

July 2, 1940.

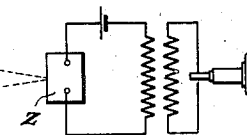
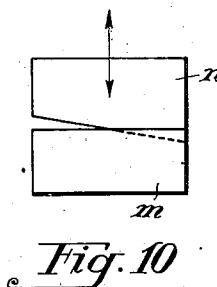
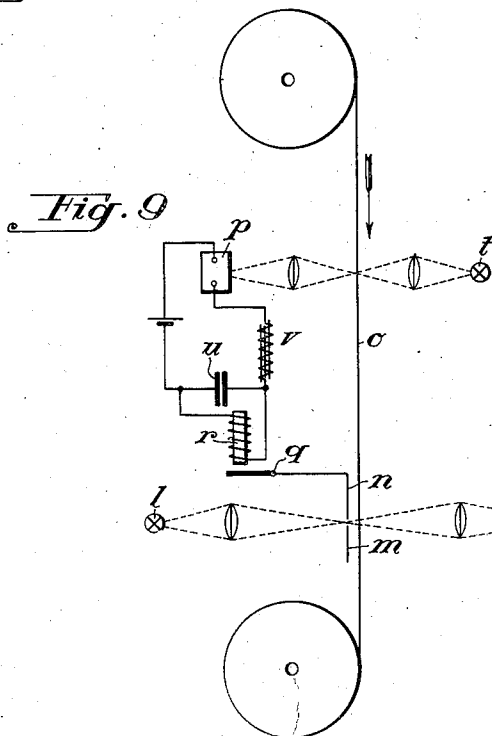
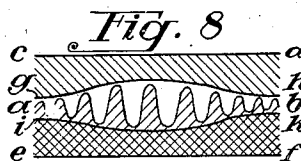
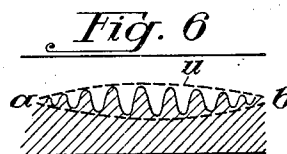
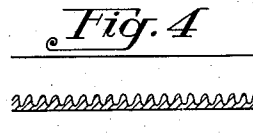
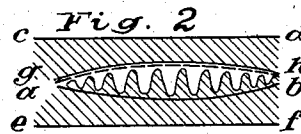
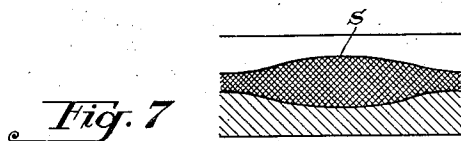
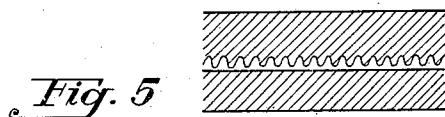
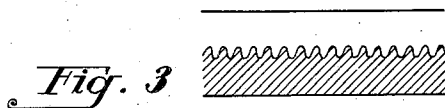
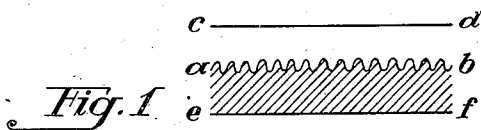
E. GERLACH

2,206,547

METHOD OF MAKING SOUND FILMS

Filed Oct. 19, 1927

2 Sheets-Sheet 1



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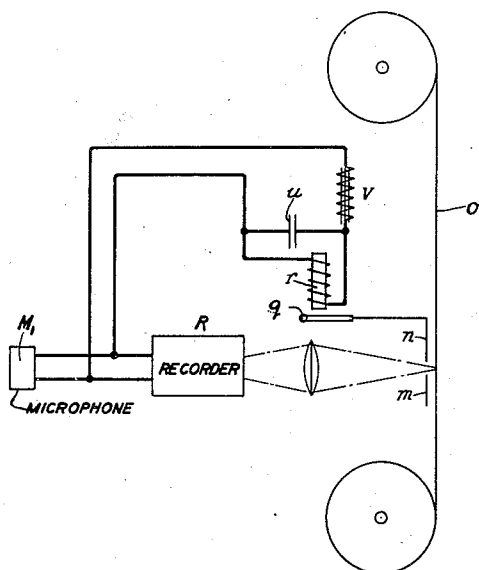
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FIG. 11



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METHOD OF MAKING SOUND FILMS

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This invention relates to a method of making sound films by which undesired noises produced during the reproduction of the sound are reduced or eliminated.

