object scanner and receiver image scanner directly

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coupled in this particular application, inasmuch as one of the kineto-optical prismatic lenses functions simultaneously as an object and image scanner, thereby eliminating the necessity of other synchronizing means. The drawing is a

vertical plane section embodying related devices for producing television images of objects, the direct vision of which is obstructed by darkness, fog or haze. The parallel scanning beams of light rays and infra-red or ultra-violet rays are shown proportionately over-sized, as it is quite obvious that high quality picture detail can be obtained only when said parallel scanning beams are extremely small in their cross-sectional area.

Description of the devices shown in the drawing will disclose their operation.

The refractive devices shown in the drawing could be useful if constructed of conventional optical media (crown and flint glass), however, for refraction of infra-red or ultra-violet rays the efficiency of said refractive devices would be increased if they were made of polystyrene or similar plastic material.

31 represents an object being scanned by a beam of infra-red or ultra-violet rays 32. 33 is a suitable filter which allows either infra-red or ultra-violet rays to pass, as may be required. The beam of rays 32 could be emitted from an object radiating infra-red or ultra-violet rays, or reflected from an object flooded with infra-red or ultra-violet rays.

The effective focus of lens assembly 34 and 35 (preferably made of polystyrene or similar plastic material) determines the size of the field of view being scanned.

Cylindrical lens 36 converges, in a vertical plane, all of the rays intercepted by lens assembly 34 and 35.

Prismatic lens 37 is a polyhedron with a concentric circular hole, which rotates in a vertical plane and at a constant speed. Its speed must be consistent with the number of polygonal sides of the polyhedron, image scanning line and frame frequencies, and the practical limits of rotational devices.

Cylindrical lens 38 converges, in a horizontal plane, all of the rays vertically deflected by rotating prismatic lens 37.

Prismatic lens 39 is a polyhedron with a concentric circular hole, which rotates in a horizontal plane and at a constant speed. Its speed must be consistent with the number of polygonal sides of the polyhedron, image scanning line and frame frequencies, and the practical limits of rotational devices.

The speed of rotation of prismatic lenses 37 and 39 increases with the required number of image scanning lines and frames per second, and varies inversely as the number of polygonal sides.

The means for rotating and synchronizing prismatic lenses 37, 39, and 46 are not shown in the drawing, for simplicity, as they are conventional devices.

The aperture in plate 40, by virtue of the related positions of prismatic lenses 37 and 39, allows only the infra-red or ultra-violet rays from the spot of the object which is being scanned at each instant to enter the photo-electric cell symbolized by 41.

Photo-electric cell 41 converts the infra-red or ultra-violet ray impulses passing through aperture in plate 40 into electrical impulses which are passed through amplifier symbolized by 42. Amplifier 42 gives the said electrical impulses sufficient gain to operate the neon, argon, or similar gas crater type of lamp symbolized by 43. This invention involves the use of any suitable transducer which would convert the electrical impulses into light impulses within a parallel beam of light having an extremely small cross sectional area.

The parallel beam of light 44 emitted from said neon lamp 43, obviously would carry the modulations of the invisible infra-red or ultra-violet ray beam 32.

Prismatic lens 46 is a polyhedron with a concentric circular hole, which rotates in a horizontal plane (i. e., relative to the rotational plane of prismatic lens 37) and at a constant speed. Its speed must be consistent with the number of polygonal sides of the polyhedron, image scanning line and frame frequencies, and the practical limits of rotational devices.

The concentric circular hole in prismatic lenses 37, 39 and 46 provides means for increasing the total deflection of the beams refracted by said prismatic lenses, to compensate for reduced refraction in the polyhedron caused by increasing the number of polygonal sides in order to obtain a rotational speed within practical limits and commensurate with present day standards of line and frame frequencies. Experiments have demonstrated that the angle of total deflection of the scanning beam within the polyhedron varies inversely as the diameter of the concentric circular hole.

As light beam 44 passes through rotating prismatic lens 37, it is vertically deflected and scans a vertical line upon screen 50 each time a polygonal side sweeps through said light beam.

Light beam 44 follows a succession of divergent paths in a vertical plane, as it is deflected by rotating prismatic lens 37. These successively divergent paths are paralleled by means of cylindrical lens 45, so that said light beam 44 may be properly deflected by prismatic lens 46 rotating in a horizontal plane.

