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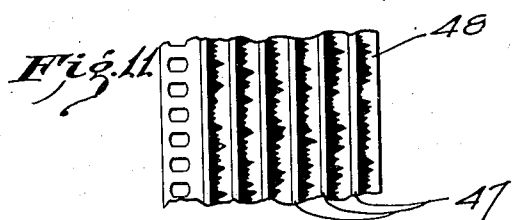
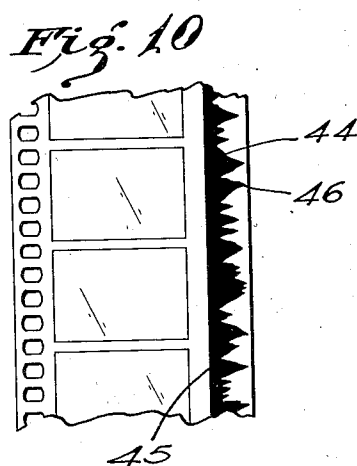
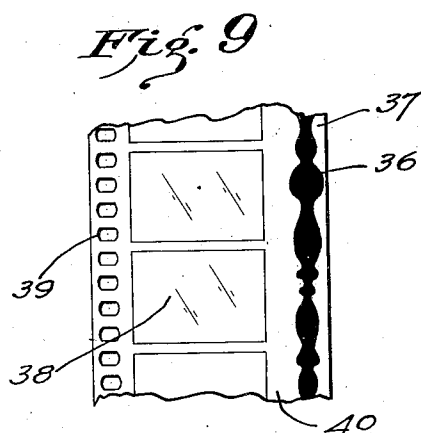
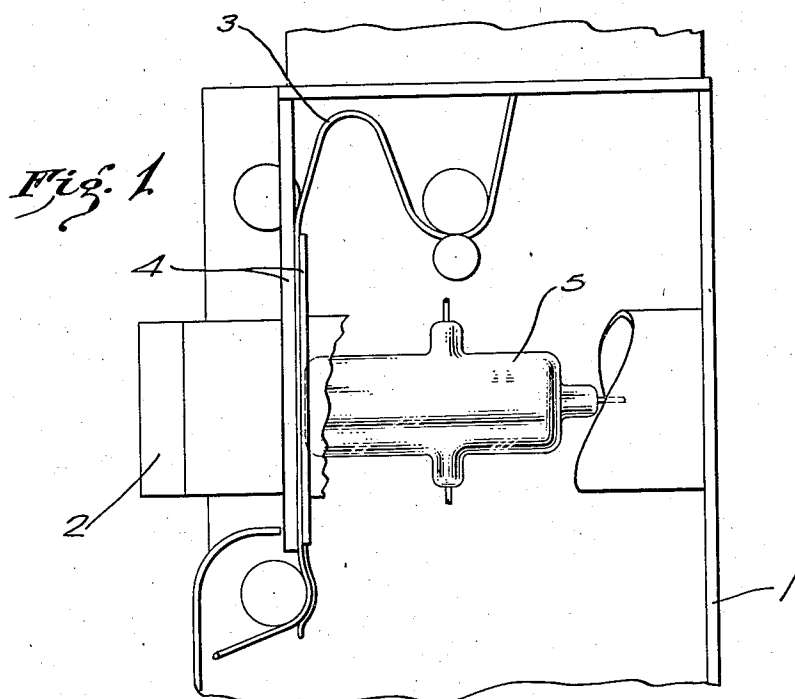
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1,998,465