5 In the optical reproduction of sound records, undesired noises are produced, which become noticeable when the amplitude of the reproduced sound is small. A considerable portion of this undesired noise is due to defects in the sound record being reproduced, such as scratches, dots or irregularities in the photographic layer. Defects which are located on a blackened surface of the reproduced record, or covered by a shutter, will not produce any undesired noise. Thus, 10 if the reproduced record is at all times as dark as possible, the undesired noise will be a minimum. For example, if the amplitude of the recorded sound is small or equals zero, as in silent scenes, the corresponding portions of the reproduced record should be substantially completely blackened. 20

The object of the present invention is to reduce the light energy impressed on the scanning device to the minimum value which will carry the modulation required for the sound being reproduced. 25

In accordance with the present invention, the undesired noises are reduced or eliminated by blocking or shuttering off the light passing through the blank portions of the reproduced sound record, particularly at the points where the sound record is of relatively small amplitude. This result may be achieved by several methods. For instance, the reproduced sound 35 record may be blackened in the partially exposed or unexposed portions until the light transmitted through the film is reduced to the extent indicated above. If the reproduced record is one made by the so-called "variable area" method 40 in which the record track is completely blackened within an area bounded by the lines through the general apices of the sound curve, the additional blackening may be obtained by covering the unexposed portion of the reproduced film with an opaque substance almost up to the line through the general apices of the sound curve, that is, mainly at the points of relatively small amplitudes. 45

Another method consists in removing from the 50 original or negative sound record the blackening due to the exposure during recording almost up to the lines through the general apices of the sound curve. The exposure may be removed in many well-known manners, such as by the 55 use of photographic reducers containing potas-

sium. The original or negative record will then be clear except in the area near the lines through the general apices of the sound curve. A reproduction or positive sound record may then be produced by printing from the modified original. 5 This reproduction sound record will be fully exposed except in the area bounded by the lines through the general apices of the sound curve.

In another method, a mask or former is made from a negative or positive copy of the original sound record. The mask or former is blackened throughout the area defined by the lines through the apices of the sound curve, and has a clear area corresponding to the clear area of a regular negative or positive copy of the original sound 10 record. The mask or former may, for instance, be hand-made by coating a negative or positive copy of the original sound record with an opaque substance within the area bounded by the lines through the apices of the sound curve and removing the exposure on the remainder of the record. A reproduction or positive copy is then 15 printed in the usual manner from the original or negative sound record. Before development, the mask or former is superposed on the exposed reproduction or positive copy and a second exposure made. This second exposure will only 20 affect the unexposed areas of the reproduction or positive film lying outside the area defined by the mask or former. The reproduction or 30 positive copy is then developed.

In ordinary sound films, the mean permeability to light is practically the same at all portions of the film, though the instantaneous permeability naturally varies above and below this mean permeability, and, as a result, an undesired noise is produced in the reproduction of the sound record, which becomes very perceptible at those portions which correspond to recorded sounds of relatively small intensity. It will be apparent 35 that, in a film made in accordance with this invention, the mean permeability to light is smaller at portions of the record corresponding to sounds of relatively small intensity than at portions corresponding to sounds of relatively great intensity, although successive portions of the record vary in their instantaneous permeability to light in accordance with the amplitude of the sound recorded. 40 45

As the mean permeability to light of the reproduction or positive sound record is less than 50 usual, particularly at the portions of the record corresponding to sounds of relatively small intensity, the mean permeability to light of the original or negative sound record must be greater 55

than usual, that is, the exposure of the original or negative sound record must be reduced. In a further method in accordance with this invention, the original or negative film is shuttered during recording to reduce the light impressed on the film to the minimum which will carry the modulation due to the sound. In records made by the so-called "variable area" method, the shuttering may be effected to such an extent that it reaches completely or almost up to the lines through the general apices of the sound curve. This shuttering should not be carried out too quickly, in order to prevent the production of spurious sounds or noises from subsequently being produced by the loudspeaker.

In cases where it is desired to avoid any change in an existing reproduction or positive sound record, the quantity of light transmitted through the reproduction or positive record may be controlled during reproduction by an auxiliary shutter interposed in the reproducing light ray. This auxiliary shutter may be operated manually or controlled automatically in accordance with the amplitude of the sound record curve. The control by this auxiliary shutter of the quantity of light transmitted through the film will supplement the control exercised by the regular reproducing system comprising the light source, the light sensitive cell, and the reproducing system.

