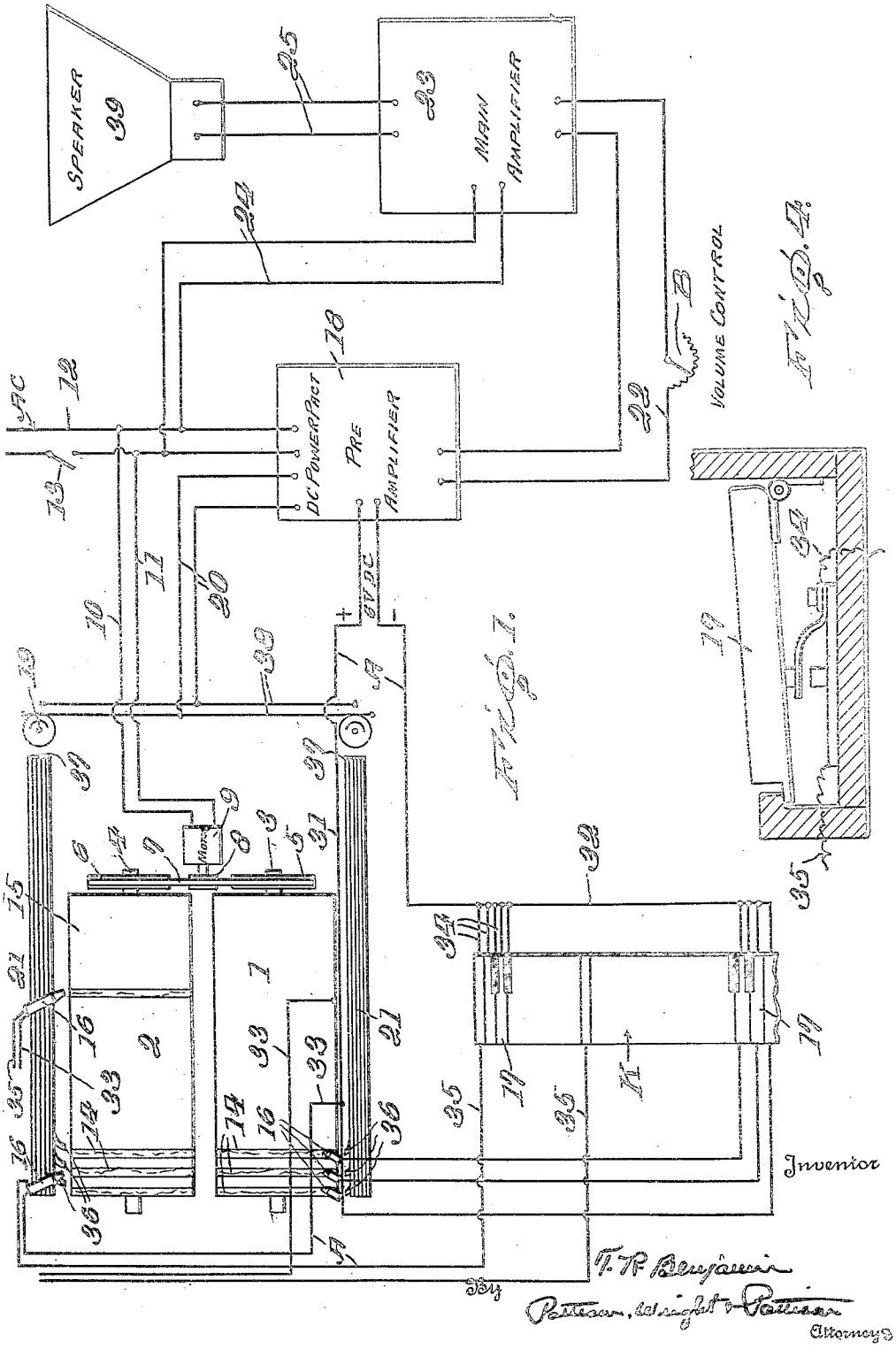
Nov. 12, 1946. T. R. BENJAMIN 2,410,956

SYSTEM OF REPRODUCING SOUND

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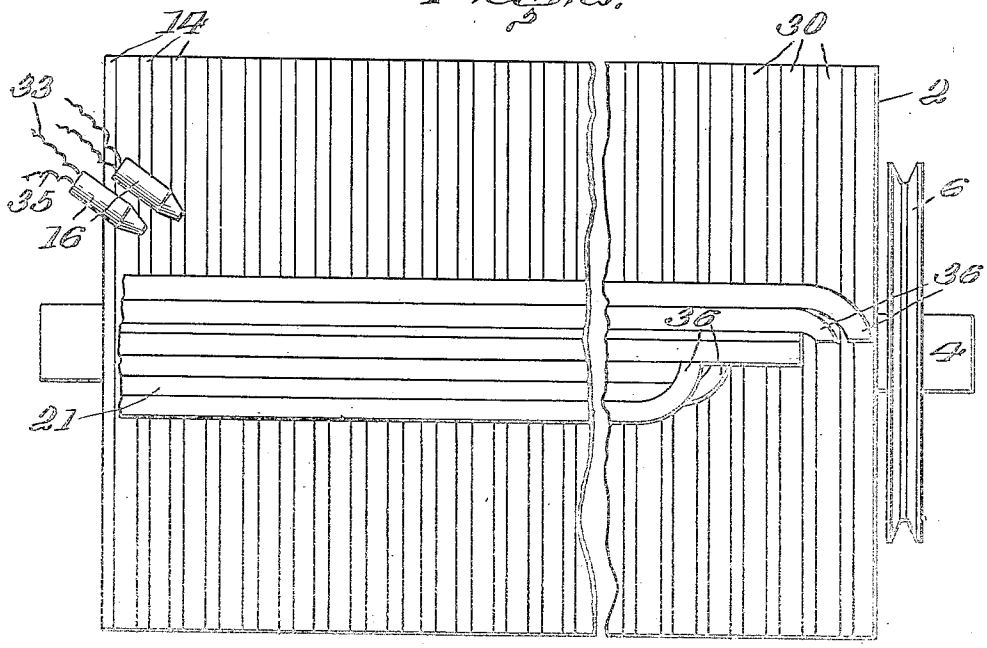