SOUND REPRODUCING APPARATUS

Filed July 15, 1929

2 Sheets-Sheet 1



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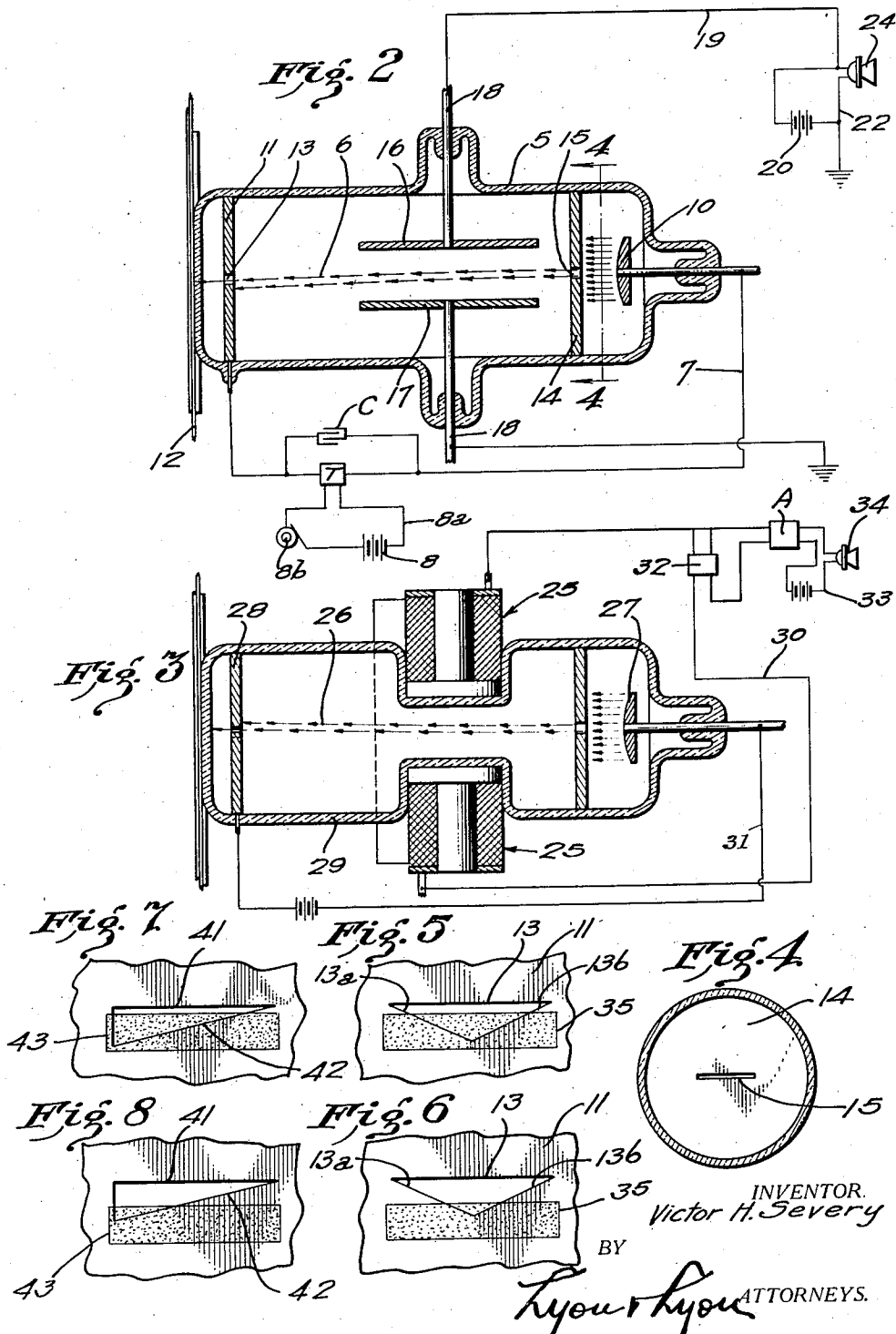
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UNITED STATES PATENT OFFICE

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SOUND REPRODUCING APPARATUS

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Application July 15, 1929, Serial No. 378,269

3 Claims. (Cl. 179—100.3)

This invention relates to the reproduction of sounds, such as music or speech. The invention is also capable of being employed as an adjunct in moving pictures for producing what are popularly called talking movies; that is to say, the invention is capable of being used in connection with moving picture films in which the speech of the actors is synchronized with the pictures. The invention relates to that type of recording apparatus and methods which employ light as a medium for producing a record on the recording member or film, the said light record being employed for controlling reproducing apparatus for translating the light record into sounds.

The general object of the invention is to provide simple and sensitive apparatus for producing an accurate light record corresponding to the sounds produced; also to produce a simple and accurate method for producing a light record of sounds.

