

PATENT SPECIFICATION (11)

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(54) SOUND GENERATING DEVICES

(71) We, NEW BRIGHT INDUSTRIAL Co., LTD., a body corporate organised and existing under the laws of Hong Kong, of 55-61 Kowloon City Road, 3rd to 8th Floors, Kowloon, Hong Kong, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to sound generating devices.

According to the invention, a sound generating device comprises a fan, a fan chamber containing the fan, drive means to rotate the fan, a resonance chamber communicating with the fan chamber by means of a nozzle, a mouth disposed near the nozzle such that air emerging through the mouth upon rotation of the fan causes generation of a sound, a hole in the resonance chamber to permit air to emerge from the resonance chamber, and valve means movable to open or close said hole to alter the pitch of said sound, wherein the resonance chamber is divided by a wall into a main resonance chamber portion and an auxiliary resonance chamber which communicate with each other via a gap, and wherein said hole is in the auxiliary resonance chamber portion and is separate from said gap.

The device produces a sound of one pitch if said hole is closed and a sound of another pitch if said hole is open. The device preferably includes valve operating means to periodically open and close the valve means whilst the drive means is in operation, whereby an alternating, two-tone sound effect is produced. Such a device is suitable for fitting to a toy vehicle, in particular a toy emergency vehicle such as a police car, ambulance or fire engine, to simulate the two-tone warning signal of the real vehicle.

The invention will now be further described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is an exploded perspective view from above of a sound generating device embodying the invention;

Figure 2 is an exploded perspective view from below of two components of a sound box constituting part of the device shown in Figure 1; and

Figure 3 is a schematic section through the sound box looking in the downward direction.

Referring to Figure 1 of the accompanying drawings, the sound generating device illustrated therein includes a sound box which is shown generally at 10 and comprises a cover 12 and a base 14 which may be of plastics and are, in use, adhesively or otherwise secured together. The cover 12 has a circular air inlet hole 16 therein. The base 14 is provided with a large circular aperture 18, a small circular hole 20, and four slots 22. The slots 22 are disposed towards opposite edges of the base 14 such that they are not covered by the cover 12 when the cover is secured to the base 14.

The construction of the sound box 10 will be further described below in more detail with reference to Figures 2 and 3.

Reverting to Figure 1, a metal connecting plate 24 is secured beneath the sound box 10 by virtue of tags 26 thereon being passed upwardly through the slots 22 in the sound box base 14 and twisted or bent. The plate 24 comprises a circular hole 28 coaxial with the circular aperture 18 in the sound box base 14. Formed in the plate 24 to depend therefrom are a pair of brackets 28, only one of which is clearly visible in Figure 1. Opposite ends of a shaft portion 30 of a valve support member 32 are received within the brackets 28 whereby the member 32 can pivot about the axis of the shaft portion 30. A hair spring 34 is mounted over an end of the shaft portion 30 to bias the valve support member 32 away from the plate 24. A valve member 36 of an elastic foam is mounted on the upper surface of the free end of the valve support member 32 such that when the member 32 is pivoted towards the plate 24 the valve member 36 will close the small circular hole 20 in the base 14 of the sound box 10.

The connecting plate 24 is mounted on

top of a gear box cover 38 by means of screws 40. The gear box cover 38 comprises three pillars 42 (only two of which are visible in Figure 1) which are received in cup portions 44 of a gear box base 46 and secured thereto by screws 48.

A miniature D.C. electric motor 50 is mounted between the gear box cover 38 and gear box base 46. An upper end portion 52 of the motor shaft extends upwardly through a hole 54 in the gear box cover 38 and the hole 28 in the connecting plate 24 and supports a fan 56 within the sound box 10 in a manner that will be more fully described below. A lower end portion 58 of the shaft of the motor 50 extends downwardly through an opening 60 in the gear box base 46 and mounts a gear 62 below the gear box base 46. The gear 62 is in mesh, below the gear box base 46, with a second gear 64 fixedly mounted on a shaft 66 extending between the gear box cover 38 and gear box base 46. The shaft 66 also has fixedly mounted thereto, in this case above the base 46, a further gear 68.

The gear 68 is in mesh with another gear 70 which is fixed to a further gear 72, the gears 70 and 72 being idly mounted on a shaft 74 extending between the gear box cover 38 and base 46. The gear 72 is in mesh with yet a further gear 74 which is fixed to another gear 76, the gears 74 and 76 being fixedly mounted on a shaft 78 extending between the gear box cover 38 and base 46. The gear 76 is in mesh with yet another gear 80. The gear 80 is idly mounted on the shaft 74 above the gear 72. The gear 80 has three projecting portions 82 formed on its upper face to form a cam arrangement.

A pair of eyelets 84, acting as electrical connectors or means for mounting electrical connectors, are secured within holes in the gear box cover 38. A flexible conductive contact member 86 is mounted at one end to that one of the eyelets 84 disposed to the right in Figure 1, the contact member 86 being disposed below the gear box cover 38.

The arrangement of the parts so far described is such that a depending, cam follower portion 88 of the valve support member 32, and also the contact member 86, are disposed above a circular path traversed by the projections 82 of the gear 80 as it rotates.