In the drawings:

Fig. 1 shows in plan view a portion of an ordinary negative sound film;

Fig. 2 is a similar view of a portion of a positive sound film embodying the invention;

Figs. 3, 4 and 5 are views showing how a negative sound film, Fig. 3, is modified according to the invention into the form shown in Fig. 4 from which the improved positive film Fig. 5 is then obtained;

Figs. 6, 7 and 8 are views showing how a negative or positive sound film, Fig. 6, is modified according to the invention to produce the mask or former shown in Fig. 7 by which the improved positive film 8 may be obtained;

Fig. 9 is a diagrammatic view of an apparatus for reproducing sound in accordance with the invention;

Fig. 10 is a detail of a shutter used in the apparatus shown in Figs. 9 and 11; and

Fig. 11 is a diagrammatic view of an apparatus for recording sound in accordance with the invention.

Fig. 1 shows a portion of the length of a film sound record produced by the so-called "variable area" method of sound recording. The curve $a-b$, varying in accordance with the recorded sound, forms a line of demarkation between the transparent portion a, c, d, b , and the blackened portion a, e, f, b of the film c, e, f, d .

In Fig. 2 is shown a film of the same character as the film shown in Fig. 1, but with the novel additional blackening in the formerly transparent portion a, c, d, b whose boundary line g, h , reaches almost up to the dotted line through the apices of the sound curve. Thus, only the narrow slip a, b, g, h and the spaces between the recorded waves are transparent. Thus any defects which are present in the area c, g, h, d are blackened out and the noise produced during reproduction will be scarcely noticeable. It will be noted that the mean permeability to light of the film shown in Fig. 2 is much less when the recorded sound is of relatively small amplitude

than when the sound is of relatively large amplitude.

Fig. 3 (which is substantially a duplicate of Fig. 1) shows a portion of the length of a negative film sound record of the character customarily produced by the so-called "variable area" method of recording and having the usual blackened or opaque lower portion. A suitable photographic reducer, such as a potassium reducer, is applied to the blackened area of the record and reduces the silver deposit thus making the record transparent. The result of this reduction is shown in Fig. 4, in which the blackening has been removed from all portions of the record except the area bounded by the lines through the apices of the sound curve. The modified negative shown in Fig. 4 is then copied photographically to produce the positive or reproduction record shown in Fig. 5, in which the entire width of the record is blackened except the area bounded by the lines through the apices of the sound curve.

Fig. 6 shows a portion of the length of a positive film sound record of the character produced by the so-called "variable area" method of recording, having the curve a, b varying in accordance with the recorded sound and forming a line of demarkation between the transparent and the exposed portions of the record. The sound record is contained within the area bounded by the lines through the general apices of the sound curve, as indicated by the dotted line u . A positive copy of the record, shown in Fig. 6, is treated to render the area between the lines through the general apices of the sound curve (the area between the dotted lines u in Fig. 6) completely opaque, which may be done, for instance, by completely exposing this area to light or by coating this area with an opaque substance. The modified copy is shown in Fig. 7 in which the completely opaque area is indicated at S . The exposure in the lower portion of the record indicated by the single lines of hatching may be removed if desired by any known photographic reducer. After the exposure is reduced, a mask or former is produced in which the area between the lines through the general apices of the sound curve is opaque, and the remainder of the area is transparent. A positive copy is made of the negative record, as shown in Fig. 6, by the usual photographic processes. Before this copy is developed, the former or mask shown in Fig. 7 is superposed on the exposed positive copy and a second exposure to light is made. The positive copy is then developed. As shown in Fig. 8 by the hatching lines sloping similarly to the lines in Fig. 6, the first exposure produced a latent image in the area a, e, f, b . The second exposure will not affect the area between the smooth lines i, k, h, g which is covered by the opaque portion S of the mask or former shown in Fig. 7, but will affect and cause a blackening of the area c, d, h, g . Also, if the blackening in the lower portion of Fig. 7 has been removed by a reducer, then the second exposure will re-expose the area i, e, f, k . This second exposure is represented in Fig. 8 by the hatching lines sloping in the opposite sense to the hatching lines in Fig. 6.

The developed film as shown in Fig. 8 is completely blackened except in the area g, h, b, a , bounded by the lines through the apices of the sound curve.

