

Jan. 30, 1940.

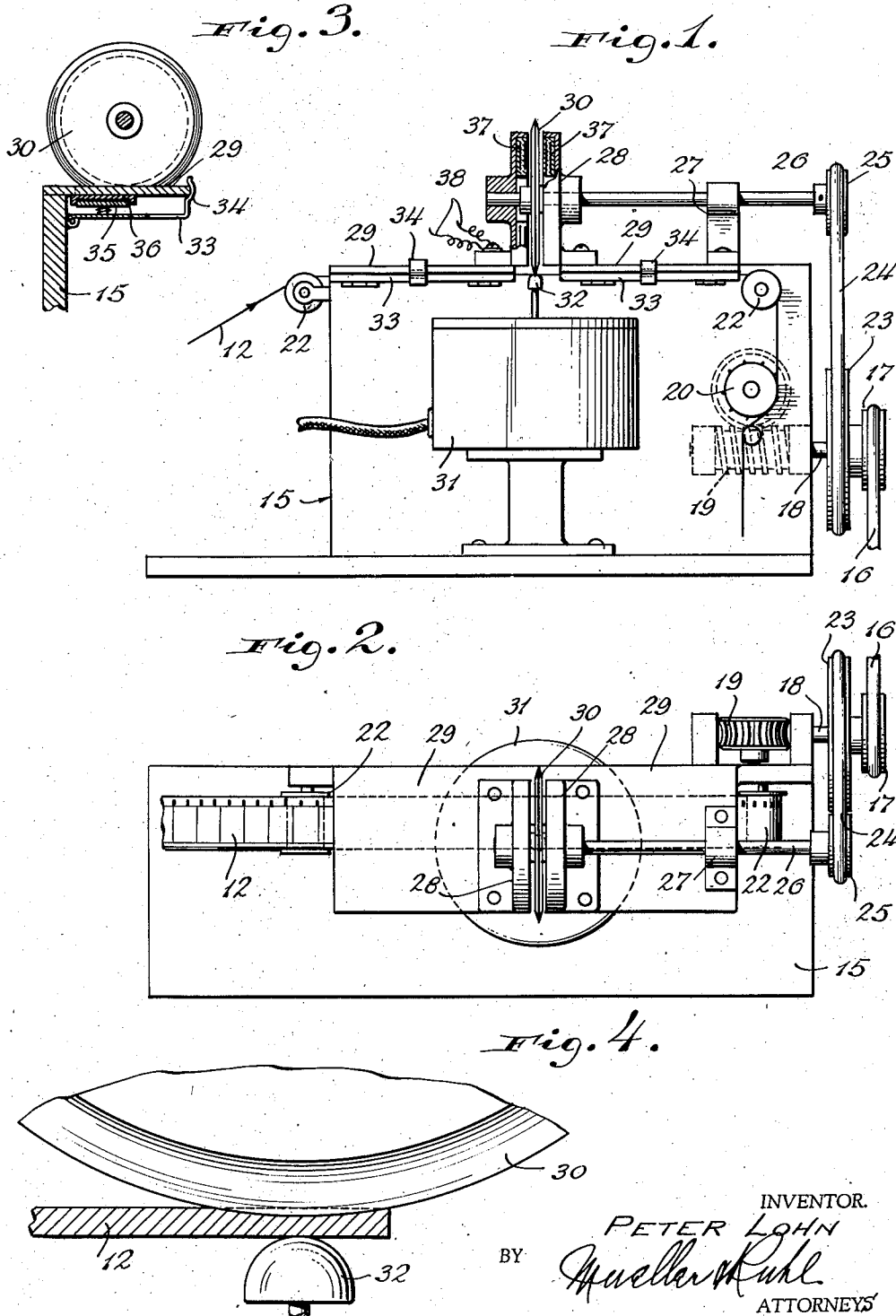
P. LOHN

2,188,687

METHOD AND APPARATUS FOR RECORDING AND REPRODUCING SOUND

Filed April 7, 1938

2 Sheets-Sheet 1



Jan. 30, 1940.

P. LOHN

2,188,687

METHOD AND APPARATUS FOR RECORDING AND REPRODUCING SOUND

Filed April 7, 1938

2 Sheets-Sheet 2

Fig. 5.

