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CONTINUOUSLY ROTATING SELECTIVELY OPERABLE APPARATUS FOR
PRODUCING VIBRATO AND TREMOLO
Filed Sept. 24, 1962

3,192,322

FIG. 1.

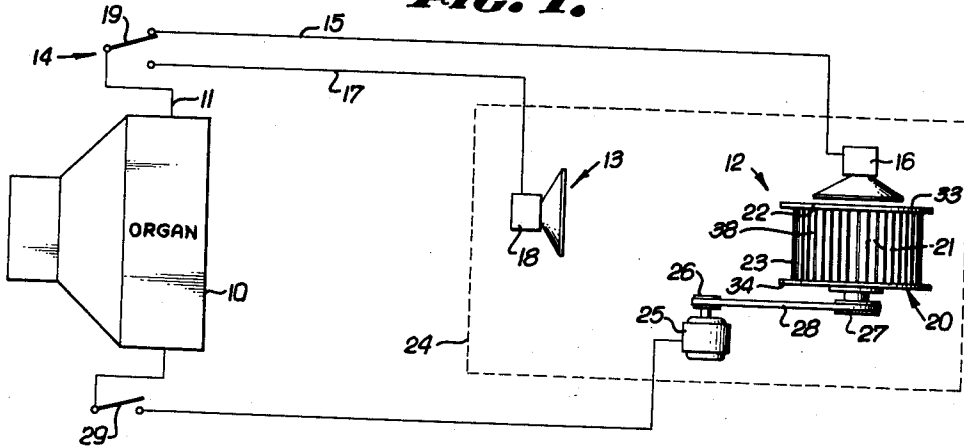


FIG. 2.

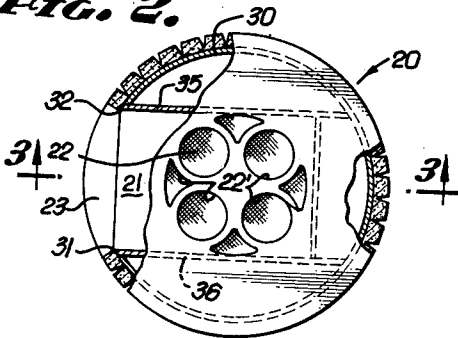


FIG. 4.

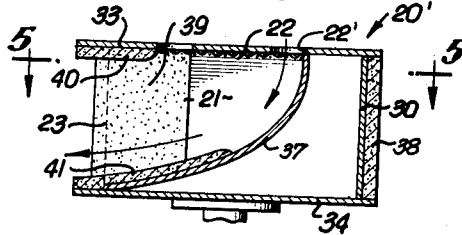


FIG. 3.

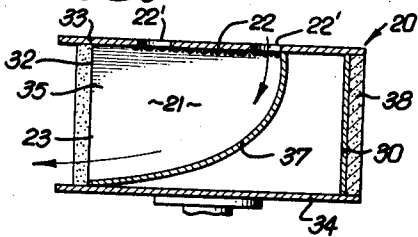


FIG. 5.

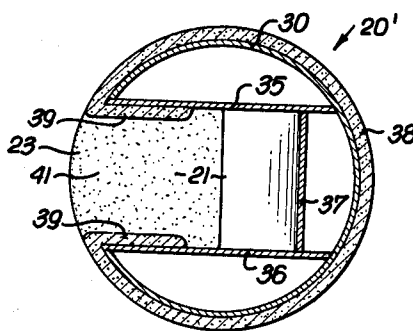
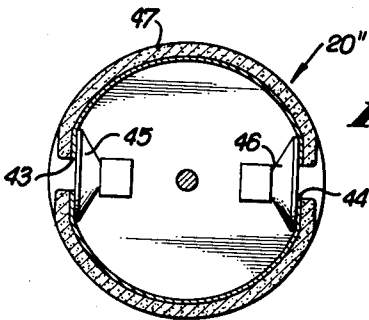


FIG. 6.



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CONTINUOUSLY ROTATING SELECTIVELY OPERABLE APPARATUS FOR PRODUCING VIBRATO AND TREMOLO

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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 speakers form the major portions of the rotating sound channels, the edges at the openings 43 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 speak-

er 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 said 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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