Sept. 12, 1933. F. RIEBER 1,926,406

SYSTEM FOR RECORDING IMPULSES

Filed Sept. 30, 1930

Fig. 1

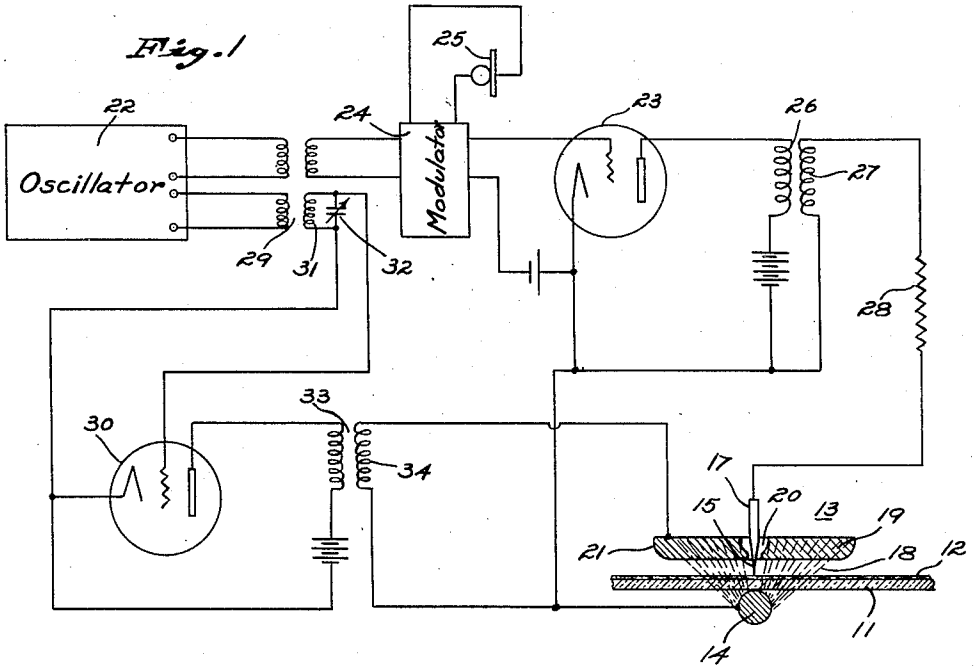


Fig. 2

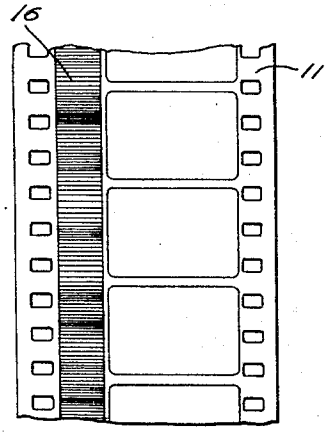


Fig. 3

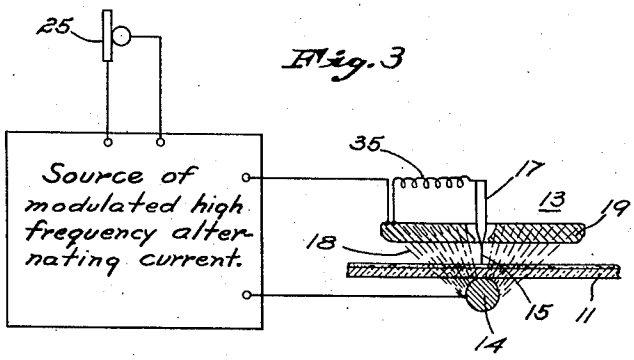
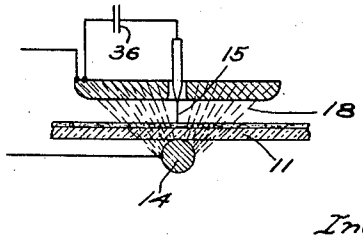


Fig. 4



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SYSTEM FOR RECORDING IMPULSES

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Application September 30, 1930
Serial No. 485,422

12 Claims. (Cl. 179—100.3)

This invention relates to a system for recording variable electrical potentials, such as are encountered in connection with recording sound on a motion picture film.

In recording sound on motion picture films or other sensitized surfaces, use has been made of a source of light, shining through a narrow aperture. The intensity of this light is modulated or varied in accordance with electrical potential variations, as determined by the sound modulations present in an electric circuit. As the motion picture film is moved past this thin beam of light, a record is produced, as a varying density of the film.

In my present invention it is proposed to obviate the need of light to affect the sensitized film. Instead use is made of an electrostatic field, the intensity of which varies in accordance with the vibrations to be recorded, and which it has been found, can affect the film by the production of ions or electrons in the gas or air in which the film is disposed.