Fig. 9 is a diagrammatic view of a sound reproducing system in which the non-exposed portions of the sound record are covered during the process of reproduction, so that a modification of the reproduced film is not required. Light

from the source *l* is focussed by a lens system on the sound film *o* which is traversed through the light in the usual manner. The light modulated by its passage through the sound film *o* is focused by a second lens system on the light sensitive cell *Z*. The output of the light sensitive cell *Z* may be supplied in the known manner to a sound reproducer or loudspeaker. Interposed in the beam of light from the source *l* is a shutter *m, n* composed of a fixed part *m* and a movable part *n* fastened to an armature pivoted at *q*. The armature is controlled by the current flowing in an electromagnet *r*. Light from a suitable source *t* is focussed by a lens system on the moving film *o*, and after modulation by the film *o* is focussed on a light sensitive cell *p*. The output of the light sensitive cell *p*, suitably amplified if desired, is supplied to the electromagnet *r* and controls the movement of the shutter *n*. The shutter *n* is designed so as to limit the light energy impressed by the source *l* on the film *o* to an amount which will be substantially completely modulated by the film *o*, that is, the transparent portion of the film *o* will be shuttered up completely or almost up to the line through the apices of the sound curve. The amount of the record which is shuttered off will depend on the output current of the light sensitive device *p*, and, as the device *p* is excited by light modulated by the film *o*, will depend on the amplitude of the waves recorded on the film *o*. In order to insure that the shutter *n* will move only in conformity with the characteristic of the line through the general apices of the sound curve and not with the variations of the individual frequencies, one or more choke coils *v* may be inserted in the circuit between *p* and *r*, and in some cases associated with parallel or shunt condensers *u* so as to prevent oscillations of the frequency of the sound from operating the electromagnet *r*.

The choke coils *v* may be omitted if the light ray from the auxiliary light source *t* is made sufficiently wide, lengthwise of the film *o*, as to be larger than or a multiple of the distance lengthwise of the film *o* occupied by one complete cycle of the lowest frequency which can be recorded. Thus, in this case, it is not the amplitude of an individual frequency which acts on the shutter, but rather the mean or average amplitude of the sound record in the area covered by the light ray.

The distance along the film between the point scanned by the main optical system *l-n* and the point scanned by the auxiliary optical system *t-p* is so chosen that the time required for the film to move along this path is of the order of the time of reaction of the auxiliary system from the instant that the light ray is modulated until the shutter part *n* is put in motion. This time of reaction is substantially dependent on the inertia of the cell *p*, the dimensions of the chokes *v* and the dimensions of the magnet winding *r*.

Fig. 10 shows a shutter *m, n* of well known type which permits of shuttering the film in a direction transverse of the film. The two active edges of the shutter parts may be arranged to form an acute angle with each other, so that the degree of the shuttering effect transverse of the film will be a multiple or sub-multiple of the movement in the direction of the arrow of the shutter part *n*.

The auxiliary device incorporated in Fig. 9, can, in the somewhat modified condition shown in Fig. 11, also be incorporated in a film sound recording system. In this case, it is necessary to substitute for the photoelectric cell *p*, an auxiliary

a microphone or a circuit from a microphone such as *M₁*, connected to the auxiliary circuit comprising the choke coil *v*, shunt condenser *u* and the magnet *r* controlling the shutter *m, n*. The shutter *m, n* is arranged to cover substantially all of the portion of the film *o* which will be exposed by the well known "variable area" recording apparatus *R* controlled by the microphone *M₁*, substantially up to the line through the apices of the sound waves, thus producing a negative or original record of the type shown in Fig. 4. The double copying, as well as the use of formers, may then be dispensed with and positive or reproduction copies may be made by the usual photographic processes.

What is claimed is:

1. The method of making sound films which includes, first, the step of making a negative photographic record of sound on a sensitized film strip by varying widths of exposure of the film in accordance with sound, second, the step of making a positive film copy of said negative record, and third, the step of exposing the portions of the positive film not used for the sound record which consists in exposing the unused portion up to a line adjacent to, and parallel with, a line drawn through the general apices of the unexposed portions representing sound.

2. The method of making a photographic sound film for optical reproduction which consists in recording sound on a sensitized film strip in accordance with sound and shuttering the exposed portions up to a line adjacent to and parallel with a line drawn through the general apices of the unexposed portions representing sound, developing such film to obtain a negative, and afterwards copying this negative film on a positive film.

