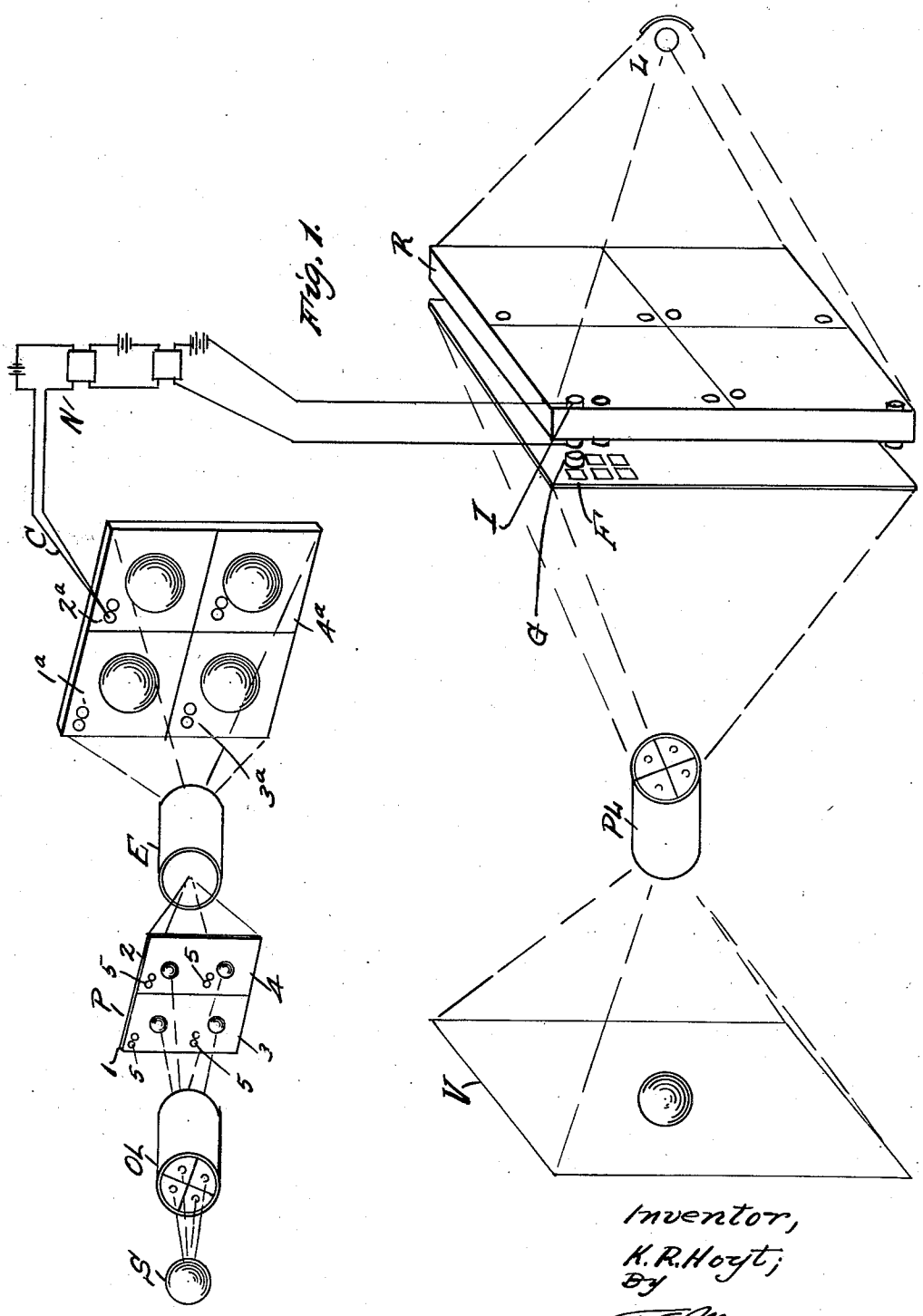
Oct. 17, 1939. K. R. HOYT 2,176,136

IMAGE TRANSMITTING AND RECEIVING SYSTEM

Filed Sept. 15, 1937 2 Sheets-Sheet 1

Fig. 1.



