Oct. 17, 1939. C. F. JONES 2,176,303

SOUND TRACK ON COLORED FILM AND METHOD OF PRODUCING SAME

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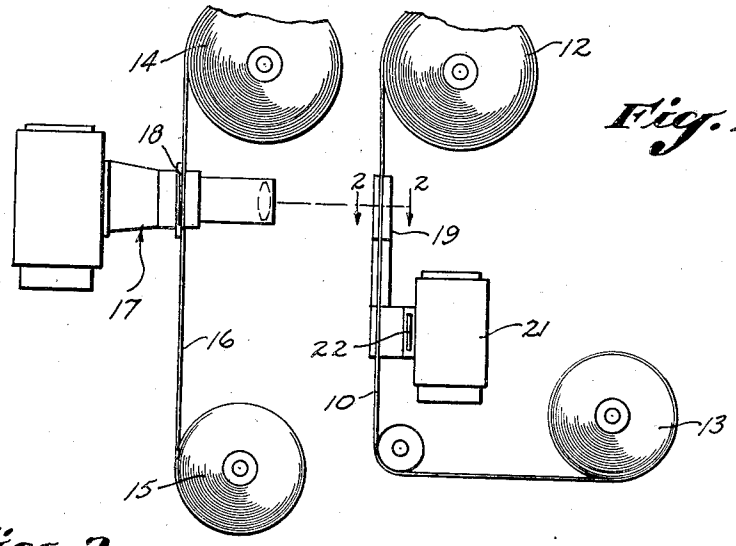


Fig. 1.

Fig. 2.

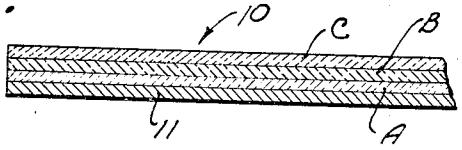


Fig. 3.

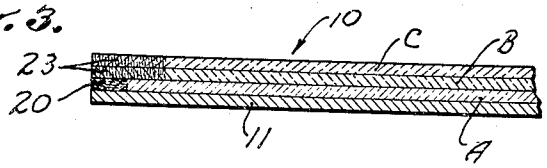


Fig. 4.

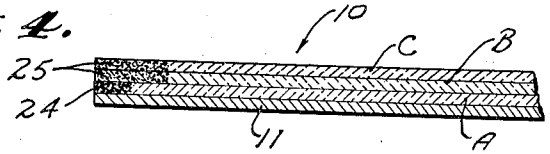
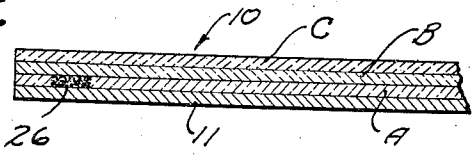


Fig. 5.



INVENTOR.
Charles F. Jones,

BY

Robert W. Fulweiler
ATTORNEY.

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SOUND TRACK ON COLORED FILM AND METHOD OF PRODUCING SAME

Charles F. Jones, Burlingame, Calif., assignor of one-fourth to J. D. Grant and one-fourth to C. W. Durbrow, both of San Francisco, Calif.

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7 Claims. (Cl. 95—2)

This invention relates broadly to the production of sound records and colored photographs on the same film strip and while it may be used in sound recording, it finds its principal application in the making of positive prints for motion picture projection.

Sound on film recording and reproduction is generally accomplished by either the variable density method or the variable area system, both of which are well known in the art, and as will become apparent hereinafter my invention may be used in conjunction with either of these systems.

There are of course numerous types of film and processes for obtaining colored photographs and it is an object of my invention to provide a system of producing sound track on colored film which is not dependent upon any particular film or method of treating it. In general my invention contemplates the production of a colored sound track in a single emulsion layer, although as will be shown, it can be used for the production of uncolored track in certain instances.

Due to the dispersive action of photographic emulsions it has been found difficult to print a plurality of sound track images in superposed emulsion layers and secure sufficient definition in the plural images to give sound reproduction of the high degree of excellence now obtained with ordinary black and white prints, and it is therefore one of the objects of the present invention to provide a method of producing a satisfactory sound track in a single layer of a multilayer film.

It is a further object of my invention to provide a method of producing sound track of a color most suitable for use with particular photocells. For instance, the usual cell now employed in sound reproduction is sensitive to the red end of the spectrum and "blind" to the blue-green end and in this case I preferably provide a blue-green sound track. On the other hand, if a cell is used which is blind to red, I would provide a red sound track and so on.

