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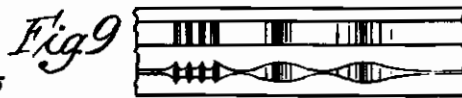
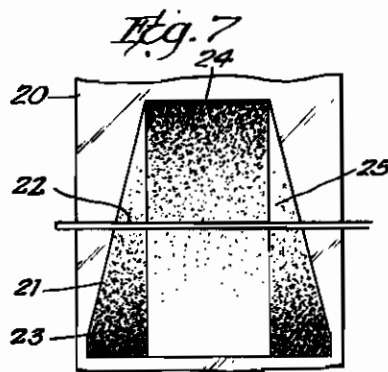
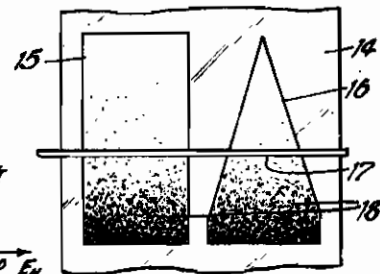
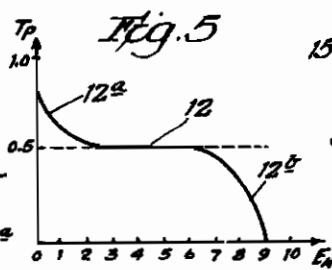
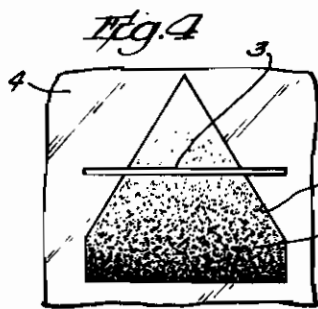
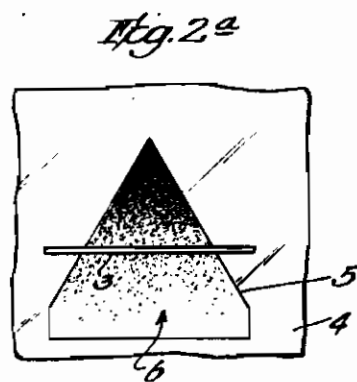
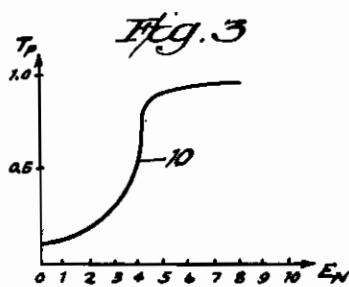
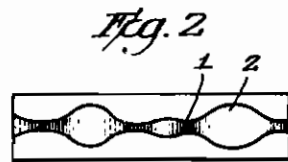
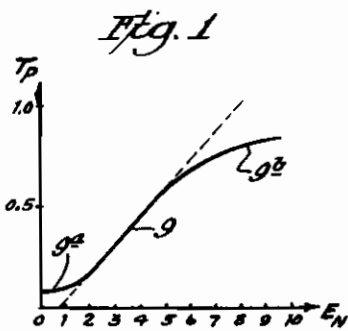
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MAY 18, 1943. METHODS OF PRODUCING SOUND RECORDS ON FILMS 379,081

BY A. P. O.

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# ALIEN PROPERTY CUSTODIAN

## METHODS OF PRODUCING SOUND RECORDS ON FILMS

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The invention relates to improvements in a method of producing sound records on film and particularly is directed to variable density sound records whose track is not of uniform width, but is varied in width during the recording.

