

Feb. 8, 1944.

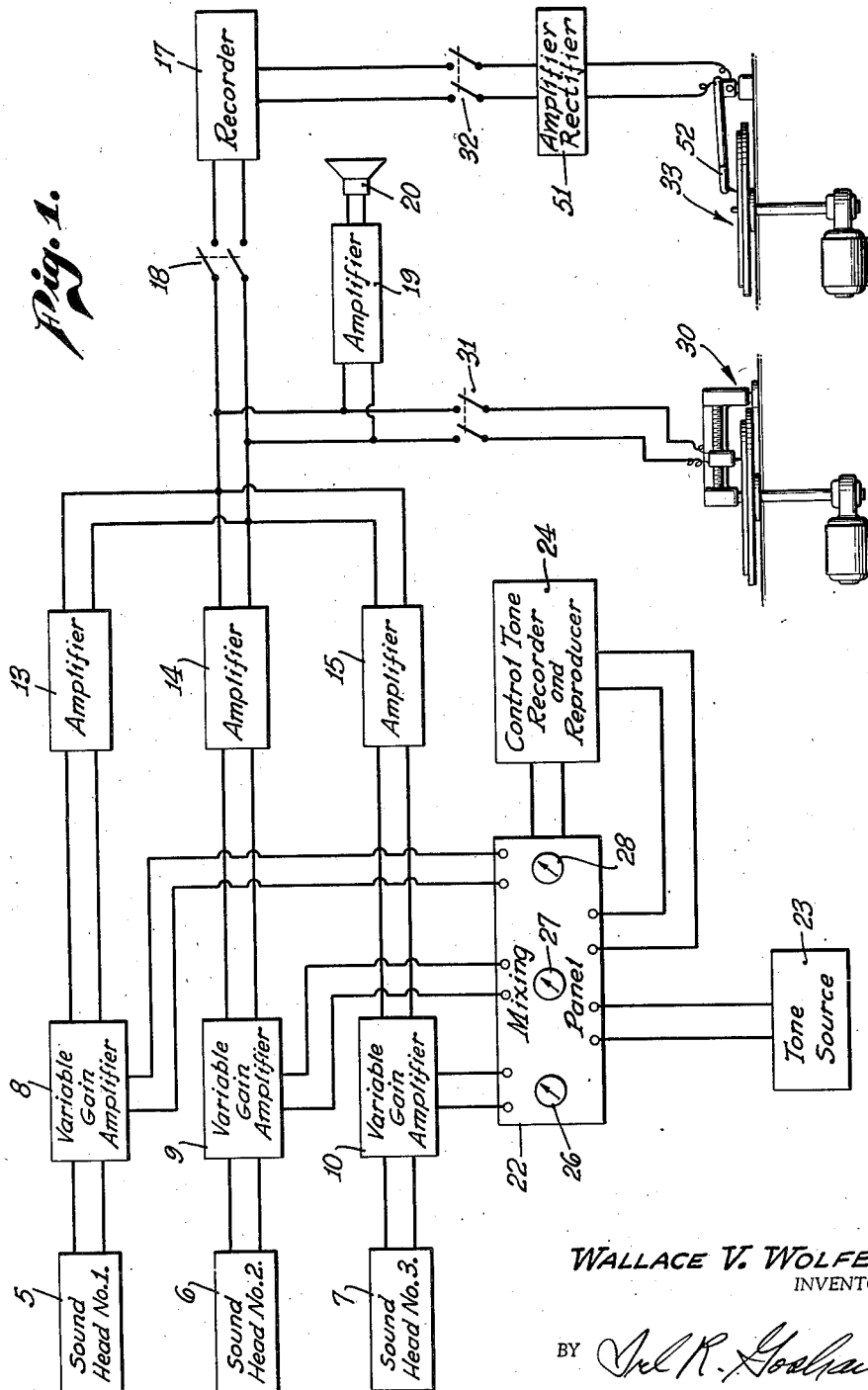
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2,341,303

SOUND RE-RECORDING SYSTEM

Filed June 12, 1942

2 Sheets-Sheet 1



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Fig. 2.

