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CONTROL SYSTEM FOR SOUND FILMS

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FIG. 1

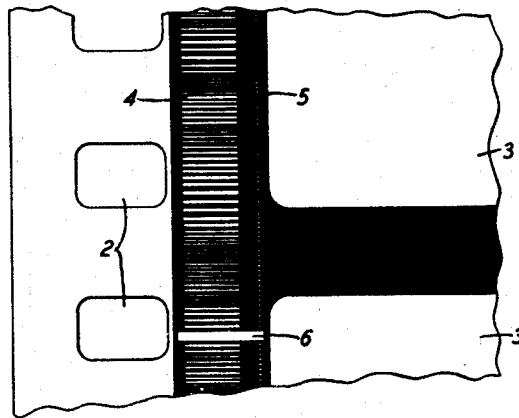


FIG. 2

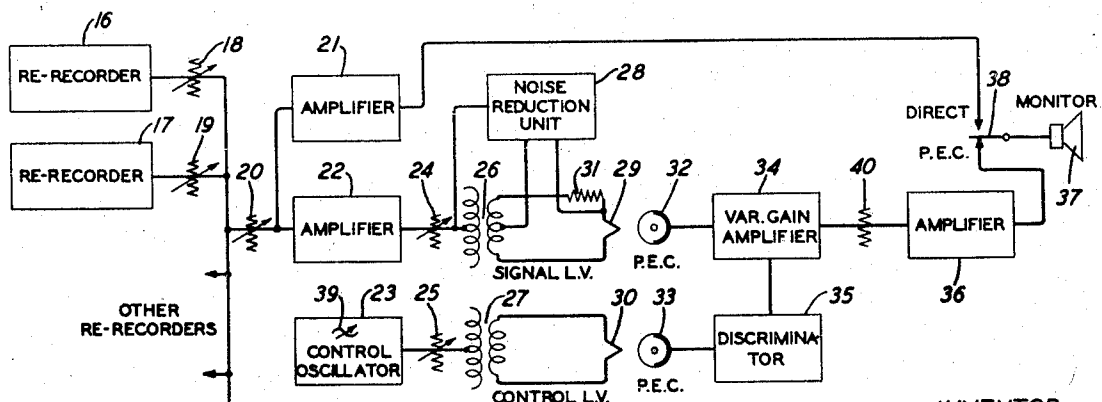
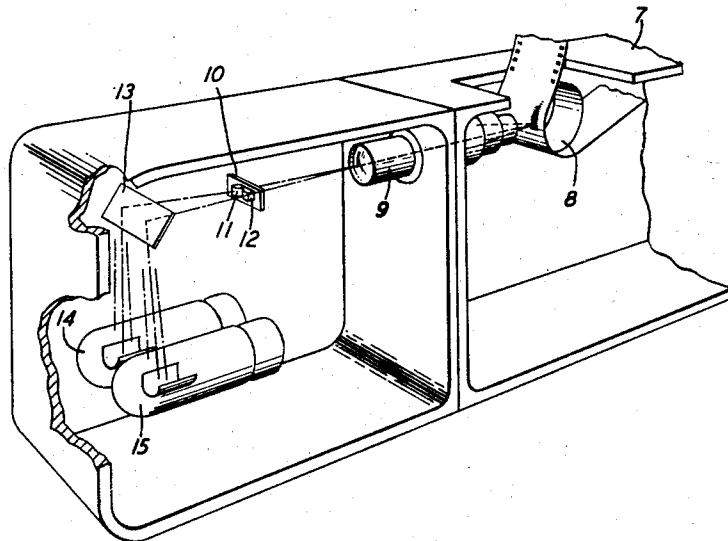


FIG. 3

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CONTROL SYSTEM FOR SOUND FILMS

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3 Claims. (Cl. 179—100.3)

This invention relates to sound recording systems and more particularly to systems for expanding the volume range of sound records photographically impressed on films.

It is the object of this invention to provide apparatus and methods by means of which sound picture films capable of reproduction in standard theatre equipment may be reproduced with greatly enhanced volume range in theatres which have been modified by adding to the standard existing apparatus a small amount of simple equipment.

A feature of the invention is the use with a sound picture film in which the picture and sound track appear in their normal positions and are of normal dimensions, of a control track of extremely narrow width. Owing to the extremely narrow width of the control track it may be placed between the sound track area and the picture area without interference with or from either area.

A further feature of the invention resides in the provision of apparatus suitable for reproducing the sound track and associated control track after they have been simultaneously scanned by existing standard reproducing equipment.