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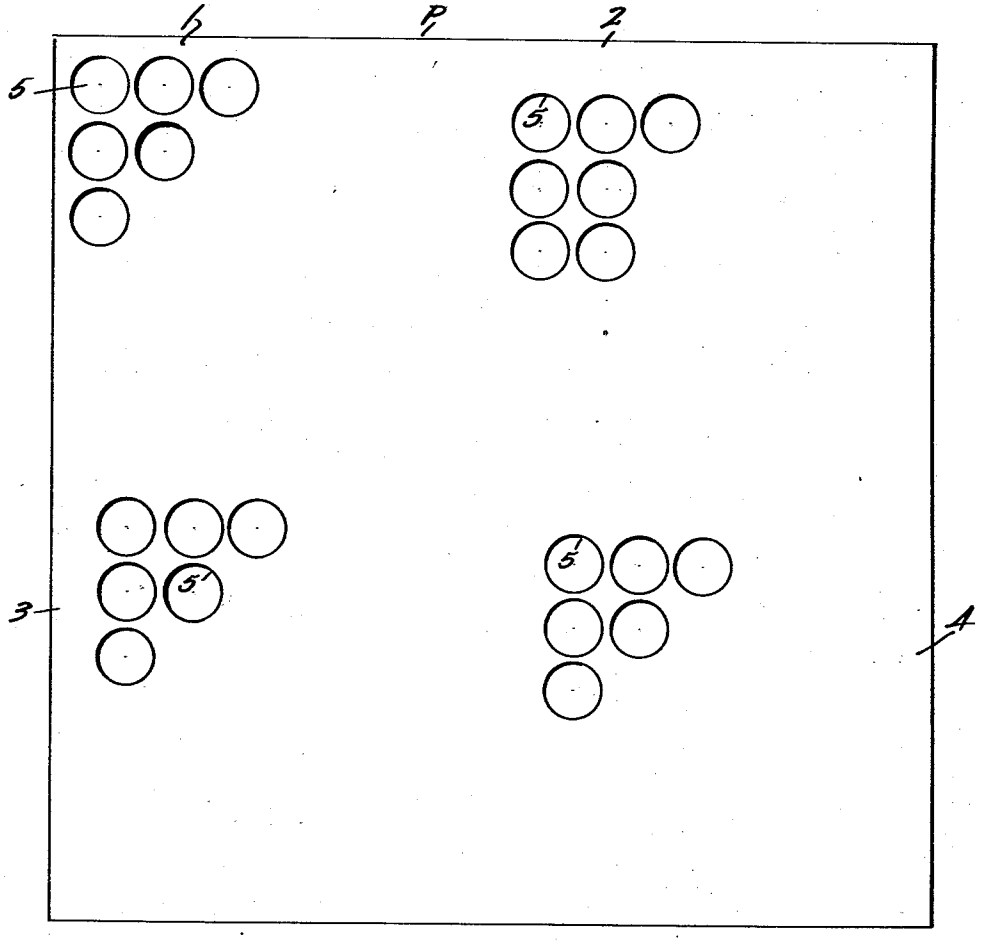


Fig. 2.

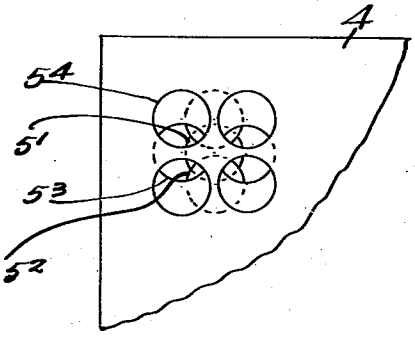


Fig. 3.

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2,176,136

UNITED STATES PATENT OFFICE

2,176,136

IMAGE TRANSMITTING AND RECEIVING SYSTEM

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Application September 15, 1937, Serial No. 164,005

3 Claims. (Cl. 178—6)

This invention is an electro-optical apparatus and method for transmitting and receiving intellectual signals particularly in the form of visible, projected images originating from a given, optically scanned subject matter.

