

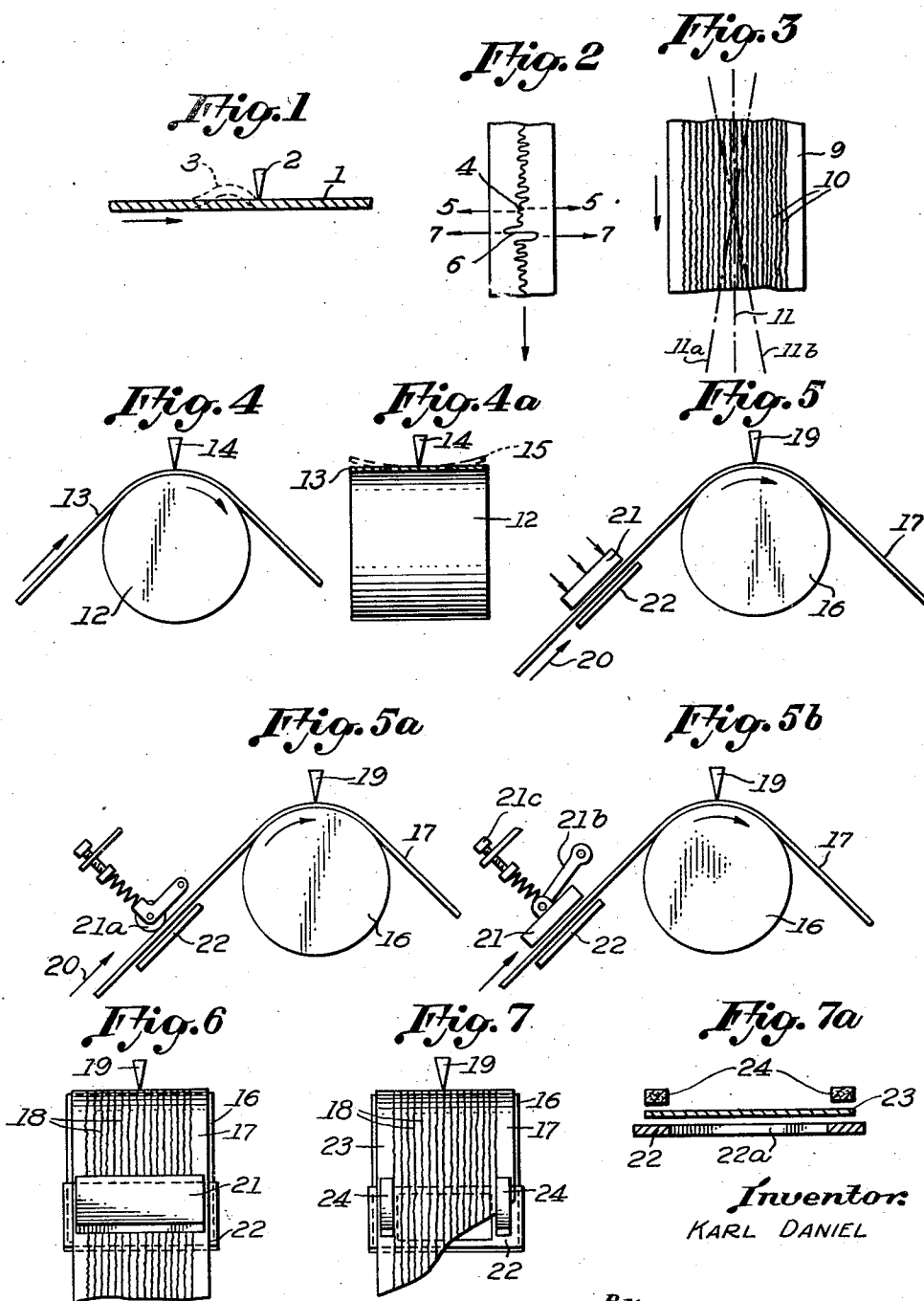
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MECHANICAL SOUND RECORDING AND REPRODUCTION

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MECHANICAL SOUND RECORDING AND REPRODUCTION

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The invention relates to a method and device for mechanical sound recording or mechanical sound reproduction and its object is to provide a compensation for the irregularities caused in the movement of the sound record support by the recording stylus or cutter in sound recording or by the reproducing needle in sound reproduction.

