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F. STEUBE
PRODUCTION OF SOUND RECORDS
Filed Feb. 17, 1942

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2 Sheets-Sheet 1

Fig. 1

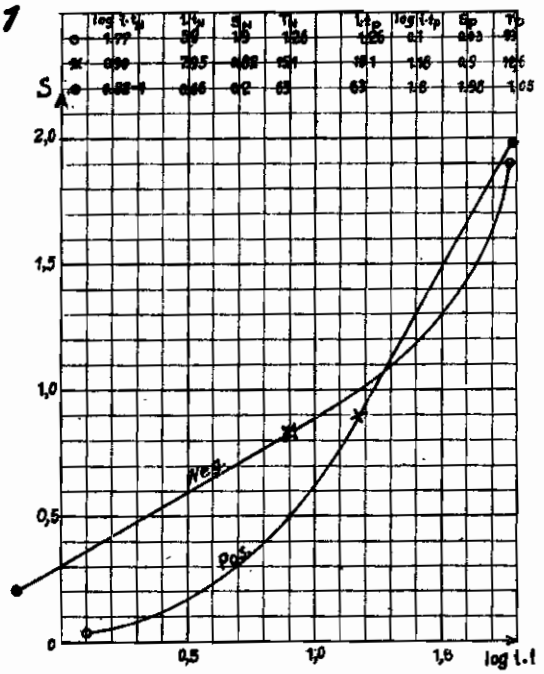
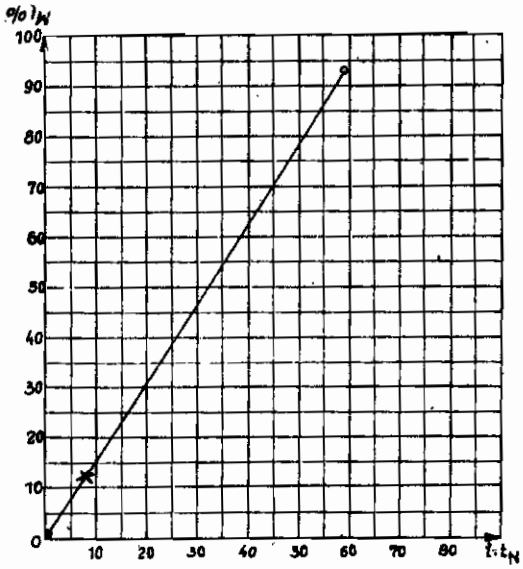


Fig. 2



Fritz Steube, inventor
By
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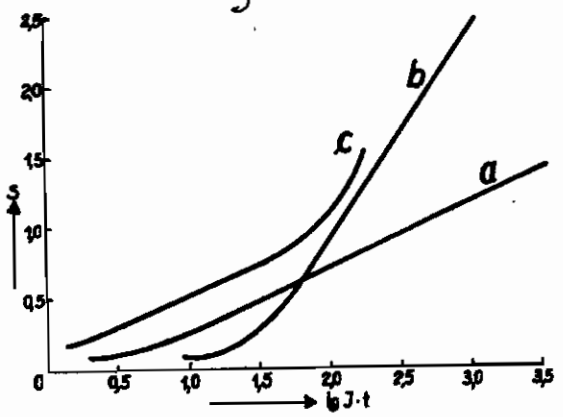
Fig. 3



Fritz Steube, inventor

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ALIEN PROPERTY CUSTODIAN

PRODUCTION OF SOUND RECORDS

Fritz Steube, Leipzig W 33, Germany; vested in the Alien Property Custodian

Application filed February 17, 1942

My present invention relates to the production of sound records and more particularly to a method in which a negative film having an especial blackening curve is used.

In accordance with my invention there is used a negative emulsion having a blackening curve so constructed that a straight copy transparency curve starting from a transparency value below 2% and ending with a value of about 80% is obtained with the usual blackening curve of the positive film. In the production of sound films according to the varying density recording system and preferably in the production of sound records free from background noises (unmodulated frequency transparency distortion) it is especially important that there is a straight transparency curve as long as possible which also takes a fully linear course with low transparency values. This requirement must be fulfilled at all events in normally recording free from background noises as well as in recording according to the push-pull-B-method and the track-limiting-method.

The invention will be better understood from the following description when considered in connection with the accompanying drawings. Referring thereto Figure 1 shows a positive and a negative blackening curve, Figure 2 a transparency curve, and Figure 3 three different negative blackening curves.

