April 26, 1949. G. L. DIMMICK 2,468,047

NEGATIVE-POSITIVE RECORDING METHOD AND SYSTEM

Filed Nov. 17, 1945

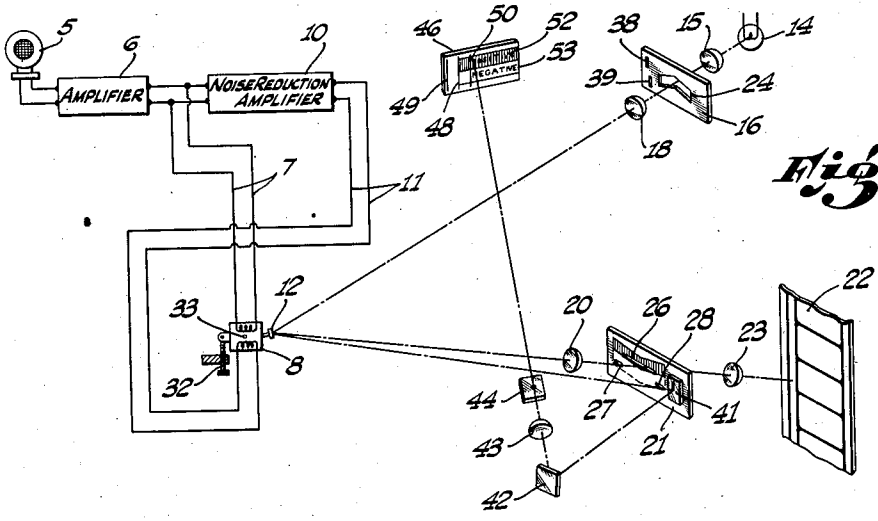

Fig. 1.

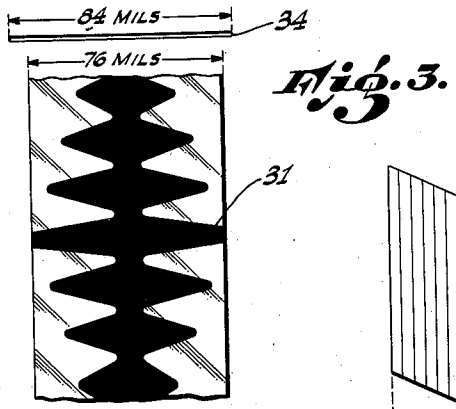

Fig. 3.

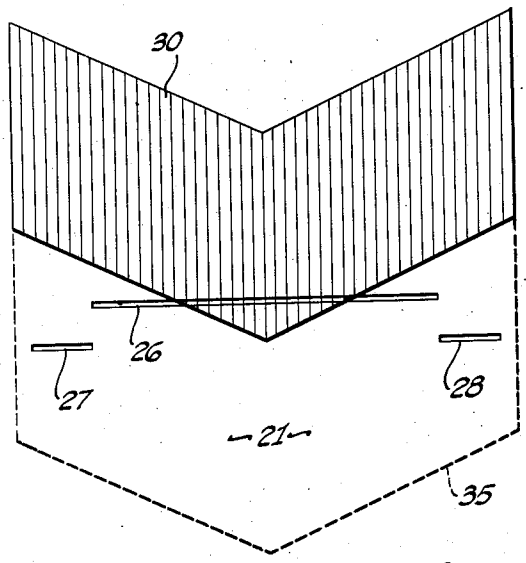

Fig. 2.

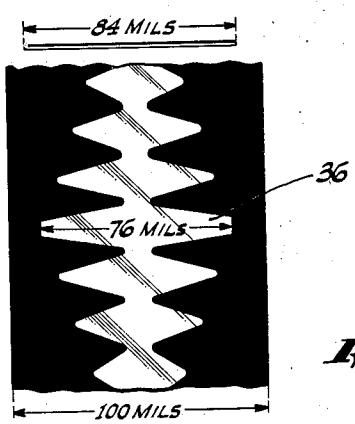

Fig. 4.

INVENTOR.
GLENN L. DIMMICK,
BY Orl R. Hoshaw
ATTORNEY.

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NEGATIVE-POSITIVE RECORDING METHOD AND SYSTEM

Glenn L. Dimmick, Indianapolis, Ind., assignor to Radio Corporation of America, a corporation of Delaware

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13 Claims. (Cl. 179—100.3)

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This invention relates to sound recording equipment, and particularly to a method of and means for recording either a negative or direct positive sound record with the same recorder.