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SYSTEM OF REPRODUCING SOUND

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FIG. 2.



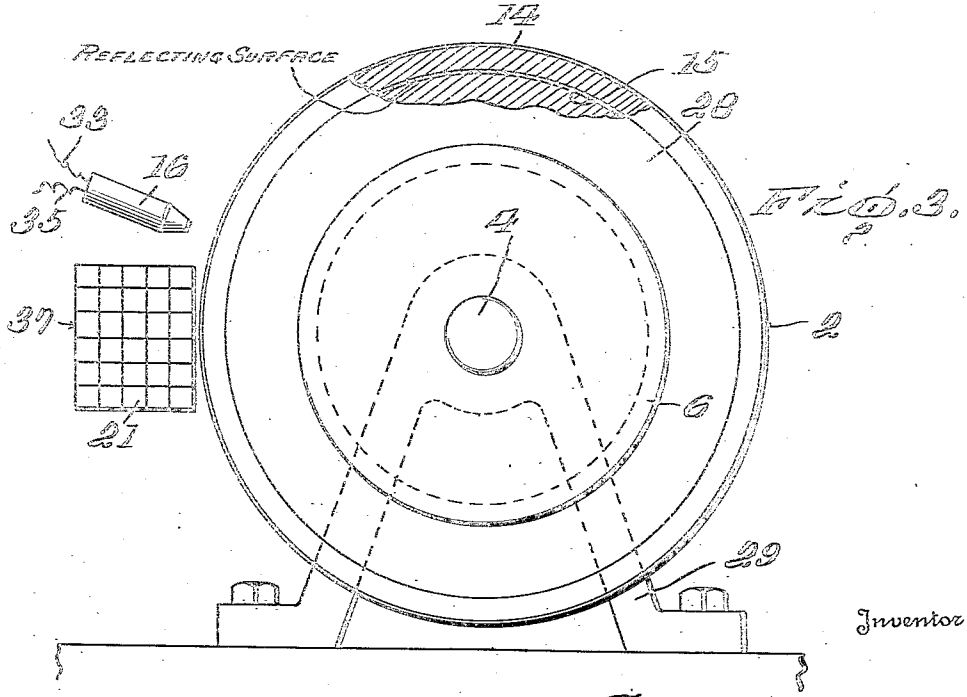


FIG. 3.

