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SOUND REPRODUCING SYSTEM

2,018,466

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FIG. 1

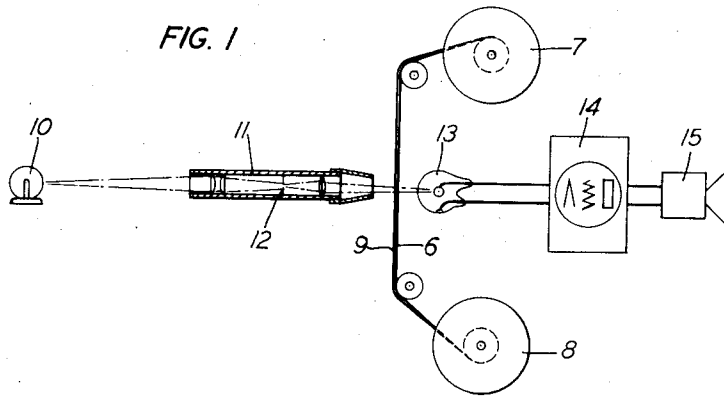


FIG. 2

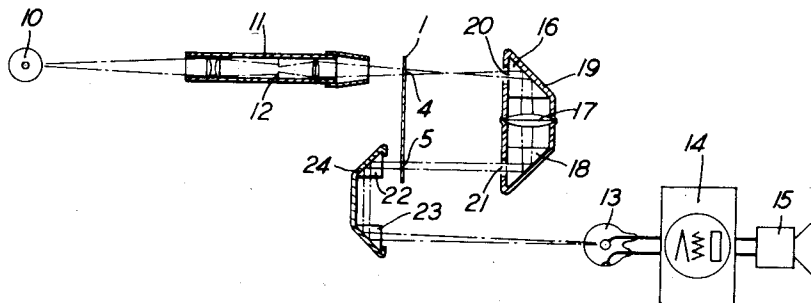
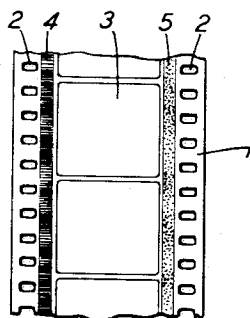


FIG. 3



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SOUND REPRODUCING SYSTEM

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8 Claims. (Cl. 179—100.3)

This invention relates to film sound reproducing systems and particularly to systems for simultaneously reproducing two complementary sound records.

5 The object of the invention is a method and means of successively scanning the complementary records with a single beam of light.

A feature of the invention resides in the use of optical means for directing the scanning light from one record to the other.

10 In the known type of sound recording system disclosed in U. S. Patent 1,623,756, April 5, 1927 to C. F. Sacia, two complementary records of the sound are produced (a) a record of the harmonic structure, or frequency and phase variations of the sound, adjusted to a substantially constant amplitude or intensity and (b) a record of the variations in amplitude or intensity of the original sound, or of the degree of modification introduced into the recording channel to adjust the harmonic structure to a substantially constant amplitude. In the above cited patent, the two records are scanned by individual beams of light. The current due to the reproduction of the harmonic record is transmitted through a communication channel to a sound reproducer. The current due to the reproduction of the amplitude record is transmitted through a control channel to a regulator which controls the amplification of the communication channel and thus restores to the reproduction of the harmonic record the variations in amplitude which were equalized during the recording process.

20 In the present invention, the control channel is no longer required, and a single standard sound reproducing channel is employed. The complementary records are successively scanned by a single beam of light, which, after passing in succession through both records, excites the light sensitive device in the reproducing channel. The order in which the records are scanned is, in general, immaterial. The two records may be placed on separate media which may then be superposed and exposed to the scanning beam, or the two records may be side by side on a single medium. In the latter case, after the scanning beam has passed through one record it may be reversed by optical means and directed through the second record to the light sensitive device in the reproducing channel.

In the drawing

Fig. 1 discloses a sound reproducing system in which the complementary records are on separate media physically superposed.

55 Fig. 2 discloses a sound reproducing system in

which the complementary records are on the same medium.

Fig. 3 discloses a fragment of sound picture film having complementary records.

In Fig. 3, a fragment of motion picture film 1, 5 having the usual perforations 2, carries a series of action pictures within the areas represented by the squares 3. A record of the harmonic structure of a sound reduced to a substantially constant amplitude is represented by the record 10 4. This record is identical with the "a" record disclosed in U. S. Patent 1,623,756. A record of the amplitude variations of the original sound is represented by the record 5. This second record is thus identical with the "b" record disclosed in U. S. Patent 1,623,756. While the records are shown side by side on a single medium, it is obvious that the records may be placed on separate media.