For the production of varying density records the straight line method or the "toe"-method have hitherto been used. In the straight line method (the blackening curve of the negative film is represented by the curve *a*, Figure 3) there are utilized the straight parts of the negative and positive blackening curves which must satisfy the requirement of yielding the gamma product 1. In this case the copy transparency curve starts from very low transparency values but ends already relatively nearly at a value of about 20% that is approximately the point × where in Figure 1 the straight part of the positive blackening curve begins. The straight line method is conveniently used for methods free from background noises. However, it is of disadvantage inasmuch as only a relatively small sound volume is attained in the reproduction. The "toe"-method (the negative blackening curve is designated by *b* in Figure 3) which depends in the negative as well as in the positive upon the bowed lower parts of the blackening curve overcomes this drawback. In Figure 1 the positive blackening curve is utilized approximately from O to ×. The resulting minimum unmodulated frequency transparency, however, is relatively great so that a satisfactory "noiseless" effect cannot be obtained.

In using normal positive film it has hitherto not been possible to combine both methods mentioned above in such a manner that the advantages of the two recording systems are also maintained as far as possible. This combination is made possible in accordance with the present invention by using an especially constructed negative blackening curve of the type as designated by *c* in Figure 3.

Figure 1 shows the normal positive blackening curve and the negative blackening curve which in connection with the former curve yields the copy transparency curve as represented in Figure 2. The negative blackening curve is rectilinear with low densities. The gamma-value thereof is the reciprocal of the positive gamma in the rectilinear portion. With higher densities about from S=0.8 the negative blackening curve is characterized by a gradual increase of the gamma-value. The course of the curve, however, may then again be rectilinear in the range of high densities.

In order more fully to illustrate the correlations between the Figures 1 and 2 three certain points ., ×, and O are represented therein. In Figure 1 the values thereof are moreover given numerically. The point O of the negative curve corresponds with a light amount of $i.t_N=59$ (Figure 2) .log i.t then is 1.77. By this illumination the blackening 1.9 or the transparency 1.26% is obtained on the negative. If the light amount i.tp of a copying light passing through the above-mentioned blackening of the negative is 1.26 and log i.tp is 0.1 (Figure 1, point O of the positive curve), the corresponding blackening is 0.03, i. e. T=93%. This value has been plotted in Figure 2 as the ordinate for O. In an analogous manner the points . and × of Figures 1 and 2 have been determined.

A negative emulsion which fulfils these conditions may be obtained by mixing at least one flatly graduated high-sensitive emulsion with at least one steeply graduated less sensitive emulsion in an appropriate proportion or casting the emulsions to form at least two layers. In this latter combination in which the "mixing proportion" may, for instance, be adjusted by controlling the thickness of the layers it is preferably possible to sensitize one or both above mentioned types of emulsion in the same or different colors and to adapt the gradation curve as completely as possible, the positive emulsion with suitably varying the color of the light during exposure.

Moreover, screen dyes and other substances usual in the production of photographic layers may be added to one or both emulsions.

The advantages which are reached in using such negative curves are great. As the most important advantage there is to be mentioned the great dynamics which can chiefly be obtained with recordings free from background noises. A further advantage resides in the superiority to the "toe"-method respecting the necessary constancy of the copying light and the strict observation of the working conditions. Inconsiderable changes of these both factors hardly influence the recording of small amplitudes which is mainly important for estimating the quality of a method. Furthermore a remarkable increase of the sound volume of about 5–10 decibel is attained compared with the straight line method. The scratching factor corresponds with that of the straight line method. Hence it is essentially lower than that of the "toe" method.

Besides the above mentioned improvements of the recording according to the "noiseless" varying density recording system combined with unmodulated frequency transparency distortion and according to the B-varying density recording system there are further advantages of the negative emulsion in question in using the track limiting varying density recording system. Due to the greater sound volume the varying density has hitherto been recorded subsequently to the "toe"-method. For this method there are necessary comparatively low copying light intensities which, however, cannot sufficiently blacken the lateral cover portions. Owing to the negative emulsion of the present invention this drawback is avoided by using as the "toe" the transition region between the flat and the steep portions of the blackening curve. It is understood that the flat straight region of the curve is conveniently utilized additionally.

FRITZ STEUBE.