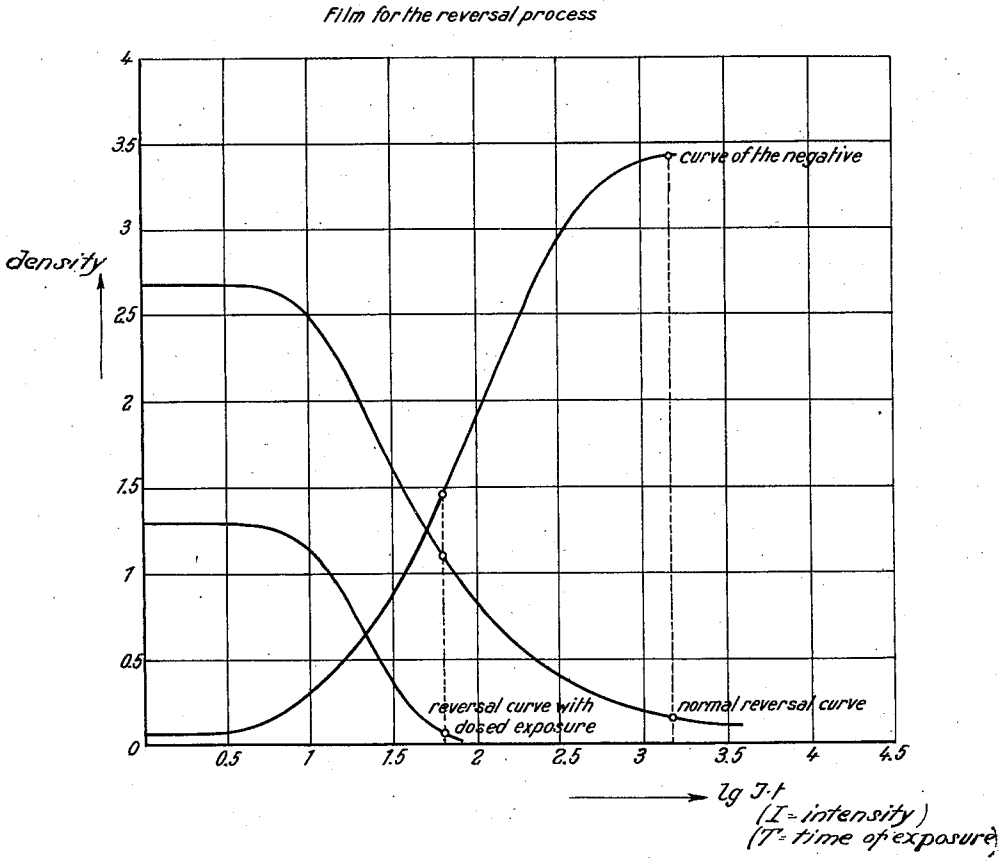
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RECORDING SOUND PHOTOGRAPHICALLY

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RECORDING SOUND PHOTOGRAPHICALLY

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Our present invention relates to photographic sound recording.

One of its objects is to provide a process of producing a photographic sound record according to the reversal method. Further objects will be seen from the detailed specification following hereafter.

In developing photographic sound records according to the reversal method a sound track is obtained which yields a bad rendering of frequencies. The cause resides in the fact that, for instance, for the recording of sounds according to the variable area method, an extremely strong first exposure must be applied in order to obtain the minimum density that is to say the density which corresponds with the fog of the photographic material. This is clear when considering that of a section of film which after reversal shall have only the density caused by the unavoidable fog, the emulsion layer must be blackened throughout its thickness by the first exposure and the first development so that the silver is completely removed from this section in the bleaching operation. In the reversal processes usual in the making of cinematographic pictures, the lowest possible density, after reversal, is obtained only with densities of between 2.5 and 3, measured after the first development. Considering the extraordinarily large amounts of light to which the layer, for obtaining so intense a density must be exposed, it is evident that the reproduction of high frequencies is heavily impaired owing to spreading.

According to the present invention the course of frequencies of a sound record on reversal film is considerably improved by conducting the exposure during the recording of sound and the further manipulation of the film in such a manner that the density obtained after the first development, that is to say the highest density of the negative, which corresponds with the lowest possible density after reversal, that is to say with the density caused by the fog, does not exceed a value of about 1.8 density units. The density D is calculated from the formula:

$$D = \log_{10} \frac{\text{incident light}}{\text{transmitted light}}$$

This value is obviously dependent upon the gradation of the emulsion to a certain extent so that only emulsions having a $\gamma > 1$ should be used. In the case of $\gamma < 1$ the exposure must produce an increase of density less than 1.8. It may also be preferable to use an increase of density less than 1.8 in the neighbourhood of $\gamma = 1$, for instance $\gamma = 1$—1.5. In this case an increase of density of about 1.4 to 1.6 may be selected. This may be achieved, for instance, by recording sound on photographic layers having so low a content of silver, or on layers being so thin that the silver halide contained in them suffices only to produce a density of 1.8 after the first development if the film is exposed throughout the thickness of the photographic layer. Or, when using a layer with a normal content of silver, precautions can be taken that only part of the unchanged silver bromide which is left after the first development is utilized for the production of the final sound record. Measures suitable to this effect are, for instance, a dosed second exposure or a dosed second development, or a reduction of the residual picture of silver bromide prior to the second development, or the like.

