

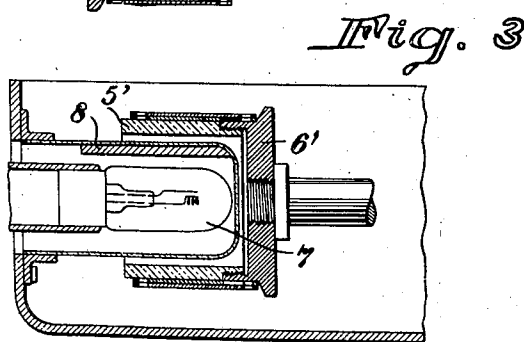
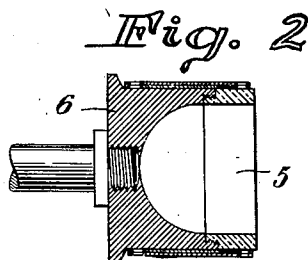
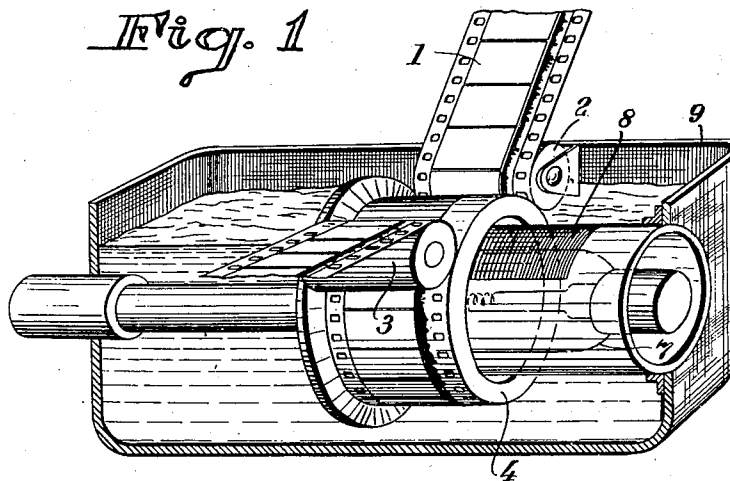
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PRODUCTION OF COLOR FILM HAVING A SILVER SOUND TRACK

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PRODUCTION OF COLOR FILM HAVING A
SILVER SOUND TRACK

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ments, to General Aniline & Film Corporation,
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Original application November 26, 1937, Serial
No. 176,668. Divided and this application Oc-
tober 19, 1940, Serial No. 361,864

3 Claims. (Cl. 95—2)

Our present invention relates to the produc-
tion of color film having a silver sound track.
This application is a divisional application of our
copending U. S. patent application Ser. No.
176,668, filed Nov. 26, 1937, now Patent No.
2,232,056 of February 18, 1941.

One of its objects is to provide an improved
process of producing a color sound film the color
images of which are produced by color forming
development. Another object is to provide an
improved apparatus for producing such color
sound films. Further objects of the invention
will appear from the detailed description follow-
ing hereafter. Reference is made to the accom-
panying drawing in which:

Figure 1 shows a perspective view of the ap-
paratus constructed in accordance with and em-
bodying a preferred form of our invention.

Figures 2 and 3 are detailed longitudinal sec-
tional views of the apparatus shown in Figure 1.

In making picture and sound films in which
a color photographic process is used for produc-
ing the pictures, the difficulty arises that unless
special precautions are taken the sound track is
also produced in color in the finished film. Since
the photoelectric cells of the sound reproducing
apparatus do not respond to colored light in the
same manner as it does to the contrasts of a
black-and-white sound track various difficulties
arise in the reproduction of the sound. In par-
ticular it is desirable to produce the sound track
in silver, since the photoelectric cell is consid-
erably more sensitive to the high contrasts in trans-
parency of a silver image than to those of a color
image. It is particularly essential to produce a
silver sound track in multi-layer color sound films
in which the color sensations are developed by
color forming development and the silver image
is subsequently completely removed.

