

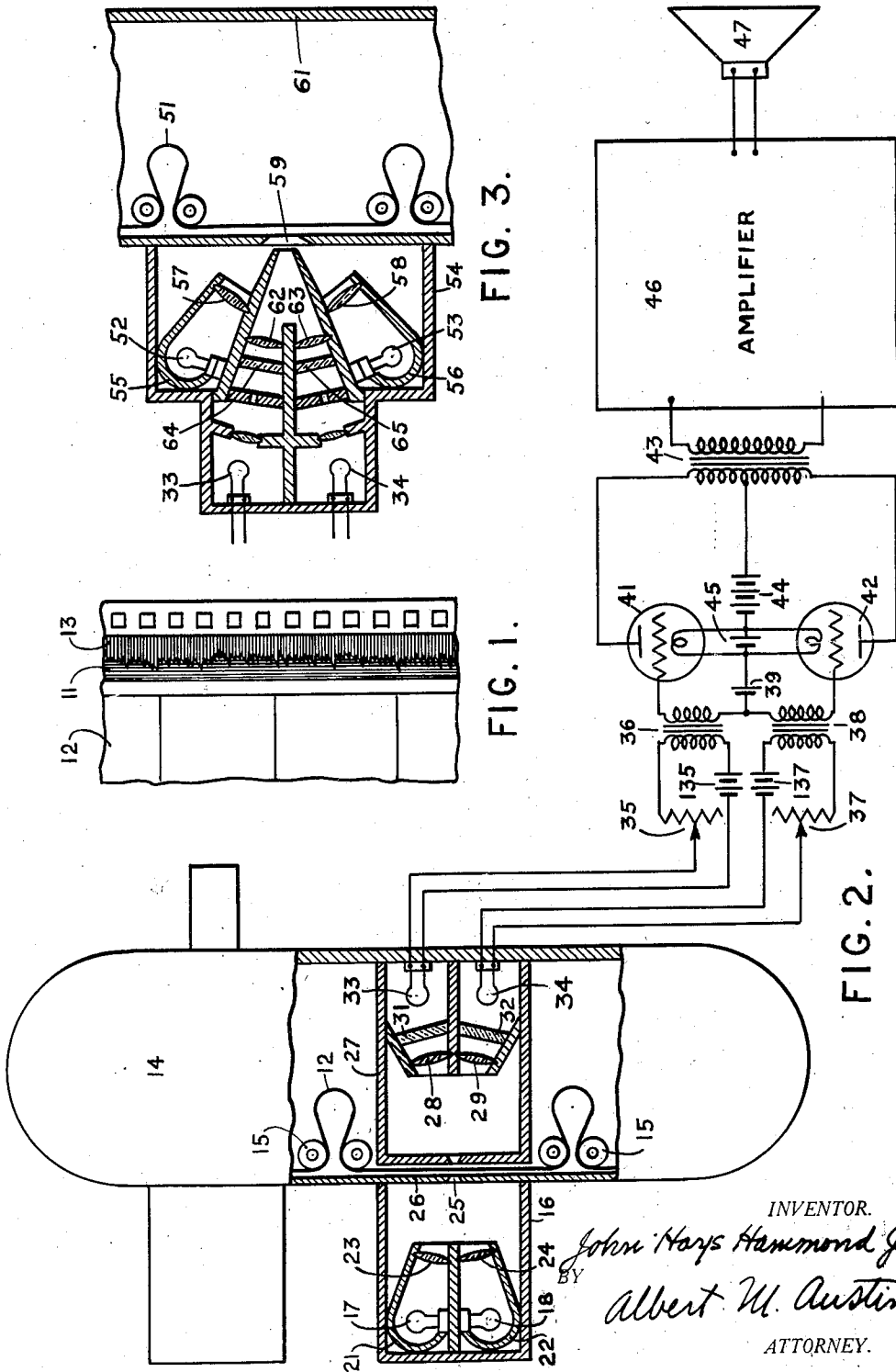
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SOUND RECORDING AND REPRODUCING