A further object of the invention is to produce a compact light record capable of use to effect reproduction of music or other sounds.

The invention consists in the novel parts and combination of parts to be described hereinafter, all of which contribute to produce an efficient sound recording apparatus.

A preferred embodiment of the invention is described in the following specification, while the broad scope of the invention is pointed out in the appended claims.

In the drawings:

Figure 1 is a diagrammatic view with certain parts broken away illustrating apparatus embodying my invention and which may be employed in practicing my method.

Figure 2 is a vertical section showing parts of the apparatus illustrated in Figure 1 and illustrating diagrammatically the electric circuits which may be employed in practicing the invention. This view represents apparatus which employs static electricity for controlling the light.

Figure 3 is a view similar to Figure 2 but showing magnetic means instead of static means for controlling the light.

Figure 4 is a cross-section taken about on the line 4—4 of Figure 2 and particularly illustrating a light stop which I prefer to employ in connection with the light beam, or cathode beam.

Figures 5 and 6 are two diagrammatical views illustrating the manner in which the controlled light beam affects the variation in light transmitted to the light-sensitive recording member.

Figures 7 and 8 are diagrams similar to 5 and

6 but illustrating a different form of slits in the light stops.

Figure 9 is a view illustrating a short section of moving picture record having a light record formed along one edge of the film. The light record illustrated has a form such as would be made by a slit of the type shown in Figures 5 and 6.

Figure 10 is a view similar to Figure 9 but showing a light record of the type that would be produced by slits of the forms shown in Figures 7 and 8.

Figure 11 is a view showing a short section of a recording member having a plurality of light records formed thereon, according to my method.

The apparatus preferably includes means for guiding a light-sensitive recording member, for example, a film, along a path, and the apparatus is so positioned that the light from the cathode ray is projected onto the recording member.

I provide electrical means, which is controlled by the sounds to be reproduced, for varying the positions of the cathode ray. In this way I vary the light passing onto the recording member. The apparatus preferably includes a screen or light stop located adjacent to the path of the recording member and this light stop intercepts a portion of the rays of the cathode beam.

In practice I prefer to give the beam a form such that the beam is elongated in one direction on a transverse axis. By passing such a beam through an elongated slot, or slit, with an inclined edge, which intercepts a portion of the rays of the beam, it will be apparent that by varying the position of the beam the intercepted area will vary greatly.

The apparatus preferably includes static, or magnetic means, adjacent the cathode ray for effecting variations in the position of the ray to correspond with the sounds to be reproduced. This electrical means is preferably located in a circuit including an amplifier which amplifier is also placed in the local circuit having a transmitter to receive the sounds to be recorded.

Referring more particularly to the parts, and especially to Figure 1, 1 represents a casing, or box, for the recording apparatus which, if desired, may include a lens 2, and other means for taking a photograph upon the light-sensitive recording member, such as a film 3 which is guided along a fixed path by guiding means 4. It should be understood, however, that I do not limit myself to the use of my apparatus to employment in conjunction with moving picture apparatus. In other words, my invention may be practiced with

a light-sensitive recording member of any type whatever.

For the purpose of illustration, however, this recording member in the present specification is in the form of a film and this may, of course, be the same film which is used for taking moving pictures. The apparatus includes a cathode tube 5 (see Fig. 2), which is placed with its longitudinal axis in line with the edge of the recording film. This tube includes the usual means for developing a luminous cathode ray, or beam, indicated at 6, said beam being formed between two terminals receiving current from an electric circuit 7, illustrated diagrammatically and including a battery 8 in a local circuit 8^a with an interrupter 8^b and connecting to a transformer T. The luminescence of the cathode beam may be attained by maintaining a proper gas and pressure within the tube. The transformer is in a branch of the circuit 7 wired in parallel with a condenser C.

This cathode ray is developed between two terminals, 10 and 11, so that the ray extends longitudinally on the axis of the tube, and so as to project the beam of the tube onto the light-sensitive record, that is to say, a film 12. In accordance with my invention, I provide, adjacent to the film 12, a screen or light stop for intercepting a portion of the rays to form a beam of definite cross section. If desired, this stop may be distinct from the terminal 11, but I prefer to use the terminal 11 for the stop by forming the terminal of a disc of conducting material and providing it with an elongated slit 13 in line with the cathode beam 6. In other words, this slit 13 is in a position such that its edges intercept portions of the rays composing the cathode beam.