In all kinds of sound recording and reproducing apparatus, it is, as is known, necessary to satisfy the condition that the record support, both in sound recording and also in sound reproduction should move past the control point at constant speed and with perfect steadiness. In apparatus in which the recording or reproduction of sound is effected optically, this condition is easy to satisfy, because in this case sound recording and sound reproduction are effected by means of a beam of light which does not cause any irregularities in the movement of the band at the control point. Feed devices for photo-sound apparatus therefore only have to satisfy the general technical conditions of any apparatus for steady feeding of the band, that is to say, the record support has only to be slightly impeded in front of the control point. It is obvious that such impeding must be effected in front of the control point regarded in the direction of feed of the band, because as is well known this condition must be observed in all apparatus, for example also cinematograph projectors, in which a band is fed and it is necessary to satisfy the condition that this band should move or lie flat at some place or other which may be referred to generally as the control point.

The conditions in needle sound apparatus are quite different, because in the case of such apparatus both sound recording and sound reproduction are effected by means of a recording stylus or cutter or a reproducing needle, which is in positive contact with the sound record support. The pressure with which the cutter or reproducing needle is applied to the sound record support is extraordinarily great. Thus for example, when recording on a gelatin coated sound record support, the effective pressure is about 70 kg./sq. cm. when the surface of contact of the cutter is already somewhat worn by use, while it is considerably higher when the cutter point is not worn.

This high effective pressure and the coefficient of friction between the cutter or needle and sound record support exert a braking effect on the movement of the latter, regardless of whether the recording is effected in lateral recording or in

contour (hill-and-dale) recording, the braking effect being dependent upon the recording amplitude, so that it varies continuously during recording and during reproduction. In needle sound apparatus, therefore, contrary to photo-sound apparatus, an irregularity is introduced into the steady feed of the sound record support, resulting from the special peculiarity of the method of needle sound recording and reproduction, and its compensation naturally requires technical measures which go far beyond the measures necessary in photo-sound apparatus.

If lateral recording is employed, a further irregularity is introduced into the movement of the sound record support by the fact that in sound recording, the cutter makes a reciprocal transverse movement relative to the direction of travel of the record, and thereby tends to move the sound record support alternately sideways. Vibrations, resulting in a defective sound record, are thereby set up in the sound record support. The same applies correspondingly to sound reproduction with lateral recording, since in this case the reproducing needle is caused by the sound record support to make lateral vibrations producing reaction forces in the sound record support which likewise appear as vibrations.

These conditions occurring in all needle sound apparatus have a particularly pronounced effect in those types which employ a relatively wide band as sound record support on which a plurality of parallel sound records are accommodated. Taking for example a band 35 mm. wide, the recording grooves of which occupy a width of 25 mm., it is by no means the same whether the first or the last sound groove is recorded or played, because in one case the groove passes through the control place is 5 mm. from one edge of the band, but in the other case it is 30 mm. from the same edge. The fluctuating braking while the band is passing through the control point, in this case, not only acts on the speed of the band as such, but the different longitudinal sections of the band are given different speeds, so that the moving band has a tendency to rock about an axis at right angles to its surface and to set itself alternately obliquely to the direction of feed. This results either in transverse dragging of the band or warping, the consequence of which is that the band no longer runs in close contact with the supporting surface at the control point, and may even be completely deformed and prematurely lose its usefulness.

It is the object of the invention to eliminate

these disadvantages occurring with needle sound apparatus, and this is accomplished by exerting directly on the sound record support in front of the control point a pressure, the braking effect of which is greater than the braking effect exerted by cutter or needle on the sound record support at the maximum amplitude in sound recording or sound reproduction.

In sound record supports with lateral recording, the magnitude of the pressure exerted in front of the control point is in addition so proportioned that it at least maintains equilibrium with the lateral mechanical stresses of the sound record support in sound recording and reproduction.