3. A sound film for optical reproduction in which the width of the exposed portion varies in accordance with sound, the transparent portions of the film being opaque up to a line adjacent to and parallel with a line drawn through the general apices of the exposed portions representing sound.

4. A sound film for electro-optical reproduction, successive portions of which film vary in their permeability to light in accordance with the intensity of the sounds, the means permeability to light being smaller at portions corresponding to sounds of relatively small intensity than at portions corresponding to sounds of relatively great intensity.

5. The method of producing a modified photographic sound record from an original photographic sound record, that includes producing a photographic opaque modification band of varying width by reference to the amplitude characteristics of the original record, and combining on a film in proper register with each other said varying width modification band and a print of said original record.

6. The method of producing a modified photographic sound record from an original photographic sound record, that includes producing a photographic opaque modification band of varying width by reference to the amplitude characteristics of the original record, and combining on a film in proper register with each other a print of said varying width modification band and a print of said original record.

7. The method of producing photographic sound records, that includes producing a normal original photographic sound record, producing a photographic varying width band of opacity whose width is correlated in required manner

with amplification characteristics found in the original record, and combining on a film in proper register with each other said varying width band and an original record.

8. The method of producing a shading record upon a photographic film having a sound record thereon, said shading record being incapable of reproducing sound, which consists in subjecting a separate portion of the film to a source of light and varying the degree to which said portion of the film is subjected to said light by exposing more or less of the film in accordance with the variations in amplitude of the sounds.

9. The method of photographically producing a shading record, said record being distinct from the sound record itself and incapable of reproducing sound, which consists in subjecting a film to a source of light and varying the extent to which said film is subjected to said light by exposing more or less of the film to said light accordingly as the sounds are increased or diminished in amplitude.

10. The method of photographically producing a shading record, as distinguished from a sound record, upon a film which consists in causing a portion of the film to traverse the rays emanating from a source of light, and in increasing or decreasing the exposed width of said portion of the film to produce exposures varying as the sounds are increased or diminished in amplitude or power.

11. The method of producing a shading record, said record being distinct from the sound record and incapable of reproducing sound, which consists in exposing more or less of a photographic film to a constant source of light simultaneously as the sounds are being recorded whereby to produce varying areas of exposed film surface, said varying areas being in correspondence with the variations in amplitude or power of the sounds recorded.

12. The method of controlling the volume of noise reproduced from a photographically recorded sound record which comprises progressively obscuring the normally clear portions of the sound-track area whereby to control the amount of light passing through said sound-track and thereby to control the volume of noise reproduced.

13. The method of producing a sound record which comprises recording the sound upon a photographic sound-track, and recording the volume of said sound independently upon the same record track.

14. The method of producing a sound record comprising a single photographic sound-track which comprises recording the sound upon the record and recording the average volume of said sound independently upon the same record track.

15. The method of recording sound which comprises producing a variable area record of the sound being recorded and varying the width of said variable area record in accordance with the average volume of said sound.

16. The method of recording sound which comprises producing a sound-track including a variable area record of the sound being recorded and varying the area of the clear portions of said sound-track in accordance with the average volume of said sound.

17. The method of making photographic sound records adapted to produce a minimum amount of ground noise upon reproduction which comprises exposing a sensitive film to a light beam, varying one side of said light beam in accordance

with the wave form of the sound being recorded and varying the other side of said beam in accordance with a component of said wave.

18. The method of making variable width photographic sound records, in which the clear area varies in accordance with the volume of the sound being recorded, which comprises, exposing a sensitive film to a single light beam, vibrating one edge of the beam laterally of the film in accordance with the sound wave being recorded and simultaneously producing a lateral displacement of the other edge of the beam in accordance with a component of said wave.

19. A sound record comprising regions of darkness interspaced with regions of lesser darkness characterized in that the average darkening of the background regions varies in accordance with the average intensity of the sound recorded.

20. A photographic record of sound comprising regions of darkness interspaced with regions of lesser darkness characterized in that the area of darkening of the background regions varies in accordance with the average volume of the sound recorded.

21. A photographic record of sound comprising regions of darkness interspaced with regions of lesser darkness characterized in that one boundary of said regions of lesser darkness varies in accordance with a sound wave and another boundary of said regions varies in accordance with a component of said wave.

