July 6, 1937. L. T. TROLAND 2,085,878

SOUND RECORD MOTION PICTURE

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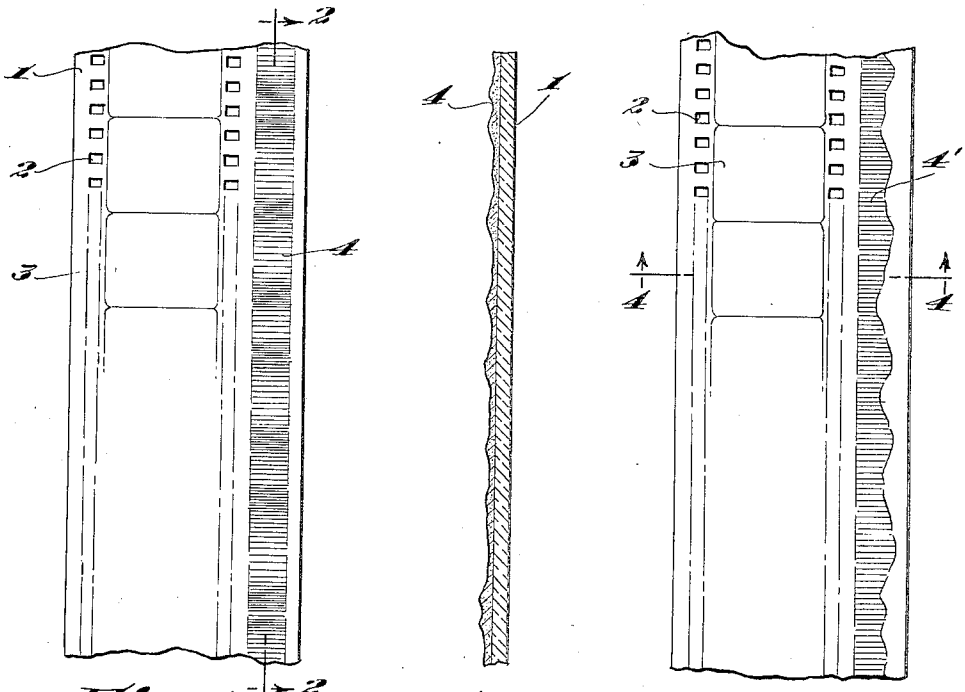

Fig. 1 Fig. 2 Fig. 3

Fig. 4

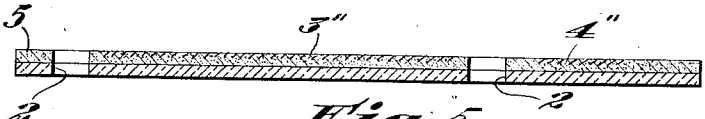

Fig. 5

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SOUND RECORD MOTION PICTURE

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12 Claims. (Cl. 88—16.2)

This invention relates to cinematographic films of the type bearing a record of sounds concomitant with the scene depicted and more particularly to sound-record film for the display of motion pictures in natural colors. The sound record may be of either of the well-known types, one of which is characterized by a variable-density constant-width band or stripe and the other by a constant-density and variable-width band. Heretofore this band or stripe has been produced by the common photographic process involving developed silver and has been unsatisfactory in that the sound waves are not accurately recorded for the reason, I believe, that the photographic characteristic of a silver emulsion is not a straight line; and in the case of constant-density variable-width recording the presence of fog adjacent the variable-width stripe makes it difficult to obtain a satisfactory degree of contrast between the stripe and adjacent areas of the film.

Objects of the present invention are to provide a film which faithfully records the sound for accurate reproduction, which is less costly to produce, and which greatly simplifies the production of sound record motion pictures in natural colors.

According to this invention the sound record is made, not by the usual photographic process involving developed silver, but forming the band or stripe, whether of variable density or variable width, with dye which, in the case of colored pictures, may be the same as one of the dyes used in forming the color pictures. The band or stripe may be formed with dye by first forming the band as a relief and then staining the relief, or by printing the band or stripe in a light-sensitive coating, rendering the coating differentially absorptive in the image and non-image portions respectively and then dyeing the absorptive portion, or by imbibition from a stained matrix on a gelatine coating or the like, or by any other suitable method of forming a dye image having a substantially straight line characteristic, at least in the regions of relatively low densities. Although the use of dyes for producing picture records has heretofore resulted in poor definition, I have discovered that the limited class of dyes hereinafter referred to are free from this difficulty.

