PATENT SPECIFICATION

303,356

Convention Date (France): Dec. 31, 1927.

Application Date (in United Kingdom): Dec. 8, 1928. No. 37,402/28.

Complete Accepted: March 18, 1930.

COMPLETE SPECIFICATION.

Improvements in the Printing by Projection of Films Bearing Picture Records for use in Colour-photography or Cinematography.

We, SOCIETE FRANCAISE CINECHROMATIQUE PROCÉDES R. BERTHON, of 24, rue de la Pepiniere, Paris, France, a French Societe Anonyme, assignees of SOCIETE CIVILE POUR L'ETUDE DE LA PHOTOGRAPHIE ET DE LA CINEMATOGRAPHIE EN COULEURS, resident in (Seine), France, a French Company, 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 printing of ordinary films by projection [illegible] minated by a punctiform source of light is viewed obliquely, the image of the point of light is seen reflected on each face of the component lenses. Since any bright point of projected image may be considered as a punctiform source, the said point thus produces partial reflections on the components of the objective. It is easy to see that if projection is done on an ordinary blank film, such partial reflections cannot have any detrimental effect upon the quality of the print; at most, the faint radiations reflected in all directions may produce a slight uniform fog on the whole surface of the print, but this fog is easily counteracted by using a suitable developer. Matters are wholly different when the projection is effected upon a lenticular film the lenticular face of which faces the projection objective. In that case, as each microscopic element of the support acts as a microscopic linear or punctiform lens, the said element takes up the image or images of each reflection and localises them at particular points of the emulsion whenever the reflection is not outside the field of the refractive elements under consideration. Finally, those reflected rays which are nearly normal to the various points of the film bring screen by means of a concave mirror are known, the object being illuminated by a source of light placed on the same side of the object as the mirror, or on the opposite side thereof, according as to whether the object to be projected is opaque or translucent. The apparatus according to the present invention is adapted to print, by projection, picture records obtained on films bearing microscopic refractive elements.

The working of the mirror and of the printing machine as a whole are detailed in the two Figures of the accompanying drawings.

Figure 1 shows diagrammatically a

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ERRATUM.

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In the heading on Page 1, *for* "Dec. 8, 1928." *read* "Dec. 18, 1928."

PATENT OFFICE,

June 17th, 1930.

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The printing of ordinary films by projecting the original picture on to a blank film by means of a lens involves no particular difficulties. When using a perfectly corrected lens it has been observed that even the prints thus obtained are of improved quality as compared with prints obtained by contact.

This is no longer the case when it is desired to print by projection picture records on lenticular films, i.e. films one side of the support of which is covered with linear microscopic refractive elements. It is found in this case that the bright objects on the original picture appear to be surrounded with a kind of halo or nebular fringe, even if the image is reproduced with accurate sharpness and hard contrasts.

This fact is a consequence of the internal reflections which unavoidably take place in any lens. It is common knowledge that when an objective illuminated by a punctiform source of light is viewed obliquely, the image of the point of light is seen reflected on each face of the component lenses. Since any bright point of projected image may be considered as a punctiform source, the said point thus produces partial reflections on the components of the objective. It is easy to see that if projection is done on an ordinary blank film, such partial reflections cannot have any detrimental effect upon the quality of the print; at most, the faint radiations reflected in all directions may produce a slight uniform fog on the whole surface of the print, but this fog is easily counteracted by using a suitable developer. Matters are wholly different when the projection is effected upon a lenticular film the lenticular face of which faces the projection objective. In that case, as each microscopic element of the support acts as a microscopic linear or punctiform lens, the said element takes up the image or images of each reflection and localises them at particular points of the emulsion whenever the reflection is not outside the field of the refractive elements under consideration. Finally, those reflected rays which are nearly normal to the various points of the film being printed, are transferred upon the layer with an intensity proportional to their brightness. This explains the halo or nebulous fringe which appears around every bright point on prints made on lenticular films.

It is the aim of this invention to obviate this defect entirely. The invention comprises apparatus for printing by projection, picture records obtained on lenticular films of the kind referred to, characterised in that an optical catoptric system eliminating internal reflections which take place in any objective is employed instead of the objective generally used. In practice, a simple spherical mirror which is silvered and polished on its concave face fulfills the conditions necessary to obtain a perfect print.

Apparatus in which an image of some object is projected on to a surface or screen by means of a concave mirror are known, the object being illuminated by a source of light placed on the same side of the object as the mirror, or on the opposite side thereof, according as to whether the object to be projected is opaque or translucent. The apparatus according to the present invention is adapted to print, by projection, picture records obtained on films bearing microscopic refractive elements.

The working of the mirror and of the printing machine as a whole are detailed in the two Figures of the accompanying drawings.

Figure 1 shows diagrammatically a

horizontal section of the printing device, at right angles to the film and passing through the optical axis of the mirror.

A is the lenticular film to be duplicated;

B is a diffusion lamp illuminating the film A.

C is a spherical mirror the optical centre of which is at O;

D is a lenticular blank film upon which the mirror C projects the reversed image of the film A.

Figure 2 shows the two channels of the printing device through which the original and blank films are fed side by side. They both face the mirror C with their lenticular surfaces but one film moves upwards while the other moves downwards, as is always done in all projection printing machines.

The channels through which the films are fed may be either accurately perpendicular to the optical axis of the mirror or slightly inclined to a plane perpendicular to that axis in order more perfectly to coincide with the focal surface of the mirror in the vicinity of the apex of that surface.

