Sept. 21, 1937. A. C. BLANEY 2,093,539

METHOD OF FORMING RECORDS

Filed Nov. 30, 1934

Fig. 1.

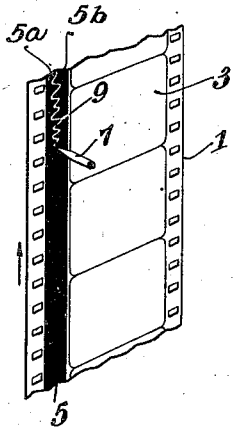


Fig. 2.

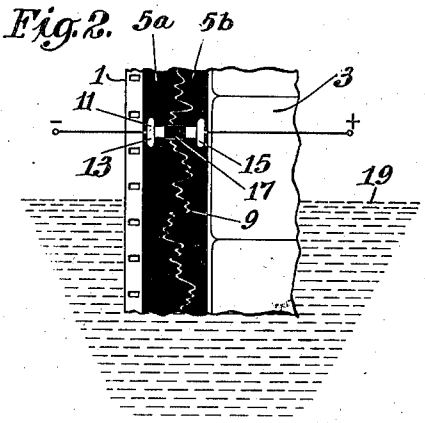


Fig. 3.

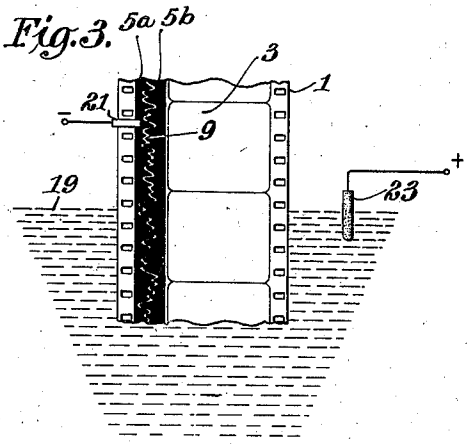
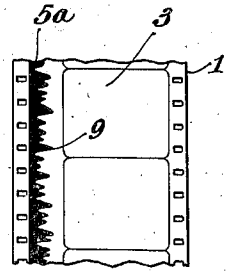


Fig. 4.



INVENTOR:
Arthur C. Blaney,
BY T. R. Goldsborough
ATTORNEY.

Patented Sept. 21, 1937

2,093,539

UNITED STATES PATENT OFFICE

2,093,539

METHOD OF FORMING RECORDS

Arthur C. Blaney, Collingswood, N. J., assignor, by mesne assignments, to Radio Corporation of America, New York, N. Y., a corporation of Delaware

Application November 30, 1934, Serial No. 755,438

19 Claims. (Cl. 274—46)

This invention relates to a method of forming records of impulses, and more particularly to a method of providing a sound record of the variable area type.

Heretofore, it has been common practice to form sound records upon photographic strips by exposing the strip or carrier either to a light source which is caused to fluctuate in luminosity in accordance with the sounds being recorded, or by causing a beam of light emitted by a constant light source to variably move across the strip in accordance with such sounds as the strip is advanced. The latter method results in what is known as the constant density, variable area track.

Since the process involved is a photographic one, both the recording itself and the developing of the exposed strip must be carried out in the dark, and the finished record can only be reproduced by the use of optical means. This, of course, limits the field of usefulness of records made by this process. Another disadvantage of the photographic process resides in the fact that it requires accurate control, both in recording and in developing, since the chemical reactions involved do not go to completion. Even where accurate control and every necessary precaution is exercised, it is very often difficult to get good detail, or sharpness of image, because of inherent limitations in the materials employed, such as the granular structure of the light sensitive emulsion, for example. Many other similar disadvantages can be found in the photographic process of forming records.

It is the primary object of my invention to provide a new and improved method of forming records of impulses, such as sound, which will be entirely free from the foregoing difficulties.

More specifically, it is an object of my invention to provide a method of forming sound records of the variable area type without the use of light and which will result in a record having much greater sharpness than one formed photographically.