The present invention is more specially concerned with the scanning of the given subject, whether still or moving, and the concurrent transmission of a number of electrical currents each of a strength determined by a particular pencil of light emanating from a definite spot in the area of the scene being scanned, and in the concurrent use of the several currents as a master light controlling medium whereby to cause to pass to an optical projector as many beams of light as are engulfed in the scanning means and whereby to automatically vary the volume of light in each beam in exact accordance with the intensity of light, as to each beam, at the source in the scanning means, and to effect the variation of the light from the projector at the identical instant of a change in its volume at the source spot per projected beam.

An important object is to provide for the concurrent transmission of a large number of pencils of light from a scene or subject and to convert the same into as many, concurrent, individual electrical streams and provide for the instant variation of the light in each relative projector beam so that the projector will effectuate an image on a screen of the source subject, whether still or moving, in true simulation.

Another object is to provide a scanning means capable of viewing the whole presented area of a subject at one time, that is, one instant of utmost briefness and provide for concurrent transmission of a cable or parallel cluster of individual currents wholly without the employment of any mechanically motivated scanning impediments.

A further object is to provide a receiving and projecting apparatus incorporating electrically controlled light regulators for actuation by respective incoming, light-controlled, electric streams whereby to project, to a viewing screen, an image of the scanned subject.

It may be said that an object is to provide an electromechanical, compound eye. That is, an object of the invention is to provide a scanning means in which there is a multiplicity of individual cells to each of which there is projected a pencil of light through a grating or scanning aperture plate to which there is projected a focused image, of the area of the grating, of the scene or subject. This image is subdivided into as many pencils of light reflected from the subject as there are apertures in the grating or plate and for each pencil there is a fixed cell or eye in the scanning means.

In this invention each cell or eye consists of a suitable light sensitive element of which several varieties are well known and readily available in the optical industry at the present time, as in the form of silenium cells, and hereinafter called the "light cell". Each of these cells is employed as a governor for the intensity of strength in a relative electric circuit employed directly or indirectly, as through a building up relay, in the actuation of a relative light stop gate forming a part of the receiving or image-making portion of the mechanical, compound eye herein disclosed.

Such receiver includes a source of light, a retinal or image screen, a projecting lens, and a light gate system of which the function is to pass as many pencils of light to the screen as are established by the scanning grating and passed to the respective light cells.

An additional object of the invention is to provide for the constant regulation and, in motion pictures, the automatic and instantaneous fluctuation of the degree of light from said source, at the receiver, in as nearly as exact proportion as possible to the strength of light dispersed by the subject through the objective lens to the scanning grating so that the image established on the receiving screen will be a replica.

To that end, the receiver light grate or shutter mechanism is provided with electromotivated shutters or irises one for each of the light-cell-controlled, electric circuits above referred to, whereby to regulate the amount of light passing from the receiver light source to a suitable projecting lens for focus of an image of the subject (scanned at the transmitter) to the receiver screen.

The invention consists in certain advancements in this art as set forth in the ensuing disclosure and having, with the above, additional objects and advantages as hereinafter developed, and whose construction, combination and details of means, and the manner of operation, and the method, will be made manifest in the description of the annexed illustrated embodiment; it being understood that modifications, variations and adaptations may be resorted to within the scope, principle and spirit of the invention as it is more directly claimed hereinbelow.

Figure 1 is a schematic diagram of the combined apparatus or compound eye. Figure 2 is

a plan of the multiple-section scanning grating or light hole panel to show the differential arrangement of the light holes in each section. Figure 3 is a plan outline of portions of the grating sections to show the overlapping relation of the light holes in the respective sections if piled center on center.

As here illustrated the scene subject S to be reproduced in remote image is optically focussed through a suitable lens OL on a plane or other grating or aperture plate which consists of a plurality of equi-sized sections 1, 2, 3 and 4 grouped in a compact quadrangle and each of which has a co-extensive system of light passing apertures 5 only a few of which are shown of equal size and symmetrical arrangement as to number and spacing in intersecting rows in their plate sections, but in each section its system of holes 5 is differently arranged as to that of the other plate sections. This differential arrangement is accurately shown in Fig. 3 in which the holes (5^1, 5^2, 5^3, 5^4) are shown as arranged in fixed relation and as if their plate sections 1, 2, 3 and 4 were superposed center on center. The purpose of the peculiar arrangement will be defined later.

