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3,501,217

ELECTRICALLY ACTUATED KALEIDOSCOPE

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FIG. 1.

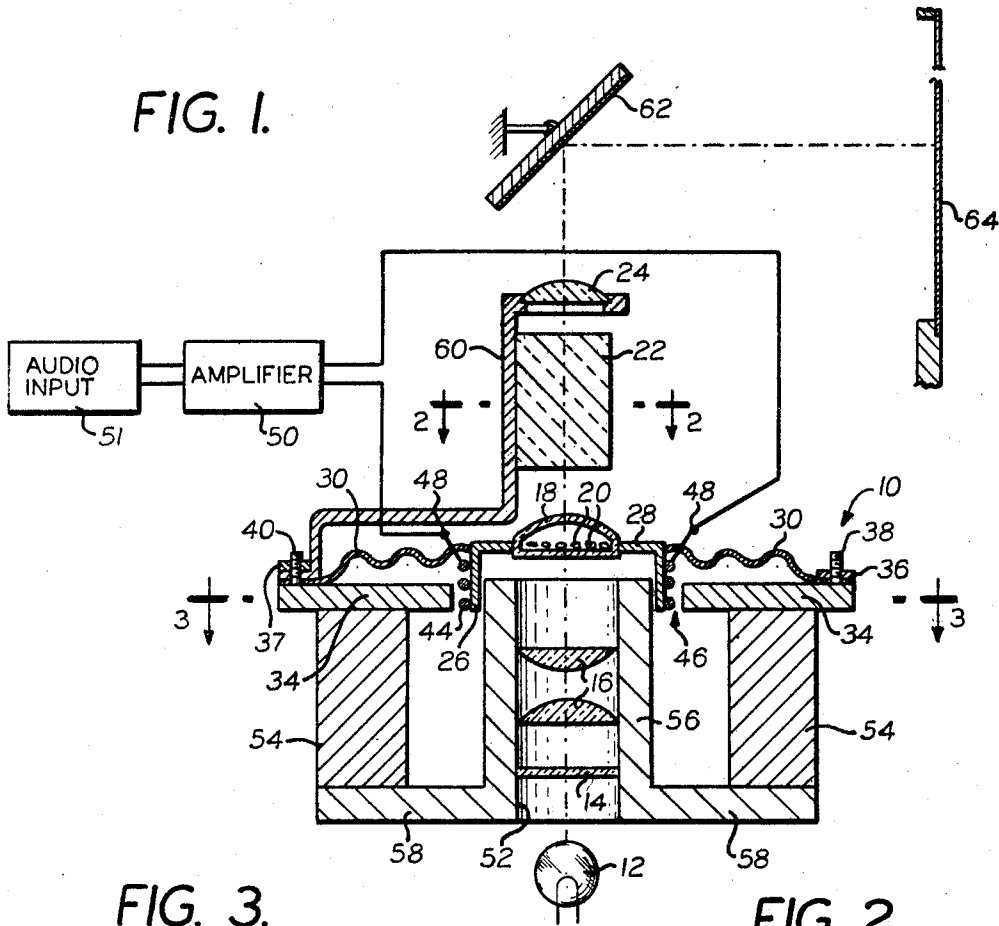


FIG. 3.

