June 29, 1965 D. J. LESLIE 3,192,322

CONTINUOUSLY ROTATING SELECTIVELY OPERABLE APPARATUS FOR PRODUCING VIBRATO AND TREMOLO

Filed Sept. 24, 1962

FIG. 1.

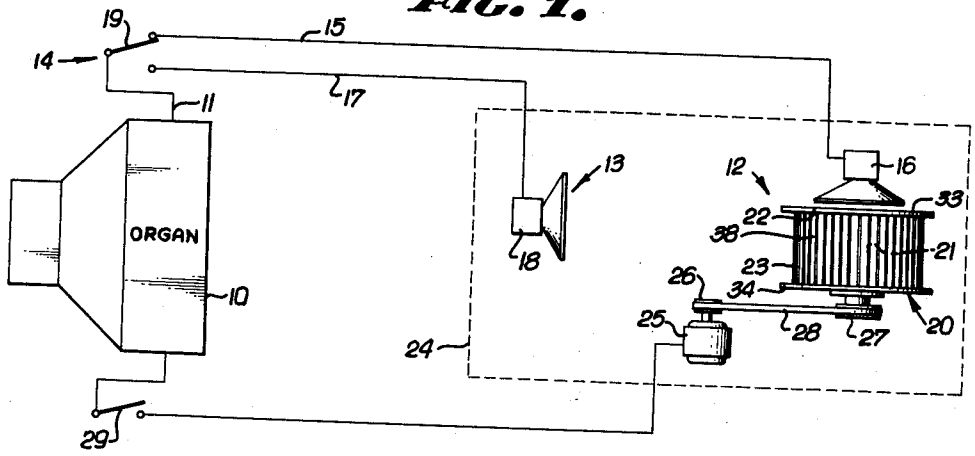


FIG. 2.

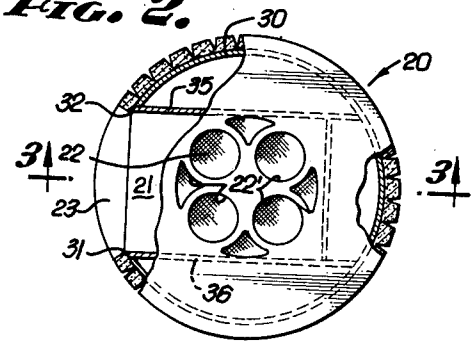


FIG. 4.

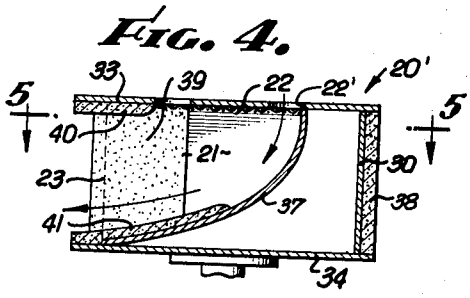


FIG. 3.

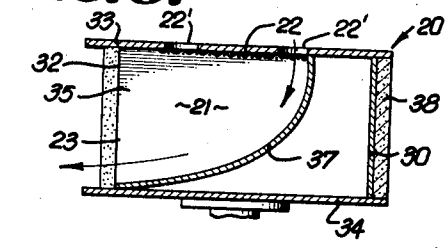
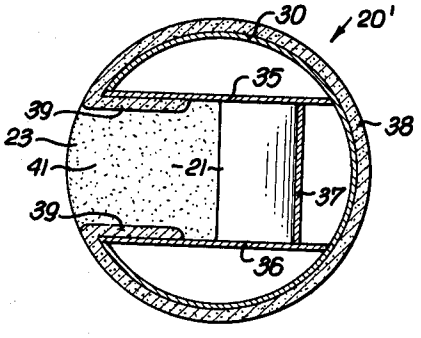


FIG. 5.



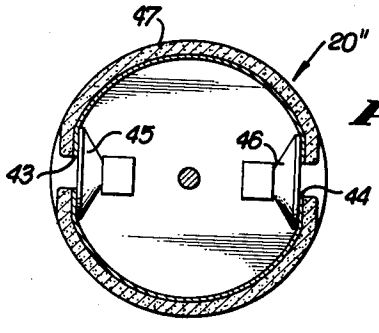


FIG. 6.

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3,192,322

Patented June 29, 1965

3,192,322

CONTINUOUSLY ROTATING SELECTIVELY OPERABLE APPARATUS FOR PRODUCING VIBRATO AND TREMOLO

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Filed Sept. 24, 1962, Ser. No. 225,583

7 Claims. (Cl. 179—1)

This invention relates to speaker systems that incorporate rotary or oscillatory means for acoustically adding vibrato or tremolo to the sound. Particularly this invention relates to speaker systems for electronic organs.

During the course of play, an organist may desire to stop or start the acoustic apparatus. This may be done in two ways. One way is to start and stop the drive for the apparatus. The other way is to switch the organ signal to fixed speakers without stopping the apparatus. Inertia of moving parts prevents quick stopping and starting. Hence, the signal switching method is best from the standpoint of instantaneous control.

