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PHOTOGRAPHIC RECORDING OF SOUND

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Fig. 4

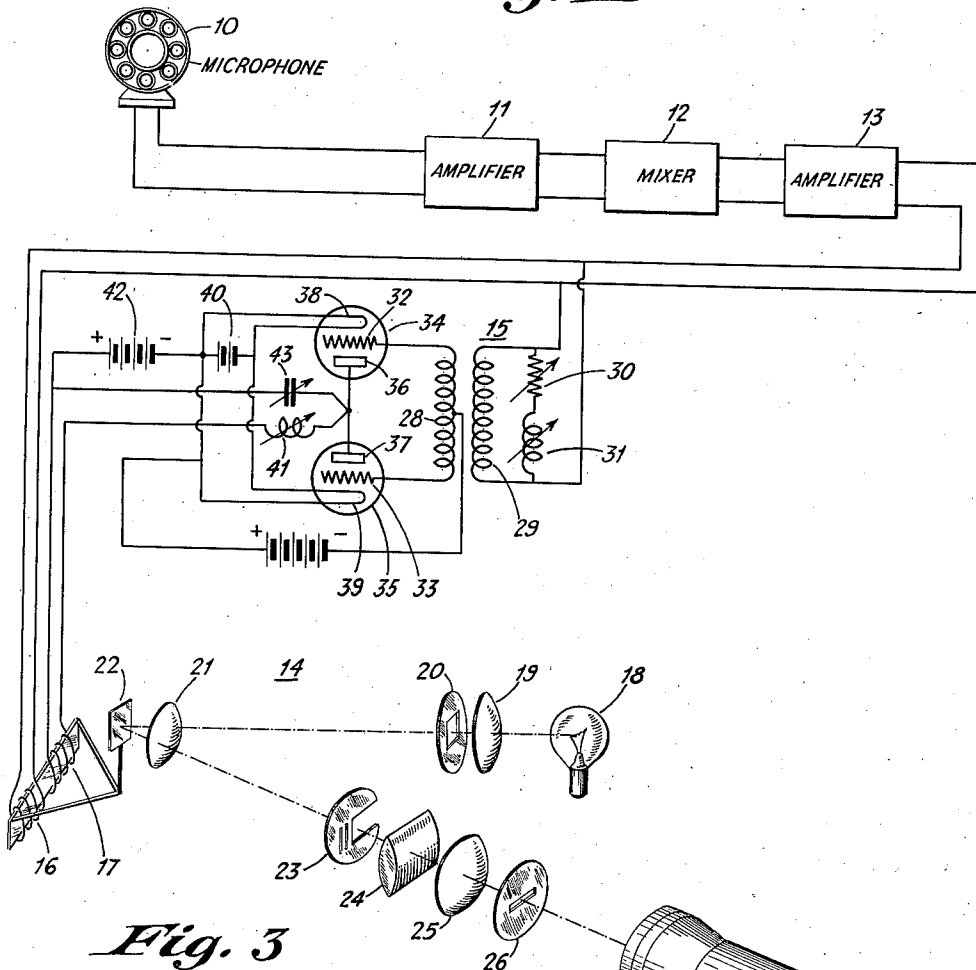
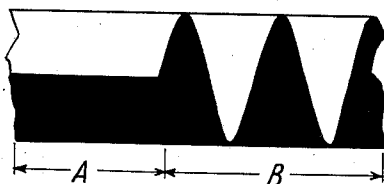


Fig. 3

Fig. 2

Fig. 1



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PHOTOGRAPHIC RECORDING OF SOUND

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3 Claims. (Cl. 179—100.3)

This invention relates to the photographic recording of sound and has for its principal object the provision of an apparatus and method of operation whereby the effect of decrease in the resolving power of the record material as the frequency of the recorded sound increases is obviated.

A further object is the provision of means for overcoming the distortion resulting from decrease in the resolving power of the record material with increase in frequency of the recorded sound by artificially producing a similar distortion of opposite phase.

A further object is the provision of a sound recorder wherein the amplified audio impulses are utilized to actuate the recording element and an auxiliary circuit responsive to the high frequency components of these impulses is arranged to modify the operation of the recording element in a manner to neutralize variation in the resolving power of the record material.

It is well known that objectionable noise, commonly known as ground noise, is produced by scratches and dust on the clear part of a sound record. Various means have been provided for eliminating such distortion. In the variable area type of recording they assume the form of a shutter which is caused to follow the envelope of the sound record and to reduce the clear portion of the record to the minimum required for proper reproduction of sound. In the variable density type of recording they assume the form of a biased light valve. Neither of these forms, however, have satisfactorily solved the problem of eliminating the undesirable effects of decrease in the resolving power of the record material as the frequency of the recorded sound increases. This effect is particularly disagreeable in the case of small records such as are used in connection with 16 millimeter recordings. In accordance with the present invention, it is avoided by the provision of means for subjecting the recording element to a biasing force which is dependent on the high frequency components of the recorded sound.

The invention will be better understood from the following description when considered in connection with the accompanying drawing and its scope will be pointed out in the appended claims.

Referring to the drawing,

Figs. 1 to 3 are explanatory diagrams, and

Fig. 4 is a diagrammatic showing of a sound recorder wherein the invention has been embodied.