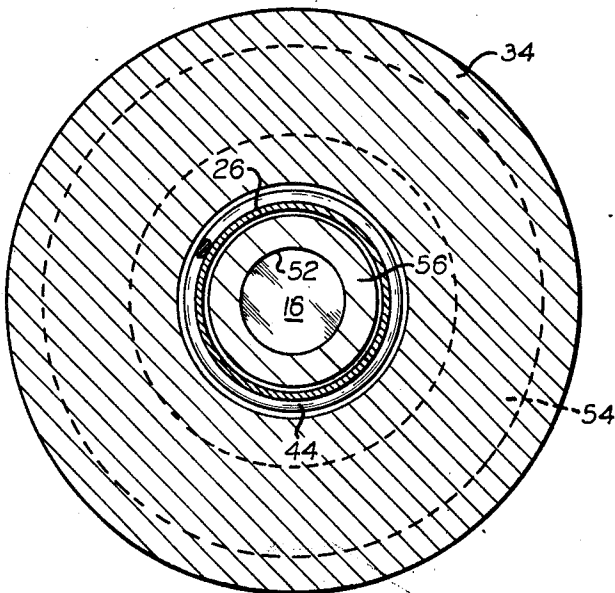
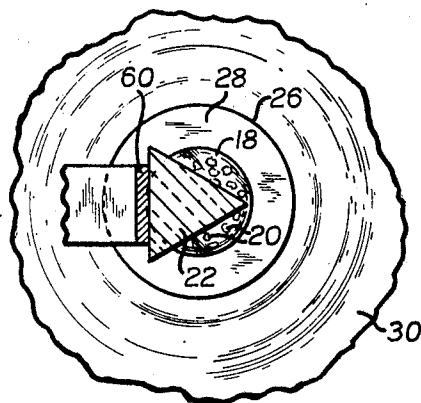


FIG. 2.



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1

2

3,501,217

ELECTRICALLY ACTUATED KALEIDOSCOPE

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Continuation-in-part of application Ser. No. 635,022, May 1, 1967. This application Oct. 22, 1968, Ser. No. 769,566

Claims priority, application Italy, May 3, 1966, 17,477

Int. Cl. G02b 27/08; G03b 21/00

U.S. Cl. 350-4

10 Claims

ABSTRACT OF THE DISCLOSURE

Apparatus for projecting kaleidoscopic images which are varied continually in accordance with an electrical signal supplied thereto. The electrical signal may, for example, be supplied by a phonograph amplifier, the images produced by the present apparatus serving as visual accompaniment to the phonograph music. Comprises an electrical coil disposed within an annular gap between the poles of a magnetic circuit which may be substantially toroidal. A transparent housing containing the multicolored light transmitting chips of the kaleidoscope is secured to the coil. The axial passage through the magnetic elements is preferably defined by a hollow magnetically permeable cylinder containing such optical elements as a heat absorbing filter, and an optical condenser; the housing containing the multicolored chips is desirably supported resiliently over one end thereof. A prism or other multi-image reflecting means, and objective lens form the kaleidoscopic images, which may be projected on a screen.

CROSS-REFERENCE TO RELATED APPLICATION

This application is a continuation-in-part of copending application Ser. No. 635,022, filed May 1, 1967, and now abandoned.

BACKGROUND OF THE INVENTION

Field of the invention

This invention relates to kaleidoscopes, wherein light is projected through a multiplicity of colored, light transmitting chips to form an image, as on a screen. More particularly, this invention involves a kaleidoscope having means for vibrating a transparent housing containing the chips to change the relative positions of the chips and thereby vary the projected image.

Description of the prior art

In an apparatus for playing recorded music, such as a jukebox, it is sometimes desirable to accompany the sound with a related visual display. For example, in United States patent application Ser. No. 676,439, filed Oct. 19, 1967, the present inventor has described apparatus wherein images from a kaleidoscope are projected onto a screen to accompany a performance of recorded music. In such apparatus, it has been found esthetically pleasing for the projected kaleidoscopic patterns to be caused to change in accordance with the music. Previously, this result has been accomplished by securing the transparent housing containing the chips to a lever system driven by a vibrating electromagnetic coil in the field of a permanent magnet, much like the voice coil of a conventional loudspeaker, and actuated similarly by the audio output of an amplifier.