When the organ signal is switched to stationary speakers, an undesirable fluttering sound results. This fluttering is due to the fact that reflected sound waves strike the rotary or oscillatory device. Since this moving device has a non-uniform reflecting surface by its very nature, the undesired modulation results.

Doors or shutters might be used to shield the moving device when the signal is switched to stationary speakers. But such doors or shutters would require complicated, and probably noisy, operating structures.

Furthermore, such structures would have inertia making instantaneous control again impossible.

The object of this invention is to provide rotary or oscillatory apparatus for producing vibrato or tremolo that has substantially uniform sound reflecting characteristics whereby the objectionable fluttering effect is eliminated.

In order to accomplish this result in the simplest possible manner, the sound reflecting characteristics of the apparatus are substantially reduced by applying sound absorbent material to the exterior of the device, and in some cases to the interior of the directional sound channel.

This invention possesses many other advantages, and has other objects which may be made more clearly apparent from a consideration of several embodiments of the invention. For this purpose, there are shown a few forms in the drawings accompanying and forming part of the present specification, and which drawings, unless described as diagrammatic, or unless as otherwise indicated, are true scale. These forms will now be described in detail, illustrating the general principles of the invention; but it is to be understood that this detailed description is not to be taken in a limiting sense, since the scope of the invention is best defined by the appended claims.

Referring to the drawings:

FIG. 1 is a diagrammatic view of the system incorporating the present invention;

FIG. 2 is a top plan view of a rotary sound channel, a portion of the walls being broken away and shown in section;

FIG. 3 is an axial sectional view taken along a plane corresponding to line 3—3 of FIG. 2;

FIG. 4 is a sectional view similar to FIG. 3, but illustrating a modified form of the present invention;

FIG. 5 is a sectional view taken along a plane corresponding to line 5—5 of FIG. 4; and

FIG. 6 is a transverse sectional view similar to FIGS. 2 and 5, but illustrating still another modified form of the present invention.

In FIG. 1 there is illustrated an electronic organ **10** that provides a signal output, as at a lead **11**. This signal output may be applied selectively to one of two speaker systems. One speaker system **12** incorporates rotary apparatus that produces vibrato or tremolo acoustically. The other speaker system **13** does not produce vibrato or tremolo acoustically. A suitable switch structure **14** is provided for routing the organ signal. In the present example, the switch structure **14** is shown as a single pole, double throw switch. It will be understood that any suitable switch may be provided.

A lead or line **15** extends from one contact of the switch **14** to a transducer **16** that drives the rotary speaker system **12**. A lead or line **17** extends from the opposite terminal of the switch **14** to a transducer **18** for driving the non-rotary speaker system **13**. A movable arm **19** of the switch **14** is connected to the organ output lead **11** and is selectively engageable with the contacts associated respectively with leads **15** and **17**. Accordingly, by manipulation of the switch **14**, the organ signal is appropriately routed.

The rotary speaker system **12**, in this instance, is of the type shown and described in my Reissue Patent No. 23,323, dated Jan. 9, 1951.

A drum **20** provides a directional sound channel **21**. The throat **22** of the channel **21** opens at one end of the drum **20**, and the mouth **23** of the channel **21** opens at the side of the drum **20**. The drum **20** is supported for rotation about its axis by bearing structures mounted upon walls (not shown) of a cabinet **24**. The transducer **16** has a speaker cone that is supported by the cabinet walls so as to register with the throat **22**. Upon rotation of the drum **20** about its axis, the sound radiation pattern is correspondingly rotated and tremolo and vibrato are imparted to the sound.

For rotating the drum **20**, a motor **25** is provided that may be attached to the cabinet **24**. Pulleys **26** and **27** are respectively attached to the shaft of the motor **25** and to the drum **20**. A belt **28** interconnects the pulleys **26** and **27**. The motor **25** is controlled by a switch **29** located at the organ console **10**.

In FIGS. 2 and 3, the drum **20** is shown in further detail. A peripheral wall **30** extends cylindrically, with end edges **31** and **32** spaced to form the mouth **23** of the sound channel. Generally circular top and bottom walls **33** and **34** overlie the top and bottom edges of the peripheral wall **30**. Openings are circularly arrayed at the center of the top wall **33** to form the throat opening **22'** that is in registry with the speaker cone of transducer **16**. Walls **35** and **36** extend across the drum respectively from the opposite edges **31** and **32** of the peripheral wall **30** to form side walls of the channel **21**. The throat opening **22** is located between these side walls as shown in FIG. 2.

A curved wall **37** fits between the side walls **35** and **36**. The curved wall **37** has one end attached to the bottom wall **34** at the mouth **23** of the drum. The curved wall **37** extends inwardly beneath the throat opening **22** and upwardly where its other end is attached to the upper drum wall **33** on that side of the throat opening remote from the mouth **23**.

In order to provide uniform reflective characteristics of the drum **20**, the sound absorbent material **38** is attached to the exterior of the wall **30**. This sound absorbent material **38** extends from the edge **32** about the peripheral wall **30** to the opposite edge **31**. The opening **23** of the drum itself has negligible reflective characteristics. The wall **30** also has negligible reflective characteristics due to the addition of the material **38**. Accordingly, a more uniform reflective characteristic is provided whereby fluttering is largely reduced.