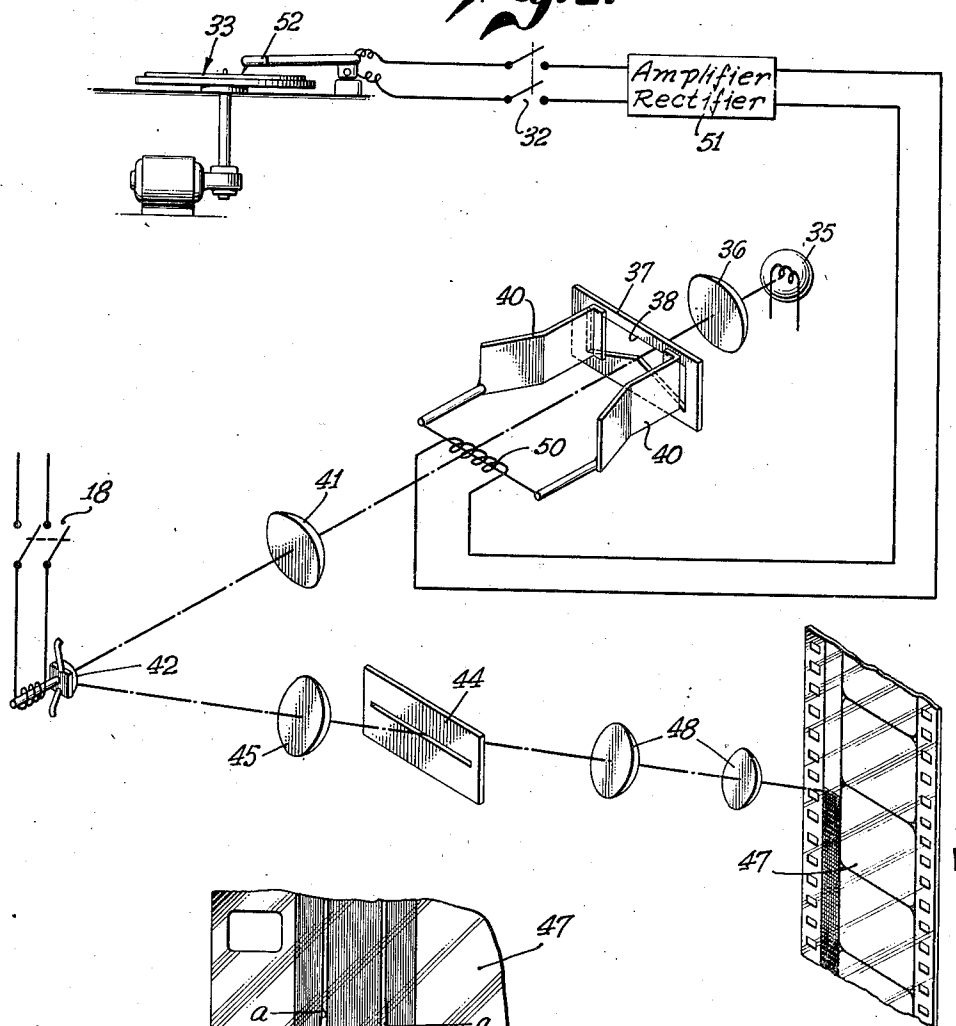
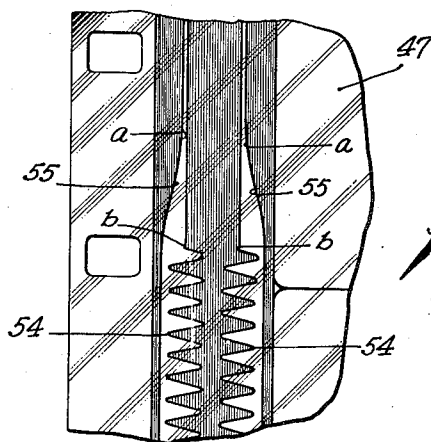


Fig. 3.



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2,341,303

SOUND RE-RECORDING SYSTEM

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Application June 12, 1942, Serial No. 446,710

8 Claims. (Cl. 179—100.3)

This invention relates to the production of sound records for motion picture films and particularly to a re-recording system in which a plurality of sound records are combined into a single composite sound record, the volume of each of said plurality of sound records being under control of one or more control records.

In the production of motion picture sound records, it is customary to re-record the original sound track of the dialogue and the incidental sounds on the set, combined with background sound effects such as crowd noises, hoof beats, thunder and the like, to a composite sound record which is eventually printed to the picture film for release to theaters. My Patent No. 2,279,018 of April 7, 1942, discloses and claims a re-recording system of this type but such a system wherein a control tone or record of the amplitude variations of each of the sound records being re-recorded is also recorded or made during rehearsal and which, in turn, controls the volume of the respective sound records during subsequent rehearsals and during the final re-recording "take."