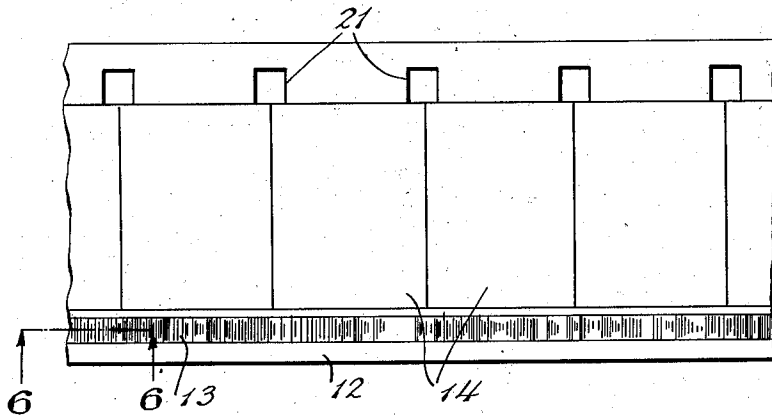


Fig. 6.

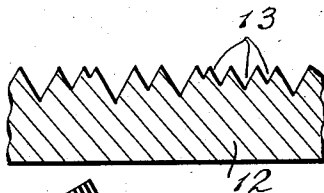


Fig. 7.

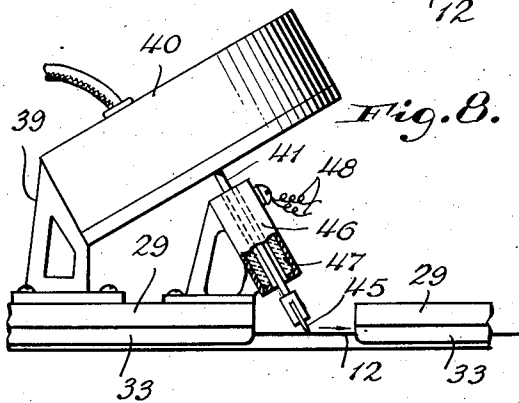
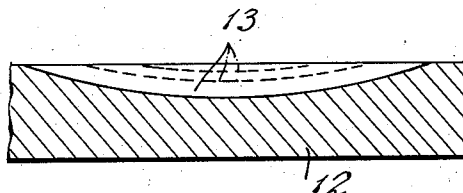


Fig. 9.

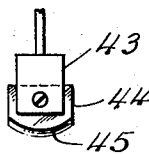


Fig. 11.

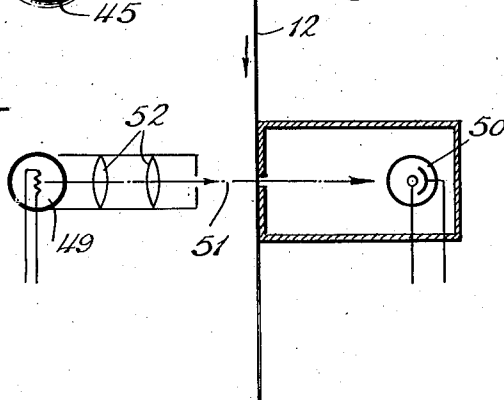
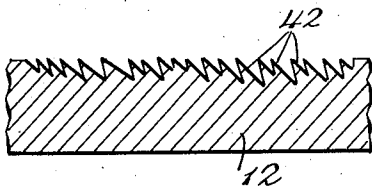


Fig. 10.



INVENTOR.
PETER LOHN
BY *Mueller & Ruhl*
ATTORNEYS

UNITED STATES PATENT OFFICE

2,188,687

METHOD AND APPARATUS FOR RECORDING
AND REPRODUCING SOUND

Peter Lohn, New York, N. Y., assignor of thirty-four per cent to Ferdinand Savignano, New York, N. Y.

Application April 7, 1938, Serial No. 200,640

3 Claims. (Cl. 179—100.4)

This invention relates to improvements in sound recording and reproducing and more particularly to a method and apparatus for the recordation and reproduction of a sound record on a film, or like recording medium, to be used in motion picture cameras and projectors.

An object of the invention is to simplify the recordation and reproduction of a sound record and to provide a practical apparatus for attaining this end which will be comparatively inexpensive, and make the invention applicable for home use.

Another object is to record sound upon a strip, such as a motion picture film, by bringing the latter into association with cooperating members one of which imparts vibrations to the strip and the other cuts a record trace therein, and by softening the surface of the strip in which the trace is formed concurrently with the cutting operation.

A further object is to electrically reproduce sound waves by the utilization of a light sensitive element which is responsive to variations in a light beam occasioned by the passage of said beam through a mechanically formed record trace in a film.

The above and other objects will appear more clearly from the following detailed description when taken in connection with the accompanying drawings which illustrate preferred embodiments of the inventive idea.