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SYSTEM OF REPRODUCING SOUND

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8 Claims. (Cl. 84—1.18)

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This invention relates to a system of reproducing sound, and more particularly to a system especially adapted to reproduce the musical notes or tones of a musical instrument such as an organ or piano whereby a photoelectric musical instrument can be produced which will have all the characteristics of the original instrument.

Another object of my invention is to provide a device having novel means for collecting and conveying the light beam from the sound track to the photoelectric cell.

Another object of my invention is to provide a photoelectric system in which an endless continuously moving transparent surface carries a sound track and a reflecting surface to receive the light beam from the sound track and reflect the same into a Lucite rod.

With these objects in view,

Fig. 1 is a diagrammatic view of an embodiment of my invention.

Fig. 2 is a top plan view of one of the cylinders partly broken away, and

Fig. 3 is an end view partly in section of the same.

Fig. 4 is a vertical sectional view through the keyboard.

The construction of a mechanism by which the present invention can be practiced may be varied in considerable degree without departing from the inventive concept and the specific construction illustrated in the drawings and hereinafter described is not to be considered limitative of the invention beyond the scope of the claims as they are interpreted in the light of the prior art.

In the illustrated construction I employ a pair of transparent surfaces in the form of glass cylinders 1 and 2. These cylinders need not necessarily be made of glass but could be made of some other suitable transparent material. There need not necessarily be two cylinders as a single cylinder could be utilized. A pair of cylinders is illustrated so as to reduce the overall size of the device which would be increased were all of the notes recorded on a single elongated cylinder, as they could be.

Sound tracks 14 are carried upon the outer faces of these cylinders in parallel spaced relationship and completely encircling the cylinders. The sound tracks are placed upon the cylinders in the following manner. Assuming that the apparatus is for the purpose of reproducing the notes of an organ or other musical instrument, all the notes of the instrument are recorded by movietone, photophone or other recording on strips of film each strip being of a length similar

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to the circumference of the glass cylinder. The sound strip of each note of the instrument is of the length of the circumference of the cylinder. The cylinder is treated with a photographic emulsion and the sound strips are secured in side by side spaced relationship around the cylinder and the cylinders thereafter exposed to the light and then developed and dried. The cylinders are then ready for use and as nothing comes in contact with the outer face of the cylinders they should last indefinitely.

The cylinders 1 and 2 are hollow and have at least one open end so that they can be slid onto and readily removed from arbors 28 which are rotatable with shiftable shafts 3 and 4 mounted in suitable bearings in the ends of the brackets 29.

This construction enables the cylinders with the recorded notes to be changed in a manner similar to the changing of a dictaphone cylinder and gives to the mechanism flexibility so that the recorded notes of any musical instrument may be reproduced by merely changing cylinders.

Each of the shafts is provided with a pulley as indicated at 5 and 6 over which are trained a drive belt 7 driven by a pulley 8 of an electric motor 9 which receives its current over the conductors 10 and 11 which are connected to the main current supplying wires or power line 12 which has a switch 13 therein.

It has previously been stated that the cylinders were ready for use. It should however be pointed out that the inner faces of the cylinders are mirrored, that is, suitably treated so that the cylinders have an inner reflecting surface 15.

The motor 9 and the belt drive provides means for revolving the cylinders in unison and at a predetermined speed. The speed of rotation of the cylinders should be the same as the speed of the recording of the notes on the film from which the notes were photographically reproduced on the outer surface of the cylinders.

The construction thus far described provides transparent mediums carrying endless sound tracks in spaced relationship. The spaced sound tracks 14 provide unobstructed spaces 30 between the tracks to allow reflected light beams to travel outwardly from the reflecting surface 15 of the cylinders for collection and transmission by Lucite rods in a manner which will now be described.

