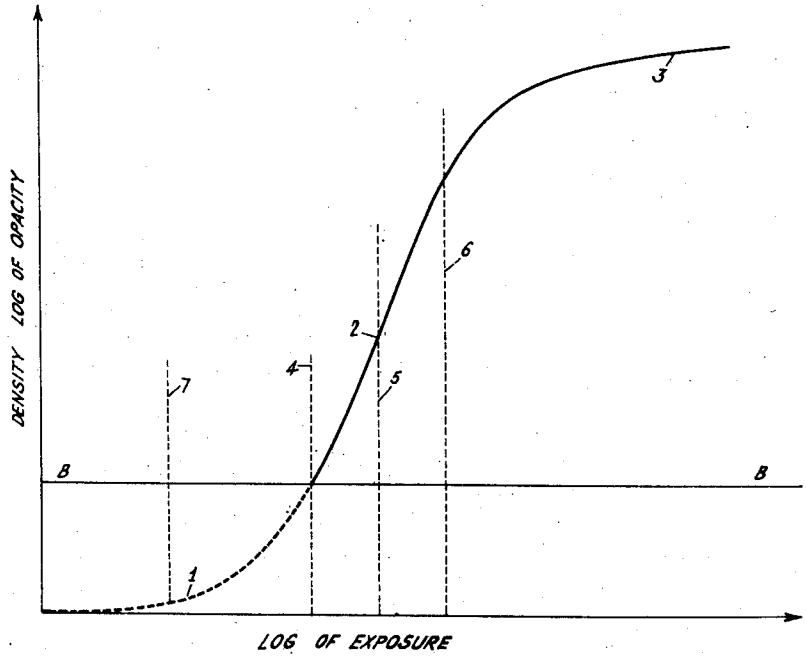
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SOUND RECORD AND METHOD OF PRODUCING THE SAME

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INVENTOR
W. L. DOUDEN
BY
ATTORNEY

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WILLIAM L. DOUDEN, OF BROOKLYN, NEW YORK, ASSIGNOR TO RADIO CORPORATION OF AMERICA, A CORPORATION OF DELAWARE

SOUND RECORD AND METHOD OF PRODUCING THE SAME

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This invention relates to sound records of the photographic type and more particularly to such sound records in the form of diapositives and the negatives from which said diapositives are made, and processes whereby such sound records may be produced.

An object of my invention is to produce a photographic sound record of the variable-density type wherein the variations in the density are strictly and/or linearly proportional to the variations of the sound to be recorded.

Another object of my invention is to produce a sound record of either variable density or the variable-area type wherein all of the frequencies capable of actuating the apparatus are recorded.

Another object of my invention is to produce a sound record which has a minimum of ground noise from photographic deficiencies.

Other objects and advantages of my invention will appear as the explanation and description thereof which will be given with the aid of the accompanying drawing, proceeds.

The single figure of drawing shows a conventional curve of log exposure plotted against log opacity.

Sound records of the types now in use on motion picture films may be divided into three classes: the type wherein a sound track of uniform width is used, and variable areas of said sound track are rendered opaque in accordance with the sounds to be recorded, the opaque portion being theoretically of uniform density, such as in sound records known as "Photophone"; sound records wherein a track of uniform width is used and wherein the density of the exposure of the entire width of the track is varied in accordance with the sounds to be recorded, such as in "Movietone," "Phonofilm," etc.; and a type not in commercial use wherein the sound is recorded in the form of a line whose position is varied laterally of the film.

In the first type of these sound records there is a tendency for the portions of the record representing the highest frequencies, i. e., 5000 cycles per second and over, to be under exposed, whereby the reproduction of such frequencies falls off in relative intensity, and beyond a certain limit of frequency depending upon the "speed" of the film, its rate of translation, and the intensity of the recording light no developable record is produced. Any over-development to bring out the higher frequencies tends to increase the ground-noise to a greater extent than it improves the opacity of the record. The same applies to the third type of sound record referred to.

In the variable-density type of sound record the densities vary with the exposure according to the curve shown in the drawing, i. e., the higher amplitudes fall into the under-exposure portion 1 of the curve while only the lower amplitudes have a density proportional to the exposure. This obviously produces a peculiar type of distortion in the sounds as reproduced, and any attempt to correct this subsequently, such as by over-development, over-exposure of the positive, etc., increases ground-noise and adds other types of less systematic distortion which are even more objectionable in that they are not readily compensated for by the use of filters, etc., in reproduction. In this form of record likewise it is impossible by present processes to record the highest amplitudes.

In carrying out my process I give the negative sound track a preliminary exposure to a uniform illumination of appropriate intensity prior to the impressing of the sound record thereon. This exposure is chosen according to the type of film, the type of record to be made, and the particular result desired as follows:

The simplest way and therefore that most generally to be preferred for the above types of records is to give the film a preliminary exposure to an amount indicated by the line 4 in the drawing. The preliminary exposure brings the entire film up to the point of minimum normal exposure, and any sound image impressed thereon will produce a record in intensity linearly proportional to the exposure as indicated by the portion 2 of the curve. It will be obvious that even the highest amplitudes will produce some increase in intensity beyond the intersection of the lines

B and 4, while the lowest amplitudes, if they do not exceed in exposure the line 6 will produce a proportional image.