In the drawings:

Figure 1 is a side elevation, partly in section, of one form of sound recording apparatus which may be mounted upon a moving picture camera.

Figure 2 is a top plan view of said apparatus.

Figure 3 is a fragmentary detailed sectional view illustrating the means for maintaining the film in cooperative relation to the element for forming the record trace therein.

Figure 4 is an enlarged fragmentary view showing the manner in which the sound record is cut in an edge of the film.

Figure 5 is an enlarged fragmentary plan view of a film showing a record trace cut therein in accordance with the invention.

Figure 6 is a longitudinal section on the line 6—6 of Figure 5.

Figure 7 is a transverse section through the portion of the film containing the sound record.

Figure 8 is a fragmentary elevation, partly in section, of another form of recording mechanism.

Figure 9 is a detail elevation of the cutter used with the mechanism of Figure 8.

Figure 10 is a longitudinal section through a

part of a record trace formed in a film by the mechanism of Figure 8, and,

Figure 11 is a diagrammatic view illustrating the manner in which electrical reproduction of the mechanically formed sound record of Figs. 6 or 10 may be accomplished.

In the use of the sound recording apparatus illustrated in the different forms of the invention, a standard photographic film 12 of the sixteen millimeter type may be employed, consisting of superimposed layers of Celluloid and sensitized emulsion and, in accordance with the present invention, the record trace 13 is cut in the Celluloid surface of the film in the space between the picture frames 14 and one edge of the film, as best illustrated in Fig. 5.

The recording apparatus shown in Figs. 1 to 4 comprises a frame, generally indicated by the numeral 15 which, if desired, may be mounted directly upon a moving picture camera or connected thereto in such a way that the film 12 is fed to the recording apparatus in an unexposed condition for the recordation of the sound record thereon after which it is fed back to the camera for picture exposure. The recording mechanism, which is supported by the frame 15, may be operated from the camera by a flexible transmission 16 extending about a pulley 17 carried by one end of the shaft 18 of said mechanism. Said shaft also carries a worm gear 19 meshing with the worm of the toothed wheel 20 the teeth of which engage in the apertures 21 of the film 12 so as to feed the same around the pulleys 22 in the direction of the arrows and past the recording mechanism that operates to form the record trace 13 in the film synchronously with the taking of pictures by the operation of the camera.

The shaft 18 is also utilized to drive the recording mechanism by means of a pulley 23 mounted on said shaft and a flexible endless element 24 engageable with said pulley and also a pulley 25 carried by one end of the shaft 26 supported intermediate its end by a bearing 27 mounted upon the frame 15. Said shaft 26 extends through a housing 28 supported upon two spaced lateral extensions 29 at the upper end of the frame 15, and so arranged on said extensions as to bridge the space between the same. Mounted upon the portion of the shaft 26 disposed within the housing 28 is a cutting element 30 in the form of a disc, the major portion of which is enclosed within the housing and which has its periphery projecting therefrom and sharpened to a knife edge for contact with the Celluloid sur-

face of the film 12 as the latter passes beneath the cutter. In disposing the cutter on the shaft 26, the plane of said cutter is arranged perpendicularly to the surface of the film in which the record trace 13 is formed by the rotation of the cutter and passage of the film therebeneath. In the operation of forming said record trace, the edge of the cutter constantly engages the film as the latter travels in its linear path, and said cutter thereby operates to form said trace by actually removing portions of the film. The varying characteristics of said trace, as illustrated in Figs. 6 and 7, which are subsequently translated into sound by a reproducing mechanism, are effected by vibrations imparted to the film in accordance with sound waves transmitted to a conventional sound pick-up device 31 mounted upon the frame 15 and having a vibratory stylus 32 engageable with the under surface of the film in opposed relation to the edge of the cutter 30. In order to properly guide the film past the cutter 30 and stylus 32 there are provided two film gates 33 hingedly supported upon the frame 15 in association with the two extensions 29, the inner adjacent ends of said gates being spaced to leave free for vibration under the influence of the stylus 32 a portion of the film contiguous to the cutter 30. Each of the gates 33 has a spring latch 34 for engagement with the free edge of its associated element 29, and said gate carries a spring pressed shoe 35 which engages the under surface of the film to retain the same in a track 36 secured to the under surface of said extension 29.