In my U. S. Patent No. 2,311,159 of February 16, 1943, a method of and means for recording a direct positive type of sound record is disclosed and claimed. This patent describes a system wherein the light is so impressed on the film that after the normal development thereof, the track or record is in the form produced by printing from the usual negative. There are many advantages in the direct recording of such a record without going through the printing operation step, as pointed out in my patent. There are also advantages in the recording of a negative, and the present invention discloses a system whereby the recorder can be very rapidly adjusted so that it will record either a negative or a direct positive record, according to the setting of the modulating element.

In Blaney U. S. Patent No. 2,235,513 of March 18, 1941, a system has been disclosed and claimed for simultaneously recording a negative record and a direct positive record of the same sound waves, these records being on different longitudinal portions of the film. The present invention differs from the Blaney system by recording on the same longitudinal portion of the film, the change from the negative to the direct positive type of recording being accomplished by a simple adjustment of the modulating galvanometer, one type of such a galvanometer being shown in my U. S. Patent No. 1,936,333 of November 28, 1933. It is to be understood that it is known that a recorder may be adjusted to record different forms of records, my U. S. Patent No. 2,095,317 of October 12, 1937, disclosing and claiming a system which may be employed to change from a variable area type to a variable density type of recording.

Briefly, some of the advantages of direct positive recording are that the system produces a positive record upon the first development, anticipatory noise reduction may be easily obtained, and the record may be used as a printing master in the printing of color films, the latter method being disclosed and claimed in copending application, Ser. No. 636,967, filed December 22, 1945. One of the features of the invention is the form of the aperture and slit combination which automatically permits the necessary blackening of the sound track area outside of the modulation area. Another feature is that no change or adjustment is required in the noise reduction portion of the system when changing from one type of recording to the other.

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The principal object of the invention, therefore, is to facilitate the recording of film sound records.

Another object of the invention is to provide an improved recording method for the production of either negative or direct positive sound tracks.

A further object of the invention is to provide an improved system for recording either a negative or a direct positive sound track.

A still further object of the invention is to provide a sound recording system which may be changed from a negative recording to a direct positive recording system, or vice versa, with a minimum modification of the system.

Although the novel features which are believed to be characteristic of this invention will be pointed out with particularity in the appended claims, the manner of its organization and the mode of its operation will be better understood by referring to the following description read in conjunction with the accompanying drawings, forming a part hereof, in which:

Fig. 1 is a diagrammatic view of a recording system embodying the invention.

Fig. 2 is a view of the slit mask showing the light beam superimposed thereon.

Fig. 3 is a section of a negative sound track made in accordance with the invention, and

Fig. 4 is a section of a direct positive sound track made in accordance with the invention.

Referring now to the drawings, in which the same numerals refer to like elements, the output of a microphone 5 is fed into an amplifier 6, and then directly over conductors 7 to a galvanometer 8. The output of amplifier 6 is also fed to a noise reduction amplifier 10, and then over conductors 11 to the galvanometer 8, it being well understood that the galvanometer mirror 12 is vibrated both in accordance with the instantaneous values of the sound waves and the envelope of the sound waves. The remaining portion of the recording system includes a light source 14, a collecting lens 15, a mask plate 16, and a lens 18, together with a lens 20, a slit mask plate 21, a lens 23, and a film 22. In such a system, light from the lamp 14 is formed into a chevron-shaped light beam by the aperture 24 in the mask 16, then projected on the mirror 12 of the galvanometer 8 from which it is reflected to the slit mask 21, the light emerging through a slit 26 and slits 27 and 28 being impressed on the film 22, as will be described hereinafter.

Referring now to Fig. 2, an elevational view of the slits 26, 27, and 28 are shown with a light beam

superimposed thereon and illustrated by the lined portion 30. In this position of the light beam, fifty percent of the slit 26 is illuminated, although, because of the noise reduction bias, the no-signal, or zero position, of the light beam would be such that only the tip portion of the chevron-shaped light beam would pass the slit 26 and produce the so-called bias line. As the amplitude of the signal increases, the output of the noise reduction amplifier moves the average position of the beam downwardly as the beam vibrates, in accordance with the instantaneous values of the sound waves. The result of this type of recording produces a record such as shown in Fig. 3, wherein the light impressed central portion of the sound track area is opaque after development and the remaining portion of the sound track area of the film is transparent. When this film is printed, however, the reverse densities occur on the print, as is well-known in the art. To illustrate the length of slit 26 as projected on the film, a modulation 31 is shown overshot, the width between flat peaks being approximately 76 mils. To illustrate that the entire width of the modulations on the print are scanned during reproduction, a reproducer scanning slit 34 of 84 mils in length is shown in relation to the film track width. This type of film track is the well-known bilateral form.