Another object of my invention is to provide a novel method of forming sound records which, while not employing light for the purpose of recording, results in a record that may be reproduced optically, as well as electrically and mechanically, the optical reproduction being possible either by reflected or by transmitted light.

Still another object of my invention is to provide an improved method of forming variable area sound records which will result in records suitable for mechanical printing.

A further object of my invention is to provide an improved method of forming variable area sound records which can be easily controlled and which necessitates far less exercise of precaution than the photographic process.

Still a further object of my invention is to provide an improved method of forming variable area records of sound or other impulses which can be freely carried out in daylight without in any way endangering the success of the recording.

Another object of my invention is to provide an improved sound record.

It is a further object to provide an improved method of forming records of sound or other impulses which will be inexpensive, which may be carried out by one relatively inexperienced, and which will be highly efficient.

In accordance with my invention, I coat upon one side of a suitable non-conductive medium or carrier, such as celluloid, for example, a very thin layer of a conductive material, such as silver, for example, and record the sound or other impulses by drawing the carrier past a sharp tool in engagement with the coated layer and vibrating in accordance with the aforesaid impulses. The vibrating tool penetrates the coated layer sufficiently to extend at least down to the non-conductive base material, thus insulating one portion of the coating from the other by a wavy or "snake" track. The material is then subjected an electrochemical treatment whereby one portion of the track is dissolved off, leaving the other portion as a variable area record of the recorded impulses which may be directly reproduced electrically, mechanically or optically and, in the latter case, using either reflected or transmitted light. If desired, the record thus formed may be employed for printing photographic copies, or it may be added to with sufficient metal for mechanical printing.

The novel features that I consider characteristic of my invention are set forth with particularity in the appended claims. The invention itself, however, together with additional objects and advantages thereof, will be best understood from the following description of a specific embodiment, when taken in connection with the accompanying drawing in which

Figure 1 is a view illustrating the manner in which the vibrating tool divides the electrically-conductive coating layer into two portions by a wavy line.

Figure 2 illustrates one method of treating the coating layer electrochemically after the impulses have been inscribed, whereby to remove one of the portions of the layer.

Figure 3 is a view illustrating another method of treating the coating layer electrochemically after the impulses have been inscribed, and

Figure 4 shows a finished record subsequent to the electrochemical treatment.

Referring more in detail to the drawing, wherein similar reference numerals indicate corresponding parts throughout, there is shown, in Figure 1, a non-conductive base material 1, such as a celluloid film or strip used for motion picture photography and whereon a series of pictures of action 3 may be recorded, if desired. The strip or carrier 1 is coated with a very thin layer of an opaque, electrically-conductive metal 5, preferably silver, which may be applied according to any of the well known methods of glass silvering to form mirrors. Thereafter, the strip 1 is moved past a sharp cutting tool 7 connected to suitable means (not shown) for vibrating it in accordance with the sound or other impulses to be recorded, the tool 7 engaging the silver coating 5 and penetrating it at least the thickness thereof. In this manner, the tool 7 cuts through the silver coating along a wavy line or track 9 dividing the coating 5 into two variable area portions 5a and 5b each electrically insulated from the other through the strip 1 which is then submitted to an electrochemical treatment to remove one of the portions, for example 5b, but leaving the other portion 5a on the strip as a variable area record of the sound.

The portion 5b may be removed from the strip 1 in several ways, one of which is illustrated in Figure 2. According to this method, the strip 1 is passed along a roller or spool 11 having two electrically-conductive end portions 13 and 15 electrically insulated from each other by a non-conductive section 17 and respectively engaging and making electrical contact with the portions 5a and 5b. Beyond the roller 11, the strip 1 passes into an electrolyte 19, such as a water solution of nitric acid, for example. A D. C. potential is applied to the sections 13 and 15 of the roller and thereby, of course, also to the portions 5a and 5b of the silver coating. This results, fundamentally, in two plates of silver in a solution of nitric acid, one plate having a negative charge thereon and the other a positive charge thereon. The plate or portion 5b, as illustrated, takes on a positive charge and goes into solution, while the plate or portion 5a takes on a negative charge and, in so doing, is prevented from going into solution. After the reaction is completed, the strip is thoroughly washed and dried and the portion 5a remains thereon as a variable area record of the sound, as clearly shown in Figure 4.