While the pictures may be printed photographically by any desired color process, preferably they are also printed along with the sound record, as by imbibition, thereby forming the picture and sound record concomitantly in the same series of operations.

Applied in the variable-width way this method will yield a band or stripe having very high density and therefore adequate contrast with the adjacent regions of the film; and when the band or stripe is in the form of a relief the contrast may be rendered very high by etching off all the gelatine in the adjacent regions leaving bare celluloid which will not, of course, imbibe the dye. In both the variable-width and variable-density methods, the contrast may be enhanced by using a dye which strongly absorbs the rays to which the pick-up or sound-reproducing device is sensitive.

A preferred mode of procedure consists in forming the sound and picture negatives, on the same film of different films respectively, printing one or more matrices from the negatives, using a separate matrix for each color aspect recorded in the case of color pictures, preferably with the sound record reproduced on one or more of the matrices, converting both the picture and sound images into gelatine reliefs (e. g. by exposure through the celluloid backing and dissolving off the unexposed gelatine as described in patent to D. F. Comstock No. 1,552,826, September 8, 1925) and then dyeing the matrix images and printing them on a suitable blank film by imbibition as described, for example, in patent to D. F. Comstock No. 1,707,710, April 2, 1929 and patent to W. E. Whitney No. 1,707,699, April 2, 1929, the sound record preferably being printed simultaneously with the pictures.

The method of the present invention includes the preliminary preparation of photographic film which may be exposed and developed with respect to one or more given color aspects of the scene to be depicted and simultaneously exposed in another portion of the same or a different film (preferaby through the transparent backing) to correspond to sound wave vibrations. The coating of the film or at least the sound record portion of the coating may be dyed (before exposure) strongly to absorb one or more colors in the variable light (other colors being less absorbed) as more fully described in copending patent to E. A. Weaver No. 1,804,727, May 12, 1931 thereby to accentuate the relative depths of penetration of the light and to exaggerate the relative contours of the sound record which is thereby produced in the gelatine after development and the removal (as by etching in hot water) of the undeveloped gelatine. While the pictures may be formed by any suitable photographic process they are preferably formed in like manner by an etching process or the similar process

involving differential hardening without etching. This film may be formed by reversing the negative or by printing a matrix from the negative.

For the purpose of illustrating the genus of the invention typical embodiments are shown in the accompanying drawing in which

Fig. 1 is a face view of a film of the variable-density type;

Fig. 2 is a section on line 2—2 of Fig. 1;

Fig. 3 is a view similar to Fig. 1 showing the variable-width type of sound record;

Fig. 4 is a section on line 4—4 of Fig. 3; and

Fig. 5 is a similar section of a dye absorptive blank printed by imbibition.

The particular embodiment of the invention shown in Fig. 1 comprises a film 1 having the usual rows of sprocket holes 2, pictures 3 between the rows of sprocket holes, and a sound record 4 on the extended lateral margin of the film. According to the preferred procedure above outlined, if this film be the negative, the film is coated with an ordinary silver emulsion, preferably treated as described in Patent No. 1,804,727, and both the picture images and the sound record are developed in black and white, the density of the sound record varying longitudinally of the film in accordance with the variable sound as indicated by the variable shading. The gelatine coating (especially of the sound record portion) preferably is sensitized with respect to the more actinic portion of the exposure light, as by adding a small amount of sodium bichromate to the gelatine emulsion, or a suitable yellow dye such as naphthol yellow or quinoline yellow or a mixture of the two. The relief matrix printed from the negative would present a similar appearance (as far as can be shown in a drawing like Fig. 1) but both the picture images and the sound record would then be in relief as shown in Figs. 2 and 4, all other portions of the film comprising bare celluloid as shown in Fig. 4. The blank film printed from this matrix by imbibition would also present a similar appearance except in that the picture and sound record would not be in relief but would comprise dye imbibed into the gelatine layer 5 (Fig. 5) of uniform thickness as shown at 3'' and 4'' respectively in Fig. 5. In producing a film in natural colors by such an imbibition process it will be understood that the blank film would first be printed with a matrix representing one color aspect of the object field, for example the red-orange aspect, and subsequently printed with another matrix representing another color aspect of the object field, as for example the blue-green aspect. In such a color process the sound record may be on only one or both of the matrices, being printed in one color only when on only one matrix and being printed in both colors in superposition when on both matrices. Likewise the process may be used for printing a three or four-color picture film.