In the re-recording of sound it is, of course, desirable to produce as noiseless a composite sound record as possible. The usual system for re-recording employs a normal sound recorder wherein standard types of noise reduction are incorporated. However, a marked improvement in noise reduction is obtained by having the noise reduction action anticipate the impression of the signal upon the film to avoid peak clipping and provide a desirable margin, and such systems have previously been proposed. For instance, Kellogg Patent 2,096,811 of October 26, 1937, discloses an anticipatory type of noise reduction re-recording system wherein the sound track being re-recorded is scanned at two positions longitudinally of the film, one scanning operation controlling the noise reduction action of the recorder and the other scanning operation controlling the actual signal recording action, such a system being satisfactory when a single sound record is being re-recorded. However, in present-day systems wherein as many as eight and ten sound records may be simultaneously combined into the final composite record, it is not practical to duplicate the system shown in the Kellogg patent for each of the sound records.

The present invention solves this problem and is particularly adaptable to the robot type of re-recording system as disclosed in my above-mentioned patent. My method of and system for accomplishing this type of anticipatory noise re-

duction action is by recording during a rehearsal a composite sound record either on film or on an acetate disc, the latter being preferred, and utilizing this record for controlling the noise reduction portion of the recorder during the final sound take in which the amplitudes of the various signals being re-recorded are automatically controlled by the control record. By using such a composite record for noise reduction control, noise reduction action will always be present whenever a signal is present. The use of any one of those signals being re-recorded is unsatisfactory for this purpose, since no one signal record is continuous for an entire reel. This is realized when it is considered that the dialogue track has silent portions during times of certain sound effects, and vice versa. By using a composite record of all signals the noise reduction action will always be present for the signal being re-recorded.

The principal object of the present invention, therefore, is to facilitate the re-recording of a plurality of sound records.

Another object of the invention is to improve the re-recording of a plurality of sound records to obtain anticipatory noise reduction in the composite record.

A further object of the invention is to provide a re-recording system in which anticipatory noise reduction is obtained on the final record during the re-recording of a plurality of sound records.

A further object of the invention is to provide a separate noise reduction control record for a plurality of re-recorded records to obtain anticipatory noise reduction on the composite record.

Although the novel features which are believed to be characteristic of this invention are pointed out with particularity in the claims appended hereto, the manner of its organization and the mode of its operation will be better understood by referring to the following description read in conjunction with the accompanying drawings, forming a part hereof, in which:

Fig. 1 is a diagrammatic arrangement of a robot re-recording system embodying the invention;

Fig. 2 is a diagrammatic view of the recording portion of the system of Fig. 1; and,

Fig. 3 is a view of a section of a composite record produced with the invention.

Referring now to the drawings, particularly Fig. 1, a plurality of sound reproducers 5, 6 and 7 translate the respective sound records therein to electrical currents. These reproducers may be in the form of film phonographs or similar units

and although only three are shown, it is to be understood that the system may operate with more than three units. The sound heads 5, 6 and 7 are connected to respective variable gain amplifiers 8, 9 and 10, the output thereof being fed into corresponding amplifiers 13, 14 and 15. The output of the latter amplifiers is combined and fed to a recorder 17 when the switch 18 is closed. The output of amplifiers 13, 14 and 15 is also fed to an amplifier 19 and a loud speaker 20 for monitoring purposes.

For controlling the volume of the signal currents from the sound heads 5, 6 and 7, a mixing panel 22 is shown connected to the variable gain amplifiers 8, 9 and 10 and to a control tone source 23 and a control tone recorder and reproducer 24, the rectifiers and other elements of which are shown in my above-mentioned Patent No. 2,279,018. With the system just mentioned, the volume variations made to signals in the respective transmission channels by manipulation of the potentiometers 26, 27 and 28 are recorded at 24 as a control tone record which, when reproduced, will repeat the volume variations made by the mixer, the mixer still being able to vary the automatically controlled amplitudes, if desired.

Connectable to the output of amplifiers 13, 14 and 15 through a switch 31 is a recording unit 30 which is shown in the form of an acetate disc recorder, although it is to be understood that any suitable type of recorder may be used. During a rehearsal the switch 31 is closed and a composite record made of the combined sounds. When the final sound take is to be made, the switch 31 is opened, and switch 18 closed and the record made at 30 is reproduced by a reproducing unit shown at 33 with a pickup 52 and fed to the noise reduction elements of the recorder 17 through amplifier rectifier unit 51 when switch 32 is closed, the acetate record being advanced ahead of the records being reproduced to provide the anticipatory noise reduction action. Although separate recording and reproducing units 30 and 33 are illustrated, these may be combined into a single unit.

