

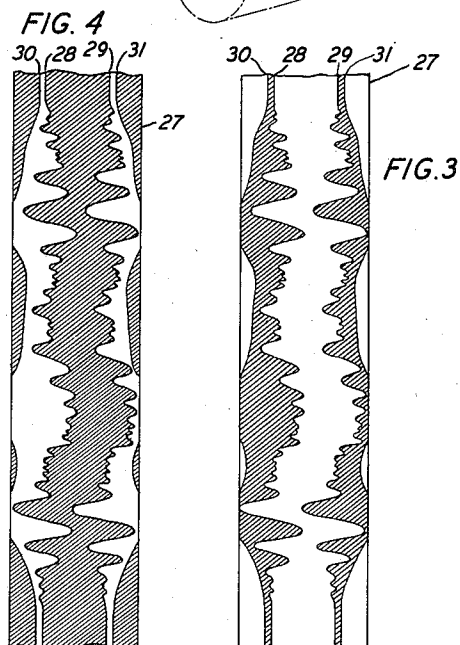
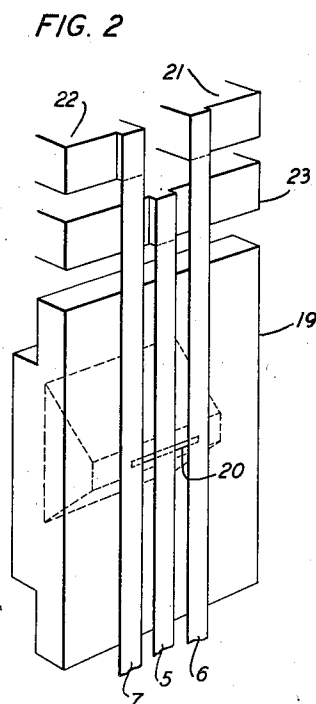
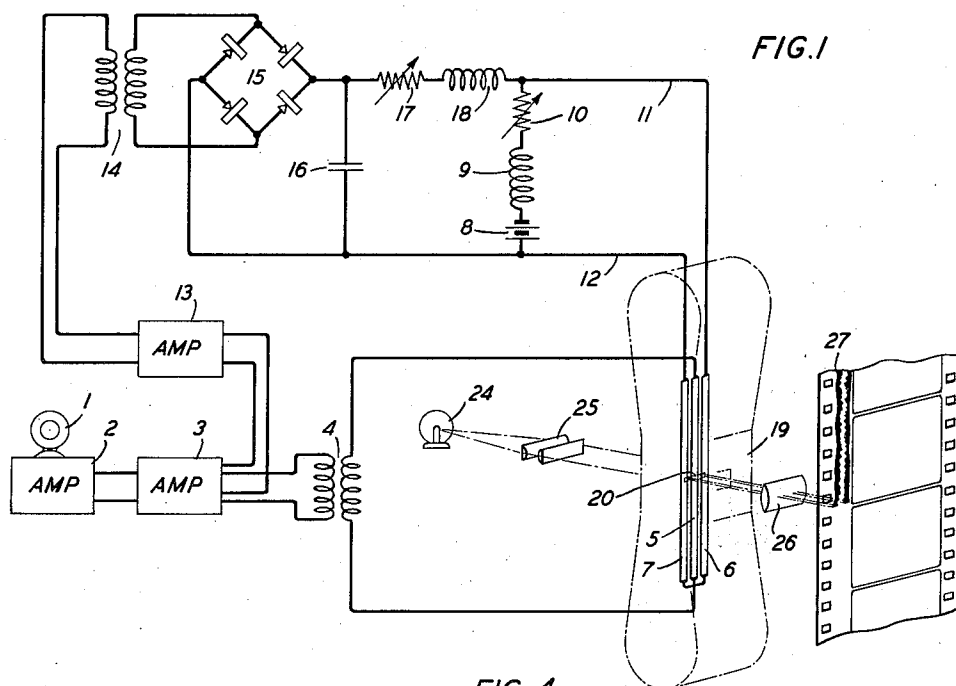
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RECORDING SYSTEM

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RECORDING SYSTEM

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8 Claims. (Cl. 179—100.3)

This invention relates to film sound recording systems and particularly to systems in which two complete complementary records of the sound waves are produced in one sound track.

5 The object of the invention is a film sound record in which the undesired noise due to irregularities in the recording material is substantially reduced and in which, when reproduced, the undesired frequencies due to distortion of the
10 wave form will be substantially neutralized. A feature of the invention is the method of producing with a single device two complete complementary sound wave representations and simultaneously limiting the area of the film from which
15 the ground noise may be produced.

Another feature of the invention is a sound record in which the sound is recorded as a series of laminae of equal length, laterally displaced from the center line of the sound track, and in
20 which the transparent area of the sound record is at all times as small as possible.