In recording these varying electrical potentials by such an electrostatic field acting on the gas in which the film moves, the varying electrical potentials are applied across electrodes disposed on opposite sides of the film. One of the electrodes can be in the form of a narrow wedge which concentrates the electrostatic field along a narrow strip. However, in order to bring the ionization or the strength of the field to a point where the film can be affected, there is apt to be a glow or corona effect that is disturbing, because it widens out the area affected by the narrow electrode and causes blurring and distortion of the sound produced from the record. It is also impossible under such circumstances to record the higher frequencies of sound, such as 8,000 or 10,000 cycles or higher which are essential for good quality.

It is one of the objects of my invention to prevent such diffused luminous energy and to make it possible to concentrate the ionization along a narrow strip transverse to the movement of the film as to record even the higher sound frequencies accurately.

I accomplish this result by arranging the electrodes betwen which the film is movable so that a guarding electrostatic field is produced, of comparatively low intensity and which surrounds the recording electrostatic field and prevents its material divergence. The surrounding or guarding field has a potential gradient insufficient to produce ionization while the "marking" field is intense enough to produce high ionization and without corona effects. Any corona present would be detrimental, because it would diffuse or blur the record.

In order further to ensure against appreciable corona effects, I provide a loading impedance in the circuits that prevents the potential gradient from reaching the stage where appreciable corona results even for large amplitude of vibrations to be recorded.

My invention possesses many other advantages, and has other objects which may be made more easily apparent from a consideration of several embodiments of my invention. For this purpose I have shown a few forms in the drawing accompanying and forming part of the present specification. I shall now proceed to describe these forms in detail, which illustrate the general principles of my invention; but it is to be understood that this detailed description is not to be taken in a limiting sense, since the scope of my invention is best defined by the appended claims.

Referring to the drawing:

Figure 1 is a schematic diagram of a system embodying my invention;

Fig. 2 is a picture of a portion of film produced by the aid of my invention;

Fig. 3 is a diagram of a further form of the invention; and

Fig. 4 shows a still further modification.

In Fig. 1 there is shown a film 11 (greatly enlarged) having a sensitized layer 12 upon which the record is to be placed. This film 11 is intended to be progressed at a substantially uniform rate past a recording station, where an electrostatic field is impressed upon the gas or air adjacent the film. In the present instance the electrostatic field is represented as produced by the two electrode structures 13 and 14. It is to be understood that the thickness of the film 11 and the various clearances have been exaggerated in the drawing, as ordinarily the two electrode structures would be placed so close together that there is just barely room for the film 11 to pass therebetween.

The electrostatic field impressed across the intervening space between the electrode structures 13 and 14 is so arranged that an intense field occurs at a localized or limited portion thereof; such as that represented by the line 15. The surrounding electrostatic field is of lower intensity and is caused to converge so as to act as a guard against the spreading of the more intense field 15. This invention relates to the maner in which this non-homogeneous electrostatic field is produced, whereby the intense field 15 serves as the record-

ing field to the exclusion of the possibility of recording outside of the limited area occupied by this field.

In Fig. 2 the film 11 is shown carrying the record markings 16 (diagrammatically shown) which are in the form of striations of varying density depending upon the varying intensity of the field 15, and which are very closely spaced together. This type of recording is now well understood in connection with ordinary glow tube recording. With the aid of an electrostatic field as described, the fineness of the individual striations making up the record 16 can be made much greater than is possible with the ordinary optical glow tube system, and especially if care be taken to prevent any diffused luminous disturbances between the electrode structures 13 and 14. The intense field 15 is produced between a tapered electrode member 17 having a point that extends transversely to the movement of the film 11 and corresponding to the width of the record 16. This point is opposed to the electrode structure 14 on the opposite side of the film 11. The less intense or non-ionizing field 18 is produced between a guard electrode structure 19 and the electrode structure 14. This guard electrode structure surrounds the member 17. The configuration of electrode 14 is such that the field 18 converges around the intense field 15. For example, this can be accomplished by making electrode structure 14 in the form of a metal cylinder, the axis of which is transverse to the movement of the film 11; while the guard electrode 19 covers a greater area.

The point of member 17 extends slightly below the edge of the aperture 20 through the guard electrode 19. This aperture 20 is so formed that there is an insulating space between the members 17 and 19, there being converging surfaces defining the aperture in order to assist in preventing spreading of the field 15. In order to ensure substantial uniformity of field 18, the edges of guard member 19 may be rounded as indicated at 21.

As thus far described, it is apparent that the guarding field 18 acts to confine the recording field 15 to a very narrow edge, the recording being accomplished by electrons or ions impacting against the sensitized surface 12.

The varying electrical potentials to be recorded by this system can be arranged to modulate either the field 18 or the field 15 to secure the varying density of the striations in record 16. In the form shown, the modulated electric potentials are impressed across electrode member 17 and the lower electrode 14. One way in which these are modulated is illustrated in Fig. 1.