While the method of removing one of the silver portions just described may be satisfactorily carried out, it has the disadvantage that, if the cutting tool 7 has failed to thoroughly insulate the two portions 5a and 5b from each other, both portions will be dissolved by the nitric acid. To eliminate this possibility, I prefer to employ the method illustrated in Figure 3 wherein a negative potential is applied to the portion 5a, as through a roller 21, and to apply a positive potential to the electrolyte 19 through an inert electrode 23, such as carbon. The portion 5a is now protected by the negative potential and the portion 5b will be dissolved by the acid as any free piece of silver would be when immersed in nitric acid. However, if the portions 5a and 5b are not entirely insulated from each other, none of the silver will be dissolved and the portions 5a and 5b will both be preserved. The defect can thereupon be corrected and the reaction subsequently carried out satisfactorily without danger of losing the portion 5a which it is desired to preserve.

Still another method of removing the portion 5b is to apply the positive potential thereto and the negative potential to the electrode 23. This will hasten the action of the nitric acid on the portion 5b to completion before the acid has had time to dissolve an appreciable quantity of the portion 5a. In any case, whatever the method employed may be, it must be understood that the proper voltage and the proper acid concentration must be used to obtain the desired results.

From the foregoing description of my invention, the numerous advantages thereof over the photographic method of forming sound records will be apparent. First of all, a much sharper image is obtainable, the sharpness being limited only by the cutting tool. Since light does not enter as a factor into my improved method, it may be carried out in daylight, just as wax cutting. Moreover, because all reactions involved go to completion, accurate control is not required.

The finished record shown in Figure 4 may either be directly reproduced or may be employed to produce photographic copies for reproduction. When directly reproduced, the transparent area of the base material 1 left bare or exposed upon the removal of the portion 5b is capable of transmitting light in accordance with the variable area thereof. If desired, the record of Figure 4 may be used to reproduce sound by means of reflected light, in which case the portion 5a serves as the light reflecting area. It is also possible to reproduce sound from the portion 5a electrically in well known manner, or mechanically by causing a reproducing element similar to the cutting tool 7 to engage and be actuated by the wavy edge 9 of the portion 5a. Moreover, it is also possible to electroplate more metal onto the record of Figure 4 to a thickness such that the metallic strip thus formed will have sufficient strength to carry its own weight, after which it can be stripped off from the base and used for ink printing in a manner well known in the art.

Where it is desired to form photographic prints of the sound track, the record of Figure 4 may, obviously, be used for this purpose in a manner similar to the usual photographic negative, and the resulting prints will have better detail than those formed from photographic negatives. The silver portion 5a could, in such case, and also where it is used to reproduce the sound by means of reflected light, be chemically or electrochemically treated to transform it to some black compound of silver, such as silver sulphide, if the reflected light should cause any difficulties.

Although I have shown and described several modifications of my invention, I am fully aware that many other modifications thereof and changes therein are possible. I desire, therefore, that my invention shall not be limited except insofar as is necessitated by the prior art and by the spirit of the appended claims.

I claim as my invention:

1. The method of forming a record of impulses which comprises applying an electrically conductive coating to a base material, dividing said coating into two portions in accordance with said impulses, and subsequently removing one of said portions electrochemically from said material but leaving the other of said portions on said material as a record of said impulses.

2. The method of forming a variable area record of impulses which comprises applying an electrically conductive coating to a base material, dividing said coating into two portions along a

wavy line in accordance with said impulses, and subsequently removing one of said portions electrochemically from said material but leaving the other of said portions on said material as a variable area record of said impulses.

3. The method of forming a variable area record of impulses which comprises applying to a transparent base material a coating of opaque electrically conductive material, dividing said coating into two variable area portions along a wavy line in accordance with said impulses, and subsequently removing one of said portions electrochemically, thereby rendering the portion of the base material thereunder free to transmit light according to the variable area thereof.