The cathode beam 6 is preferably given a substantially rectangular form, that is to say, it is elongated along a transverse axis. In order to accomplish this I interpose a screen or light stop 14 having a slit 15 in it substantially parallel with the longitudinal axis of the slit 13 and in line with the same. With this arrangement it will be evident that the screen or light stop 14 will intercept most of the rays of the cathode beam but will permit a beam of rectangular cross-section to pass to the cathode or terminal 11.

Any suitable means may be employed for producing a relative movement of the beam and the slit 13 to effect variations in the light passing onto the film 12. As illustrated in Figure 2, the means for this purpose includes two condenser plates 16 and 17 connected to terminals 18 connected in a circuit 19, including a battery 20 and this circuit passes through an amplifier 21, which is also connected in a local sound circuit 22, including a battery 23 and a transmitter 24. It is to be understood that the circuit 19 corresponds to the loud speaker circuit of radio receiving apparatus. In other words, it is a circuit in which the electric pulsations have been amplified from a regular telephonic circuit.

Figure 3 illustrates apparatus similar to that shown in Figure 2 except that instead of employing condensers 16 and 17, I employ electro-magnets 25 disposed opposite to each other and on opposite sides of the cathode beam 26 formed between terminals 27 and 28. If desired, the wall of the cathode tube 29 can be off-set inwardly to form pockets to receive the electro-magnets, thereby enabling the armatures of the magnets to be brought quite close to the cathode ray.

The coils of the electro-magnets 25 are connected into an electric circuit 30 corresponding

to the circuit 19 already described. The apparatus shown in Figure 3 also includes a circuit 31 corresponding to the cathode circuit 7. The circuit 30 is connected up to form an amplifying talking circuit, including amplifier A corresponding to the amplifier 21, and this amplifier is connected in a local sound circuit 33, including a battery and a transmitter 34, the sound circuit being connected up to a transformer 32.

Figure 4 shows the screen or light stop 14 and indicates the position of the slit. Assuming that the film 12 is advanced in a vertical direction the slit 15 would be elongated in a horizontal direction; likewise, as to the slit 13.

In accordance with my invention, one of the slits 13 or 15 has an inclined edge.

Referring to Figures 5 and 6, 35 indicates the rectangular outline of the cathode beam produced by a rectangular slit 15. These figures indicate a slit 13 having two inclined edges 13^a and 13^b to cooperate with the beam to intercept more or less of its rays as the relative position of the beam changes with respect to the slit 13.

For example, Figure 6 shows the rectangle 35 of the beam considerably depressed so that nearly all of the beam is intercepted by the light stop 11.

Figure 5 shows the beam more elevated with a much smaller area of its cross-section intercepted by the light stop. The slit 13, in this case has the form of an isosceles triangle. The use of such a slit would result in producing a record of the form indicated by the shaded area 36 in Figure 9. In other words, the light-record 37 of the film would have a recording area of symmetrical form with respect to a longitudinal axis and varying in width to correspond with the variations in position of the cathode beam caused by the pulsations of current in the circuit. This view, Figure 9, indicates the pictures, or frames, 38 which produce the moving pictures when the film is run through a projecting machine. For this purpose the edge of the film opposite the light record 36 may be provided with the usual perforations 39 to cooperate with the feeding mechanism of the camera. This film 40 illustrated in Figure 9 illustrates the character of a record produced by an actor in which the recorded speech on the light record 36 would synchronize with the pictures or "frames" 38.

If desired, the slit 13 may have the triangular form of the slit 41 (see Figs 7 and 8). This slit presents a long inclined intercepting edge 42 for the light beam, indicated by the rectangle 43. As the beam rises or falls it will be evident that the edge 42 will intercept more or less of the rays of the beam.

For example, Figure 8 shows the rectangle of the beam dropped down to such an extent that only a very small area of the beam passes through the slit.