The construction of the sound box 10 will now be further described with reference to Figures 2 and 3. The sound box cover 12 and base 14, when secured together, define within them a fan chamber 90, accommodating the fan 56, and a resonance chamber 92. The resonance chamber 92 communicates with the fan chamber 90 by way of a nozzle 94. In the region of the nozzle 94 there is provided a whistling mouth 96 having a tapered or bevelled edge 98. The

resonance chamber 92 is divided by a wall 100 into a main resonance chamber portion 102 and an auxiliary resonance chamber portion 104, the portions 102 and 104 being connected by an elongate air passage 105 leading from a gap 106 to the auxiliary portion 104. The above-mentioned hole 20 communicates the auxiliary resonance chamber portion 104 to the ambient atmosphere.

The sounding device described above functions in the following manner. When the motor 50 is energised, the fan 56 revolves within the fan chamber 90 of the sound box 10. Rotation of the fan 56 draws in air through the circular inlet 16 in the cover 12 of the sound box 10 and expels the air through the mouth 96, whereby a whistling tone is produced.

Rotation of the motor 50 is transmitted via the gears 62, 64, 68, 70, 72, 74, 76, in that order, to the gear 80 having the projections 82 thereon, whereby the gear 80 revolves synchronously with the motor but at a much lower speed.

Assume that at a particular instant in time the cam follower portion 88 of the valve support member 32 is disposed between a pair of adjacent projections 82, whereby the member 32 is urged by the spring 36 away from the plate 14 and sound box 10 secured thereto, whereby the hole 20 at the end of the auxiliary resonance chamber portion 104 of the sound box 10 is open. Under these circumstances, the total volume defined by the main resonance chamber portion 102 and auxiliary resonance chamber portion 104 acts as a large resonance chamber and determines the pitch of the sound produced by the air leaving the mouth 96. A sound is in fact produced by the same principle as a sound is produced in an open organ pipe.

Suppose now that the gear 80 has revolved such that one of the projections 82 is beneath the cam follower portion 88 of the valve support member 32. Under these circumstances, the member 32 is pivoted upwardly and the valve member 36 closes the hole 20. In these circumstances, only the volume of the main resonance chamber portion 102 acts as an effective resonance chamber, because the gap 106 connecting the main resonance chamber portion 102 and auxiliary resonance chamber portion 104 is sufficiently small and the air passage 105 joining them is so narrow that the effect of the auxiliary resonance chamber portion 104 becomes insignificant. As a consequence, the pitch of the sound produced by the air leaving the mouth 96 is higher than it is in the case when the hole 20 is opened, the high pitch being produced by the same principle as that in which a higher pitch is produced in the case of a stopped or closed organ pipe. This is in spite of the fact that

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the pitch of a stopped or closed organ pipe is one octave lower than that of an open pipe of equal length.

It will therefore be appreciated that, as the motor continues to turn, the pitch of the sound produced by the air leaving the mouth 96 will alternately be of a relatively low and a relatively high pitch. That is to say, an alternating two-tone sound is produced. By regulating the respective sizes of the main resonance chamber portion 102 and the auxiliary resonance chamber portion 104, different alternating two-tone sounds may be produced.

The invention can, of course, be embodied in other ways than that described above by way of example. For instance, other drive means than a motor can be used to rotate the fan 56. Further, the hole 20 can be opened and closed by other arrangements than a cam operated member.

A sound generating device as described above is suitable, inter alia, for fitting to a toy vehicle for generating a sound simulating the two-tone warning signal produced by a real emergency vehicle, for instance a police car, ambulance or fire engine.

In the arrangement described above, as well as causing periodic opening and closing of the hole 20 rotation of the gear 80 causes periodic electrical connection and disconnection of the eyelets 84 by virtue of interaction of the projections 82 with the contact member 86.

WHAT WE CLAIM IS:—

1. A sound generating device comprising a fan, a fan chamber containing the fan, drive means to rotate the fan, a resonance chamber communicating with the fan chamber by means of a nozzle, a mouth disposed near the nozzle such that air emerging through the mouth upon rotation of the fan causes generation of a sound, a hole in the resonance chamber to permit air to emerge from the resonance chamber, and valve means movable to open or close said

hole to alter the pitch of said sound, wherein the resonance chamber is divided by a wall into a main resonance chamber portion and an auxiliary resonance chamber which communicate with each other via a gap and wherein said hole is in the auxiliary resonance chamber portion and is separate from said gap.

2. A sound generating device according to claim 1, wherein the valve means is pivotally movable to open or close said hole.

3. A sound generating device according to claim 1, or claim 2, including valve operating means to periodically open and close the valve means whilst the drive means is in operation.

4. A sound generating device according to claim 3, wherein the valve operating means comprises a gear box driven by the drive means and cam means driven by the gearbox to move the valve means to open and close said hole.

5. A sound generating device according to any one of claims 1 to 4, wherein said wall defines an elongate passage extending between the gap and the auxiliary resonance chamber.

6. A sound generating device according to any one of the preceding claims, wherein the drive means comprises an electric motor.

7. A sound generating device according to any one of the preceding claims, wherein an edge of the mouth is bevelled.

8. A sound generating device according to any one of the preceding claims, wherein said hole is round.

9. A sound generating device substantially as herein described with reference to the accompanying drawings.

10. A toy vehicle fitted with a sound generating device according to any one of the preceding claims.

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hole to alter the pitch of said sound, wherein the resonance chamber is divided by a wall into a main resonance chamber portion and an auxiliary resonance chamber which communicate with each other via a gap and wherein said hole is in the auxiliary resonance chamber portion and is separate from said gap.

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