A source of light 16 is disposed adjacent each sound track on each cylinder. This might properly be called an exciter light and may be of any type best suited for the purpose. It could be the common filament type electric light or a Neon or

gas filled type. Possibly under some circumstances the filament type light might not prove as desirable as could be wished as it might be too slow in action as the filament lights up very much slower and cools down, that is goes out, slower than does a gas filled type of light. On rapid action, as for instance the running of arpeggios or scales, a drag or slow action light would be detrimental and if a filament light were found to be too slow a Neon or gas filled exciter light should be used.

The endless note tracks and endless reflecting surfaces continually move in unison so that clear notes are obtained in the reproduction of the desired sound.

Each of the exciter lights is arranged in an open electric circuit A. The source of power for this circuit is a D. C. power pact 18 which is as shown, connected to the power line 12. From the source of power a pair of conductors 31 and 32 extend to a keyboard designated as an entirety at K. This keyboard is provided with suitable keys 17 each of which acts as a switch in the open circuit so as to close the circuit when a key is depressed. One terminal of the lights 16 is connected to the conductor 31 as by wires 33 while an individual conductor 34 connects each of the keys 17 to the conductor 32. Each key in turn is connected to the other terminal of the exciter lamp 16 by a conductor 35. The manner in which the keys act as switches to close the open circuit A appears in detail, in Figure 4 of the drawings.

The depression of a key 17 is for the purpose of reproducing a selected note or tone and immediately one or more of the keys are depressed the electric circuit is closed to one or more of the lamps 16 and when this occurs the particular lamp which is lighted will direct a beam at an angle downwardly through the particular sound track 14 with which it is associated. This beam will be reflected outwardly through the space 30 adjacent the particular sound track through which the light beam is projected and is collected by a Lucite rod, as will be shortly specifically described.

By reason of the cylinders rotating in unison a single keyboard can be used and obviously the particular construction of the circuit closer, such as the key 17, is variable. The provision of an independent exciter light for each sound track of each cylinder provides a selective system as any one or any plurality of notes or tones can be produced either in succession or simultaneously. A plurality of Lucite rods designated 21, corresponding in number to the number of reflecting spaces 30, are disposed adjacent but in spaced relationship to each cylinder. Each of these rods has an inwardly turned end 36 which terminates closely adjacent a reflecting space 30. A photoelectric cell 19 is associated with the ends 37 of each group of Lucite rods 21.

The inwardly turned end 36 of each rod picks up the reflection from the track paralleling reflecting space 30 with which it is associated. These rods "pipe," as it were, to the photoelectric cell the particular light beam which it picks up. "Lucite" the composition of which is CH_3 has the particular characteristic of transmitting light rays without distortion and these light rays will be so conducted through the "Lucite" rods even though the rods are bent or curved. The use of "Lucite" permits a compact arrangement so that the ends 37 of the rods can be grouped and permit the use of a single photoelectric cell for each group of rods. At most, provided there were an unusual number of rods, two photoelectric cells for each group of rods would be necessary.

The photoelectric cells are interconnected by a pair of conductors 28 to which direct current is brought from the power pact 18 by conductors 20.

The power pact 18 or its equivalent is necessary as the current supply to the exciter lights as well as the photoelectric cells should be direct current. Additionally the device 18 is a preamplifier as a preamplifier is a desirable unit in the present type of sound reproduction.

The apparatus is completed by the provision of a main amplifier 23 which is connected to the preamplifier by the conductors 22; the volume control B; and the speaker 39 which is connected to the main amplifier by the conductors 25. Current for the main amplifier is provided from the power lines 12 by the conductors 24.

The device operates as follows: Upon the closing of the switch 13 the motor will cause the glass cylinders to rotate and upon the depression of the proper key 17 the note represented by that key is reproduced. This reproduction is accomplished by reason of the fact that the depression of the key causes the ignition of the proper exciter light the beam of which passes through its associated sound track 14 as said track passes or spins through the light beam. The mirrored inner surface of the cylinder reflects the note backwardly and upwardly and outwardly through the reflector space 30 into the end of the associated Lucite rod which carries the note to the photoelectric cell 19 from which it is conveyed to the preamplifier, through the volume control to the main amplifier and out from the speaker.