In a sound record production in which the intensity of recording illumination is controlled solely in proportionate ratio to the sound waves to be recorded, there is produced a record with a characteristic which is not entirely satisfactory. The characteristic referred to is the one which shows the relation between the exposure of the film during the recording and the light transparency of the film at its reproduction. The very fact that a relatively small portion only of this characteristic is presented by a straight line and that a proper control of the sound reproduction is limited to this straight line portion of the characteristic has not only a restricting effect upon the volume of the reproduced sound, but also has a restricting effect upon the factors of tolerance admissible during the processing of the film. In spite of the fact that the variable density type of recording has a number of advantages in the art of sound recording, the tendency is to revert again more and more to variable area recording, because only the latter type of sound record makes it possible to apply to the film a great range of transparency without distortion. The method of producing a variable density sound record has the further drawback that it is influenced to a considerable extent by variations in the intensity of the source of light, and also by irregularities during the processing of the sound film.

The suggestion has already been made to produce variable density sound records in which, for the purpose of attaining predetermined effects, the width of the recorded sound is varied. In this suggested method the recording elements are constructed and arranged in such manner that the width of the record decreases proportionately to the decrease in the transparency of the film. Hence, there was a simultaneous application or superimposition of sound variation due to the fact that the two ways of recording are recorded at locations on the film where the sound record has its narrowest areas, and vice versa. The resulting characteristic of a film of this type has a substantially quadratic course. The disadvantages of such a characteristic is well known.

It is an object of the present invention to eliminate in a very advantageous way the disadvan-

tages which up to now were inherent to variable density recording. According to the invention, there taken place in this type of variable density sound recording, which simultaneously employs a variation of the width of the sound record upon an increase in transparency of the film, a decrease in the width of the recording area.

Another object of the invention is to produce in addition to a normal variable density record a second record which is arranged parallel and in phase to the normal variable density record and in which the width of the area varies in inverse proportion to the transparency of the film. The reproduction of this double record, preferably, taken place by scanning devices which may be known in themselves, as for instance, from scanning push-pull sound records.

It is also an object of the invention to produce a sound record of the above named type in which the greatest variation in the width of the record does not exceed one-half of the entire width of the sound track.

Still another object of the invention is to produce a system of recording in which a satisfactory regulation may be effected even with transparencies which up to now had been considered too low for successful performance.

The invention is illustrated in the drawing which not only explains of few examples of the invention but which at the same time illustrates the advantages of the same over the prior state of the art.

Fig. 1 illustrates the characteristic of a conventional variable density sound record on a standard film with normal exposure and development.

Fig. 2 illustrates a combined variable density and variable area sound record of the prior art.

Fig. 2<sup>a</sup> illustrates diagrammatically the essential parts of the sound recording device which produces the sound record of Fig. 2.

Fig. 3 illustrates the characteristic of the sound record of Fig. 2.

Fig. 4 illustrates diagrammatically the essential parts of the sound recording device employed in practicing the present invention.

Fig. 5 illustrates the characteristic of the sound record produced according to the present invention, and the

Figs. 6 and 7 illustrate diagrammatically modified embodiments of a sound recording device for practicing the present invention.

Referring to Fig. 1 which shows a characteristic curve 9 or a conventional variable density sound record on a standard film normally exposed and developed, the exposure during the re-

recording is indicated in the coordinate system along the abscissa and the transparency during the reproduction along the ordinate. It will be seen from this characteristic 9 that a relatively small portion thereof only is straight and that, as has been mentioned above, the range within which a proportionate control is feasible is too small for practical purposes.

Fig. 2 illustrates the sound track of a record of the prior art, wherein variable density, as indicated at 1, is combined with variable area, as shown at 2, while Fig. 2<sup>a</sup> illustrates diagrammatically the essential parts of the recording device which enter into its recording method. The recording device substantially consists of a slit 3 which is photographed upon the film, and a diaphragm 4 which represents the triangularly shaped cut-out 5 for a gray wedge 6. This diaphragm 4 is actuated in accordance with the vibrations of the sound waves to be recorded and thereby produces a sound record of the type illustrated in Fig. 2. Fig. 3 shows the characteristic of this sound record. It is conspicuous by a very wide range of high transparencies for a narrow range of exposures.