Original Filed March 27, 1930 2 Sheets-Sheet 1



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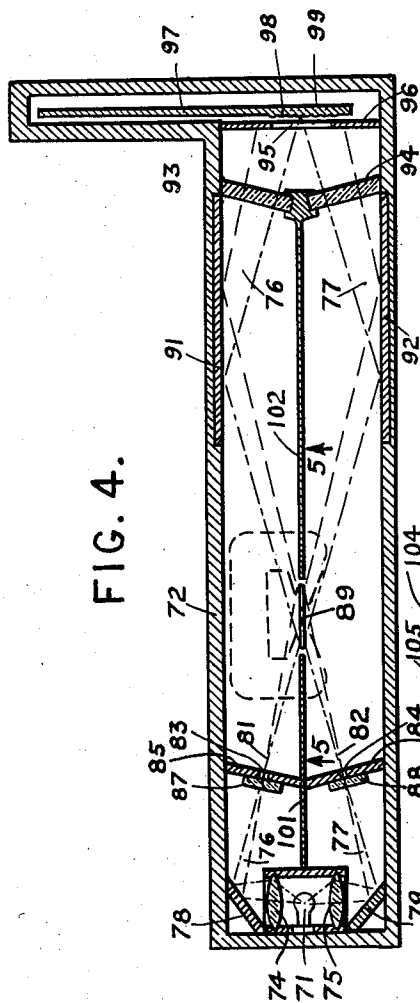


FIG. 4.

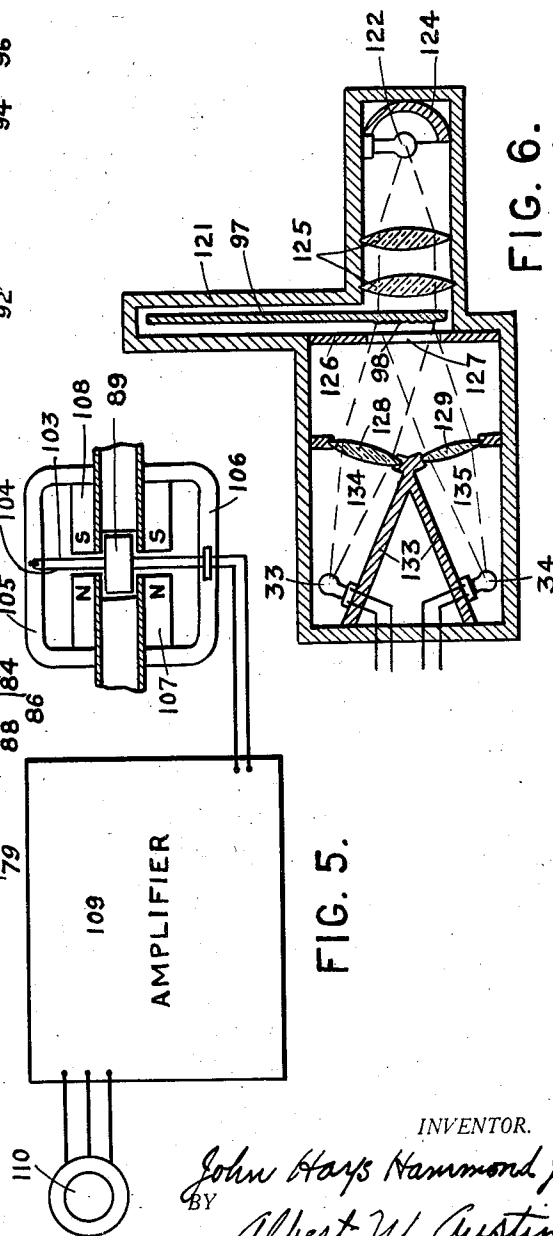


FIG. 5.

