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T. J. BUITKUS
PHOTOELECTRIC TONE GENERATOR

3,098,889

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FIG. 1

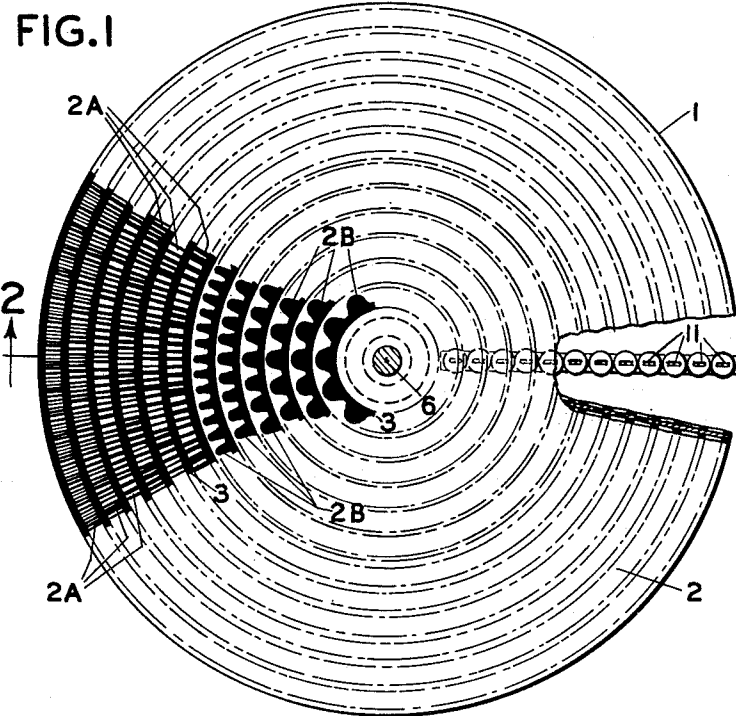


FIG. 3

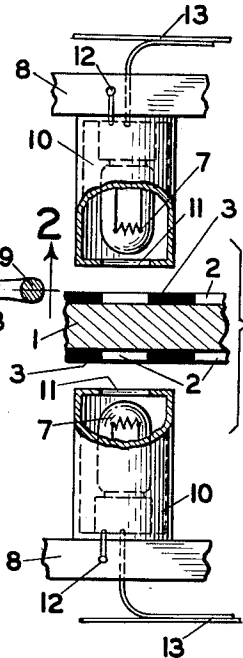


FIG. 2

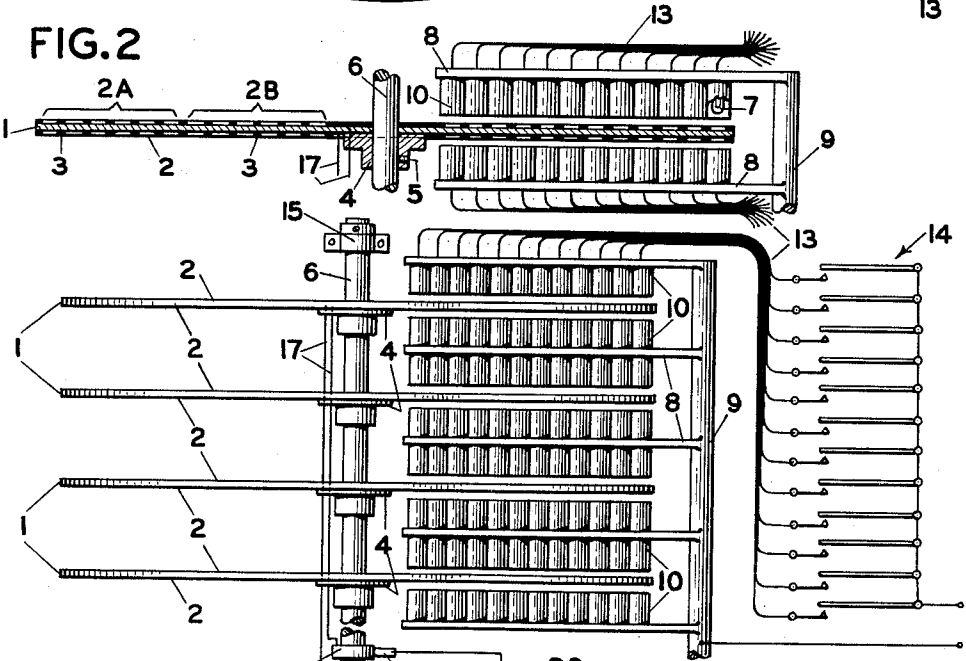
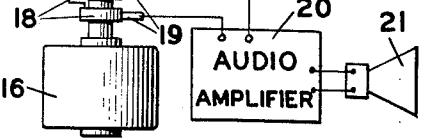