22. In combination, means for exposing a light sensitive surface to light, means for causing said light to vary in response to sound, and additional means for causing the amount of said light reaching said surface to vary, said additional means being independent of said first mentioned means.

23. In combination, means for exposing a light sensitive surface to light, means for causing said light to vary in response to sound, and independent additional means for causing the average amount of said light reaching said surface to vary as a function of the loudness of the sound being recorded.

24. In combination, means adapted to continuously expose a light sensitive surface to the action of a beam of light, sound controlled means for influencing said light, and independent additional means controlled by the loudness of the sound for further influencing said light.

25. Apparatus for recording sound on a moving light sensitive member, comprising means for variably exposing the member in accordance with sound waves, and means for varying said exposure in accordance with the amplitudes of said sound waves independently of their frequencies.

26. Apparatus for recording sound on a moving light sensitive member, comprising means for variably exposing the member in accordance with sound waves, and means for simultaneously varying said exposure in accordance with the amplitude of said sound waves independently of their frequencies.

27. In combination, means for making a photographic sound record within a single sound-track area, and means controlled by the audio current of the sound being recorded for continuously altering the character of the record so that, when the original sounds are reproduced therefrom, ground noise is minimized, said means including means responsive to said current for shading the normally clear portion of the finished sound-track area to the maximum amount possible to

still permit obtaining sufficient clear portion to properly reproduce the recorded sound.

28. In combination, means for making a photographic sound record within a single sound-track area and means, responsive to the audio current of the sound being recorded for controlling the average opacity of the sound-track area, said last mentioned means comprising means responsive to said current for shading the normally clear portion of said sound-track area to the limit possible still retaining sufficient of said clear portion to permit accurate reproduction of recorded sounds.

29. In combination, means for exposing a light sensitive surface to light, means responsive to audio current impulses for causing said light to vary in response to sound, and additional means controlled by said impulses for causing the amount of light reaching said surface to vary independently of the frequencies recorded by said first mentioned means.

30. In combination, means for exposing a light sensitive surface to light, means responsive to said audio current impulses for causing said light to vary in response to sound, and independent additional means controlled by said impulses for causing the average amount of light reaching said surface to vary as a function of only the loudness of the sound being recorded.

31. In combination, means responsive to audio current impulses for directing a narrow line of light into a portion of film reserved for photographic sound record, means for causing one end of said line to move transversely of said film in response to sounds, and means controlled by said impulses for causing the other end of said line to assume and maintain an average position with respect to the boundary of said portion corresponding to the loudness of the sound represented by said record.

32. The method of making a sound track on a moving sensitive film, which comprises transmitting a beam of light to the film and separately varying in accordance with waves of different character, the position of the two edges of the light beam corresponding respectively with the two edges of the sound track.

33. The method of recording sound on a moving sensitive film which comprises producing a line of light on the film transversely to the direction of movement of the film, varying the length of the line at one end in accordance with a characteristic of sound, and varying the length of the line at the other end in accordance with another characteristic.

34. In apparatus for use in recording sound on a moving photographically sensitive film, means for transmitting a beam of light to the film for tracing a record track thereon, means for varying the position of one edge of the track in accordance with sound wave energy of certain character, and means for varying the position of the other edge of the track selectively in accordance with wave energy of different character.

35. In a light controller for use in conjunction with a line source of light in recording sound on a moving sensitive film, a vibratable light modulator and means to vibrate the same to vary the length of the line at one end of the line in accordance with sound controlled current, and another vibratable light modulator and means to vibrate the same to vary the length of said line at the other end selectively in accordance with a current having a characteristic differing from that of said first mentioned current.

36. In a light controller for use in recording sound on a moving sensitive film, means arranged to define the length of a line of light to be produced on the film, said means including means to vary the length of the line at one end in accordance with sound controlled current and means to vary the length of the line at the other end selectively in accordance with a current having a characteristic differing from that of said first mentioned current.

37. In apparatus for use in recording sound on a moving sensitive film, means for producing a line of light on the film transversely to the direction of movement of the film, means to vary the length of the line at one end in accordance with sound controlled current, and means to vary the length of the line at the other end selectively in accordance with a current having a characteristic differing from that of said first mentioned current.