The invention will be best understood from the following detailed description, reference being made to the accompanying drawing.

In the drawing:

Fig. 1 shows the relative positions of sound track area, control track area and picture area on an enlarged portion of a standard motion picture film;

Fig. 2 shows the auxiliary equipment necessary to utilize the sound record and associated control track of Fig. 1; and,

Fig. 3 is a diagram showing the interrelation of various circuits used in recording the sound track and control record.

It is to be noted that that part of the equipment which is used as monitoring equipment during the recording operation is identical with the equipment used in the theatre during reproduction.

Referring now to Fig. 1 a portion of a standard photographic film is portrayed. The film is provided with the usual sprocket holes 2. Picture areas of standard dimensions are indicated at 3 and a standard sound track of standard width and in standard position is indicated at 4. The track shown is of the variable density type but may be any one of the relatively large number of types of sound tracks which are available at the present time. The control track is indicated

at 5. This track is of extremely narrow width, being of the order of 5 mils in width. It is a record of varying frequency, the frequency range extending preferably from 2,000 to 4,000 cycles. A rectangle 6 indicates the manner in which a single scanning light beam may be used to scan both tracks.

Fig. 2 shows the invention applied to standard reproducing equipment of the type more completely disclosed in U. S. Patent 2,094,063 which issued to J. C. Davidson on September 28, 1937. It will be obvious that the invention may be practiced with any desired form of film reproducing device.

A main housing 7 encloses a film driven roller 8 which forms a support for the sound film at the translation point. A scanning beam passes through an edge portion of the film including the sound track and control track, to an optical system terminating in an objective lens 9 which projects an enlarged image of the records to a fixed slit in the back of plate 10. Film propelling means and the optical equipment by means of which light from an exciting lamp is projected for the so-called rear scanning of the film have not been disclosed in detail as they are disclosed in complete form in the above-mentioned patent to Davidson. A beam splitting device of any well-known form may be used to divert that portion of the scanning beam which has traversed the sound track from that portion of the scanning beam which has passed through the control track. This device is indicated by optical elements 11 and 12 mounted on the front face of the element on the rear of which the slit plate is mounted. The diverging beams are reflected by a mirror 13 to photocells 14 and 15.

In practice it will probably be desirable to replace the standard slit plate 10 with a plate carrying a slit of slightly wider than standard dimensions, with the beam-splitting elements 11 and 12 previously mounted on the front of the plate, the whole constituting an easily mounted replacement unit.

In Fig. 3 the outputs of rerecorders 16 and 17, suitably mixed by means of control elements 18 and 19, are supplied to a main amplifier 22. The over-all volume of the mixed products of the rerecorders is controlled by a volume controlling device 20. The rerecorders are of standard form, being in effect high quality reproducers to which sound films recorded in accordance with standard practice are supplied. The mixed outputs of the rerecorders may be monitored by means of a monitoring loud-speaker 37

over a path including a power amplifier 21 and the upper contacts of a key 38. Sound track 4 is recorded on the sound film by means of a light valve 29 and control track 5 is recorded by means of a light valve 30. Details of the film driving mechanism and of the light valves are not necessary to an understanding of the invention as they may be of any desired form. Preferably the light valves 29 and 30 are part of a unitary structure four-ribbon light valve such as has been standard in this art for some time. In using a four-ribbon light valve the only modification necessary is suitable masking of the pole-pieces of the second valve so as to lay down the very narrow control track, which as has been previously stated, is of the order of 5 mils in width.

The mixed output of the rerecorders is amplified in an amplifier 22 and supplied to the signal light valve 29 by means of a transformer 26. A noise reduction channel indicated generally at 28 is bridged across the input to the signal recording circuit in accordance with well-established principles which need not be discussed in this connection. The output of the noise reduction unit which is rectified, and filtered current corresponding in amplitude to the envelope volume variations of the sound is supplied to the light valve circuit through a bridge or simplex circuit. An impedance 31 corresponding in value to the impedance of light valve 29 forms one arm of the bridge in accordance with established practice.

An oscillator 23 may be of any well-known type, its only requirements for the purposes of this invention being that its frequency may be manually varied by means of a control element 39. This control element may be a variable resistor, capacitor or inductor depending on the type oscillator used. The output of the oscillator is subject to volume regulation by means of a control element 25 and supplies the control light valve 30 through a transformer 27. A portion of the varying light beam recorded on the film by light valves 29 and 30 is directed to monitoring photoelectric cells 32 and 33. The output of the signal cell 32 is amplified in an amplifier 34 and after further amplification is directed to loud-speaker 37 by way of the lower contacts of key 38. The output of amplifier 34 is subject to control by regulator 40 which may vary either the volume or quality of the output. The output of cell 33 is applied to a discriminating network, so designed that the ratio of output voltage to input voltage varies with the frequency of the input in accordance with a suitable characteristic. The output of the discriminating network is amplified, rectified and filtered to provide a control voltage which is supplied to the variable gain amplifier 34 to regulate its volume.