As contrasted with the prior method, the present invention proposes a method in which the gradation of the gray wedge 6, illustrated in Fig. 2<sup>a</sup> combined with the triangularly shaped cut-out 5 of the diaphragm 4, is arranged in the opposite direction, as shown in Fig. 4 wherein the gray wedge is designated with 8<sup>a</sup>. Fig. 5 shows the characteristic 12 of a sound record produced by a control making use of the device diagrammatically illustrated in Fig. 4. Within the range in which the characteristic of the pure variable density record is a straight line, the characteristic of Fig. 5 also is a straight line. But this straight line is now parallel to the abscissa or exposure axis. This is due to the fact, that the control of the width of the record is effected inversely to the control of the transparency of the film, so that the light which during the scanning passes through the film, remains practically constant within the range indicated by the parallel straight portion of the characteristic of Fig. 5. In those portions, however, in which the characteristic of Fig. 1 shows curves, at 9<sup>a</sup> and 9<sup>b</sup>, the characteristic 12 of Fig. 5 shows curves at 12<sup>a</sup> and 12<sup>b</sup>, which are oppositely directed to those of Fig. 1. This indicates that with a controlling device as illustrated in Fig. 4, it is possible to compensate all those defects which are caused in a normal variable density recording by the curvatures of the characteristic.

Practically, the invention as outlined above, provides two substantially advantageous applications in the art of sound films.

The first employment may, for instance, be one in which a single control or regulating mechanism is used to produce a normal variable density record, and parallel and in phase therewith a sound record of the type of the present invention is produced. These two sound records, which appear on the film side by side are then reproduced according to the push-pull method. Fig. 6 illustrates diagrammatically a control device of this type, namely a diaphragm 14 having

a rectangular cut-out 15 for the normal variable density record, and also having a triangular shaped cut-out 16 for the sound record of the present invention. The slit is designated with 17 and the gray wedge covering both cut-outs with 18.

This method has the advantage that, owing to the auxiliary record, the toe and shoulder curves of the characteristic 9 of Fig. 1 may be counteracted or compensated, thereby producing a sound record of variable density which not only may be regulated as to transparencies up to their maximum values, but also may be reproduced absolutely free of distortions. Thus, it would be possible to add to a normal variable density record, the present auxiliary record as a matter of precaution. If then the normal variable density record on the finished film is satisfactory, this normal variable density record will be the one which is employed exclusively for making the theatre films. If, however, the exposure of the film of its subsequent processing has been faulty, it is feasible to produce a second record by employing together with the normal record the auxiliary record and to compensate by means of this auxiliary record any distortions which had their origin in defective exposure or in irregularities during processing. It should also be mentioned that the present method makes it possible at these points of the record at which the regulation has been a feeble one only, to utilize a very low transparency because in this manner the curved parts 9<sup>a</sup> and 9<sup>b</sup> of the characteristic 9 of Fig. 1, may be compensated. Therefore, the present method provides for a considerable increase in volume or intensity of sound.

The second employment of the invention consists in the combination of the same with a normal variable density sound record, whereby the scanning is accomplished in conventional manner and not by the push-pull method. Fig. 7 illustrates diagrammatically a control mechanism for this manner of practicing the invention, in which the diaphragm plate 20 has a single trapezoidal cut-out 21, movable relatively to the slot 22, and covering three wedges 23, 24 and 25 of which the center one is arranged with its denser portion opposite to the denser portion of the other wedges. It is true, that in this instance there is not produced a characteristic with a straight curve, but there is produced an absolutely symmetric characteristic which has advantages, inasmuch as with a symmetric characteristic, the distortions due to the curvature of the characteristics are far less obnoxious than in a sound record having an asymmetric characteristic.

It is of particular advantage to make use of a mirror oscillograph for the control of the light in the method of the present invention, and particularly in those two methods which have been described in the above. The mirror oscillograph would utilize the triangular diaphragm in combination with a gray wedge or with an edge which is reproduced in blurred condition on the slit and parallel to the same.

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