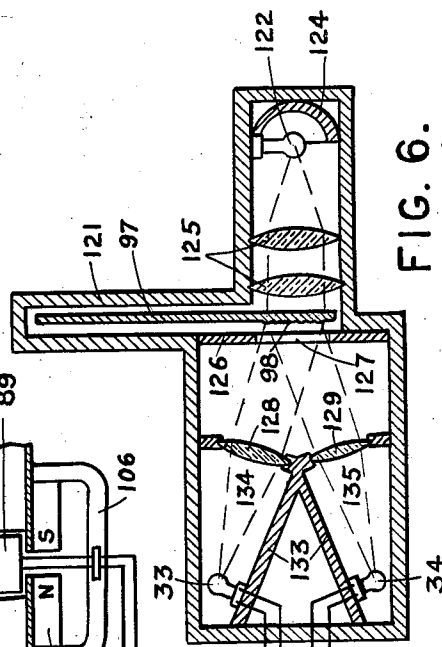


FIG. 6.

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SOUND RECORDING AND REPRODUCING

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This invention relates to sound recording and reproducing.

According to a preferred embodiment of the invention, a photographic film is provided with a sound track having two portions, one of which varies according to the sound selection and the other of which varies inversely as the sound selection. If desired, the two portions may be of different colors and suitable pick-up devices such as photoelectric cells with color filters may be provided for picking up the separate portions of the sound track. A device for combining the energy thus picked up, such as a push-pull amplifier, may also be provided. The positive and negative portions of the record may be located upon the same tablet or upon different tablets and the tablets may be ordinary phonograph records in addition to the talking films illustrated.

The invention also consists in certain new and original features of construction and combinations of parts hereinafter set forth and claimed.

Although the novel features which are believed to be characteristic of this invention will be particularly pointed out in the claims appended hereto, the invention itself, as to its objects and advantages, the mode of its operation and the manner of its organization may be better understood by referring to the following description taken in connection with the accompanying drawings forming a part thereof, in which

Fig. 1 illustrates a photographic film having a sound track produced in two colors;

Fig. 2 is a diagrammatic view partly in section of a moving picture projector constructed in accordance with this invention;

Fig. 3 shows a reproducing means for reflected light;

Fig. 4 is a sectional view of a system used for producing the two colored sound record by the use of the Eastman color film;

Fig. 5 is a fragmentary sectional elevation taken on line 5-5 of Fig. 4; and

Fig. 6 is a sectional view of a reproducing mechanism for this type of film.

In the following description and in the claims parts will be identified by specific names for convenience, but they are intended to be as generic in their application to similar parts as the art will permit.

Like reference characters denote like parts in the several figures of the drawings.

For making the sound record shown in Fig. 1, any standard form of variable area recording means may be employed. By this means the area 11 on the film 12 will be exposed to light producing certain definite and well known chemical changes. When the film is developed and printed, this area is caused to be printed in a certain color; for example, red. This may be done by the use of a selective dye which will only

print on the part of the film which has been exposed to light. The rest of the sound track 13 is then printed in some other color such; for example, blue. This may be done by the use of another type of selective dye which will only print that portion of the film which has not been exposed to light. This printing of the record in two colors may also be done by any other well known and standard process of two color printing.

The film 12 is then placed in a projector apparatus 14 which is provided with the usual rollers 15 for feeding the film. Mounted in front of the film 12 is a casing 16 which contains two lamps 17 and 18 provided with two reflectors 21 and 22. The light from these lamps is focused by means of two lenses 23 and 24 upon a narrow slit 25 in a diaphragm 26. Behind the film 12 is a second casing 27 in which are mounted lenses 28 and 29. These lenses focus the light which passes through the film 12 through two color filters 31 and 32 upon two photoelectric cells 33 and 34. The color filter 31 only permits light which passes through the red part of the film 11 to be focused upon the photoelectric cell 33, and the color filter 32 only permits the light which passes through the blue part of the record 13 to be focused upon the photoelectric cell 34.