According to our invention the desired silver
sound track is produced in a color picture and
sound film in which the color sensations are de-
veloped by color forming development by sub-
jecting to a fresh exposure, before the removal
of the residual silver bromide image resulting
from the color-forming development, either the
strip of film carrying the sound track or that
carrying the picture image, whilst that part of the
film which is not to be exposed is masked. For
example, the silver produced in the color form-
ing development (in the picture and sound
images) can be converted into silver chloride and
the sound track can be subjected to an exposure
of the correct magnitude, so that only the silver
bromide can then be developed; or the residual

silver bromide can be converted into silver iodide
before the silver is transformed. The developed
silver or the sparingly soluble silver iodide then
forms the sound track. When the color pictures
are produced by the reversal process the sound
track can, for example, be masked during the
second exposure of the picture area, the silver
removed and the residual sound track consisting
of silver bromide exposed and developed. Or the
silver produced in the development of the color
picture can be converted into silver chloride, the
sound strip of the film subjected to a calculated
exposure, the silver bromide developed to silver
and the silver chloride removed by fixing. An-
other procedure applicable in cases in which the
color picture is produced by the reversal process
is as follows:

After the second exposure of the picture rec-
ord, the film is developed, the residual silver
bromide in the sound track is converted into
silver iodide, the developed silver is converted
into silver chloride or silver bromide and removed
by fixing and the silver iodide sound track is
blackened by any known process.

By another feature of the invention the steps
in these processes are conducted in an after-ex-
posure apparatus in which the film passes around
a hollow drum within which is arranged a source
of light. The apparatus is preferably specially
adapted for the process of the invention by the
provision of a drum consisting of interchange-
able cylindrical rings which are respectively
transparent and opaque. The drum is arranged
inside a container for liquid, preferably con-
structed of a matt black material.

According to one procedure for producing color
pictures on a film having a number of superim-
posed layers adapted for color forming develop-
ment, there is first produced on said multi-layer
film a negative in which the colors are comple-
mentary to those of the original; this negative
is then copied on a three-layer positive film and
developed in color, the silver precipitate is
bleached and the film fixed. If now the sound
track is copied as usual onto the same film and
treated in the same manner as the picture, a
color track on a transparent background is ob-
tained. An effective sound track can be obtained
in accordance with the invention in the follow-
ing manner:

The picture and sound records are printed in
the usual manner, the print is developed in color,
the silver bleached without removal of the re-
maining silver bromide, the sound track is ex-
posed a second time, if necessary to a calculated

extent, and the print is developed in a usual developer and fixed. There are thus obtained a silver sound track and a complementary color sound track. The sound track is preferably printed with light of such color that the color image of the sound track obtained transmits light to which the photo-electric cell is sensitive. In this case the second exposure must be effected so that the silver sound track is produced in the same layer as that in which the color sound track was first produced. In this case therefore the sound track is subjected to a reversal development.

If the finished color sound film is to be produced by a reversal process and not by printing from a negative, the following method may be used:

The second exposure in the reversal process may be so conducted that the picture image of the film is exposed whilst the sound track is masked by a diaphragm. No silver is then formed in the sound track in the second development. The silver is then dissolved as in the normal reversal process, the sound track consisting of a residual silver bromide image. After dissolution of the silver, the silver bromide in the sound track is exposed and blackened by a further development. The process is completed by fixing the remaining silver bromide and the like in the usual manner.

This process can thus always be used if, in the production of color sound films a second exposure is used and the developed silver is dissolved. In contradistinction to processes in which a coating of a lacquer or the like is used this method of producing the sound track has the advantage that it includes no stage which can lead to contamination of the film or the baths.

In some processes, the silver developed in the picture layer is re-converted into a silver halide, for example, silver chloride. If now the layer were fixed the silver bromide would also be removed and the sound track thus destroyed. Before fixing, therefore, the sound track consisting partly of silver bromide and partly of silver chloride is exposed. The quantity of light is so adjusted that only the silver bromide is rendered capable of development. By development, the sound track is then obtained, whereupon the undeveloped silver chloride can be removed simply by fixing. It is advantageous to insert in the path of light during the exposure a filter which is opaque to ultra-violet light, which alone renders silver chloride capable of development. In order to avoid fogging the picture it is advantageous to mask the light for producing the final blackening so that it falls only on the sound track.

A corresponding process for producing a silver sound track is also possible in the negative-positive process. For example, after the color forming development and the chlorination of the silver the remaining silver bromide can be made capable of development by a renewed exposure without affecting the chloride. One half of the sound track then consists of a color image, and the other adjacent half of a silver image. Only a negligible quantity of light is absorbed by the dyestuff so that its presence does not interfere with the sound reproduction. If the dyestuff were strongly absorbent a silver sound track would be unnecessary, so that in that case the special treatment of the silver bromide would be unnecessary. Silver chloride is, however, generally already capable of being blackened by a

developer even when unexposed so that the process described is subject to a certain limitation.