Sound recording systems are known in which the original or negative record is respectively exposed from the two marginal edges inward
25 to form two complete complementary sound wave representations. In the systems heretofore known, such as the system shown in U. S. Patent 1,833,373, two separate light sources were used respectively to produce the two exposures on the
30 marginal edges of the sound track. As the two channels leading to the recording light and the recording lights themselves rarely have identical characteristics, the two records produced are not usually identical in shape. A certain measure of
35 distortion is thus produced by this recording method. Also, when recording sounds of small amplitude by such a recording system, substantially one half of the record produced is transparent and as the transparent areas of the film
40 tend to give rise to undesired noise upon reproduction, the undesired noise from such a film is unduly large.

In the present system of recording an opaque conducting ribbon is placed in the recording beam
45 of light having its longer axis aligned with the longitudinal axis of the film. An image of the ribbon occupying substantially one half the width of the sound record is formed upon the film. The conducting ribbon may be oscillated laterally in
50 accordance with the signal currents. Two other conducting ribbons are respectively stretched on opposite sides of the central ribbon in the recording beam and spaced so as to limit the outer edge of the recording beam to the width of the sound
55 track. The two outer ribbons are moved lateral-

ly of the film in accordance with the envelope of the amplitude variations of the signal currents and thus limit the exposed area of the original or negative film to the least amount which will carry the modulation of the center ribbon.

The film produced by the present recording system comprises in the original or negative record a central unexposed area of constant width which is varied in position laterally of the sound track in accordance with the variations in the signal current, an exposed area on both sides of the central unexposed area, and two unexposed areas respectively extending from the marginal edges of the record track very close to the unexposed areas in the center of the track. The exposed area of the original or negative record is thus as small as possible. When a reproduction sound record is printed of such an original or negative record, the exposed areas of the reproduction prints will be as large as possible, the transparent areas of the reproduction prints consequently being as small as possible. Thus, when such a record is reproduced, the ground noise arising from the transparent areas of the reproduction prints will be a minimum.

In the drawing, Fig. 1 is a diagrammatic representation of a sound recording system embodying these inventions;

Fig. 2 is a fragmentary enlarged view of a light valve adapted for use in the system of Fig. 1;

Fig. 3 is a representation of the original or negative film sound record produced by the recording system of Fig. 1.

Fig. 4 is a representation of a positive print of the record shown in Fig. 3.

In Fig. 1 the microphone 1 and amplifier 2 form a source of electric waves modulated in accordance with a desired signal. Any other source of modulated signal waves may be used, such as a phonograph pick-up, a radio receiving set, a telephone line, etc. The modulated signal wave may be further amplified in amplifier 3 and supplied through a transformer 4 to a conductive ribbon 5 immersed in a constant magnetic field. The magnetic field produced by the current flowing in the conducting ribbon 5 will react with the constant magnetic field to produce a lateral oscillation of the ribbon 5.

A constant current from a battery 8 flowing through an inductor 9 and a resistor 10 is supplied through the wire 11 to a pair of conductive ribbons 6 and 7 connected in serial relationship and disposed on each side of the conductive ribbon 5 and in the same magnetic field. The cur-

rent flowing through the ribbons 6 and 7 returns through the wire 12 to the battery 8.

A portion of the modulated currents from the amplifier 3, further amplified, if desired, in the amplifier 13 are supplied through the transformer 14 to the bridge type full-wave rectifier 15. The output of the rectifier 15 charges up the capacitor 16. The charge on the capacitor 16 will tend to flow through the resistor 17, inductor 18, resistor 19 and inductor 9 thus opposing the flow of current from the battery 8. The above elements constitute a well-known form of noise reduction circuit similar to that disclosed in U. S. Patent 1,923,757 patented August 22, 1933 to H. C. Silent. The present invention is in no way limited to the specific type of noise reduction circuit disclosed as any other type of circuit which will produce a current varying in accordance with the envelope of the amplitude variation of the signal current may be substituted for the circuit shown.

In the absence of sound the constant current from the battery 8 flowing through the ribbons 6 and 7 is adjusted to draw the ribbons 6 and 7 very close to the ribbon 5. When signal currents are applied to the noise reduction circuit the rectified current produced overcomes the effect of the current from the battery 8 and permits the ribbons 6 and 7 to move laterally away from the ribbon 5 so that the ribbon 5 may oscillate in accordance with the signal current without striking the ribbons 6 and 7.

The light valve disclosed in Fig. 1 may be structurally similar to the light valve disclosed in my previous Patent 1,914,186 patented June 13, 1933 to E. C. Wentz except that the light valve has three ribbons in place of two and the ribbons are disposed parallel to the longitudinal axis of the sound record. In Fig. 2 the member 19 corresponds to the support 7 disclosed in my patent. The ribbons 5, 6 and 7 are disposed at right angles to the small orifice 20 pierced in the member 19. The ribbons 6 and 7 are stretched in their proper position and attached to suitable supports, such as 21 and 22. The ribbon 5 may be similarly stretched and attached to a support 23 which is recessed so as not to interfere with the movement of the ribbons 6 and 7. As the ribbon 5 operates on much higher frequencies than the ribbons 6 and 7, the ribbon 5 may be much shorter in length, and may be tensioned to resonate at a higher frequency than ribbons 6 and 7.