FIG. 4



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PHOTOELECTRIC TONE GENERATOR

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3 Claims. (Cl. 84-1.18)

This invention relates generally to photoelectric tone generating apparatus. More specifically, it relates to a multiple-single tone audio generator comprising a plurality of endless optical sound tracks superimposed on photoelectric cells together with means for translating the audio sources into continuous audible tones. This application is a continuation-in-part of my copending application bearing Serial Number 837,751, filed September 2, 1959, now abandoned.

Various types of photoelectric instruments have hitherto been disclosed. In the present state of the art, rotary discs or drums having optical sound tracks depicted thereon serve to modulate light sources which are made to impinge upon photoelectric cells or tubes spatially separated from said discs or drums. In such arrangements, only a single series of optical sound tracks may be accommodated along a given plane of each rotating member since the light beams must by necessity pass completely through the discs or drums before reaching the light sensitive surface of the photoelectric cells or tubes.

It is a primary object of the present invention to provide a means for accommodating twice the number of optical sound tracks, not heretofore possible on a given size disc or drum, by the novel arrangement of superimposing the optical sound tracks directly upon the light sensitive surfaces of the photoelectric cells.

Another object of the present invention is to provide a self-contained audio tone generator capable of the production of a large number of varied tones and timbres suitable for use in the manufacture of a compact and relatively inexpensive musical instrument.

In the accompanying drawing, forming a part of this application, and in which like numerals are used to designate like parts throughout the same:

FIG. 1 is a fragmentary face view of one rotary disc-shaped photoelectric cell showing optical sound tracks depicted thereon and relationship of individual light sources thereto.

FIG. 2 is a cross-sectional view of the photoelectric tone generator disc with related light sources taken along the line 2-2 of FIG. 1.

FIG. 3 is an enlarged, fragmentary detail view of two light sources, various parts associated therewith being broken away, with related optical sound tracks and photoelectric cell shown in cross section.

FIG. 4 is a diagrammatic plan view illustrating the basic components of the tone generator and their general relation one to another.

Referring to FIGURES 1 and 2, a disc-shaped double faced photoelectric cell 1 is shown having a plurality of endless, concentric optical sound tracks 2 residing upon both sides of said cell. Self-generating barrier layer photoelectric cells of the selenium or silicon type may be employed. It is to be understood, however, that the present invention is not limited necessarily to the use of photoelectric cells of the photovoltaic type as the term "photoelectric" used hereinafter shall also include photosensitive cells of the photoconductive and photoemissive types. The light sensitive surface of the photoelectric cell 1 is completely covered or masked by an opaque light barrier 3 except for the endless, concentric optical sound tracks 2 which appear within the opaque areas as transparent waveform patterns exposing the light sensitive surface of the underlying photoelectric cell 1. The term "optical sound tracks" referred to hereinafter shall

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be understood to comprise endless bands in which opaque and transparent areas alternate in a manner so as to have a light modulating or interrupting function. Optical sound tracks of the variable density type 2A consisting of variations in the density or opacity of a track of constant width or a variable area type 2B consisting of variations in the width of exposed area may be used. Such optical sound tracks may be formed from a transparent substance in which opaque areas are provided photographically or otherwise or by stamping or otherwise perforating an opaque material to provide for the passage of light. Optical sound tracks may also be created by utilizing an electro-magnetically driven cutter to engrave variable area tracks into a transparent material covered by a thin opaque coating. Said optical sound tracks may contain the waveforms characteristic of various orchestral instruments or may consist of synthetic waveforms. The width of the transparent portions are limited in accordance with the fineness of the variations of the sound tracks to permit proper scanning. It will be apparent that by varying the size of the photoelectric cell, a greater or lesser number of optical sound tracks may be accommodated thereon. The photoelectric cell disc 1 is provided with a hub 4 and setscrew 5 for attachment to shaft 6.