More specifically, in previously employed apparatus, the axis of the coil is disposed horizontally alongside the optical elements of the kaleidoscope, so that as the coil vibrates, it actuates a lever arm perpendicular to its axis

and parallel to the light path through the kaleidoscope. The lever arm is pivoted near its opposite end, and a horizontal lever arm extends therefrom between the pivot and the transparent container containing the multicolored chips to be vibrated. In operation horizontal oscillations of the coil are transmitted by the aforesaid lever system to cause the transparent housing to oscillate through a short vertical arc, thereby displacing the chips therewithin and causing the kaleidoscopic images to change continually.

Such a previously used kaleidoscope, wherein the permanent magnet, coil and lever are arranged on one side of the optical system, is relatively bulky. In addition, the metal lever system, which transmits the vibrations from the coil to the housing, has a tendency to distort these vibrations, e.g. by absorbing some, resonating with others, and in general responding sluggishly because of its relatively high inertia.

SUMMARY OF THE INVENTION

The improved kaleidoscope of the present invention provides a means for vibrating the container or housing which is of high sensitivity and therefore has a very faithful response to the audio signal applied to the moving coil. To obtain this result, the present invention has eliminated the metal lever system of the prior art. The present invention further provides an electrically actuated kaleidoscope of greatly reduced size. This result is obtained by disposing the electromagnetic means for vibrating the container coaxially with the optical path within the kaleidoscope.

The electrodynamic transducer preferably comprises a magnetic circuit having an air gap, preferably annular, between poles and an electrical coil movably mounted in the air gap coaxially therewith. In a preferred embodiment, the magnetic circuit may, for example, comprise an inner cylinder or first pole piece of magnetizable material, an annular flange of magnetizable material extending outwardly from one end of the cylinder, an axially magnetized cylindrical permanent magnet coaxial with and surrounding at least a portion of the inner cylinder, one end of the permanent magnet being mounted on the flange and spaced from the magnetizable cylinder, and an annular second pole piece mounted on the end of the permanent magnet opposite the annular flange, the second pole piece extending toward the inner cylinder so that the two pole pieces define an annular air gap therebetween. The housing is rigidly affixed to the coil by suitable mounting means, and the coil is selectively energized by suitable means, such as for example an audio amplifier. Of course, an electromagnet having an unvarying field could be substituted for the cylindrical permanent magnet.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a vertical sectional view of a kaleidoscope embodying the present invention;

FIG. 2 is a sectional view taken along the line 2-2 of FIG. 1; and

FIG. 3 is a sectional view taken along the line 3-3 of FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawing in detail, a preferred embodiment of the kaleidoscope 10 has an optical path defined by a light source 12, a heat filter 14 of suitable heat absorbing material such as catathermal glass, an optical condenser 16, a transparent housing 18 containing colored translucent chips 20 therewithin, a prism 22, desirably having a triangular cross-section, and an objective lens 24. The housing 18 is desirably of transparent plastic but may be glass, and the chips 20 contained therewithin

are desirably variously colored pieces of glass or plastic. The chips 20 are free to move within the housing 18, so that as the housing is vibrated, the chips move in a random manner. The prism 22, having a pair of internally reflective surfaces which intersect at an acute angle, serves to provide the conventional kaleidoscopic effect of multiple reflections forming a pattern about the optical axis.

In order to move the chips 20, an electromagnetic transducer is employed. As shown in the drawings, the electromagnetic transducer comprises a magnetic circuit including a cylindrical magnet 54 which is magnetized axially, an annular pole piece 34, secured to one pole of magnet 54, a flanged cylinder 56, secured to the other pole of magnet 54, and an air gap 46 between pole piece 34 and cylinder 56. More particularly, secured to the upper end of the magnet 54 is the annular magnetically permeable member 34. Secured to the opposite or lower end of the permanent magnet 54 is the outer end of the annular flange 58 of the flanged cylinder 56 which is coaxial and concentric with cylindrical magnet 54 and annular flange 34. The upper end of flanged cylinder 56 is in closely spaced relation with the inner edge of the annular member 34, whereby to produce the magnetic air gap 46 therebetween. Thus, the inner cylinder 56 and annular member 34 may be regarded as pole pieces. Naturally, cylinder 56 and its flange 58 are also made of highly magnetically permeable material such as iron. It will be recognized of course that the entire magnetic structure including annular member 34, permanent magnet 54, flange 58 and inner cylinder 56 could be formed integrally and could be permanently magnetized so that the poles would be in spaced confronting relation across the air gap 46. Alternatively, an electromagnet having a substantially unvarying field could be substituted for the permanent magnet 54.