The centre of curvature of the mirror must in all cases be exactly between the two films in order to reduce aberrations to a minimum. Likewise, the radius of the mirror must be of such length that the length of the long side of the pictures is negligible relatively to said radius. Finally, the diameter of the mirror must be such that its aperture, in relation to its radius, is equivalent to the aperture of the objective used for recording the original picture (viz. generally 1 to 2.5).

The above device does not cover the elimination of waterings, this elimination being essential for obtaining a correct print of the picture on a lenticular film. It is, of course, possible, according to the Berthon process, described in British Patent Specification No. 265,069, to interpose in the beams to or from the mirror any of the optical devices provided to that end, but reflections are still introduced thereby.

In order to eliminate the watering effect obtained with the apparatus according to the invention, a further feature of the invention comprises apparatus in which the mirror is composed of sections, preferably three sections, which are displaced relatively to one another in such a way that the images of the linear lenticular elements formed by the respective sections of the mirror are not superposed, but are displaced at right angles to said linear elements. The simplest arrangement consists in dividing the spherical mirror into three sections by planes perpendicular to the linear elements of the film, and causing a relative displacement, at right angles to the linear elements, of the respective images formed by the three sections, by an amount equal to one third of the width of the linear elements. For example, if there are 30 lines to the millimeter, the images furnished by the three sections will have to be displaced by 1/90 of a mm. relatively to one another. Under these conditions the image of the lenticular elements will be blurred.

It is further possible to obtain a similar blurring of the image of the lenticular elements by producing very slight local deformations of the material serving as a support to the mirror during the manufacture so as to produce three zones, each of which has a curvature differing slightly from that of the others. The amount of deformation is infinitesimal, and therefore the sharpness of the resulting image is not affected to any appreciable extent.

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

1. Apparatus for printing by projection, picture records obtained on lenticular films of the kind referred to, characterised in that an optical catoptric system eliminating internal reflections which take place in any objective is employed instead of the objective generally used.

2. Apparatus as claimed in Claim 1, characterised by a simple spherical mirror silvered and polished on its concave face which is substituted for the objective, the films being fed in opposite directions, with their lenticular faces facing the mirror, the centre of curvature of which lies exactly between the two films, which may be either perpendicular to the optical axis of the mirror or slightly inclined to a plane perpendicular to that axis.

3. Apparatus as claimed in claim 2, characterised in that the mirror is composed of sections, preferably three sections, which are displaced relatively to one another, in such a way that the images of the linear lenticular elements formed by the respective sections of the mirror are not superposed, but are displaced at right angles to said linear elements.

4. Apparatus as claimed in claim 2, characterised in that the mirror is subjected to slight local deformations in order to blur the image of the lenticular elements.

5. Apparatus for printing by projection, picture records obtained on lenticu-

lar films substantially as described with reference to the accompanying drawings.

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Chartered Patent Agents.

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Fig.1

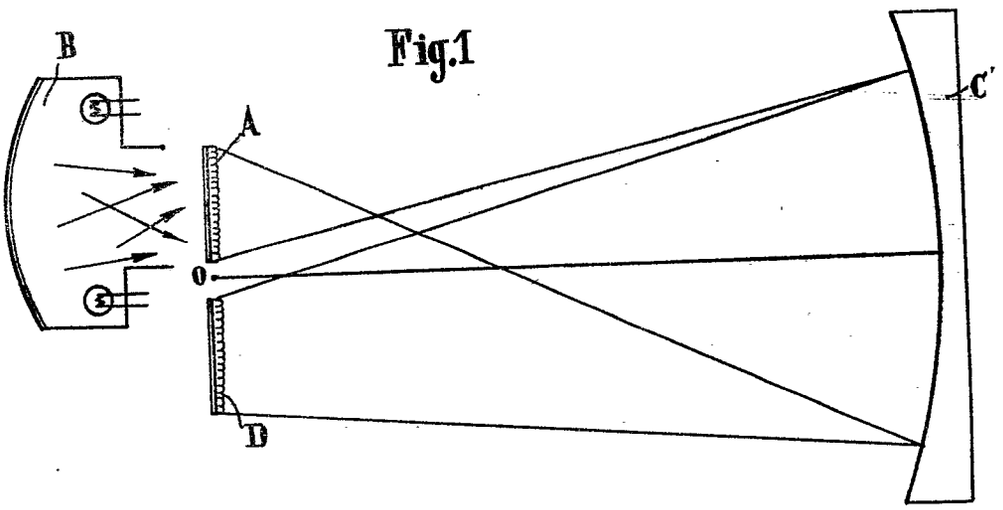
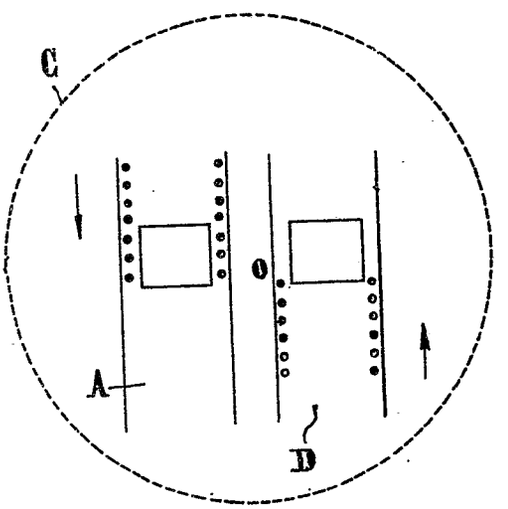


Fig.2



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