Thus oscillator 22 is intended to affect the input circuit of amplifier tube 23. This oscillator can be arranged to generate oscillations of uniform amplitude at a high frequency, generally much higher than audio frequencies. These waves can be modulated by the modulator 24, affected by the vibrations to be recorded; as, for example, by a microphone 25.

The output circuit of tube 23 includes the transformer 26, the secondary coil 27 of which is connected across the members 17, 14. Included in this circuit is an impedance such as a resistance 8, acting as a ballast to prevent any corona illumination to exist between members 17 and 14, even when the modulations are of a large amplitude.

The guard field 18 is arranged to be in phase with the recording field. To effect this result, the oscillator 22 can be coupled as by a transformer 29 to the input circuit of the amplifier tube 30. The secondary coil 31 of this transformer can be tuned as by the variable condenser 32, to the carrier wave frequency, whereby there is a further assurance that the circuits respectively affecting the potential gradients for the fields 15 and 18, are kept non-interfering. The output circuit of tube 30 includes the transformer 33, the secondary coil 34 of which is connected across the guard electrode 19 and electrode 14 in order to provide the field 18.

The intensity of this guard field, as heretofore mentioned, is below the ionization point for the gas or air separating the electrode structures 13 and 14; while the intense recording field, is strong enough due to its modulations, to produce ionization in this gas and therefore to produce the variable density record.

Other schemes for limting the maximum intensity of field 15 in place of the insertion of the series resistance 28 could be utilized. For example, in the form of Fig. 3, there are electrode structures 13 and 14 similar to those of Fig. 1, but the modulated high frequency alternating current is impressed across the guard electrode structure 19 and the lower structure 14. An impedance, such as the coil 35, can be inserted between the marking or recording electrode member 17 and the guard electrode member 19. Since the area of the guard electrode member 19 is much greater than the recording edge of member 17, the relative intensities of the two fields are maintained.

In place of the coil 35, there is shown in Fig. 4 a corresponding impedance in the form of a condenser 36 for providing the same limiting effect as coil 35.

I claim:

1. Means for recording varying electric potentials on a sensitized surface, comprising means creating a recording electrostatic field acting on gas adjacent said surface over a limited portion thereof, and means for producing a guarding field surrounding said electrostatic field, of an intensity insufficient to affect the surface.

2. Means for recording varying electric potentials on a sensitized surface, comprising means creating a recording electrostatic field acting on gas adjacent said surface over a limited portion thereof, and means for producing a converging guarding field surrounding said electrostatic field and of an intensity insufficient to affect the surface.

3. Means for recording varying electrical potentials on a sensitized surface, comprising means creating a recording electrostatic field acting on gas adjacent said surface over a limited surface thereof, means restricting said field against diverging, and means for limiting the potential gradient of the recording field below the point of diffuse luminous discharge.

4. Means for recording varying electrical potentials on a sensitized surface, comprising means creating a recording electrostatic field acting across a gas adjacent said surface and over a limited portion thereof, and means for producing a field surrounding the recording field and in phase therewith, said surrounding field being of an intensity insufficient to affect the surface.

5. In a recorder using a carrier frequency, the combination of a recording electrode structure and another electrode structure between which structures a recording surface is passed, a third electrode structure surrounding said recording electrode, and electrical connections between said three electrodes to cause a carrier frequency elec-

tromotive force to be impressed across said recording electrode and said other electrode, and across said third electrode and said other electrode, thus providing two electrically parallel fields, and means to keep the frequency in each field in phase with the frequency in the other field.

6. The combination as defined in claim 5, in which the field across the recording electrode and the other electrode is confined to a narrow area.

7. The combination as defined in claim 5, with means for limiting the value of the field across the recording electrode and the other electrode below the corona point.

8. The combination as defined in claim 5, with means to impose on the carrier field across the recording electrode and the other electrode a recording frequency without disturbing the field across the third electrode and the other electrode.

9. The process of recording potential fluctuations on a sensitized surface which comprises creating a normally diverging electrostatic recording field, and subsequently preventing said recording field from diverging by surrounding said recording field by a converging non-recording field.

10. The process of recording potential fluctuations on a sensitized surface which comprises creating a normally diverging electrostatic recording field, and subsequently causing said normally diverging electrostatic field to converge to a focus by surrounding said recording field by a converging non-recording field.

11. The process of recording potential fluctuations on a sensitized surface which comprises creating a normally diverging electrostatic recording field, subsequently preventing said recording field from diverging by surrounding said recording field by a converging non-recording field, and varying said recording field without disturbing said non-recording field.

12. The process of recording potential fluctuations on a sensitized surface which comprises creatitng a non-homogeneous electrostatic field, a portion of which is intense enough to produce ions for recording, the remainder of the field being less intense than is required to produce ions in the medium in which the film is used, and directing said remainder to focus said intense portion to form an elemental image on said surface.

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