Disposed in movable relation about the upper end of the inner cylinder 56 is a cylindrical mounting 26 having an inwardly directed flange 28 connected to the housing 18 for the chips 20. Desirably, the mounting 26 is made of a light weight material such as aluminum or plastic. As shown, mounting 26 is slidably disposed on inner cylinder 56 although other forms of movable disposition may be employed. The mounting 26 and the transparent housing 18 are held in a normal position by a yieldable corrugated support 30 which is annular and which is connected at its inner edge to the upper end of the cylindrical mounting 26 and is secured at its outer edge to the annular member 34. As shown, the outer edge of the corrugated yieldable support 30 is secured to the annular member 34 by threaded studs 38, 40 extending through the outer marginal portion of the support 30 and nuts 36, 37 threadedly mounted thereon. Support 30 may be formed of plastic, plastic impregnated cloth, paper or other suitable deformable material.

Wound about the cylindrical mounting 26 in fixed relation therewith is a coil 44, the coil being so disposed on the cylindrical mounting 26 that it is located within the air gap 46. The input terminals 48 of the coil 44 are connected to the output terminals of the audio amplifier 50 fed by audio input 51, whereby to energize the coil 44 in accordance with the audio output of the amplifier 50. Accordingly, the coil 44 which is secured to movable cylindrical mounting 26 will move with mounting 26 axially in accordance with the input of the coil 44 from the audio amplifier. This movement will be permitted by the corrugated annular support 30 and will result in a corresponding movement of the housing 18 whereby to cause the chips 20 therein to reorient themselves as the housing 18 moves. Thus, movement of the housing 18 will be in accordance with the audio output of the amplifier 50.

The axis of the inner cylinder 56 lies along the aforesaid optical path, and the condenser and heat filter 14 are desirably disposed within the cylinder 56. The prism 22 and objective lens 24 are desirably further along the optical path than the housing 18, i.e. they are further from

the light source 12, and are secured in position such as by a bracket 60 secured to the annular member 34 as by nut 37 and stud 40.

In operation of the kaleidoscope 10, an electrical signal, as of audio frequencies, is supplied by audio input 51 and is amplified by amplifier 50 and applied across the terminals 48, which causes the coil 44 to vibrate axially as described hereinabove. This vibration is transmitted directly from the coil 44 to the housing 18 by the mounting 26 fixed therebetween. The translucent chips 20 within the housing 18 are vibrated, and they accordingly move about with respect to each other within the housing 7. Along the optical path, light from the light source 12 passes through the heat filter 14, condenser 16, and the housing 18 containing the varicolored translucent chips 20. The light then passes through the prism 22 and objective lens 24, forming the image of a kaleidoscopic pattern, which is desirably reflected by a mirror 62 and projected upon a screen 64. Of course, a prism or other means could be substituted for the mirror 62 for projecting the images onto the screen 64. As the housing 18 is vibrated in accordance with the signal applied across the terminals 48, the varicolored chips 20 are caused to change position, thereby changing the kaleidoscopic patterns displayed by the device in accordance with the varying oscillations and pulses of the signal.