In Fig. 1 light from the source 24 is focused by the lens system 25 on the small orifice 20 pierced in the support 19. The light transmitted through the orifice 20 is focused by the lens 26 on the record track of a photographic film 27 moved through the beam at uniform speed in a known manner.

The two edges of the ribbon 5 imaged upon the moving film 27 will define the two lines of exposure 28 and 29 shown on Fig. 3. When signal currents are applied to the ribbon 5 causing the ribbon to oscillate laterally of the film 27 the lines 28 and 29 will vary laterally of the film in position or alignment but are at all times spaced the same distance laterally of the film from each other. The edge of the ribbon 6 imaged upon the film 27 will form a line serving to define an unexposed area extending inward from the marginal edge of the sound track and varying in width inversely in accordance with the envelope of the amplitude variations of the signal. The edge of the ribbon 7 imaged upon the film 27

forms a line 31 similar to the line 30. The exposed area of the original or negative film is thus at all times as small as possible. Thus when a reproduction sound record is printed of such an original or negative record, such as shown in Fig. 4, the exposed area of the reproduction print will be as large as possible thus reducing the transparent areas of the reproduction print from which the ground noise arises during reproduction. The corresponding lines in Figs. 3 and 4 have been designated by the same numerals.

The positive or reproduction print shown in Fig. 4 may be reproduced by two separate channels, as shown in U. S. Patent 1,833,373, or by a bridge arrangement connected to a single channel, as shown in U. S. Patent 1,879,423, or by the beam splitting arrangements shown in British Patent 332,197 or French Patents 713,816 and 773,532.

What is claimed is:

1. A positive photographic record of sound comprising an exposed area substantially one half the width of the record track, centrally disposed in the record track and laterally displaced in accordance with the variations in the sound and two exposed areas respectively disposed in the marginal edges of the sound track and varying in width inversely in accordance with the envelope of the amplitude variations of the sound.
2. The method of recording sounds upon a photographic sound track which comprises projecting light upon an opaque element having its axis aligned with the longitudinal axis of the sound track, forming an image of said element upon the sound track, said image occupying substantially one half the lateral width of the sound track, laterally oscillating said element in accordance with the sound to be recorded, respectively defining the two margins of the light impressed upon the sound track by means of two elements having their axes aligned with the longitudinal axis of the sound track and laterally displacing said last two elements in accordance with the envelope of the amplitude variations of the sound.
3. A negative photographic record of a modulated electric current comprising an unexposed area substantially one half the width of the record track and laterally displaced in accordance with the variations in the modulated electric currents and two unexposed areas respectively disposed in the marginal edges of the sound track and varying in width inversely in accordance with the envelope of the amplitude variations of the modulated electric current.
4. A negative record of a modulated electric current comprising an unexposed area of substantially constant width centrally disposed in the record track and laterally displaced in accordance with the variations in the modulated electric current and two unexposed areas respectively disposed in the marginal edges of the sound track and extending inwardly substantially to the envelope of the variations in the central unexposed area.
5. The method of recording a modulated electric current upon a photographic film which comprises projecting a narrow beam of light having its longer axis transverse to the axis of the film upon an opaque element having its axis aligned with the longitudinal axis of the film, forming an image of said element upon the film occupying substantially one half the lateral width of the sound track, laterally oscillating said element in accordance with the modulated electric current,

respectively defining the two margins of the light beam impressed upon the film by means of two opaque elements having their axes aligned with the longitudinal axis of the film and laterally displacing outward said last two opaque elements in accordance with the envelope of the amplitude variations of the modulated electric currents.

6. In a system for recording modulated electric currents in combination, a photographic film moved at constant speed, an opaque plate pierced by a small orifice having its longer axis transverse to the axis of the film, a source of light, a lens system for focusing light from said source to illuminate said orifice, magnetic means for forming a constant magnetic field including said orifice, a lens system for forming an image of said orifice upon said film, an opaque conducting ribbon having its longer axis parallel to the axis of the film centrally located in the light from said orifice and immersed in said magnetic field, a source of modulated electric current, means for supplying current from said source to said ribbon to cause said ribbon to oscillate laterally of the film in accordance with the variations in the modulated electric current, a pair of opaque conducting ribbons respectively disposed on each side of said first ribbon and parallel thereto, means for supplying a constant current to said

two ribbons to limit the width of said image impressed upon said film and a detector for deriving an electric current varying in accordance with the amplitude variations of said modulated electric current and connected to nullify the effects of said constant current on said two last named ribbons.

7. A positive photographic record of sound comprising an exposed area of substantially constant width centrally disposed in the record track and laterally displaced in accordance with the variations in the sound and two exposed areas respectively disposed in the marginal edges of the sound track and varying in width inversely in accordance with the envelope of the amplitude variations of the record.

8. The method of recording a modulated electric current upon a photographic film which comprises projecting a narrow beam of light upon an opaque element, forming an image of said element of substantially constant width laterally on said film, laterally oscillating said image by and in accordance with the variations in said current, respectively defining the two margins of said beam impressed upon said film, and laterally displacing said margins in accordance with the envelope of the amplitude variations in said current.

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