To illustrate the method of obtaining the noise reduction action, reference is made to Fig. 2, wherein a standard type of sound recorder is represented to include a light source 35, the light from which is collected by a lens 36 and projected on a mask 37 having an aperture 38 therein. The emergent light through the aperture 38 and past noise reduction shutters 40 is projected by a lens 41 to the mirror of a galvanometer 42 from which it is reflected to a slit mask 44 through a lens 45. The light through the slit of the mask 44 is projected on the sound track portion of the film 47 by projection lenses 48. The noise reduction shutters 40 are operated by an electromagnet 50 fed from the amplifier rectifier unit 51 which is connected to the pickup element 52 of reproducer 33 when switch 32 is closed. Thus, with the switch 18 closed and the switch 32 closed, the print of the negative sound track recorded will appear as illustrated in Fig. 3.

Referring now to Fig. 3, the signal modulations are shown by the wave form 54, while the noise reduction envelope is shown at 55. Ordinarily the point *a* on the noise reduction envelope would be positioned longitudinally of the film record at the point *b*. However, by advancing the noise reduction control record a predetermined amount, the noise reduction action can be made to anticipate the signal record by such an amount shown by the distance between the points

a and *b* longitudinally of the film. By such anticipation, peak clipping is avoided and any desirable margin obtained as disclosed and claimed in my U. S. Patent No. 2,289,893, of July 14, 1942.

The production of such a control record is also advantageous for other reasons, since it may be reproduced to provide a check on the final film record or used in subsequent re-recording operations where it has been found desirable to make changes in the composite record.

Although an acetate disc type of recorder for reproducing the noise reduction control record is illustrated, it is to be understood that this control record may also be recorded on film or wire with recording systems of these respective types.

I claim as my invention:

1. A sound re-recording system comprising a sound recorder having light modulating means responsive to the instantaneous values of sound waves to be recorded and light modulating means responsive to the average value of said sound waves, means for individually reproducing a plurality of separate sound records to comprise said sound waves to be recorded, means for making a record of said plurality of separate sound records reproduced, means for reproducing said record of said plurality of separate sound records reproduced, means for impressing the combination of said sound waves being individually reproduced on said first-mentioned modulation means, and means for simultaneously impressing the average value of the reproduced combination record of said plurality of separate sound records previously recorded on said second-mentioned modulating means to produce a combination record of said plurality of separate records, said combination record having noise reduction.

2. A sound re-recording system in accordance with claim 1 in which the reproduction of said record of the combination of said sound waves previously recorded is started a predetermined time interval ahead of the reproduction of said sound waves being recorded.

3. A sound re-recording system comprising a plurality of sound record reproducers, means for controlling the volume of reproduction of the sounds from each of said reproducers, means for mixing said reproduced sounds, a first sound recorder for recording said reproduced sounds without noise reduction, a second sound recorder for said reproduced sounds, means for reproducing a record of said reproduced sounds made by said first sound recorder, and means for impressing a current corresponding to the average value of the combined reproduced sounds previously recorded on the noise reduction portion of said sound recorder to produce a combination record of the output of said plurality of sound record reproducers having noise reduction.

4. A sound re-recording system in accordance with claim 3 in which the volume of reproduction of said plurality of records is controlled automatically by a control record of the volume variations of said plurality of records.

5. The method of obtaining anticipatory noise reduction in a composite record being re-recorded from a plurality of individually reproduced records comprising individually reproducing said plurality of records, controlling the relative volume of reproduction of said records, recording a first composite record of said individually reproduced records, again reproducing said plurality of records, reproducing said first composite record, recording a second composite record of said

individually reproduced records, and using the average amplitude variations of the sounds of said reproduced composite record to apply noise reduction to said second recording of said individually reproduced records.

6. The method in accordance with claim 5 in which the reproduction of said plurality of records is delayed with respect to the reproduction of said first composite record.

7. The method of obtaining anticipatory noise reduction in a composite re-recorded record comprising recording a first composite record of a

plurality of records, recording a second composite record of said plurality of records, reproducing said first composite record during the recording of said second composite record, and using the reproduction of said first composite record to control the noise reduction action in the recording of said second composite record.

8. The method in accordance with claim 7 in which said noise reduction action is in advance of the recording of said second composite record.

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