March 12, 1940. K. SCHWARZ 2,192,988

PRODUCTION OF PUSH-PULL SOUND RECORDS

Filed May 31, 1938

Fig. 1.

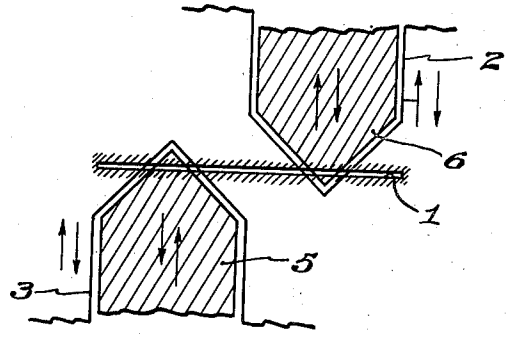


Fig. 2.

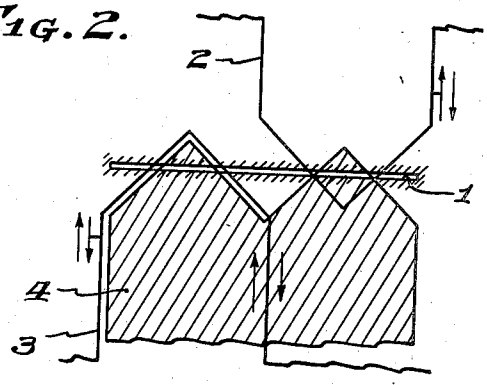


Fig. 3.

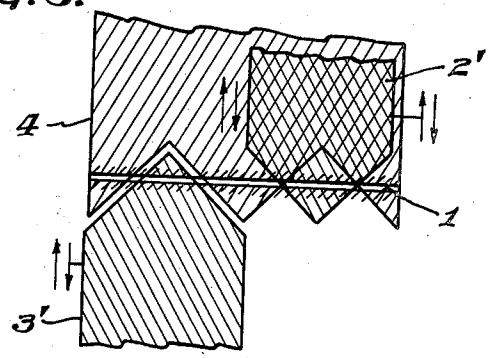


Fig. 4.

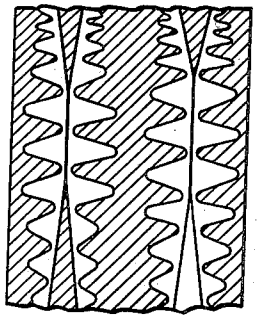
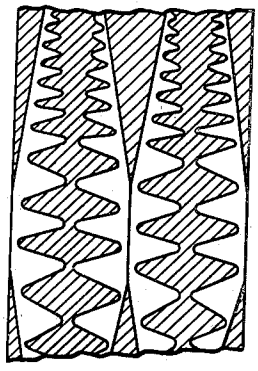


Fig. 5.



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PRODUCTION OF PUSH-PULL SOUND RECORDS

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In Germany June 5, 1937

5 Claims. (Cl. 179—100.3)

The present invention concerns the making of push-pull sound records, particularly the making of push-pull sound tracks of the uni- or multi-double hump variable area type. However, the invention can also be applied to push-pull records of the variable density type if a dynamics compensation is provided for the loss which occurs at small amplitudes.

By push-pull records one means those records with which two sound tracts the phases of which are displaced by 180° are made.

With the push-pull record of the variable area type two kinds of records can be distinguished: First, the so-called Class-A (in connection with the Class-A amplifier) and the second, the so-called Class-B (in connection with the Class-B amplifier). With the Class A record the luminous spot in the position of rest is over the slot. Therefore, the film has an exposure of rest. With the Class-B record the luminous spot in the position of rest is at the top edge or the bottom edge of the recording slot.

The Class-B record has no ground noise, but has the great disadvantage that the small amplitudes are recorded in a distorted fashion because the amplitudes become linear only from that point where the point of the recording light has reached the top slot edge, i. e. lies over the entire slot. Therefore, pronounced distortions occur in reproducing with small amplitudes.

Therefore, the Class-A record is preferably employed for recording. However, this record has ground noise which is very disturbing especially with small amplitudes.

For this reason, it has been suggested to blacken those sections of the sound track that are not used for recording on the positive, so that the mean transparency over the entire sound track becomes smaller with small amplitudes. This blackening is accomplished by covering the luminous spot, making the record, by an additional diaphragm, the so-called noiseless diaphragm, which is moved at the rhythm of the envelope or volume of the sound vibrations. In this way, the corresponding points become transparent on the negative and are blackened on the positive.

The well-known noiseless diaphragms have such a position in relation to the recording diaphragm or to the recording ray that they nearly cover it up and allow light to fall only on a small section of the film which is transparent on the positive print.

In recording a double tooth or hump record, the motion of such a noiseless diaphragm takes place in such a way that with small amplitudes the diaphragm protrudes far into the slot and correspondingly recedes with large amplitudes. Consequently, the noiseless diaphragm moves in the direction of motion of the recording diaphragm.