From the foregoing it will be seen that I have provided an extremely simple and yet effective apparatus for giving a true reproduction of a photographically recorded note or sound and that numerous constructional departures can be made without departing from the inventive concept as expressed in the following claims.

I claim:

1. In a device for reproducing the notes of a musical instrument consisting of an endless transparent surface having its inner surface mirrored to form an endless outwardly reflecting surface, a plurality of spaced sound tracks disposed on the outer face of said transparent surface each containing a note, an electric light disposed adjacent each sound track to direct a beam at an angle through said sound track against the reflecting surface, a Lucite rod disposed opposite the space between each of said sound tracks to collect and convey the same, and a photoelectric cell disposed at the end of said rod.

2. A system for reproducing sound comprising, an endless continuously moving transparent surface having a plurality of transversely spaced sound tracks on its outer face and an outwardly reflecting surface on its inner face, a plurality of sources of light each disposed to be projected at an angle through one of said sound tracks against said reflecting surface, a photoelectric cell, a Lucite rod having a curved end disposed between each of the spaces between said sound tracks and its other end terminating at said photoelectric cell, and means for selectively supplying electrical energy to the individual sources of light.

3. A system for reproducing sound comprising, a photographic sound record composed of a plu-

rality of transversely spaced sound tracks formed on an endless transparent surface adapted to move continuously, said transparent surface having its inner surface mirrored to form an outwardly reflecting surface, a photoelectric cell, an electric light disposed adjacent each sound track for directing a ray at an angle through said sound track against said reflecting surface, and a plurality of Lucite rods disposed adjacent said surface each having one end disposed between a pair of sound tracks and its other end disposed to direct a ray upon the photoelectric cell.

4. In a sound reproducing apparatus employing a sound track arranged on a moving transparent surface and a light projected at an angle directly through the sound track and transparent surface onto a moving outwardly reflecting surface, a photoelectric cell, and a Lucite rod interposed between the reflected light beam and photoelectric cell.

5. In a sound reproducing apparatus, a plurality of transversely spaced sound tracks arranged on a revolving transparent drum having an inner surface in the form of an outwardly reflecting mirror, a source of electric light for each of said sound tracks, each of said light sources arranged for directing a light ray downwardly through its respective sound track at an angle so that said ray is reflected upwardly and outwardly through the space on said drum between said sound track and the next adjacent sound track, a photoelectric cell, and a Lucite rod interposed between the reflected light beam and the photoelectric cell.

6. In an apparatus for reproducing sounds, a rotatable driven arbor, a hollow cylinder slidable onto and removable from said arbor for rotation therewith, said cylinder being formed of transparent material and having its inner face in the form of an outwardly reflecting mirror, a plurality of endless sound tracks positioned on the outer face of said cylinder in spaced relationship longitudinally of the cylinder, a source of light associated with each of said sound tracks, each of said light sources arranged for directing a light ray downwardly through its respective sound track at an angle thereto so that said ray is reflected upwardly and outwardly by said cylinder mirror through the space on said cylinder between said sound track and the next adjacent sound track, a photo-electric cell remotely positioned exterior of said cylinder, and a Lucite rod associated with each of the spaces on said cylinder between said tracks for conveying to the said cell the light rays reflected outwardly through the said spaces on said cylinder.

7. A construction as defined in claim 6 wherein, said Lucite rods are arranged in parallelism and extend longitudinally of the cylinder, one of the ends of said rods terminating adjacent said cell, and the other ends of said rods bent inwardly towards the cylinder to position one end of each Lucite rod opposite and closely adjacent the space on said cylinder between a pair of said sound tracks.

8. A construction as defined in claim 6 wherein, the outer face of the hollow cylinder is provided with a photographic emulsion and the sound tracks are printed on said cylinder outer surface.

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