The exposure-density curve given is a typical curve applicable to substantially all commercial photographic materials, such as will be found in practically any text book on photography.

The preliminary exposure may be accomplished by exposing the entire film for a brief period to a light of low intensity before the film is inserted in the recording apparatus, or the recording apparatus itself may be so constructed as to secure the auxiliary exposure therein either simiultaneously with or immediately preceding the exposure to the recording light. The exact quantity of exposure required to reach the desired point on the exposure-density curve given herewith is determined in the manner well known in the art from the "speed" of the film or other negative as given by the manufacturers thereof or as determined in the usual manner.

If, in making a record of the variable-density type, a source of illumination is used which is varied above and below a predetermined luminosity, then the initial exposure should be so chosen that the average luminosity of the said light source will produce an exposure falling substantially in the middle of the normal-exposure portion of the curve, indicated by line 5.

The maximum exposure, of course, should not exceed that indicated by the line 6, but this is readily taken care of by either decreasing the intensity of the light source directly or by insertion of filters or diaphragms if there is any tendency to exceed this exposure. Over-exposure ordinarily will not occur with any of the apparatus now available, as it is ordinarily necessary to sacrifice fineness of grain of the film in order to secure adequate exposure.

Results which are a substantial improvement over those now produced in that the higher amplitudes may be recorded even though the record is not otherwise strictly linear may be secured by an initial exposure of the quantity indicated by the line 7, but although this, to a degree, secures the desired results it is not a preferred procedure.

By printing on film made in the manner described above on to positive stock to normal intensity a sound record is secured wherein all available frequencies are recorded and wherein in the variable-density type of record the densities are strictly proportional to the original sounds, whereby the sounds may be reproduced with almost total lack of distortion from photographic causes.

It will readily become apparent that various modifications may be made to the method hereinabove described, and I believe myself to be entitled to make any and all modifications and changes such as fall fairly within the spirit and scope of the invention as defined by the hereinafter appended claims.

Having now described my invention, what I claim is:

1. The process of making photographic sound records comprising initially exposing a sound track area of light-sensitive material to a uniform illumination such that any further exposure of any portion thereof will produce a developable image and there after photographically recording sound thereon.

2. The process of making photographic sound records comprising initially exposing a sound track area of light-sensitive material to a uniform illumination such that any further exposure will produce an increase in density linearly proportional to said further exposure and thereafter photographically recording sound thereon.

3. The process of making photographic sound records comprising initially exposing a sound track area of light-sensitive material to a uniform illumination such that the entire sound record will fall within the linear portion of the exposure curve and thereafter photographically recording sound thereon.

4. The process of making photographic sound records comprising initially exposing a sound track area of light-sensitive material to a uniform illumination and thereafter photographically recording sound thereon.

5. A photographic sound record wherein the densities are strictly proportional to the exposure produced by the recorded sound.

6. A photographic sound record wherein the densities are linearly proportional to the exposure produced by the recorded sound.

7. A photographic sound record wherein the densities are strictly linearly proportional to the exposure produced by the recorded sound.

8. A photographic sound record wherein the densities are proportional to the exposure produced by the recorded sound.

9. A photographic sound record comprising an area of uniform exposure and superposed areas of increased exposure to sound waves.

10. A photographic sound record including areas of differing densities and wherein the least density is greater than that of an unexposed recording area.

11. A photographic sound record comprising a sound-track area wherein the minimum density is uniformly greater than zero.

12. The process of making photographic sound records comprising exposing a sound track area of light-sensitive material to a uniform illumination such that any further exposure of any portion thereof will produce a developable image and photographically recording sound thereon.

13. The process of making photographic sound records comprising exposing a sound track area of light-sensitive material to a

uniform illumination such that any further exposure will produce an increase in density linearly proportional to said further exposure and photographically recording sound thereon.

14. The process of making photographic sound records comprising exposing a sound track area of light-sensitive material to a uniform illumination such that the entire sound record will fall within the linear portion of the exposure curve and photographically recording sound thereon.

15. The process of making photographic sound records comprising exposing a sound track area of light-sensitive material to a uniform illumination and photographically recording sound thereon.

16. The method of making a photographic sound record adapted for reproduction by means of apparatus responsive only to the variations of the light transmission of the record, which comprises exposing the light-sensitive member to light varied in accordance with the sound and giving the member an auxiliary uniform exposure thereby reducing the inertia of the film without affecting the quality of the reproduced record.

17. A photographic sound record carrier having thereon a plurality of superposed impressions, one of said impressions resulting from a light exposure varied in accordance with sound waves and another of said impressions resulting from a uniform light exposure corresponding substantially to the lower end of the straight portion of characteristic curve of the sensitive material of said carrier.

18. A sound record film having thereon a plurality of photographic impressions, one of said impressions comprising a sound record adapted for reproduction by apparatus responsive to the variations only in the light transmission of the record and another of said impressions resulting from a predetermined uniform light exposure.

19. A photographic sound record including a sound-track area having a range of densities within the substantially linear portion of the characteristic curve of the photographic emulsion.

20. A photographic sound record including a sound-track area having a density range entirely above the lower portion of the characteristic curve of the photographic material wherein no material change of density results from change of exposure.

21. A photographic sound record including a sound-track area having a density range entirely above the initial substantially horizontal portion of the characteristic curve of the photographic material.

WILLIAM L. DOUDEN.