Light beam 44 then passes through rotating prismatic lens 46, its horizontal deflection causing the vertical lines scanned upon screen 50 by prismatic lens 37 to appear adjacent to each other in rapid succession, as each polygonal side of prismatic lens 46 sweeps through said light beam.

Light beam 44 follows a succession of divergent paths in successive horizontal planes, as said light beam is vertically deflected by prismatic lens 37 and simultaneously deflected horizontally by prismatic lens 46. These successively divergent paths, in successive horizontal planes, are paralleled by means of cylindrical lens 47; thusly form-

ing a television image with the modulations of light beam 44 for projection upon screen 50.

The size of the television image appearing upon screen 50 is determined by the effective focus of lens assembly 48 and 49.

Observer 51 can make the devices sensitive to infra-red, ultra-violet, or visible rays by simply changing or removing the filter 33, as may be required.

The infra-red or ultra-violet sensitivity of photo-electric cell 41 would be increased, if at least a portion of the bulb through which the rays pass was made of polystyrene or similar plastic material.

This invention may have other embodiments without departing from its spirit.

What is claimed as new and desired to be secured by Letters Patent is as follows:

1. In the art of television and the like, a device which combines the scanning of an object with the scanning of an image of said object for the purpose of viewing said object when enveloped in fog, haze, or darkness, comprising a lens assembly for intercepting a succession of parallel beams of infra-red or ultra-violet rays radiated from the surface of said object, means for filtering said successive parallel beams, a dual purpose rotating polyhedral prismatic lens having a concentric circular hole and related cylindrical lenses providing means for simultaneously and vertically deflecting said successive parallel beams of infra-red or ultra-violet rays and a parallel beam of visible light rays hereinafter described, a second rotating polyhedral prismatic lens having a concentric circular hole and related cylindrical lens for horizontally deflecting said parallel beam of infra-red or ultra-violet rays, and an aperture plate which by virtue of the successive related positions of the said rotating prismatic lenses allows only the rays within said infra-red or ultra-violet scanning beam to convey modulating impulses to a photo-electric cell; a photo-electric cell or similar device, an amplifier and related means for producing a parallel image scanning visible light beam modulated by the output impulses of said amplifier, a third rotating polyhedral prismatic lens having a concentric circular hole and related cylindrical lens for deflecting said parallel beam of modulated visible light rays in a plane perpendicular to the plane in which said modulated beam of visible light rays are deflected by the aforementioned dual purpose rotating polyhedral prismatic lens, and a lens assembly providing means for determining the total viewing screen area scanned by said modulated parallel visible light beam thereby determining the size of the television image projected upon said screen.

2. In the art of television and the like, means for producing and controlling object and image scanning beams, comprising a lens assembly for intercepting a succession of parallel visible or invisible object scanning beams emitted or reflected from the surface of said object, means for filtering said successive parallel beams, a kineto-optical polyhedral prismatic lens having a concentric hole or core of required refractive index and related cylindrical lenses providing means for simultaneously and vertically deflecting said successive parallel visible or invisible beams and a parallel image scanning visible light beam hereinafter described, and a second kineto-optical polyhedral prismatic lens having a concentric hole or core of required refractive index and a related cylindrical lens providing means for hori-

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zontally deflecting said successive parallel visible or invisible beams radiated from the surface of said object, an aperture which in combination with said parallel beam deflecting lenses functions to determine the successive scanning spot areas on the surface of said object, photo-electric and electro-optical means for amplifying and conveying modulation impulses to the aforementioned parallel image scanning visible light beam in relation to the modulation impulses in each said successive object scanning beam, a light source for producing said parallel image scanning visible light beam having an extremely small cross-sectional area and extending to the viewing screen, a third kineto-optical polyhedral prismatic lens having a concentric hole or core of required refractive index and a related cylindrical lens providing means for deflecting said parallel beam of modulated visible light rays in a plane perpendicular to the plane in which said beam of visible

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light rays are deflected by the aforementioned dual purpose kineto-optical polyhedral prismatic lens, and a lens assembly for controlling the projection of said modulated and deflected parallel image scanning visible light beam upon said viewing screen to produce an enlarged scanned image of the scanned said object.

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