It has not been considered necessary to disclose specific circuits for the circuit elements discussed in connection with Fig. 3. These circuit elements are in and of themselves well known in the art and form no part of the present invention.

The circuits necessary for reproduction in the theatre with enhanced volume effects are identical with those used during rerecording. Thus, photocell 14 supplies a variable gain amplifier corresponding to amplifier 34 and photocell 15 supplies a discriminating network corresponding to discriminator 35 which exercises a suitable control on the amplifier corresponding to amplifier 34. From this point the standard theatre power amplifiers and speakers may be used.

From the foregoing it is obvious that a film has been provided which is capable of reproduction by means of standard theatre equipment in which case no use is made of the control track. When the theatre is to be equipped to obtain an enhanced effect it is merely necessary to add the auxiliary apparatus of Fig. 2, a variable gain amplifier corresponding to amplifier 34, and a discriminator 35 and its associated amplifier, rectifier and filter.

The use of a frequency varied control track has numerous advantages over the use of an amplitude modulated control track, particularly when a track of very narrow width is contemplated. The amount of expansion controlled by it is not subject to variations caused by fluctuations in sound track density, reproducing lamp intensity or photocell sensitivity. It is also subject to much less variation due to accumulations of dirt and scratches which vary the transmission of the track.

While the signal to noise ratio of a 5 mil track is much lower than that of a track of standard width, it has been found possible to obtain an ample range of volume control. In practice, the output of the control photoelectric cell is passed through a conventional filter, which passes frequencies above 2000 cycles. The discriminator is tuned to 4000 cycles. A 30 decibel range of volume control may be obtained.

Given a 30 decibel range of volume control it may be desirable at times to utilize the system for increasing signal-to-noise ratio rather than merely as an enhancing control. Thus a 20 decibel range may be added to the upper volume level and the remaining 10 decibels utilized for bettering the signal-to-noise ratio of the film. If this is to be done, volume control 25 must be operated to increase the level in the signal channel supplying light valve 29 while simultaneously the oscillator control 39 is operated to produce a compensating adjustment on the control record. This method of operation produces a signal track in which the lower end of the volume range has been compressed and thus when reproduced in standard equipment will show a decreased over-all volume range. When reproduced in theatre equipment provided with equipment utilizing the control track the signal-to-noise ratio is better, due to the fact that when the lower levels are reproduced they will be further reduced in volume by the action of the control track. This reduction in volume will apply to both signal and noise and thus the over-all signal-to-noise ratio will be considerably improved.

Since the control track is intended for use on the release print, it is recorded during the dubbing operation on the release negative. Various individual tracks are mixed in the usual manner to maintain the proper balance between music, dialogue and sound effects. The control of the variable frequency oscillator is preferably located in the mixing console.

What is claimed is:

1. In a sound film system, a sound picture film including a normal sound track area, a sound track therein, a normal picture area, and a frequency-modulated control track of dimensions such that said control track may occupy the area between said normal sound track area and said picture area, and means for reproducing said sound picture film including a scanning device common to said sound track and said control track.

2. In a sound film system, a sound picture film

including a normal sound track area, a sound track therein, a normal picture area, and a frequency-modulated control track of the order of 5 mils in width occupying the area between the normal sound track area and said picture area, 5 and means for reproducing said sound picture film including a scanning device common to said sound track and said control track, the output of said normal sound track being subject, during said reproduction, to volume enhancement under 10 the influence of said control track.

3. In a sound film system, a sound picture film including a standard sound track area, a standard sound track therein, a standard picture area 15 and a frequency-modulated control track of the order of 5 mils in width occupying the area between said standard sound track area and said picture area, a first standard sound-picture film

projector, a second standard sound-picture film projector including a scanning device common to said sound track and said control track, said second projector being modified to include a plurality of photosensitive devices and optical means located between said scanning device and said photosensitive devices for operatively associating a photosensitive device with each of said tracks, means to project said sound picture film at times by means of said first projector, said standard sound track being reproduced without interference from said control track, and means to project said sound picture film at other times by means of said second projector, in which case 15 said standard sound track is subject, during reproduction, to volume enhancement under the influence of said control track.

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