The braking effect exerted by pressure on the sound record support in front of the control point in an apparatus for either recording or reproducing, is preferably about two orders of magnitude greater than the braking effect or lateral stressing of the sound record support exerted by the cutter or reproducing needle at maximum amplitude.

In apparatus intended both for sound recording and for sound reproduction, the braking effect exerted on the sound record support in front of the control point is so selected that it amounts to a multiple of the braking effect or lateral stressing of the sound record support exerted by the cutter when recording the maximum amplitude.

In apparatus in which the sound record support is a band having a plurality of adjacent sound grooves, the braking effect in front of the control point is preferably exerted by a pressure on the entire width of the band, but it has been found that the desired result is also obtained when the brake pressure is exerted only on the two unrecorded edges of the band.

For carrying out the method according to the invention, the latter provides a slide brake or runner brake, situated in front of the control point of the sound recording or reproducing apparatus, and acting directly on the sound record support and preferably having its brake pressure adjustable.

In the accompanying drawing:

Figures 1, 2, 3, 4 and 4a illustrate the disadvantages occurring in needle sound apparatus, the elimination of which is the object of the invention.

Figures 5, 5a, 5b, 6, 7 and 7a show diagrammatically some constructional examples of a device for carrying out the method according to the invention.

In Figure 1, 1 denotes a film band, in the gelatin layer of which a sound groove is cut by means of a cutter 2. The resistance encountered at the cutter in doing this causes the film band to warp or buckle in front of the cutter, as indicated at 3. In contour or hill-and-dale recording, this resistance varies with the amplitude to be recorded, and the same applies in lateral recording. Irregular movement of the film band at the control point is caused thereby.

Making a sound record in lateral recording further results, according to Figure 2, in the film band being moved to-and-fro laterally, according to the amplitude to be recorded. If the amplitude is small, as at 4 in Figure 2, small, lateral movements of the film band take place, as indicated by the arrows 5, the film band being moved alternately to the right and left. If the amplitude is large, as at 6 in Figure 2, large lateral movements occur, as shown at 7. In

addition to these lateral movements, there are also the fluctuations in the film movement occurring in the direction of the film 8 and having their cause in the disadvantages illustrated in Figure 1.

Figure 3 shows a film band 9 having a plurality of adjacent parallel sound grooves 10. The longitudinal axis of the film is indicated by the dot-and-dash line 11. While the cutter is cutting the left or right hand outer sound grooves in sound recording, the movement of the film band is retarded on the left or right hand side. The consequence of this is that the film axis 11 assumes an oblique position. The extreme oblique positions of the film axis are shown exaggerated at 11a and 11b. These oblique positions of the film band likewise result in incorrect sound recording or reproduction.

Finally, operation with the cutter also results in warping of the film band in a transverse plane. This is illustrated in Figure 4, in which in end view and in Figure 4a side view the control drum is denoted by 12, the film by 13 and the cutter by 14. The cutter presses the film against the control drum, and due to this pressure the film band bends or warps as shown exaggerated at 15. When the cutter operates in the middle of the film band, the warping of the latter is symmetrical, but warping is absolutely unsymmetrical when the cutter is cutting sound grooves in the vicinity of the unrecorded edges of the film band.

The disadvantages occurring in sound recording as shown in Figures 1 to 4 also occur correspondingly during sound reproduction, in consequence of the use of a reproducing needle.

These disadvantages may all be obviated according to the invention by exerting directly on the sound record support in front of the control point a pressure, the braking effect of which is greater than the braking effect exerted on the sound record support at maximum amplitude by the cutter or needle, the magnitude of the brake pressure, if lateral recording is employed, being so proportioned that it at least maintains equilibrium with the lateral mechanical stresses of the sound record support. Experiments have shown that the pressure is conveniently selected to be so great that its braking effect is substantially two orders of magnitude greater than the braking effect or lateral stressing of the sound record support exerted by the cutter or reproducing needle at the maximum amplitude.

In apparatus intended both for sound recording and sound reproduction, the irregularities of the movement of the film band are greater in the case of sound recording than in the case of sound reproduction. It is therefore advisable to make the pressure exerted in front of the control point so great that its braking effect is a multiple of the braking effect or lateral stressing of the sound record support exerted by the cutter in recording the maximum amplitude.