In order to carry out the process in spite of this, the following method may be used:

After the color forming development the still undeveloped silver bromide in the sound track is exposed. The silver is then converted into silver bromide and subjected to another development. Only the silver bromide which was exposed before the bromination can be blackened by this development. After fixing, a silver sound track is obtained.

Another method is as follows:

If the second development has been conducted without causing development of the silver bromide of the sound track it is possible to convert this bromide into silver iodide. For this purpose use may be made of the known Renwick solution which contains potassium iodide, sodium sulfite and thiosulfate. It is known that silver iodide is considerably more difficult to fix than silver chloride or bromide. If the silver still present is then converted into silver chloride or bromide, this can be fixed with the aid of a usual fixing bath. The sound track is then obtained in the form of silver iodide and can be used as such for sound reproduction. It is, however, better to develop this silver iodide or to blacken it, for example, by sulfiding, so that a silver sulfide sound track is obtained. Since only silver iodide is to be blackened, a developer can be used which is relatively powerful, this being necessary because silver iodide is more difficult to develop than silver chloride.

In order to be able to conduct efficiently the various exposures, namely, the exposure of the sound track without the picture and the exposure of the picture without the sound track, there may be used the exposure apparatus illustrated in the accompanying drawing.

The film 1 to be illuminated is guided as shown in Figure 1 by guide rollers 2 and 3 around a drum 4, preferably hollow, which has, as it is to be seen in Figure 2, a transparent cylindrical ring 5 and an opaque portion 6. The transparent portion and the opaque portion are interchangeably connected in such a manner that the transparent portion 5 can be exchanged for an opaque portion 6' and the opaque portion 6 for a transparent portion 5' (Fig. 3). These portions may be joined, for example, by a screw thread, bayonet joint or the like. The transparent portion extends as far as it is desired that the film should be exposed. The exposure is effected by a lamp 7 in the interior of the drum 4, 5, 6. At the points at which the film comes into contact with and leaves the drum there are provided means for preventing undesired exposure, for example a diaphragm 8 (Figures 1 and 3). Since part of the light penetrates the film means must be provided for preventing this light from reaching a point at which it can again fall on the film. This is most easily attained by painting a matt black the container 9 in which the whole apparatus is enclosed under water and in which the exposure occurs. Or a strip of black material may be passed through the apparatus in contact with the film.

It is advantageous to use a source of light with a relatively small illuminating surface. In order that the film may be easily inserted, the film guide 4 is mounted so that it is laterally movable. The exposure is made as far as possible under water in order to obtain good optical contact. In this case the lamp must be protected

from the water, for example by means of a glass container. This glass container can be designed to screen off false illumination, for example by a metallic reflecting coating. By this means the best possible use is made of the light. If desired, for particular purposes the container may be made of colored glass or provided with a filter layer.

What we claim is:

1. In a process of producing a silver sound track in color sound film comprising silver halide in which the color images are produced by color development, wherein color formers are reacted with an aromatic color developer, the improvement which comprises exposing said film to produce latent picture and sound images, developing said images and at least said latent picture images by color development, removing the silver formed during development without fixation of silver halide, re-exposing residual silver halide of the sound area only, developing the latent sound images so produced in a black and white developer and fixing to remove any residual silver halide.

2. In a process of producing a silver sound track in color sound film comprising silver halide in which the color images are produced by color

development, wherein color formers are reacted with an aromatic color developer, the improvement which comprises exposing said film to produce latent picture and sound images, developing said images in a black and white developer, re-exposing only the picture area of said film, color developing the images so formed, removing the silver from the film without fixation of silver halide, re-exposing the residual silver halide of the sound area, developing the image so produced in a black and white developer and removing silver halide by fixation.

3. In a process of producing a silver sound track in color sound film comprising silver halide in which the color images are produced by color development, wherein color formers are reacted with an aromatic color developer, the improvement which comprises exposing said film to produce latent picture and sound images, color developing both said images, removing silver without fixation of silver halide, re-exposing only the residual silver halide of the sound area developing the image so produced in a black and white developer and fixing to remove silver halide.

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