A slit of the character indicated in Figures 7 and 8 would produce a light record 44 such as that illustrated in Figure 10, characterized by the fact that the inside edge 45 of the light record would be a straight line and the outer edge a succession of peaks 46. Of course it is immaterial whether the left-hand or right-hand edge is the straight edge.

If desired my invention may be practiced to produce a plurality of light records on a recording member, for example, a film (see Fig. 11) consisting of a plurality of zones 47, each zone having a light record 48 upon it. Such a record can be produced by exposing one of the strips 47 at a time to a cathode ray controlled with my ap-

paratus so as to produce a record, for example, a musical record. After forming one of these record strips 47, the film should be adjusted over so as to bring the next strip or zone in line with the axis of the recording tube. In using the apparatus in this way of course the portions of the film not in line with the cathode ray should be kept dark by suitable means to prevent any access of light to them.

In this way a plurality of light records, for example, 6, as illustrated in Figure 11, can be formed on a single film. This film can be carried on a roll and then run through a translating apparatus such as used in moving picture houses so as to effect sound producing apparatus through the medium of selenium cells or any other light-sensitive apparatus controlling a current through the medium of a light record such as the light records 36 and 44. A record, such as the record 47, could be employed in dwellings to reproduce the music of operas and the film enables the records to be of considerable length though occupying very little space.

In the operation of the apparatus it will be evident as the sounds are received in the transmitters 24 or 34 they will produce corresponding variations in the impulses in the circuits 19 and 30, thereby producing variations in the magnetic field developed between the condenser plates or between the electro-magnets 25. In this connection it should be understood that the flat side of the beam 6 or 26 is located toward the terminals. The variations in the magnetic field will oscillate the beam up or down and thereby affect the area of beam intercepted at the slit in the stop 11 or 28. The cathode ray would normally pass to the center of the terminal 11 or 28 because that is the shortest distance from the terminal 10.

It is understood that the embodiment of the invention described herein is only one of the many embodiments this invention may take, and I do not wish to be limited in the practice of the invention, nor in the claims, to the particular embodiment set forth.

What I claim is:

1. In apparatus for recording sound, the combination of a pair of terminals for an electric circuit, means for developing and projecting a luminous cathode beam between the terminals, means for guiding a light-sensitive film along a path transverse to the direction of the said beam, and adjacent one of said terminals, the latter terminal constituting a light-stop adjacent the path of

the film for intercepting portions of the beam and having a slit for passing a portion of the beam, a second light-stop adjacent the other terminal and having a slit to cooperate with the first-named slit to pass portions of the luminous beam, and sound-controlled means for deflecting the beam between the said terminals and cooperating with the light-stops to project the beam more or less across the edge of the slit of the terminal to vary the light passing to the film.

2. In apparatus for recording sounds, the combination of means for guiding a light sensitive recording member along a path, means for projecting a beam of cathode rays toward the recording member, a light stop in the path of the beam intercepting a portion of the rays composing the beam, a second light stop in a direct line with the first named stop and in a direct line with the beam passing from the first named stop and lying adjacent the path of the recording member, said second light stop having an opening therethrough with an inclined edge, an electric circuit including electrically controlled means adjacent the cathode beam for varying the position of the beam operating to displace the beam more or less across the said inclined edge to vary the area of light passing to the recording member, and sound controlled means for controlling the current in said circuit.

3. In apparatus for recording sounds, the combination of means for guiding a light sensitive recording member along a path, means for projecting a beam of cathode rays toward the recording member, a light stop in the path of the beam intercepting a portion of the rays composing the beam and having an opening therein determining the cross-section of the beam, a second light stop having an opening located in a direct line with the first-named opening and in a direct line with the beam passing from the first-named stop, and lying adjacent the path of the recording member, one of said openings having an inclined edge, an electric circuit including electrically controlled means adjacent the cathode beam for varying the position of the beam and operating to displace the beam more or less as it passes through the second-named light, said inclined edge of one opening cooperating with the edge of the opening in the other stop to vary the area of light passing to the recording member, and sound controlled means for controlling the current in said circuit.

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