In the case of narrow sound record supports with only one sound groove, it is as a rule sufficient if the pressure exerted on the sound record support in front of the control point is exerted on the middle part of the film band which is also provided with the groove. In apparatus in which the sound record support consists of a band provided with a plurality of adjacent sound grooves, the brake pressure must, however, be exerted over the entire width of the film band or at least uniformly on its unrecorded edges.

In Figures 5 and 6, 16 denotes the control drum, 17 the film band provided with a plurality

of parallel sound grooves 18, and 19 the cutter or reproducing needle. The direction of movement of the film band is shown by the arrow 20. In the direction of the movement of the film, there is situated in front of the control point defined by the cutter or reproducing needle a slide brake 21 which, as will be seen in Figure 6, extends over the entire width of the film band. The brake consists, for example, of a strip of felt or the like which is pressed against the film band, and a supporting plate 22 may be provided below the film band. A roller 21a may be employed instead of the plate, Figure 5a.

The brake may be incorporated in a film gate through which the film passes, but it may also be mounted on a spring-controlled lever arm 21b carrying the felt pad on its free end, Figure 5b. The pressure with which the felt pad is pressed against the film may be adjusted by the screw 21c.

Instead of a slide brake, in which a felt pad extends over the entire width of the film band, it is also possible to employ a runner brake acting only on the unrecorded edges of the film. Such a runner brake is shown diagrammatically in Figure 7. In this figure, 16 again denotes the control drum, 17 the film band provided with a plurality of parallel sound grooves 18 and 19 the cutter or reproducing needle. The unrecorded edges of the film band are shown at 23. As will be seen from the drawing, the brake consists of two narrow, runner-shaped felt strips 24 which bear only against the unrecorded edges of the film band and are pressed against said edges. In this case also, a plate 22 mounted on the apparatus housing and arranged below the film band serves to support it against the pressure of the brake strips 24, but it may be cut out in its middle part 22a corresponding to the sound grooves 18 of the film band as shown in the transverse section, Figure 7a. Instead of a supporting plate provided with a central cut-out portion, it is also possible of course to use two narrow plates situated below the unrecorded edges of the film.

The invention is not limited to the constructional examples shown and described, but on the contrary numerous modifications may be made, for example, in the construction and arrange-

ment of the slide brake or runner brake without departing from the essence of the invention.

I claim:

1. In apparatus for recording or reproducing sound by means of a sound record strip having transversely spaced multiple sound tracks thereon, a stylus selectively engageable with one of said sound tracks, and means for longitudinally moving the strip past the stylus, the combination therewith of braking means located in front of the stylus and effectively engaged with the strip for exerting thereon a longitudinal braking effect which is a multiple of the longitudinal braking effect exerted upon the strip by said stylus at the maximum amplitude, and including means for regulating the braking effect exerted thereby.

2. Apparatus for recording or reproducing sound by means of a sound record strip having transversely-spaced multiple sound tracks thereon with unrecorded edge portions, a stylus selectively engageable with one of said sound tracks, and means for longitudinally moving the strip past the stylus, the combination therewith of braking means including elements spaced transversely of the strip and located in front of the stylus and effectively engaged only with said unrecorded edge portions for exerting thereon a braking effect which is a multiple of the longitudinal braking effect exerted upon the strip by said stylus at the maximum amplitude.

3. Apparatus for recording or reproducing sound by means of a sound record strip having transversely-spaced multiple laterally-recorded sound tracks thereon with unrecorded edge portions, a stylus selectively engageable with one of said sound tracks, and means for longitudinally moving the strip in an arcuate path past the stylus, the combination therewith of braking means including elements spaced transversely of the strip and located in front of the stylus and effectively engaged only with said unrecorded edge portions for exerting thereon a braking effect which is a multiple of the longitudinal braking effect exerted upon the strip by said stylus at the maximum amplitude and for also exerting on said strip at points longitudinally spaced from the stylus a transverse braking effect for preventing lateral displacements of the strip by lateral mechanical stresses exerted by said stylus.

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