Because there are no levers between the coil 44 and the housing 18, and because of the very low inertia of the movable assembly comprising the coil 44, the mounting 26 and the housing 18, the sensitivity of a kaleidoscope 10 of the present invention is substantially increased over that of prior kaleidoscopes using relatively heavy lever systems. In addition, a more compact structure is achieved in accordance with the illustrated preferred embodiment since the heat filter 14 and condenser 16 are disposed within the cylindrical passage 52 through the inner cylinder 56 and are supported thereby, eliminating the necessity of an additional supporting tube for these parts. A further advantage of the present invention is that the flange 58 and inner cylinder 56 in contact therewith help to dissipate the heat absorbed by the filter 14, thereby permitting higher light intensities to be used without danger of harming the lenses, prism, housing and chips by overheating or of causing the permanent magnet 54 to lose magnetic strength through being subjected to the heat.

Various changes and modifications may, of course, be made without departing from the scope and spirit of the present invention.

What is claimed is:

1. In a kaleidoscope comprising:

- a transparent housing,
- a multiplicity of colored, translucent elements movably supported within said housing,
- a light source disposed at the beginning of an optical path which extends through said housing,
- a plurality of reflecting surfaces disposed at acute angles to each other, parallel to said light path and on the opposite side of said housing from said light source, whereby kaleidoscopic images are formed,
- an improved means for vibrating said housing in response to electrical signals, which comprises
- a magnetic circuit including a magnet and a pair of spaced apart, substantially coaxial, hollow pole pieces defining an air gap therebetween,
- a wire coil at least partially disposed within said air gap and having its longitudinal axis substantially coaxial with said hollow pole pieces,
- means for resiliently supporting said coil for longitudinal movement relative to said air gap,
- means operatively connecting said coil to said transparent housing for moving said housing concomitantly with the movement of said coil,
- and means for connecting said coil to a variable electrical signal source, whereby to move said coil in

5

said air gap and thereby vibrate said translucent elements.

2. The kaleidoscope of claim 1, further comprising an optical condenser and an objective lens, said condenser being disposed along said light path between said light source and said housing, and said objective lens being disposed along said optical path on the opposite side of said reflecting surfaces from said light source.

3. The kaleidoscope of claim 2, wherein one of said hollow pole pieces comprises a cylinder coaxial with the light path, said optical condenser being disposed within said cylinder, and wherein said transparent housing is disposed along said light path adjacent said cylinder in register therewith.

4. The kaleidoscope of claim 3, further comprising a projection screen and means for projecting the kaleidoscopic images onto said screen.

5. The kaleidoscope of claim 1, wherein one of said pole pieces is an annular flange, the other of said pole pieces is a cylinder, and said magnet is cylindrical and coaxial with said pole pieces, said magnet being axially magnetized.

6. The kaleidoscope of claim 5, wherein said magnet is disposed outside of said cylindrical pole piece and with one end of said magnet in abutting relation with said annular flange, said magnetic circuit further comprising a magnetically permeable flange extending from the end of said cylindrical pole piece remote from said air gap to the other end of said magnet, said light path extending substantially along the axis of said cylindrical pole piece, and further comprising a heat filter disposed within said cylindrical pole piece.

7. The kaleidoscope of claim 5, wherein said means connecting said coil to said transparent housing is a mounting element comprising a cylindrical wall, said

6

wall being at least partially disposed within said air gap and being fixedly secured to said coil, said mounting element further comprising an inwardly directed annular flange fixedly secured to said housing, whereby said housing is secured in register with the axial passage defined by said cylindrical pole piece.

8. The kaleidoscope of claim 7, wherein said means for resiliently supporting said coil comprises a resilient supporting element secured between said mounting element and said annular flange, whereby to mount said mounting element for axial movement relative to said pole pieces.

9. The kaleidoscope of claim 8, wherein said reflecting surfaces comprise a prism, and wherein said kaleidoscope further comprises an objective lens disposed along said light path on the opposite side of said prism from said light source, said kaleidoscope further comprising a bracket secured to said outer cylindrical element, to said prism, and to said objective lens.

10. The kaleidoscope of claim 9, further comprising a projection screen and means for projecting the kaleidoscopic images onto said screen.

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JULIA E. COINER, Primary Examiner

U.S. Cl. X.R.

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