

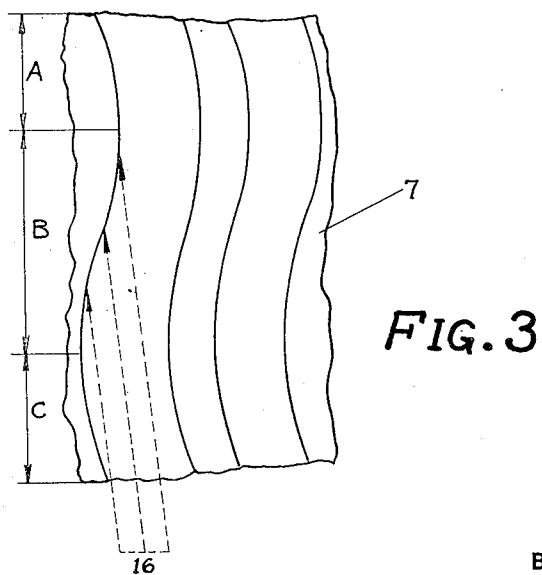
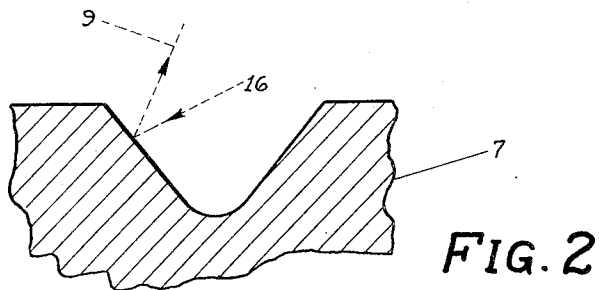
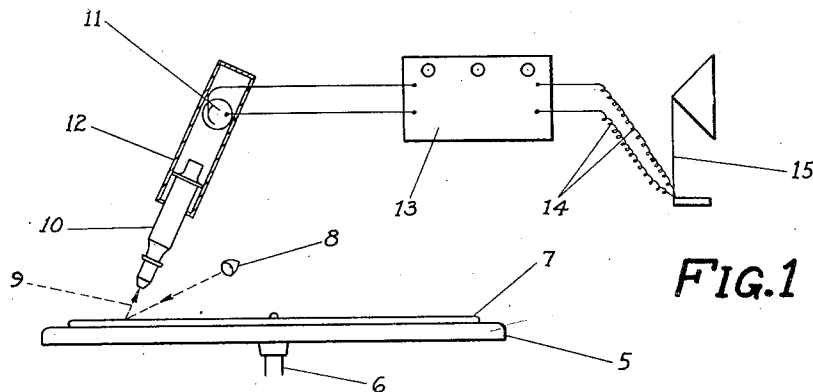
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SOUND REPRODUCING MEANS AND METHOD

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SOUND REPRODUCING MEANS AND METHOD

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This invention relates to new and useful improvements in method and means of reproducing sound.

An object of the invention is to provide a method of reproducing sound wherein the object bearing the recorded sound is not touched during the reproducing operation.

Another object is to provide a method of reproducing sound, the method including the step of intercepting reflected light beams and converting them into sound.

A further object is to provide a more delicate means for reproducing the sound recorded on a phonograph record.

Another object is to provide a method of reproducing sound from an ordinary disc phonograph record without mechanical contact with the sound groove of the record.

An additional object is to provide a method of reproducing sound from a disc phonograph record consisting in casting a light beam on the record and intercepting reflected light rays and converting them into sound.

A still further object of the invention is to provide a means for carrying out the foregoing objects.

Yet another object is to provide a means and method for the purpose indicated, which means and method is adapted to reproduce sound from a wax master; from a metallic electroplate of the wax master (be the electroplate either positive or negative), whose surface is polished or covered with mercury or some other plating capable of taking high polish such as silver, gold, nickel or uranium, or from the ordinary commercial disc phonograph record.

Other objects and advantages will become apparent from the following detailed description taken in connection with the accompanying drawing, wherein in a more or less diagrammatic manner is illustrated an embodiment of the invention.

In the drawing:—

Fig. 1 is a diagrammatic view showing the hook-up and the relationship of the parts to the disc or other object carrying the recorded sound;

Fig. 2 is a section greatly enlarged showing a single record groove and also diagrammatically showing the light beam entering

the groove and reflected by the side wall thereof; and

Fig. 3 is a plan view of a section of the record greatly enlarged and illustrating the manner in which the wall of a groove is illuminated.

By the present disclosure, the invention is shown as applied to the reproduction of sound from an ordinary commercial phonograph record. However, it will be understood that the invention has other applications and that the present disclosure is for the purpose of illustration only and that reference must be had to the claims for a definition of the limitations of the invention.

In the following description and in the claims, the words "sound record" or the word "record" is used to indicate any object carrying a recording of sound. "Record disc" or "phonograph record" is used to designate any phonograph record or any disc shaped record be it made as is the ordinary commercial phonograph record, or be it a wax master or an electroplate of the latter.

Referring in detail to the drawing, at 5 is shown a phonograph turn table, carried by a spindle 6 adapted to be rotated by any suitable means (not shown), and mounted on the turn table 5 is an ordinary disc phonograph record 7. According to the present invention, a steady light is emitted from a source 8 and directed into and along the grooves of the record 7.