Referring again to Fig. 1, the position of the galvanometer 8 is controlled by a manual screw 32, the galvanometer being adapted to pivot in any suitable manner, such as on and about a point 33. With the galvanometer adjusted by the screw 32 so that the light beam 30 is impressed on the slit plate 21 with respect to the slit 26, as shown by the lined portion in Fig. 2, a negative type of record, as shown in Fig. 3, will be produced. It will be noted that the perpendicular distance between the ends of slit 26 and the lower edge of the light beam 30 is the same as the distance between the slit 26 and the slits 27 and 28. Thus, no light will pass through the slits 27 and 28, even during overloads up to one hundred percent, such overloads usually being prevented by the limitations of the galvanometer and the amplifiers.

Now, if it is desired to record a direct positive type of record, such as shown in Fig. 4, and which will be the same as the print made from the negative shown in Fig. 3, it is only necessary to tilt the galvanometer 8 slightly by the screw 32, so that the light beam 30 assumes the position shown by the dotted lines 35 in Fig. 2. Again, it will be observed that in the position shown in the figure, the slit 26 passes light along fifty percent of its length, but at the ends rather than the central portion, while light is also passed through apertures 27 and 28. However, at the no-signal, or zero position, of the light beam, light is passed by the entire slit, except for a short, narrow portion at the center, to produce the bias line on the film, light being passed by slits 27 and 28 at all times, even during overloads. It is realized that this adjustment of the galvanometer can be made very rapidly, while the noise reduction adjustment, or bias, is always in the same amount and in the same direction, regardless of the type of record being recorded.

The result of the shifting of the galvanometer so that the light beam 30 takes the position shown by the dotted lines 35 is a record such as shown in Fig. 4, wherein the central modulated portions will be transparent and the remaining portions up to one hundred mils in width will be opaque upon the development thereof. To again illustrate the length of slit 26 as impressed on the film, modulation 36 is shown overshot. Also, the 84 mil reproducing slit is shown in Fig. 4 to illustrate that the entire modulated portion of the sound track will be scanned during reproduction. Thus, to produce either the record shown in Fig. 3 or the record shown in Fig. 4, it is only necessary to tilt the galvanometer 8 slightly by the screw 32, whereupon, with one normal development, the desired type of record is produced. Although the dimensions of 76, 84, and 100 mils have been given as desirable for 35 mm. film recording today, it is to be understood that other values will be more appropriate for other width sound records.

Referring again to Fig. 1, it will be noted that in the mask 16, two vertically elongated apertures 38 and 39 are shown. Light from either one of these apertures according to the position of the galvanometer 8 will be reflected by a mirror 41 on the slit mask 21 to a mirror 42, then upwardly through a projection lens 43 to a mirror 44, and then to a monitor card 46. Because of the reflections, the images of these apertures will be horizontal, as shown by the rectangles 52 and 53. On the card 46, is a line 48 to indicate fifty percent modulation of the light beam, and lines 49 and 50 to indicate one hundred percent modulation, the rectangular beams of light moving horizontally with the vibrations of mirror 12. When the galvanometer 8 is adjusted so that the light beam is in the position shown at 30 in Fig. 2, the rectangle 53 will be illuminated, and when the light beam is in the position shown by the dotted lines 35 in Fig. 2, the rectangle shown in the dotted lines 52 will be illuminated. In the rectangle 52, the word "positive" is printed, and in the rectangle 53, the word "negative" is printed. Thus, the operator not only will be able to adjust the bias of the system and observe the extent of modulation during recording, but will be able to observe whether the system is adjusted to record a direct positive record or a negative record. This monitoring system is disclosed and claimed in my copending U. S. application, Ser. No. 629,295, filed November 17, 1945. It may be pointed out that for making a direct positive record for use as a printing master for color films, the film is advanced through the recorder in the reverse direction to the direction it is advanced for recording a negative, as disclosed in the above-mentioned copending application, Ser. No. 636,967, filed December 22, 1945.