While as mentioned, my invention can be used in conjunction with many and varied color processes, it is particularly applicable to processes using a film comprising a plurality of superposed strata or layers each of which is sensitive to a different color. Processes employing such a film in general secure a plurality of superposed color value images which are subsequently given colors either corresponding to or complementary to the sensitivity range of the particular emulsion layer carrying the image. In all of these processes it is of course essential from a commercial standpoint that they be kept as simple and economical as possible and it is therefore another object of my invention to provide a system for the accomplishment of the foregoing and other objects which can be employed at no increase in cost and which is both simple and efficient.

It is a further object of my invention to produce a colored photograph having a colored sound track thereon which is restricted to one emulsion stratum of said film.

These and other objects and advantages of my invention will become apparent from the following description of a preferred form thereof and by reference to the accompanying drawing in which:

Fig. 1 is a diagrammatic portrayal of one form of apparatus for reproducing sound track according to my invention.

Fig. 2 is a cross-section of a typical multilayer film for color photography.

Fig. 3 is a cross-section of the film of Fig. 2 with latent images in the sound track area.

Fig. 4 is a cross-section of the film of Fig. 3 after development.

Fig. 5 is the finished film after reversal.

For purposes of illustration I will first describe my invention as applied to a reversal process which employs a film of the type shown in the drawing. Referring first to Fig. 2, the numeral 10 indicates generally a light sensitive film comprising a base 11 and superposed emulsion layers A, B and C which may be separtaed by intermediate strata (not shown) if desired. In the form illustrated the emulsion layer A nearest the base 11 is red sensitive, the intermediate stratum B is green sensitive and the outer emulsion layer C is blue sensitive. It will be understood of course that while it is preferable to have the individual strata selectively sensitized to relatively narrow spectral ranges, that from a practical standpoint it may be more advisable to allow them to be sensitive to other colors than the one which they are to record, and to limit the spectral range of the light impinging on the various layers by filter or other suitable means, which form no part of this invention. By appropriate means the resultant image obtained in the inner emulsion layer A is colored blue-green, the middle image in emulsion layer B is colored magenta and the outer image in layer C is colored yellow. As is well known in the art, the projection of these three superimposed images upon a screen will give a substantially natural color picture.

When accomplishing this result by a reversal

process the film is first exposed in the ordinary way, preferably with the outer emulsion C facing the lens and three latent color value images are obtained. The film may then be developed and reversed in known manner to change each of the images from negative to positive as to density. After the three images have been reversed they are colored by suitable means to produce a finished positive photograph formed by the superimposition of the three colored part images.

In making copies of this finished colored print the photograph is printed by appropriate means to a sensitive film of the same kind, having three emulsion layers A, B and C as before, and after a suitable exposure the film is developed, reversed and colored as just explained. The usual procedure followed in the production of sound pictures is to record the sound on a separate film and then print it to the film bearing or to bear the pictures to give what is termed a composite print, i. e., one which has a picture in its major portion and a sound track along a narrow strip adjacent the edge of the film.

In making composite colored prints by the foregoing method and employing my process of producing the sound track, an apparatus such as illustrated in Fig. 1 may be employed. The numeral **10** again indicates a multilayer selectively sensitized film and the numerals **12** and **13** indicate suitable feed and take-up reels for carrying said film. A second pair of reels **14** and **15** may be provided adjacent the reels **12** and **13** for carrying a film **16** upon which a sound track has been recorded, it being understood that the track on film **16** may be either positive or negative depending upon other factors as hereinafter set forth. A projection printer indicated generally by the numeral **17** is provided with a filter **18** (in this case red) and is adapted to have the sound track film **16** and the raw stock **10** passed therethrough, the track of film **16** being printed with red light on to the corresponding edge portion of film **10**.

The printing light being of but one color, in this case red, is recorded in only one of the emulsion layers of the film **10**, in this example, emulsion A, as strata B and C are insensitive to red light. In effecting this printing I deem it highly desirable to expose the film **10** through the transparent base **11**, for if exposure is made through the face of the film a certain amount of diffusion of the light takes place in passing through emulsions B and C which are only translucent. If the base has been previously provided with an antihalation dye covering this may be removed before printing if desired. The result of this printing operation is shown in Fig. 3 where the shaded portion **20** indicates the latent sound track image formed in the emulsion layer A of film **10**. As it is usually desirable to have a positive track on the finished copy, when using a reversal process the sound film **16** used for printing is a positive and the image **20** on film **10** obtained therefrom is a negative.