The film shown in Fig. 3 is similar to that shown in Fig. 1 except in that the sound record is of the constant-density variable-width type. As in the case of Fig. 1, Fig. 3 serves to illustrate any one of the three films above referred to, namely the negative, the matrix or the imbibition print. In the case of the negative the picture and sound images may comprise developed silver, in the case of the matrix they may be in the form of dyed reliefs, and in the case of the printed blanks they may be in the form of dyed prints.

From the foregoing it will be understood that for the display of pictures in black-and-white the dyed relief film, which constitutes the intermediate of the three films above described, may be used as the projection film instead of transferring the dye contained therein to a dye-adsorptive blank.

According to this invention the presence of a small amount of fog (such as is ordinarily present in commercial methods of black-and-white photography) in the regions adjacent a variable width sound record such as shown in Fig. 3 does not affect the finished product, whether it be a relief as shown in Fig. 4 or an imbibition print as shown in Fig. 5, for the reason that all of the gelatine is etched off in those regions leaving bare celluloid which imbibes no dye.

One aspect of the invention consists in the discovery that greatly improve definition may be attained with a small class of dyes characterized by slow and shallow diffusion into wet gelatine. While it is not entirely clear why the few dyes of this classification afford such marked improvement in sharp definition I believe it is due to the fact that penetration of these dyes is retarded in such marked degree (due to viscosity and/or chemical affinity for gelatine) as to confine the dye substantially to the surface of the gelatine and thereby prevent lateral diffusion. Typical examples of these dyes comprise Fast Red A Extra (Color Index 176) Fast Acid Green B (Color Index 667) Fast Wool Blue B (Color Index 209) and Anthracene Yellow GR pure (similar to Color Index 195 and Shultz 177). Dyes of this class are particularly applicable to the production of sound records of the variable-width constant-density type.

I claim:

1. The method of making sound-record film which comprises forming a variable width relief image corresponding to the sound in a film which is bare adjacent the image and dyeing the relief image to form the sound record in dye.

2. The method of making sound-record film which comprises forming a relief image corresponding to the sound, dyeing the relief image, and transferring the dye to an imbibition blank to reproduce the sound record in pure dye.

3. The method of making sound-record film which comprises forming a relief image corresponding to the sound on a film rendering the film bare adjacent to the image, dyeing the relief image, and transferring the dye to an imbibition blank to reproduce the sound record in pure dye.

4. The method of making sound-record motion-picture film which comprises forming images of the sound and scene, dyeing the images with the same dye, and concomitantly printing both images on a dye-absorptive blank by imbibition.

5. The method of making sound-record motion-picture film which comprises forming relief images of the sound and scene, dyeing the images with the same dye, and concomitantly printing both images on a dye-absorptive blank by imbibition.

6. A film bearing a record of acoustic vibrations comprising a layer of imbibition material having therein an image formed of dye characterized by slow and shallow diffusion, the image being substantially confined to the surface stratum of the layer and characterized by sharp definition.

7. A film bearing a record of acoustic vibrations comprising a layer of imbibition material

having therein a variable width sound track formed of dye characterized by slow and shallow diffusion, said track being substantially confined to the surface stratum of the layer and characterized by sharp definition, and constant intensity.

8. The method of recording sound which comprises forming in a sensitized film an image corresponding to the sound, dyeing said film according to the variations in exposure, and transferring the dye to an imbibition blank to form a sound record in dye.

9. The method of recording sound which comprises forming in a sensitized film a variable width relief image corresponding to the sound with the film bare adjacent its variable edge, forming a light-modulating sound record with dye imbibed in said relief image, by transferring the dye to an imbibition blank to reproduce the image in dye.

10. The method of recording scenes and accompanying sound which comprises forming on sensitive film images corresponding to the scene and sound respectively dyeing said film according to variations in exposure, and transferring the dye to imbibition film to form both records in dye.

11. A film for reproducing sound comprising a layer of dye-absorbent material of approximately uniform thickness containing a variable width sound record in dye characterized by slow and shallow diffusion, the variations in width of the dye record corresponding to the sound variations.

12. A film according to claim 11 further characterized in that the film is bare of said material adjacent the variable edge of said width.

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