15 In Fig. 1, a film 6, carrying the pictures of the action and one of the complementary records is traversed from reel 7 to reel 8 in the usual manner. A second film 9 carries the other complementary record, which is located in exact physical superposition on the first record and is similarly traversed between the reels 7 and 8. It is immaterial which of the complementary records is on the upper film and which is on the lower film. Light from a lamp 10 is directed by a lens tube 11 of known type on the film 9. The lens tube 11 contains a fine slit 12, illuminated by the source 10 and imaged on the film 9 as a narrow beam of light. The beam of light passes through the film 9 and is modulated by the record on film 9. The modulated beam then passes through the film 6 and is further modulated by the record on film 6. As the two records on films 9 and 6 together form complementary records of the original sound, the successive modulations of the beam of light will produce a modulation corresponding to the original sound. The successively modulated light is directed on a light sensitive device 13 and produces a current varying in accordance with the original sound. This modulated signal current may then be amplified in the usual manner in an amplifier 14 and utilized as desired, for example, the original sound may be reproduced by a reproducing device 15.

20 In Fig. 2, a film 1 similar to the film shown in Fig. 3, is traversed normal to the plane of the drawing between suitable reels (not shown). Light from a source 10 is directed by a lens tube 11 to the film 1, as previously described under Fig. 1. The beam of light passes through and is modulated by one of the complementary rec- 55

ords, for example, the record 4 in Fig. 3. It is immaterial which of the complementary records is scanned first. The modulated light passing through the record 4 is directed on an optical reflector 16, such as a prism or mirror, and reflected through a lens 17 to a second optical reflector 18 and thence reflected to the second complementary record 5. The lens 17 is convenient for correcting undue divergence of the beam reflected on the record 5. The reflectors 16 and 18 and the lens 17 may be contained in a housing 19, suitably supported on the projector and, if desired, completely enclosing the optical elements except for the apertures 20, 21. The light transmitted through and modulated by the record 5 is directed to a light sensitive device 13. When the light sensitive device 13 is located in the rear of the film, as disclosed, the modulated light from the record 5 may be reversed in direction by the optical reflectors 22, 23 contained in a housing 24 supported on the machine. The successively modulated light falling on the light sensitive device 13 produces a current varying in accordance with the original sound, which may be amplified in the amplifier 14, and utilized, for example, to actuate the reproducer 15. It will be apparent to those skilled in the art that the invention is not limited to records which are transparent, but is equally applicable to photographic records imprinted on a reflecting base which are scanned by reflected light.

What is claimed is:

1. In a reproducing system, a record of the harmonic structure of a sound wave modified in amplitude, a complementary record of the amplitude variations of said wave, means for simultaneously moving both said records, a single beam of light successively modulated by both said records and means for transforming said modulated beam into sound energy.
2. In a reproducing system, a record of the harmonic structure of a sound wave modified in amplitude, a complementary record of the amplitude variations of said wave, means for simultaneously moving both said records, a single beam of light successively modulated by both said records in superimposed relation and means for transforming said modulated beam into sound energy.
3. In a reproducing system, a record on a photographic film of the harmonic structure of a sound wave, a complementary record on the same film

of the amplitude variations of said wave, means for moving said film, a single beam of light modulated by one of said records, means for directing said modulated beam to the other of said records, and means for transforming said doubly modulated beam into sound energy.

4. In a reproducing system, a record on a photographic film of the harmonic structure of a sound wave modified in amplitude, a complementary record on the same film of the amplitude variations of said wave, means for moving said film at constant speed, a beam of radiant energy transmitted through one of said records, means for directing said modulated beam through the other of said records, and means for transforming said doubly modulated beam into sound energy.

5. The method of reproducing sound from a photographic record of the harmonic structure of a sound wave and a photographic record of the amplitude variations of said sound wave which comprises producing a beam of radiant energy, successively modulating said beam with each of said records and transforming said doubly modulated beam into electrical energy.

6. In a reproducing system, a photographic record of the harmonic structure of a sound wave, a complementary photographic record of the amplitude variations to be reproduced in said wave, means for moving said records at the same constant speed, a beam of radiant energy transmitted through one of said records, optical means for directing said modulated energy through the other of said records and means for transforming said doubly modulated beam into sound energy.

7. The combination in claim 6 in which said optical means comprise surfaces for successively deflecting said beam.

8. In a reproducing system, a photographic record of the harmonic structure of a sound wave, a complementary photographic record of the amplitude variations to be reproduced in said wave, means for moving said records at constant speed, a beam of radiant energy transmitted through one of said records, optical means for directing said modulated beam through the other of said records, said optical means comprising a pair of right angled prisms, other optical means for directing said doubly modulated beam on a light sensitive device, and means for reproducing the output of said device.

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