The film **10** bearing the latent image **20** is then passed in front of a lamp **21** and filter **22** with its face preferably facing the lamp to fully expose the track area of emulsions B and C with light to which they are sensitive but which will not be recorded by emulsion A. In this case the light rays from lamp-house **21** would be blue and green. This exposure produces a latent image in the entire track area of emulsion strata B and C as indicated by the numeral **23** in Fig. 3. When these latent images **20** and **23** are then developed, preferably in the same bath used for developing the accompanying picture images on the film **10**, black silver images **24** and **25** are formed from the latent images **20** and **23** respectively, as seen in Fig. 4. The film is then reversed in accordance with the usual procedure as before outlined which removes the images **24** and **25** or renders them transparent and provides a positive image **26** of the sound track in the emulsion stratum in which image **20** was first formed. The film is then subjected to appropriate treatment to produce the required colors in the various superposed part images and the finished film then carries a natural colored picture and a colored (in this case blue-green) positive sound track at **26**, the spaces formerly occupied by images **24** and **25** being transparent. The resulting sound track then is contained in a single emulsion stratum only, and is of the desired color for the most effective cooperation with the light sensitive cell used in the sound reproducing apparatus.

While the foregoing description of the production of the sound track on the final positive print is predicated upon the separate production of a black and white track from which the colored track is printed, it will be obvious to those skilled in the art that substantially the same procedure is involved when the sound is recorded directly on the picture film, as is sometimes the case in newsreel and amateur work. In this instance the film **16** is of course eliminated and a recording head is substituted for the projection printer **17**. Light of a predetermined spectral range to which one emulsion only is sensitive is used for the recording with the result that a sound track image **20** is recorded directly on the film **10** at the same time that a picture is produced thereon by camera means (not shown) through which the film **10** passes. The outer emulsions of the exposed film may then be exposed to the light from lamp-house **21** as before and the film developed, reversed and colored as previously described. By directly recording the sound on film **10**, the first image **20** is negative, as before, giving upon reversal, a positive sound track image **26** as required. Copies may be made from this composite print using red light to print the track in the manner previously described, which gives first a negative track image **20** and subsequently upon reversal a positive image **26** which is normally colored blue-green in the system described. In that the procedure is substantially the same when printing from a film or recording direct, it is to be understood that wherever in the claims I use the term "printing", it is to be deemed to include the production of a photographic sound track either by exposure direct in a recording head or through a film bearing a sound track thereon.

In commercial work where a great number of copies are required, it may be found advisable not to reverse the picture negative as to density, but merely to color the part images complementarily as usual. In this case then we have a printing film for the picture that is negative as to density and negative as to color as the images have been colored complementary to the spectral sensitivity range of their respective strata. The production of the positive picture in color is accomplished by printing in the usual manner and again coloring the resulting positive images complementary to the color sensitivity of their respective strata to give a resulting copy which is positive as to density and correct as to color.

If a seprate sound track negative has also been

recorded as is usual in motion picture production, it is printed through the base of the film 10 using the projection printer 17 and filter 18 to produce a latent image 20 is emulsion A as before. However, in this instance the emulsions B and C need not be exposed to rays emanating from the lamphouse 21, but may be left unexposed. When the film is placed in the developing solution the image 20 develops up to give an image 24 which would be a positive of course if a negative track 16 were used for the printing. When the film is subjected to the action of the fixing bath in the usual course of procedure, the unexposed portions of emulsion A are fixed out and the entire sound track area of emulsions B and C is likewise fixed out leaving that space transparent. When the film is then subsequently colored, the sound track and picture image in emulsion A will be colored blue-green as before.

As previously mentioned, it is customary to have the red sensitive emulsion next to the base 11. However, if the order of the emulsions is changed so that the red sensitive emulsion is for instance on the outside layer, the procedure according to my invention would be the same except that the sound track would be recorded or printed directly to the face of the film, instead of through the base as heretofore described and in that case the printing could be done either optically or by contact. In this instance also I would use a printing light of the color to which the emulsion was sensitive so as to restrict the track to a single emulsion to insure a clear image with good definition.