The photoelectric cell 33 is connected through a rheostat 35 and battery 135 to the primary of a transformer 36, and the photoelectric cell 34 is connected through a rheostat 37 and battery 137 to the primary of the transformer 38. The secondaries of these transformers are connected to one side of a battery 39, the other side of which is connected to one side of the filaments of two audio tubes 41 and 42. The grids of these two tubes are connected to the other sides of the secondaries of the transformers 36 and 38. The plates of these two tubes 41 and 42 are connected to opposite sides of the primary of a transformer 43, the middle point of which is connected through a battery 44 to the filaments of the tubes 41 and 42. These filaments are heated by a battery 45. The secondary of the transformer 43 is connected to an amplifier 46 the output of which is connected to a loud speaker 47.

In the operation of the form of the invention shown in Figs. 1 and 2, the film 12 is fed between the walls of casings 16 and 27 by means of the rollers 15 in the usual manner for talking movie projectors. As the two color sound track passes behind the slit 25, light from both the lamps 17 and 18 will be focused on this record by means of the lenses 23 and 24. The light from these two sources then passes through the sound record and is focused by means of the lenses 28 and 29 on the photoelectric cells 33 and 34. As the light passes through the filter 31, all the rays will be eliminated except the red; thus the photoelec-

tric cell 33 will only receive light from the red sound track 11. The filter 32 will only allow the blue light to pass through; thus the photoelectric cell 34 will only receive light from the blue track 13. These two sound tracks, it will be seen, are complementary and are also substantially equal in area so that if one increases, the other decreases in the same proportion. Therefore, the two fluctuating currents from the photoelectric cells 33 and 34 will be fluctuating in opposite directions at the same time.

These two currents are then combined in the output circuit of the push pull amplifier so that the resulting current in the transformer 43 will closely follow the fluctuations of the boundary line between the red and blue records 11 and 13. In this way this current will be caused to follow this line more closely than will the current in an ordinary talking movie using the variable area record, as the push pull amplifier will cause a quicker reaction to changes in the shape of this line. The current in the secondary of the transformer 43 will then be amplified by the amplifier 46, the output current of which actuates the loud speaker 47 which reproduces the original sounds made in making the records.

In the modified form of the invention shown in Fig. 3 a film 51 is employed on which the sound record is printed by any well known process. In this type of record the background of the sound track may be of one color and, after it has been acted upon by light and suitable chemicals, that portion will be changed to a different color, or the two colors may be produced by superimposing one color on the other, thus producing a two color sound track. This sound track is opaque and in this system is used for reflecting light and not transmitting it.

In order to accomplish this result two lamps 52 and 53 are mounted in a casing 54 and are provided with reflectors 55 and 56. The light from these lamps is focused by two lenses 57 and 58 upon the sound track on the film 51 from which the light is reflected through an opening 59 in a secondary casing 61. This light is focused by means of two lenses 62 and 63 through two color filters 64 and 65 upon the photoelectric cells 33 and 34 which are connected to the push pull amplifier as described in connection with Fig. 2.

In the operation of this form of the invention, the light from the two lamps 52 and 53 brightly illuminate the two color record on the film 51. The light is reflected from this record and focused by means of the two lenses 62 and 63 upon the photoelectric cells 33 and 34, the color filter 64 cutting out all the light except that reflected from the red record, and the color filter 65 cutting out all the light except that reflected from the blue record. The photoelectric cell 33 only receives fluctuations of light from the red record and the photoelectric cell 34 only receives fluctuation of light from the blue record. The operation of this form of the invention from here on is identical with that described in connection with Fig. 2.