38. In apparatus for use in recording sound on a moving photographically sensitive film, means for transmitting a beam of light to the film for tracing a record track thereon, means for varying the position of one edge of the track in accordance with sound wave energy of certain frequency, and means for varying the position of the other edge of the track selectively in accordance with wave energy of different frequency.

39. In apparatus for use in recording sound on a moving sensitive film, means for defining the length of a line of light to be produced on the film transversely to the direction of movement of the film, said means including means to vary the length of the line at one end in accordance with sound controlled current within a certain frequency range and means to vary the length of the line at the other end selectively in accordance with a current of a different frequency range.

40. The method of making a sound track on a moving sensitive film, which comprises transmitting a beam of light to the film, vibrating an edge of the light beam corresponding with one edge of the sound track selectively in accordance with high frequency components of a sound wave, and vibrating another edge of the light beam corresponding with the other edge of the sound track selectively in accordance with low frequency components of a sound wave.

41. In apparatus for use in recording sound on a moving sensitive film, means for defining the length of a line of light to be produced on the film transversely to the direction of movement of the film, said means including means to vary the length of the line at one end selectively in accordance with high frequency current and means to vary the length of the line at the other end in accordance with low frequency current.

42. In apparatus for use in making a variable width sound record on a moving sensitive film, means for defining the length of a line of light to be produced on the film transversely of the direction of movement of the film, said means including a vibratable light modulator for varying the length of the line at one end of the line and another vibratable light modulator for varying the length of the line at the other end of the line, means including a frequency selective circuit responsive to sound controlled current for vibrating one of said modulators, and means including another frequency selective circuit responsive to current of a different frequency for vibrating the other of said modulators.

43. In apparatus for making a negative photo-

graphic sound film the positive copy of which is intended to be reproduced optically, means for recording the sound by varying width of the exposed portion of the film in accordance with sound, an auxiliary shutter arranged in the path of the light, and an electrical system for varying the aperture of the shutter in such a manner that the usually exposed part of the film remains covered and unexposed up to a line adjacent to and parallel with a line drawn through the general apices of the unexposed portions representing sound.

44. In an apparatus for making a negative photographic sound film the positive copy of which is intended to be reproduced optically, means for recording the sound by varying width of the exposed portion of the film in accordance with sound, an auxiliary shutter in the optical path of the apparatus, having an aperture which is variable in the transverse direction of the film, a microphone, and a rejector circuit through which the currents of said microphone flow to control said shutter electromagnetically in such a manner that the usually exposed part of the film remains covered and unexposed up to a line adjacent to and parallel with a line drawn through the general apices of the unexposed portions representing sound.

45. A photographic record of sound comprising regions of darkness varying with the sound, and regions of darkness shading the normally lighter portions of the record to the maximum amount possible to still permit properly reproducing the sound.

46. The method of reducing the noise reproduced from a photographically recorded sound record which comprises progressively obscuring the sound track inversely with the volume of sound recorded.

47. The method of recording sound which comprises moving a sensitive medium at constant speed through a beam of light, varying said beam in accordance with the instantaneous variations in the sound to be recorded, and varying the average power of said beam directly with the volume of the sound.

48. The method of recording sound which comprises producing electrical waves varying in accordance with the sound, utilizing a portion of said waves for controlling the production of an impression in a photographic medium varying in accordance with said waves and simultaneously utilizing another portion of said waves for modifying the production of said impression in accordance with the envelope of the amplitude variation of said waves.

49. The method of reducing the volume of noise reproduced from a photographically recorded positive sound record which comprises placing an opaque substance upon the normally clear portions of the sound track area whereby the amount of light passing through said sound track is reduced.

50. The method of recording sound which comprises moving a sensitive medium at constant speed through a beam of light, controlling said beam so that in the absence of sound the quantity of light energy impressed upon said medium is small, increasing the average quantity of light energy impressed upon said medium with an increase in the amplitude of the sound waves recorded, and varying the quantity of light energy impressed upon said medium in accordance with the instantaneous variations in the sound recorded.

ERWIN GERLACH.

CERTIFICATE OF CORRECTION.

Patent No. 2,206,547.

July 2, 1940.

ERWIN GERLACH.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 3, second column, line 1, strike out the article "a" before "microphone" first occurrence; line 48, claim 4, for "means" read --mean--; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 1st day of October, A. D. 1940.

(Seal)

Henry Van Arsedale,
Acting Commissioner of Patents.