In order to facilitate the formation of the record trace 13 in the film, it is desirable to soften the Celluloid portion thereof in which the record is cut, simultaneously with the cutting operation. To this end, provision is made in the housing 28 for containing heating elements 37, preferably in the form of coils, disposed on opposite sides of the cutter 30 and connected through conductors 38 to a suitable source of current. In this manner the cutter 30 is heated by the coils 37 and, through conduction, this heat is transmitted to the periphery of the cutter where it engages the film to heat and thus soften the same at the instant the film is being cut. Through such arrangement, the film is heated only for a time sufficient to facilitate the formation of the trace therein and this permits the film to immediately cool off after the cutting operation so that a minimum of time will elapse during which the film is actually heated.

In the form of recording apparatus shown in Figs. 8 and 9, the film 12 is fed through the gates 33 in the same manner as previously described except that, in this instance, the position of the film is reversed so that its Celluloid surface in which the record trace is formed, is uppermost. On one of the extensions 29 of the frame 15, there is mounted, by means of a bracket 39, a sound pick-up device 40 having a vibratory stylus 41 which is preferably disposed at an angle of about 45 degrees to a surface of the film in which the record trace 42 (Fig. 10) is to be cut. The lower free end of the stylus 41 is provided with a head 43 in which is secured a blade 44 having an arcuate cutting edge 45 for engagement with the upper surface of the film 12 in the space between the extensions 29 and gates 33 so that as said stylus is vibrated by the diaphragm (not shown) of the device 40 the unsupported portion of the film 12 will be free to flex slightly under the influence of the pressure

of the cutter 44 thereagainst and at the same time the record trace 42 will be cut into the film.

Similar to the first embodiment described, the cutter blade 44 is heated to facilitate the formation of the record trace and, for this purpose, a housing 46 is secured to the same extension 29 of the frame 15 upon which the device 40 is mounted, and is provided with a central opening through which the intermediate portion of the stylus 41 extends. The housing 46 encloses a heating coil 47 which encircles the stylus 41 and is supplied with current through the conductors 48 connected to a suitable source. The heat thus supplied to the stylus 41 is transmitted, by conduction, to the cutting blade 44 and from thence to the surface of the film as said blade contacts the latter so that said film is temporarily softened while the sound record is being formed therein.

In the production of sound from the record traces 13 and 42 mechanically formed in the film in the manner above described, it has been found that an accurate and faithful reproduction may be had by employing an electrical apparatus such as partially and schematically shown in Fig. 11. Said apparatus may include an exciter lamp 49 and a light sensitive element 50, such as a photo-electric cell, arranged to have the film 12, and more particularly that portion thereof containing the record trace, passed therebetween so that a beam of light 51 having its source at the lamp 49 and extending through a conventional optical system 52, will be directed upon the record trace as the film is fed between the elements 49, 50. As said beam is impinged upon the cuts forming the record trace, the angles of said cuts produce refraction of the light beam passing through the film and thus the luminosity of the light sensitive element 50 will be varied in accordance with the degrees of refraction and, in a manner well known in the art, such variations in said element 50 may be translated into sound.

What is claimed is:

1. Sound recording apparatus comprising, in combination, a sound responsive device having a vibratory element engageable with one surface of a film to impart vibrations thereto in accordance with sound transmitted to said device, a cutter engaging the other surface of said film in opposed relation to said vibratory element, means to heat said cutter, means to feed said film past said element and cutter, and spaced film gates forming enclosed passageways for said film disposed on opposite sides of said element and cutter and through which said film is guided with the portion of the film in the space between said members unsupported so that it will flex in response to the vibrations of said vibratory element.

2. Sound recording apparatus comprising, in combination, a supporting frame having horizontally spaced lateral extensions, a sound responsive device having a vibratory element engageable with one surface of a film to impart vibrations thereto in accordance with sound transmitted to said device, a housing supported by said extensions contiguous to the space therebetween, a cutter revolvably mounted in said housing and extending into said space in engagement with the other surface of said film in opposed relation to said vibratory element, means within said housing to heat said cutter, means to feed said film past said element and cutter, and film gates supported by said frame

and each associated with one of said extensions for guiding said film as it is fed to and beyond said cutter.

5 3. Sound recording apparatus comprising, in combination, a supporting frame having horizontally spaced lateral extensions, a sound responsive device having a vibratory element engageable with one surface of a film to impart vibrations thereto, a housing supported by said
10 extensions adjacent the space between the latter, a rotary cutter mounted in said housing and

extending into said space and engaging the other surface of said film in opposed relation to said vibratory element, heating elements arranged in said housing on opposite sides of said cutter, means to feed said film past said vibratory element and cutter, and film gates pivoted to said supporting frame and cooperating with said extensions to support and guide said film in its movements.

PETER LOHN.

10