4. The method of forming a variable area record of impulses which comprises applying to a non-conductive base material a coating of electrically conductive material, dividing said coating along a wavy line throughout the depth thereof into two variable area portions in accordance with said impulses whereby to electrically insulate said portions from each other, and subsequently removing one of said portions electrochemically but leaving the other of said portions on said base material as a variable area record of said impulses.

5. The method of forming a variable area sound record which comprises applying to a base material a coating of electrically conductive material susceptible of being cut by a cutting tool, advancing said coated material past a cutting tool with the coated surface thereof in engagement with the tool, vibrating said cutting tool in accordance with the sounds being recorded, whereby to divide said coating into two portions, and subsequently removing one of said portions electrochemically but leaving the other of said portions on said base material as a variable area record of the sound.

6. The method of forming a variable area record of sound which comprises applying to a transparent base material a coating of an opaque, electrically conductive material susceptible of being cut by a cutting tool, advancing said coated material past a cutting tool with the opaque coating surface in engagement with the tool, vibrating said cutting tool in accordance with the sounds being recorded, whereby to divide said coating into two portions, and subsequently removing one of said portions electrochemically but leaving the other of said portions on said base material whereby the exposed transparent portion of the base material left bare by the removed coating portion is capable of transmitting light in accordance with the variable area thereof.

7. The method of forming a variable area record of sound which comprises applying to a strip of non-conductive material a thin coating of electrically conductive material susceptible of being cut by a cutting tool, advancing said coated strip past a cutting tool with the electrically-conductive coating in engagement therewith and said cutting tool penetrating at least the thickness of said coating, vibrating said cutting tool in accordance with the sounds being recorded while said strip is advanced whereby to divide said coating into two variable area portions each electrically insulated from the other through said strip, and subsequently removing one of said portions from said base material electrochemically but leaving said other portion on said base material as a variable area record of the sound.

8. The invention set forth in claim 7 characterized in that said one portion of the coating is removed by passing the strip through an electrolyte adapted to dissolve the coating material and characterized further in that a potential is applied to the other portion of said strip to prevent said other portion from being dissolved.

9. The invention set forth in claim 7 characterized in that the base material comprises a transparent non-conductive material whereby the removal of one of the portions of the coating material leaves the exposed portion of the base material bare to render it capable of transmitting light in accordance with the variable area thereof.

10. The invention set forth in claim 7 characterized in that the strip comprises transparent celluloid, characterized further in that the electrically-conductive coating thereon comprises silver, and characterized further in that one portion of the divided silver coating is removed by passing the strip through a solution of nitric acid while applying a negative potential to the other portion of the coating.

11. The method of forming a record of impulses which comprises coating a transparent base material with silver, advancing the coated material past a cutting tool in engagement with the silver coating, vibrating said tool in accordance with said impulses whereby to form said coating into two portions separated by a wavy line, and subsequently removing one of said portions electrochemically from said base material along said line.

12. The invention set forth in claim 11 characterized in that the retained portion of the silver coating is transformed into a black compound of silver after removal of said one portion.

13. The invention set forth in claim 11 characterized in that the retained portion of the silver coating is transformed into silver sulphide after removal of said one portion.

14. A sound record comprising a base material and a continuous variable area coating of silver thereon representative of recorded sound.

15. A sound record comprising a transparent base material and a continuous variable area coating of another material thereon representative of recorded sound, said other material including silver as an ingredient.

16. A sound record comprising a transparent celluloid base and a variable area, continuous coating of silver thereon representative of recorded sound.

17. A sound record comprising a transparent celluloid base and a continuous, variable area coating of a black compound of silver thereon representative of recorded sound.

18. A sound record comprising a transparent celluloid base and a continuous, variable area coating of silver sulphide thereon representative of recorded sound.

19. The method of forming a record of impulses which comprises applying an electrically conductive coating to a base material, dividing said coating into two portions in accordance with said impulses, and subsequently removing one of said portions with the aid of an electric current from said material but leaving the other of said portions on said material as a record of said impulses.

ARTHUR C. BLANEY.