Positioned along one half of the diametrical portion of each side of the tone generator disc 1 is a row of lamps 7 supported by arm 8 which forms part of a fixed lamp-holder mounting bracket 9. A separate lamp 7 (FIG. 3) is provided for each sound track. Each lamp is enclosed by a shield 10 provided with a light emitting slit 11 allowing only a narrow beam of light to be projected from the lamp onto its related sound track. The purpose of the shields is to prevent light from straying to adjacent tracks and sounding notes not intended. One of the wires 12 of each lamp is grounded to the lampholder mounting bracket 9 while the other wires are merged into a cable 13 connected to the control circuit. The lamps are individually controlled by electric switches or keys 14 permitting a single lamp or a plurality of same to be illuminated. Said lamps may be of either the glow type or incandescent type. Incandescent lamps do not reach full brilliance or complete extinction instantly. This lag may be employed to advantage as the resultant audio signal is characterized by a gradual increase and decrease in volume which eliminates the abrupt sounding of notes.

It will be seen that whenever a lamp is illuminated, a beam of light is projected onto and traverses the sound track as the disc 1 is rotated. The light passing through the sound tracks 2 to the underlying photoelectric cell is thus made to vary periodically in intensity corresponding to the waveform patterns of transparency and opacity in said optical sound track. Since the electrical output of the photoelectric cell 1 is influenced by the amount and intensity of radiant energy received by its photosensitive area, a continuous electrical waveform is thus generated corresponding to the light modulating character of the optical sound track. When several lamps are illuminated simultaneously, the light beams passing through their related optical sound tracks results in the generation of a compound or composite waveform by the photoelectric cell. It can be seen that each optical sound track functions as a light modulator with the associated photoelectric cell translating the modulated light into electrical waveforms.

A plurality of photoelectric tone discs 1 attached to shaft 6 in tandem are shown in FIG. 4. One end of shaft 6 is provided with a bearing 15 while the other end is coupled to a synchronous electric motor 16 or the like in order that the discs may be rotated at a constant speed.

The electrical output of the photoelectric tone discs 1 is removed from the rotating members by conductors 17 which are connected to slip-rings 18 having brushes 19 bearing thereon. The audio amplifier 20 and loudspeaker 21 serve to amplify and transduce the electrical waves into audible tones either singly or collectively.

While a disc-shaped photoelectric cell in association with optical sound tracks has been chosen for illustrative purposes, it will be apparent the photoelectric cells in the shape of cylinders and the like may be substituted without departing from the scope and intent of the present invention.

While this invention has been described with particular reference to the construction shown in the drawing and while various changes may be made in the detail construction, it shall be understood that such changes shall be within the spirit and scope of the present invention as defined by the appended claims.

Having thus described the present invention, what is now claimed as new and desired to be protected by Letters Patent of the United States of America is:

1. A photoelectric transducer comprising, in combination, a substantially disc shaped photoelectric cell having a photosensitive area on each face, a plurality of endless concentric optical sound tracks depicted upon said photosensitive areas, light sources coinciding with said optical sound tracks and means for removing electrical output of said photoelectric cell.

2. An audio tone generator comprising, in combination, a plurality of rotatable disc shaped photoelectric cells having a photosensitive area on both faces of each cell, a plurality of endless concentric optical sound tracks in contiguity with the photosensitive surface areas of both faces of each cell, means for projecting light beams through said optical sound tracks onto said photoelectric cells together with means for translating electrical output of said photoelectric cells into audible tones.

3. An audio tone generator comprising, in combination, a plurality of disc shaped photoelectric cells axially mounted in tandem on a shaft, each of said cells having a photosensitive area on both faces, a series of endless concentric optical sound tracks depicted upon said photosensitive areas, means for rotating said photoelectric cells, individual light sources coinciding with each optical sound track, switch keys for controlling said light sources, together with means for removing electrical output of said photoelectric cells and translating same into audible tones.

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