A preliminary exposure of the film to the required light intensity and limited to the zone of the film which is to receive the sound record, is also a suitable expedient.

The effect of a dosed second exposure on the reversal development of a cinematographic film is illustrated, by way of example, in the accompanying drawing, in which the exposure curves of a negative and of positives obtained according to a normal reversal process and according to a process using a dosed second exposure are shown.

In the drawing the "negative curve" represents the density produced in the first development of the reversal film as a function of the exposure, whereas the "normal reversal curve" represents the densities obtained after dissolution of the first silver picture and after the second development of the silver bromide residual picture which has been exposed throughout. If this normal reversal is to yield, during the second development, a normal minimum density of about 0.17, that is to say the density due to the fog of the film, there must be obtained as appears from the curves, a very intense density during the first exposure, which according to the present example would be realized by an exposure of $\log I.t = 3.13$, in which formula I is the intensity and t the time of exposure. When applying so intense a first exposure there would be produced a heavy spreading, so that the reversed sound film would be practically useless.

However, by dosing the amount of light employed in the second exposure, for instance by reducing the source of light, which at a voltage of 220 operates a complete illumination, to a voltage of 120, the "reversal curve with dosed ex-

posure" is obtained. In this case a maximum density of only 1.45 on the negative curve corresponds with a minimum density of only 0.07 on the reversal curve. To this end the exposure is effected in recording sound with an intensity of light of log $I.t=1.8$ only, so that spreading in the sound record need not be feared.

If the aforesaid mode of operation is applied for the registration of sounds according to the variable density method the highest density is given only such a value (in any case below $d=1.8$), that after the dosed exposure and reversal the minimum density lies so much above the density due to the fog (for instance $d=0.25$) that the corresponding value of the transparency still lies on the rectilinear part of the transparency curve.

The process of recording sounds on reversal film as described may be used for the production of films bearing besides the sound record also a picture record.

What we claim is:

1. A process of producing photographic sound records on a moving reversal film having a $\gamma>1$ and provided with a silver emulsion which comprises modulating a beam of light in accordance with sound vibrations, projecting said beam of light on said reversal film, the maximum exposure producing a density on the film of not more than about 1.8, working up the film in such a manner that after it has been treated according to the reversal method, the minimum density on the film corresponding with the maximum exposure is substantially equal to the density of the fog of the finished film.

2. A process of producing photographic sound records on a moving reversal film having a $\gamma>1$ and provided with a silver halide emulsion which comprises modulating a beam of light in accordance with sound vibrations, projecting said beam of light on said reversal film, the maximum exposure producing a density on the film of not more than about 1.8, said reversal film having been preexposed to such an extent that the maximum exposure in recording sound produces a density of the film that after reversal the places of maximum exposure on the film show a minimum density substantially equal to the density of the fog of the finished film, and working up the film according to the reversal method.

3. A process of producing photographic sound records on a moving reversal film having a $\gamma>1$ and provided with a silver halide emulsion which comprises modulating a beam of light in accordance with sound vibrations, projecting said beam of light on said reversal film, regulating the intensity of said projected light so that the maximum exposure produces a density on the film of not more than about 1.8, developing said film, removing the silver, exposing said film a second time to actinic light, regulating the amount of said light so that after a further development the minimum density on the film corresponding with the maximum exposure is substantially equal to the density of the fog of the finished film, developing said film a second time, and fixing said film.

4. A process of producing photographic sound records on a moving reversal film having a $\gamma>1$ and provided with a silver halide emulsion, which comprises modulating a beam of light in accordance with sound vibrations, projecting said beam of light on said reversal film, the maximum exposure producing a density on the film of not more than about 1.8, developing said film, removing the silver, exposing said film a second time to actinic light, developing said film a second time to such an extent that after a further fixing operation the minimum density on the film corresponding with the maximum exposure is substantially equal to the density of the fog of the finished film, and fixing said film.

5. A process of producing photographic sound records on a moving reversal film having a $\gamma>1$ and provided with a silver halide emulsion which comprises modulating a beam of light in accordance with sound vibrations, projecting said beam of light on said reversal film, said reversal film containing so much silver that the exposure produces a maximum density of 1.8, and working up the film according to the reversal method.

6. A process of producing photographic sound records on a moving reversal film having a $\gamma>1$ and provided with a silver halide emulsion, which comprises modulating a beam of light in accordance with sound vibrations, projecting said beam of light on said reversal film, the maximum exposure producing a density on the film of not more than about 1.8, developing said film, removing the silver, exposing said film a second time to actinic light, reducing the remaining amount of the silver halide in a fixing bath until after a second development the minimum density on the film corresponding with the maximum exposure is substantially equal to the density of the fog of the finished film, and developing said film a second time.

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