The procedure in a process where the various part images forming the picture are given a color corresponding to the sensitivity range of their respective strata is of course similar to that hereinbefore outlined for examples of processes which give the individual part images colors complementary to their respective strata, and it is not thought necessary to describe this adaptation of my process in detail other than to state that the track should be restricted to a single stratum for the sake of definition and should be colored the same color as that of its corresponding picture image in the same stratum, this color preferably being blue-green for the usual photocell of today.

While it is usually desirable to have the sound track colored the same color and at the same time as the picture image in its respective stratum, my invention also finds utility where a black and white or uncolored sound track is to be produced. In this case the track is printed with substantially monochromatic light to restrict it to a single emulsion as before, and the sound track area of the film is treated to render its nonreceptive to the subsequent coloring operations, with the result that the film ultimately bears a colored picture produced by any desired process, and also bears a black and white sound track in but one of the several emulsion strata.

As previously mentioned, my invention is readily adaptable to numerous color films and processes, and it is to be understood that the examples herein given are merely illustrative of the fundamental concepts of my invention and that the same is not to be limited thereby but is to be afforded the full scope of the appended claims.

I claim as my invention:

1. The method of reproducing a photographic sound track on a film comprising a plurality of superposed differently sensitized emulsion strata which includes: printing said sound track to said film using a printing light to which but one of said strata is sensitive; completely exposing the sound track areas in the other of said strata to light to which they are sensitive; developing the images thereby obtained; bleaching said images; exposing said film to light; redeveloping said film; and coloring the resulting sound track image in said first stratum.

2. The method of reproducing a photographic sound track on a film comprising a plurality of superposed differently sensitized emulsion strata which includes: printing said sound track to said film using a printing light to which but one of said strata is sensitive; completely exposing the sound track areas in the other of said strata to light to which they are sensitive; developing the images thereby obtained; bleaching said images; exposing said film to light; redeveloping said film; and coloring the resulting sound track image in said first stratum a color complementary to the sensitivity range of its emulsion stratum.

3. The method of reproducing a photographic sound track on a film comprising a plurality of superposed differently sensitized emulsion strata which includes; printing said sound track to one side of said film using a printing light to which but one of said strata is sensitive; exposing the other side of said film to light to which said other strata are sensitive to completely expose the sound track areas in said other strata; developing the images thereby obtained; bleaching said images; exposing said film to light; redeveloping said film; and coloring the resulting sound track image in said first stratum.

4. The method of reproducing a photographic sound track on a film comprising a plurality of superposed differently sensitized emulsion strata which includes: printing said sound track to one side of said film using a printnig light to which but one of said strata is sensitive; exposing the other side of said film to light to which said other strata are sensitive to completely expose the sound track areas in said other strata; developing the images thereby obtained; bleaching said images; exposing said film to light; redeveloping said film; and coloring the resulting sound track image in said first stratum a color complementary to the sensitivity range of its emulsion stratum.

5. The method of reproducing a photographic sound track on a film comprising a plurality of superposed differently sensitized emulsion strata which includes: printing said sound track to said film through the base thereof using a printing light to which the inner stratum is sensitive, but to which the other strata are insensitive; exposing the face of said film to light to which the other of said strata are sensitive to completely expose the sound track areas in said other strata; developing said images obtained thereby; bleaching said images; exposing said film to light; redeveloping said film; and coloring the resultant image a color which is complementary to the sensitivity of its emulsion stratum.

6. The method of producing a colored picture and sound track on a single film comprising a plurality of superposed differently sensitized emulsion strata which includes: printing a sound track to but one of said strata using a light to which said stratum alone is sensitive; completely exposing the sound track area of said other strata to light to which they are sensitive; producing a color value picture image in the picture area of each of said strata; developing said picture and sound track images; bleaching said images; ex-

posing said film to light; redeveloping said film; and coloring the resulting images in each stratum a color complementary to the sensitive range of their respective strata.

7. The method of producing a colored picture and sound track on a single film comprising a base and a plurality of superposed differently sensitized emulsion strata thereon which includes: printing a sound track to the stratum adjacent said base using red light; completely exposing the sound track area of said other strata to blue and green light; producing a color value picture image in the picture area of each stratum, developing said picture and sound track images; bleaching said images; exposing said film to light; redeveloping said film; and coloring the inner stratum picture image and the sound track image blue-green.

CHARLES F. JONES.