The sound absorbent material **38** may be of any suitable material. For example, it may be balsa wood provided with parallel saw cuts to provide flexibility for wrapping about the drum and for increased sound absorbent characteristics. Optionally, the material **38** may be of foam plastic material, such as urethane or the like.

In the form of the invention illustrated in FIGS. 4 and 5, a drum **20'** is provided that is similar to the drum **20**. In addition to sound absorbent material about the peripheral wall of the drum, additional sound absorbent material is provided at the mouth of the channel. Sound absorbent material at **39** lines the side walls of the channel at the mouth; sound absorbent material **40** lines the top wall of the drum; and material **41** lines the outer end of the curved wall.

The added sound absorbent material further decreases any non-uniformities in the sound reflecting characteristics of the device, and the sound waves incident at any point upon the drum will be modulated equally and independently of angular position of the drum.

In the form of the invention illustrated in FIG. 6, a rotary drum **20''** is shown that has a number of peripheral openings **43** and **44**. Speaker structures **45** and **46** are attached to the inside of the drum and register with the sound channel openings as at **43** and **44**. In this instance, the cones of the peakers form the major portions of the rotating sound channels, the edges at the openings **4 3**and **44** forming the outer termini of such sound channels. Sound absorbent material **47** lines the exterior of the drum **20''**. As in the forms previously described, the sound reflecting characteristics of the drum are substantially uniform.

The inventor claims:

1. In a system for acoustically adding vibrato or tremolo to sound: means forming a sound channel; a transducer for operating the sound channel forming means; means for supporting the sound channel for cyclic movement; motive means for causing the sound channel to move cyclically for imparting tremolo or vibrato to the sound of said channel forming means; companion speaker means; switching means cooperable with the speaker means and the transducer for determining the production of sound either by said transducer or the companion speaker means; and sound absorbent material supported exteriorly of the said channel forming means for cyclic movement therewith whereby fluttering is minimized upon operation of the switching means to determine sound production by said companion speaker means.

2. In a system for acoustically adding vibrato or tremolo to sound: means forming a sound channel; a transducer for operating the sound channel forming means; means for supporting the sound channel for cyclic movement; motive means for causing the sound channel to move cyclically for imparting tremolo or vibrato to the sound of said channel forming means; companion speaker means; switching means cooperable with the speaker means and the transducer for determining the production of sound either by said transducer or the companion speaker means; and sound absorbent material attached to said supporting means to provide substantially uniform sound reflecting characteristics whereby fluttering is minimized upon operation of the switching means to determine sound production by said companion speaker means.

3. In a system for acoustically adding vibrato or tremolo to sound: means forming a sound channel; a transducer for operating the sound channel forming means; means for supporting the sound channel for cyclic movement; motive means for causing the sound channel to move cyclically for imparting tremolo or vibrato to the sound of said channel forming means; companion speaker means; switching means cooperable with the speaker means and the transducer for determining the production of sound either by said transducer or the companion speaker means; and sound absorbent material attached to said supporting means and said sound channel forming means to provide substantially uniform sound reflecting characteristics whereby fluttering is minimized upon operation of the switching means to determine sound production by said companion speaker means.

4. In a system for acoustically adding vibrato or tremolo to sound: a rotary drum having one or more peripheral openings; a speaker for each of the openings and attached within the drum; means for rotating said drum at a rate to impart tremolo or vibrato to the sound; companion speaker means; switching means for transmitting a musical signal either to each of seaid drum speakers or to said companion speaker means; and sound absorbent material about the periphery of said drum for making the sound reflecting characteristics thereof substantially uniform to avoid fluttering upon operation of said switching means to cause the musical signal to operate said companion speaker means.

5. In a system for acoustically adding vibrato or tremolo to sound: a drum having means forming a sound channel opening at the side of the drum; means supporting the drum for rotation about an axis to impart orbital movement to the opening of the sound channel to impart tremolo or vibrato to the sound; and sound absorbent material wrapped about the drum for making the sound reflecting characteristics of the drum substantially uniform.

6. In a system for acoustically adding vibrato or tremolo to sound: a drum having means forming a sound channel opening at the side of the drum; means supporting the drum for rotation about an axis to impart orbital movement to the opening of the sound channel to impart tremolo or vibrato to the sound; and sound absorbent material wrapped about the drum for making the sound reflecting characteristics of the drum substantially uniform; said sound absorbent material comprising semi rigid material having parallel cuts for providing flexibility for wrapping about the drum as well as for increased sound absorbent characteristics.

7. In a system for acoustically adding vibrato or tremolo to sound: a drum having wall means forming a sound channel opening at the side of the drum; means for supporting the drum for rotation about an axis to impart orbital movement to the said opening of said sound channel to impart tremolo or vibrato to the sound; sound absorbent material attached peripherally to the drum as well as along the said wall means of said drum whereby the sound reflecting characteristics of the drum are substantially uniform with respect to angular position of the drum about said axis.

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