I claim:

1. A sound recording system adapted to record different types of sound tracks comprising a source of light, means for forming light from said source into a beam, a vibrator for said light beam, means for adjusting said vibrator, a film on which portions of said light beam are impressed, and a mask having a light slit therein for determining the portions of said beam impressed on said film, said first mentioned means including a mask having an aperture therein which shapes said beam into a configuration having a lower edge spaced from its upper edge a distance greater than the maximum recording movement of said beam perpendicular to said slit, and which, when only one edge thereof is vibrated over said slit by said vibrator, an anti-ground noise negative type of record is produced, and when only the other edge thereof is vibrated over said slit, an anti-ground noise direct positive record is produced, the set-

ting of said adjusting means controlling the type of record being produced at any time.

2. A sound recording system in accordance with claim 1, in which said aperture in said mask has a chevron configuration, one edge of said chevron producing one type of record, and the other edge of said chevron producing said other type of record.

3. A sound recording system in accordance with claim 1, in which said aperture is chevron-shaped to form a chevron-shaped light beam, said negative record being produced when said adjusting means is set so that the tip of said light beam is vibrated across said slit, and said direct positive record being produced when said adjusting means is set so that the ends of said light beam are vibrated across said slit.

4. A sound recording system in accordance with claim 1, in which said slit mask has at least three slits therein, two of said slits being a longitudinal continuation of said first mentioned slit but displaced at a predetermined distance from said first slit, said predetermined distance corresponding to the distance between the ends of said first slit and the lower edge of said beam when said beam covers substantially fifty percent of said first slit.

5. A sound recording system adapted to record either a negative anti-ground noise sound record or a direct positive anti-ground noise sound record along the same longitudinal portion of a film comprising a light source, an aperture mask adapted to form light from said source into a predetermined shaped beam, means for vibrating said beam, a slit mask having a slit therein for passing light to said film in accordance with the position of said vibrating means determined by the amplitude of the sound waves being recorded, said light beam having a shape such that the distance between the opposite edges thereof adapted to be intercepted by said slit is greater than the maximum vibration of said beam perpendicular to said slit during the recording of over-loads up to one hundred percent, and means for adjusting the normal, or no-signal, position of said beam on said slit mask to determine which edge of said beam is vibrated along said slit for the recording of either a negative sound record or a direct positive sound record at any instant.

6. A sound recording system in accordance with claim 5, in which said beam is chevron-shaped, said adjusting means being set so that the tip of said beam being vibrated over said slit produces a negative record, and said adjusting means being set so that the ends of said beam being vibrated over said slit produces a direct positive record.

7. A sound recording system in accordance with claim 5, in which said slit mask has a pair of additional slits forming a longitudinal continuation of said first mentioned slit but displaced away from said first slit in the direction of vibration of said light beam, said distance corresponding to the distance between the ends of said first mentioned slit and the lower edge of said beam when said beam covers substantially fifty percent of said first mentioned slit.

8. The method of recording a direct positive anti-ground noise record or a negative anti-ground noise record on the same longitudinal portion of a film with the same elements of a recording system comprising forming light into a predetermined shaped beam, vibrating said beam in accordance with sound waves to be recorded, projecting a certain portion of light from only one edge of said beam on said film to form a negative record, and projecting certain portions of light from only another edge of said beam on said film to form a direct positive record.

9. The method in accordance with claim 8, in which the center portion of one edge of said beam is used for said negative record and the end portions of said beam are used for said direct positive record.

10. The method of utilizing the same sound recording elements for recording either a negative record or a direct positive record comprising forming light into a chevron-shaped light beam, vibrating said light beam, projecting to a moving film the only varying section of the central portion of the tip edge of said chevron-shaped beam to record a negative record, and projecting to a moving film only the varying end portions of the other edge of said chevron-shaped beam to record a direct positive record.

11. A sound recording system comprising a light source, an aperture plate having a certain shaped aperture therein for forming light from said source into a beam of the same shape, a light slit on which said beam is impressed, said light beam having a shape such that the distance between the opposite recording edges thereof adapted to intercept said slit is greater than the maximum vibration of said beam perpendicular to said slit during the recording of over-loads up to one hundred percent, a film on which the emergent light from said slit is impressed a vibrator for vibrating said beam across said slit, and adjusting means for said vibrator, said adjusting means being set so that when said beam is vibrated across said slit from the center outwardly one type of record is obtained, and when said beam is vibrated across said slit from the ends inwardly a second type of record is obtained.

12. A sound recording system in accordance with claim 11, in which said aperture and beam are chevron-shaped.

13. A sound recording system in accordance with claim 11, in which said aperture and beam are chevron-shaped, the tip of said beam being vibrated from the center outwardly along said slit to form a negative record, and the ends of said beam being vibrated from the ends inwardly along said slit to form a direct positive record.

GLENN L. DIMMICK.

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