Fig. 1 illustrates a sound track including an unmodulated section A and a fully modulated constant frequency section B. If the exposed portion of the unmodulated section A is perfectly black it is evident that the average transmission for this section would be fifty percent. Also, if the sine wave modulation of the constant frequency section B is perfectly recorded the average transmission or resolving power is still fifty percent. It has been found, however, that the resolving power of the photographic film ordinarily utilized in sound recording is not perfect but decreases with increase in the frequency of the recorded sound.

As shown by Fig. 2 the valleys of the waves are badly fogged, the density being greatest near the base and least near the top. It is quite apparent that the average transmission of a high frequency sound track such as that illustrated is less than if the track were unmodulated. It is also apparent that the light modulation produced by the track shown in Fig. 2 is necessarily less than that produced by section B of the sound track shown by Fig. 1, and that the peaks contribute more to the light modulation than do the valleys.

When a sibilant sound is recorded on the film the high frequencies vary in amplitude. Such a variation is represented in Fig. 3. Fogging of the valleys in this case gives rise to a new wave not present in the original sound. This new wave is approximately the same shape as the curve of the envelope of the high frequencies and is represented in Fig. 3 by a dotted line. When the sibilant sound covering the pronunciation of the letter S is reproduced from a 16 millimeter film a lower frequency for noise is usually held. This noise is proportional to the intensity of the sibilant sound and especially pronounced in records in which the high frequencies have been boosted to compensate for the loss due to the film.

As will be apparent to those skilled in the art, the invention is applicable to different types of recording apparatus. In order to simplify an understanding of it, it is illustrated as utilized in connection with a galvanometer type of recorder.

Referring more particularly to Fig. 4, the apparatus includes a microphone 10, a microphone amplifier 11 which may be mounted in the same casing as the microphone, a mixer 12, an amplifier 13, a galvanometer recorder 14, and an auxiliary high frequency responsive circuit 15. It will be apparent that the recorder is of the

usual type except that it is provided with two actuating coils 16 and 17. It includes a light source 18, a lens 19, a light stop 20, a lens 21, a mirror 22 which is actuated by the coils 16 and 17, a gauge 23, a cylindrical lens 24, a spherical lens 25, a slit 26 and an objective 27.

The output circuit of the amplifier 13 is connected directly to the galvanometer coil 16 and is connected through the auxiliary circuit 15 to the galvanometer coil 17. The auxiliary circuit 15 includes a transformer provided with a winding 28 and a winding 29 which is connected to the output of the amplifier 13 and is shunted by a filter 30—31 which allows more high frequencies than low frequencies to pass from the amplifier 13 to the transformer 28—29. The opposite terminals of the secondary winding 28 are connected to the grids 32 and 33 of a pair of half wave rectifiers 34 and 35. It will be observed that the anodes 36 and 37 of these rectifiers are connected together and that their cathodes 38 and 39 are also connected together. A battery 40 is provided for supplying heating current to the cathodes. The anodes 36 and 37 are connected to one terminal of the galvanometer coil 17 through inductance 41, and the other terminal of the coil 17 is connected to the cathodes 38 and 39 through a battery 42. A capacity 43 may be connected across the galvanometer coil 17 and the inductance 41 for the purpose of smoothing out the rectified current, although this filtering action is not always necessary for satisfactory operation of the apparatus. It will be understood that a half wave rectifier may be substituted for the full wave rectifier, as found expedient.

The operation of the apparatus will be readily understood. The galvanometer coil 16 functions in a well known manner to vibrate the mirror 22 and vary the width of the sound track recorded on the film. The galvanometer coil 17 responds only to the higher frequency components of the recorded sound and functions to shift the mean position, or change the zero point, of the recording light beam by an amount equal to the change in the resolving power of the film at the particular frequency

being recorded. The mean transmission of the film is thus made constant for all frequencies in the useful range and distortion and spurious frequencies as described above, due to change in the resolving power of the film with frequency, are eliminated.

Having thus described my invention, what I claim is:

1. The combination of a source of electrical impulses, a light source, means for directing light from said source onto a photographic film, means in the path of said light for modulating the light in accordance with said impulses, means connected to said source to isolate high frequency impulses therefrom, and means connected to said isolating means for shifting the zero point of said modulating means in accordance with the envelope of said isolated impulses, whereby spurious envelope frequencies are neutralized.

2. The combination of a source of electrical impulses, a light source, means for directing light from said source onto a photographic film, means in the path of said light for modulating the light in accordance with said impulses, means connected to said source to isolate high frequency impulses therefrom, and means connecting said isolating means to said modulating means for shifting the zero point of said modulating means in accordance with the envelope of said isolated impulses, whereby spurious envelope frequencies are neutralized.

3. The combination of a source of electrical impulses, a light source, means for focussing a narrow line of light from said source onto a photographic film, means in the path of said light for modulating the light in accordance with said impulses, means connected to said source to isolate high frequency impulses therefrom, and means connecting said isolating means to said modulating means for shifting the zero point of said modulating means in accordance with the envelope of said isolated impulses, whereby spurious envelope frequencies are neutralized.

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