In the form of the invention shown in Figs. 4 and 5, the system is shown as applied to the type of film developed by the Eastman Kodak Company for their color moving pictures. A lamp 71 is mounted in one end of the casing 72. The light from this lamp is focused by two lenses 74 and 75 into two beams of light 76 and 77. These beams are reflected from two plain mirrors 78 and 79 mounted in the corners of the casing 72.

The beams 76 and 77 are brought to foci at

the points 81 and 82 where they pass through small holes 83 and 84 in two diaphragms 85 and 86. Mounted on these two diaphragms are two color screens 87 and 88, the former of which transmits only red light, and the latter only blue light. It will be understood that these color filters are not essential to the operation of the invention, as the record on the film does not depend on the color of the light but on the direction from which it comes.

The two beams of red and blue light 76 and 77 then strike a small mirror 89 from which they are reflected to two larger mirrors 91 and 92. From these mirrors the beams pass through two cylindrical lenses 93 and 94 which cause them to be focused as narrow strips of red and blue light through an opening 95 in a diaphragm 96 upon one side of a moving picture film 97. The portion of the film 97 which passes opposite the slit 95 is provided with longitudinal corrugations 98 which are similar to those used on the Eastman color films. On the back of the film 97, opposite the corrugations 98, is the photographic emulsion 99.

The small mirror 89 is mounted between two longitudinal partitions 101 and 102 and is carried by two fine wires 103 and 104. These wires are mounted above in a frame of insulating material 105 and below in a second frame of insulating material 106. Mounted on the casing 72 and located with their poles adjacent to the wires 103 and 104 are two permanent magnets 107 and 108. The wires 103 and 104 are connected to the output circuit of an amplifier 109, the input of which is connected to a microphone 110.

In the operation of the form of the invention shown in Figs. 4 and 5, the two beams of red and blue light normally strike the film 97 so that the red light impinges on half of the corrugated strip 95 and the blue light on the other half. When speech or music is received by the microphone 110 and amplified by the amplifier 109, fluctuating currents are caused to pass through the wires 103 and 104, thus causing these wires to move in the magnetic fields produced by the permanent magnets 107 and 108. This causes a very slight rotation of the mirror 89 about a vertical axis, this action being similar to that of a standard vibration galvanometer. This causes the reflected beams of light 76 and 77 to be moved back and forth across the corrugations 95, the red and blue beams always touching at their edge but never overlapping.

The red beam 76 will be refracted by the corrugations 98 so that this red light will affect the photographic emulsion 99 at certain definite points behind each corrugation, these points depending on the direction in which the light strikes the film, and the size and curvature of the corrugations. In a similar manner the blue light from the beam 77 will be refracted by these corrugations and affect the photographic emulsion 99 at slightly different positions. In this way two separate records are made on this emulsion of the two beams of light, this record being similar in outline to the one shown in Fig. 1, but it is of course colorless.

This film is then developed in the usual manner by the Eastman color process and is then used in the reproducing mechanism shown in Fig. 6. In this mechanism the film 97 passes down through a casing 121 in one end of which is mounted a lamp 122. The light from this lamp is reflected by means of a reflector 124 through a lens system 125 and onto the rear of the film 97 opposite the corrugated strip 98. In front of this

film is a diaphragm 126 provided with a narrow slit 127. Mounted in front of this slit are two lenses 128 and 129 which focus the light received by them upon the two photoelectric cells 33 and 34 which are mounted on an internal wall 133.

In the operation of the reproducing mechanism shown in Fig. 6, the light from the lamp 122 passes through the film 97 where it is refracted by the corrugations 98 into two beams of light 134 and 135. The intensity and extent of the beam 134 will be the same as that of the beam 76 used in producing the record of red light, and the intensity and extent of the beam 135 will be the same as that of the beam 77 used in producing the record with the blue light. These two beams of light pass through the lenses 128 and 129 and are focused upon the photoelectric cells 33 and 34, the current from which passes to the push pull amplifier as described in connection with Fig. 2. From here on the operation is the same as that described in connection with Fig. 2.