This steady light is reflected by the smooth inclined wall of the record groove, as indicated by the line 9 into a microscope 10. Due to the curvature of the wall of the groove and the undulations in the wall, the reflected light is intermittent or flickering. The intermittent or flickering light is passed through the microscope 10 and falls upon a light sensitive cell such as a photo-electric cell 11 enclosed within a casing 12 disposed over the end or eye-piece of the microscope 10.

Since the photo-electric cell 11 is disposed above the eye-piece of the microscope and receives the intermittent or flickering light from the microscope, a correspondingly intermittent current is caused to flow through the circuit connecting the photo-electric cell

11 to a suitable amplifying arrangement indicated at 13, and thence through wires 14 to a loud speaker 15 which transforms the electrical impulses into sound.

5 Figs. 2 and 3 illustrate the manner in which the light is reflected and made to flicker according to the sound surface. A cross-section of the groove is shown in Fig. 2, the arrow line 16 illustrating the path of light entering the groove and the arrow line 10
9 indicating the path of the reflected light from the groove to the microscope 10.

Fig. 3 illustrates the direction of the illuminating rays along the groove. Quite obviously, the section of the wave marked "A" will be comparatively dark since it is over the crest, while the section marked "B" will be highly illuminated and will therefore reflect rays into the microscope when this section of the groove or wave passes under the light source as the record rotates. The section marked "C" will be comparatively dark and the reflected light reduced to a minimum. In this way, the amount of
25 light passing through the microscope and falling on the photo-electric cell is varied, and corresponds to the sounds recorded on the record.

The photo-electric cell produces a pulsating electrical current corresponding to the light received. This current when amplified and applied to a loud speaker, produces sound in accordance with the impulse received. In this way, I reproduce the sound
35 carried by a phonograph record to which the device is applied.

Many obvious advantages will readily suggest themselves and a few of them will be here pointed out.

40 More faithful reproduction will be obtained than with the usual method of reproduction of phonograph records, since this usual method includes mechanical contact with the record groove by a needle carrying a stylus bar and diaphragm for acoustic production and by a needle carrying an armature for electric production. Each of these systems involves a needle or stylus with a mechanical load attached to its top end.

50 The needle and its load are quite clumsy when compared with the magnitude and velocity of the sound vibrations they are attempting to transmit. When it is considered that the reproduction of a 6,000 cycle wave
55 involves starting this mechanical bulk in one direction, stopping it and then starting it in the other direction 6,000 times each second, we realize that we are requiring too much of such a system. Measurements show that the amount of a 6,000 cycle sound reproduced with mechanical means is almost negligible.

In addition to the weight and elasticity of the mechanical contact system, there are
65 other faults. It is known that a phono-

graph needle wears flat at the point as it travels through the groove and that this "flat" has a dimension of .0068 inches, measured along the groove. The dimension of a 5,000 cycle wave at a point half-way through the ordinary disc record is .0067 inches from crest to crest, and it is much less near the end of the record. Obviously, the flattened needle cannot follow this wave, but merely bumps along from crest to crest reproducing the wave in a distorted shape and in a greatly reduced volume.

Aside from the consideration of quality reproduction, there are other faults of the mechanical system of reproducing sound, such as wear and tear on the record, needle scratch and surface noise. These mechanical faults in addition to their harmful effect on reproducing, are a problem in manufacturing the disc, and although this problem has been fairly well solved, it would be capable of a more satisfactory solution, should the element of wear be removed. As now manufactured, the disc must have two essential virtues, namely, wearing quality and smoothness of surface. With the necessity for the first mentioned virtue removed, greater freedom is allowed in formulating the record material with an object of securing a smoother surface.

Having thus described the invention, what is claimed is:—

1. In a machine for reproducing sound, in combination, a sound record, means for throwing a beam of light on to said record, a microscope positioned to receive reflected light rays from a portion of the record, a light sensitive cell disposed beyond the eyepiece of said microscope, an amplifier, a circuit to said amplifier adapted to be closed when light is directed against said cell, and a loud speaker operated by said amplifier.

2. The combination as in claim 1, including a casing enclosing the cell and the eyepiece of the microscope.

3. In combination with a body having a record groove therein, means for throwing a beam of light into said record groove, means for intercepting light rays reflected from said groove, a light sensitive cell, and said light ray intercepting means directing the intercepted light rays on to said light sensitive cell.

4. In a sound reproducing device to reproduce sound, a grooved record, a light source to cast light upon the record and a light sensitive element to receive light reflected from the record.

5. The method of reproducing consisting in casting light rays on a sound record having a groove, collecting light rays reflected from the groove of the record, passing said collected light rays through a light sensitive cell and maintaining the collecting means in close proximity to the record surface.

6. In a sound reproducing device to re-
produce sound, a grooved record, a light
source to cast light upon the record, a light
sensitive element to receive light reflected
5 from the record, an amplifier in circuit with
said light sensitive element, and a loud speak-
er in circuit with said amplifier.

7. A reproducer to reproduce sound from
a grooved record, the same comprising a
10 lens system, a means to maintain said lens
system in position to receive reflected light
from the groove of the record, and a light

sensitive element arranged to receive light
from said lens system.

8. A record reproducing means compris-
ing means to cast light onto a grooved rec-
ord to be reproduced and means to direct 70
light reflected from said record onto a photo-
electric cell.

Signed at New York, in the county and
State of New York, this 17th day of May,
A. D. 1929.

REGINALD T. FRIEBUS.

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