The lens OL is therefore of a multiple, parallel, objective lens system type such as is shown in U. S. Patent No. 2,090,398, of August 17, 1937, to K. R. Hoyt, showing two lens sets. The lens OL of the present invention includes four objectives grouped on the axis of the said lens OL. Thus there is one lens set for each of the grating sections 1, 2, 3 and 4 and each lens set focuses directly on a given or relative grating section.

From the sectional grating P the uninterrupted image pencils of light pass through coordinate holes 5 to a suitable enlarging lens E by which they are severally cast onto a scanning or eye device in the form of a panel made up of a number of isolated light-sensitive cells C which are arranged co-extensively in four groups 1^a, 2^a, 3^a, 4^a, to correspond with the arrangements and numbers of light holes 5 in the plate sections 1, 2, 3 and 4, of their relative lens system O.

It will now be seen that each light cell C is excited at any instant to a degree that is determined by the volume of light coming to it from the subject S through the relative hole 5 in the grating or plate P. Each cell C is included as a detector and regulator in a relative, suitable electric circuit N which may be utilized by relay or amplification, to motivate a suitable light shutter or iris I. As many of these so-controlled irises as there are light cells C are arranged in a panel R in an order or system corresponding to the hole system of the master or transmitter grating P in as compact a manner as may be practical. Onto the panel of irises there is directed a beam of light from a suitable source L, and this light will be passed in full, or reduced, or stopped by each iris according as this is set by the actuating current in its relative circuit N (which may be regarded as a nerve in the sending and scanning part of the compound eye mechanism); the strength of the current being governed by the volume of light impinging on the relative light cell C. If such a cell is scanning a bright pencil from the master grating P then it will send a current to widely open its iris I and this will pass a bright beam pencil from the source L to a receiving or viewing screen V.

As the light pencil to any cell C varies the current power in the relative circuit N will likewise vary and the relative iris I will be motivated to reduce or to increase the amount of light it passes.

The light passing to the screen is intercepted by a projecting lens PL of similar quadruple set combination to the object scanning lens OL and the images made by the collected light from the operative irises I will be finally brought into accurate register and focus on screen V.

Interposed between the projecting lens PL and the panel of irises I is a bank of collecting lenses G, one coaxial with each iris, to direct its light pencil to a relative aperture in an aperture plate F having an aperture section for each section of the iris panel. The projecting lens PL therefore picks up the pencil of light from each aperture and projects all of the pencils into a single, composite image on the viewing screen V.

The purpose of the relative off-setting of the grating holes 5 in the different sections 1, 2, 3 and 4 is to insure that there will be no blind spots in the ultimate image as would be the result if the total presented area of the subject S were not picked up by the combined area of the scanning or detecting cells C.

It is understood that each panel group 1^a, etc., is made up of a co-extensive system of the cells C only one of which is indicated in the diagram circuit N, there being one cell C for each aperture 5 in the plate P, and that there is a respective, individually-motored shutter or iris I, in the panel R for each cell C so that each shutter is constantly controlled by the current impulse as sent out by its respective cell C. Also, the systems of shutters I in the panel R are arranged in accordance with the arrangement of a relative system of the cell groups 1^a, etc.

In circuit N the feeble current from receiver C is suitably amplified, as by included relay devices of any desired type, and is passed to a relative shutter I; it being understood that there is one such circuit for each receiver device C and each shutter I.

What is claimed is:

1. Image transmitting apparatus including a multi-set, objective lens, a focal plane, master grating having foraminous sections equal in number to the lens sets and having co-extensive, like systems of equal number and size holes, the set of holes of each system being differentially off-set as to the arrangement of the sets of the other systems and each lens focusing a separate, common image on a given one of the sections; said grating sections in the aggregate passing light pencils of a full view of the lens subject; and a panel of groups, one for each of said sections, of current control devices equal in number to the holes in said sections and in the same arrangement in the group as are the holes in said master grating, said devices presenting isolated light sensitive faces for excitation by light pencils passed from correspondingly located holes in the grating.

2. Apparatus as set forth in claim 1, and means including a system of illuminated shutters one for each of and operatively controlled by said devices for reproducing an image of the lens subject.

3. Apparatus as in claim 1, and an enlarging lens interposed between the said devices and the grating.

KARL ROBERT HOYT.