NOTE.—*The application for a Patent has become void.*
This print shows the Specification as it became open to public inspection.

PATENT SPECIFICATION

Convention Date (France): May 23, 1921.

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Application Date (in United Kingdom): May 3, 1922. No. 12,408/22.

Complete not Accepted.

COMPLETE SPECIFICATION.

Improvements in Optical Devices for Vision or Projection in Colours of Films with Microscopical Refractive Elements.

I, ALBERT KELLER-DORIAN, of rue Daguerre, Mulhouse, France, a citizen of the French Republic, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

The present invention relates to improvements in optical devices for the vision or projection of films with microscopical refractive elements.

The employment of films with microscopical refractive elements for the registration of coloured radiation of objects is well known; each of these microscopical elements registers the image of the luminous disc of the objective this latter carrying such a selective system that the radiations of each elementary colour traverse it according to the different zones.

When the image is to be reconstituted in colours either by projection or by direct vision it is found that there is a certain strict optimum relation between the dimensions, distances, radii of curvature, and the like which comprise all the elements of the optical system, considered as a whole.

The thickness of the film carrying the refractive microscopical elements constitutes the basis of all the dimensions under consideration. Supposing a film of $0.12^{m}/_{m}$. thickness is under consideration; to obtain the best results from the sensitive layer—being given the absolute definition of the commercial emulsions—it is necessary to employ on the average 16 refractive elements per linear millimeter or 256 elements per square millimeter. The focal length of these elements being $0.12^{m}/_{m}$. their radius of curvature will be approximately $0.04^{m}/_{m}$. The scale of reduction of the luminous disc of the objective itself will be about $1/_{500}$ which would entail the use of photographic lenses, the opening of which could only vary in the limits of f/2.5 to f/2. The field admissible for practical purposes without the production of aberrations due to the admission of rays which are too inclined, may then not exceed three fifths of the focus of the objective.

Thus for the commercial films of ordinary thickness the extreme limits of the constants of the system are clearly defined, *viz.* an opening of between f/2 and f/2.5, 200 to 300 refractive elements per square millimeter of film and a maximum photographic field $3/_{5}$th of the opening of the objective.

By following the path of luminous rays after passing through the above-defined optical system, conditions of visibility or projection of views with the best possible colour definition are obtained.

As near as possible to the film should be such an optical system that rays emanating from each coloured zone of the objective onto any one of the refractive elements of the film, should be brought into a bundle parallel to or at least coincident with the normal convergence of the eyes. This result cannot be obtained with a single lens, thus at least two separate lenses must be employed the dimensions and radii of curvature of which are defined by the size of the images to be

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viewed or projected. For example, in the case of cinematographic pictures the lens nearest the film should be approximately 35 m/m. diameter, should be plane on the side facing the film and should have a radius of curvature of 38 to 40 m/m. on the other face. At about 110 m/m. from this lens should be placed a second plano-convex lens of about 80 m/m. diameter and 150 m/m. radius of curvature. Finally the observer (or in case of projection, the condenser of the lantern) will stand at distance of approximately 150 m/m. from this second lens. It should be well understood that these two lenses must be exactly centered on the optical axis of the objective and of the film in the position in which it has been exposed, this system then forming, as previously stated, a uniform whole.

The reversibility of such a system is sufficiently perfect to enable it to be employed in projection, equally well in either sense, that is to say either as above-described, or by placing the projection lamp on the side of the objective furnished with the radiation analysing apparatus and by placing a second projection lens beyond the lenses to bring the rays back into parallel after their passing through the film. This method of projection shows a real superiority over the usual method in which a single objective is employed owing to the fact that it is infinitely less sensible to the variations of colours due to a bad central adjustment of the light.

The accompanying drawings show by way of example an embodiment of the arrangement forming the subject of the present invention.

As can be seen from the drawings:

A is the analyser for the coloured radiations,

B is the objective for taking the views,

C, D is the film, C being the support with the microscopical elements and D the coating of emulsion.

E is the lens comprising the first element of the condenser arranged behind the film for direct vision or for projection.

F is the second lens of the condenser,

G shows the direction in which the observer or the projection objective is situated if the illumination is on the left hand side of the drawing.

As regards the projection, it should be borne in mind that it could be also effected as previously stated, when the illumination is on the right hand side of the drawing.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. An optical system for the vision or projection in colours of films with microscopical refractive elements, comprising an analyser for the coloured radiations, a photographic objective behind said analyser, and a film of ordinary thickness behind said objective, certain well defined optimum relations being maintained between the dimensions, distances, radii of curvature and the like, of the elements constituting said system.

2. In the optical system as set forth in Claim 1, the maintenance of the opening of the objective between f/2 and f/2.5 the number of refractive elements per square millimeter of film, 200 to 300 and the maximum photographic field three-fifths of the opening of the objective.

3. In the optical system as set forth in the preceding claims, the arrangement in the immediate vicinity of the film of another optical system adapted to bring back into parallel, or into coincidence with the convergence of the eyes, the rays emanating from each coloured zone of the objective onto one of the refractive elements of the film, said second system comprising two separate lenses, having dimensions and curvatures determined by the size of the image to be seen or projected.

4. Optical system as set forth in the preceding claim, in which the system for bringing back into parallel or coincidence with the convergence of the eyes the rays emanating from each coloured zone of the objective comprises a plano-convex lens of approximately 35 millimeters diameter, and of a radius of curvature of 38 to 40 millimeters, having its plane surface in immediate proximity to said film, a second plano-convex lens of about 80 millimeters diameter placed at a distance of approximately 110 millimeters to said first lens with its convex surface facing the convex surface of said first lens, and having a radius of curvature of approximately 150 millimeters.

5. The optical system for the vision or projection in colours of films with microscopical refractive elements, substantially as described and as illustrated in the accompanying drawing.

Dated this 3rd day of May, 1922.

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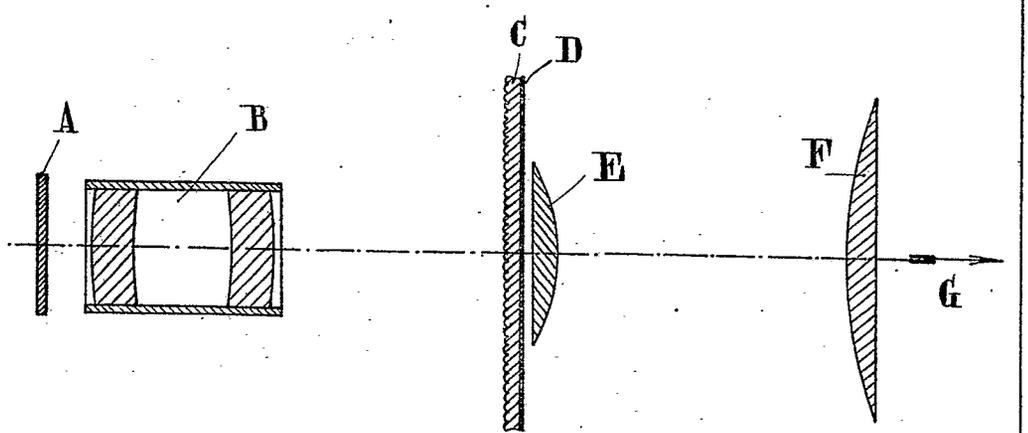

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