While certain novel features of the invention have been shown and described and are pointed out in the annexed claims, it will be understood that various omissions, substitutions and changes may be made by those skilled in the art without departing from the spirit of the invention.

What is claimed is:

1. In a phonographic record system, a photographic member having a sound record thereon, said record comprising a portion which varies according to the sound selection and a second portion whose amplitude varies inversely as the sound selection, said portions being closely interdisposed on the record, one of said portions being of one color and the other portion being of a different color, a separate pick-up device selective to each color, an amplifier fed by said devices and a speaking device fed by said amplifier.

2. In a phonographic record system, a photographic film having a sound record of uniform width, said record comprising portions whose meeting edge describes a curve corresponding to the sound selection, one of said portions being of one color and the other portion being of a different color, a separate pick-up cell for each color exposed to said record, each cell having a color filter to transmit its own color only, a push pull amplifier fed by said cells and a speaking device fed by said amplifier.

3. In a sound record system, a photographic sound record of uniform width comprising portions of two different colors having a common meeting edge, one of said portions varying in width according to the sound selection, and the other of said portions varying in width in a complementary manner to said first portion, a separate pick-up device selective to each color, an amplifier fed by said pick-up devices and a speaking device fed by said amplifier.

4. In a photographic record system, a photographic sound record made up of two inter-disposed portions of different colors, the relative amounts of the two colors varying according to the sound selection, a separate pick-up device for each color having a color filter, a push-pull amplifier fed by said pick-up devices and a sound reproducer fed by said amplifier.

5. In a sound reproducing system, a photographic sound record in two colors, an amplifier, a translating device fed thereby, a first means for selectively controlling said amplifier accord-

ing to one of said colors and a second means for selectively controlling said amplifier according to the other of said colors.

6. In a sound reproducing system, a photographic sound track comprising parallel sound records in two different colors, the first said record varying according to the sound selection and the second said record varying inversely to said first record, a pair of color filters and a pair of pick-up devices associated with each said record, an amplifier fed by said pick-up devices and a translating device fed by said amplifier.

7. In a sound reproducing system, a photographic sound record of uniform width comprising portions of two different colors having a common meeting edge, one of said portions varying in light transmitting ability according to the sound selection and the other of said portions varying in light transmitting ability in a complementary manner to said first portion, a separate color filter and pick-up device for each color, an amplifier fed by said pick-up devices and a translating device fed by said amplifier.

8. In a sound reproducing system, a photographic sound record in a plurality of colors, a plurality of color filters selective to said colors, respectively, a plurality of pick-up devices associated with said filters, a translating device fed by said pick-up devices, one of said pick-up devices controlling the intensity of the total signal fed to said translating device according to one of said colors, and another of said devices controlling the intensity of the same signal according to the other of said colors.

9. In a sound record system, a sound record comprising a sound track of uniform width, said sound track having a sound recording in one color and an auxiliary recording in a second color adjacent said first recording and occupying a different area from said first sound recording, pick-up devices for selectively picking up said colors, a translating device operated by said pick-up devices, and means whereby each of said colors operates to affect the intensity of all registers of the same signal.

10. In a sound record system, a sound record comprising a plurality of separate recordings occupying different areas in the same sound track, said recordings having different optical characteristics, pick-up devices having different optical characteristics for selectively picking up said recordings, and translating devices fed by said pick-up devices.

11. In a sound record system, a sound record having a single sound track comprising two parallel variable area recordings, each recording comprising the same selection, said recordings varying in optical characteristics in a complementary manner to each other and having a common irregular boundary edge, said recordings having different optical characteristics, pick-up devices having different optical characteristics for selectively picking up said recordings, and translating devices for said pick-up devices.

12. In a sound record system, a sound record having a sound recording in one color and an auxiliary recording in a second color, said recordings occupying different areas on the record, pick-up devices for selectively picking up said colors, and a translating device operated by said pick-up devices.

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