However, in the recording of a push-pull record the two recording rays, that are triangular, for example, move counter-movement-like over the slot, i. e. when one light triangle moves toward the slot, the other recedes correspondingly. Therefore, with small amplitudes the noiseless diaphragms must move toward each other and with large amplitudes, away from each other. Consequently, their motion takes place in the opposite direction and is in the contra-phase.

This reciprocal motion of the noiseless diaphragms can be effected only by complicated mechanical devices and, therefore, has great disadvantages.

The present invention relates to an improvement and a simplification of such diaphragms. According to the invention, the two noiseless diaphragms are arranged on the same side of the recording slot, so that they can be moved in one direction and at an equal phase over the slot. In this way, it is possible to design a very simple driving mechanism for these diaphragms. Another inventive idea is to make the diaphragms of a single piece, e. g. of a piece of plate. The effect obtained is, however, the same as mentioned above. With small amplitudes, the noiseless diaphragms protrude far into the slot, with large amplitudes, they recede.

One object of the invention is to provide an improved push-pull recording apparatus.

Another object of the invention is to provide an improved method of push-pull recording.

Another object is to provide an improved ground noise reduction mask.

Other and incidental objects of the invention will be apparent to those skilled in the art from a reading of the following specification and an inspection of the accompanying drawing, in which:

Figure 1 shows the hitherto customary arrangement of the noiseless recording diaphragms,

Figures 2 and 3 illustrate the noiseless diaphragms according to the present invention, and

Figures 4 and 5 show the positives of sound records made with such diaphragms.

Referring first to Fig. 1, the recording slot over which luminous triangles 2 and 3 move (in push-pull relation) is indicated at 1. In each case,

the arrows indicate the direction of oscillation of the recording diaphragms or the corresponding direction of motion of the noiseless diaphragm. The noiseless diaphragms that must move in the hitherto well-known manner in the opposed direction and in contra-phase are designated at 5 and 6.

Fig. 2 shows the diaphragm arranged according to the present invention. The recording slot over which luminous triangles 2 and 3 move is indicated at 1. The noiseless diaphragm which moves in accordance with the envelope of the sound vibrations recorded is designated with 4. According to the invention, the two parts of this diaphragm move over the slot at an equal phase and in one direction. With small amplitudes the diaphragm parts have about the position indicated, so that a large section of the sound track is blackened on the positive. With large amplitudes the diaphragms recede correspondingly to afford space for the wider resulting record produced.

Fig. 3 differs from Fig. 2 by the fact that diaphragms 2′ and 3′ are designed as opaque diaphragms which modulate the light, falling on the recording slit 1 according to the sound vibrations. In this case, the noiseless diaphragm 4 moves to and fro in accordance with the envelope of the sound waves over the recording slit 1. With small amplitudes the outside edges are blackened by the diaphragm 4 and the center of the two sound tracks are blackened correspondingly by the diaphragms 2 and 3. With large amplitudes noiseless diaphragm 4 recedes, so that the blackening is a minimum on the positive.

These considerations show that with the diaphragms, as they are illustrated in Fig. 2 or Fig. 3, there can be obtained push-pull records, as they are represented as positive in Figures 4 and 5, that possess a pronounced blackening with small amplitudes and with which the mean transparency is small with small amplitudes. It should be understood in the case of Fig. 3 that the light reaching the slit 1 is determined or controlled by the diaphragms 2′, 3′ and 4.

Having now described my invention, I claim:

1. In combination with sound recording apparatus having a slit member adapted to select a predetermined portion of a pair of oppositely moved triangular beams of light, a unitary obscuring member movable to and fro in a single direction across said slit in such relation to said beams of light as to simultaneously obscure similar portions of both beams.

2. The method of producing a ground noise reduction push-pull sound record, comprising the steps of vibrating two triangular beams of light oppositely across a slit in accordance with the sound waves to be recorded, and simultaneously and similarly obscuring portions of said beams in accordance with the envelope of the sound waves to be recorded by a single masking member.

3. In combination with sound recording apparatus having a slit member adapted to select a predetermined portion of a beam of light having oppositely directed triangular beam-defining portions, a unitary obscuring member movable to and fro in a single direction across said slit in such relation to said beams of light as to simultaneously obscure similar portions of both beams.

4. The method of producing a ground-noise reduction push-pull sound record comprising the steps of vibrating a beam of light having two oppositely-directed triangular beam-defining portions across a slit in accordance with the sound waves to be recorded, and simultaneously and similarly obscuring portions of the complementary parts of said beam in accordance with the envelope of the sound waves to be recorded by a single masking means.

5. Apparatus for making push-pull sound records free from ground noise including a slit member, means for directing a modulated beam of light including two oppositely-directed triangular beam defining portions upon said slit, and two integral diaphragms adapted to be simultaneously and similarly moved across the slit in said member.

KARL SCHWARZ.