United States Patent

[11] 3,631,481

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[54] **SOUND GENERATOR**
11 Claims, 4 Drawing Figs.

[52] **U.S. Cl.** **340/388**
[51] **Int. Cl.** **G08b 3/00**
[50] **Field of Search** 340/388

[56] **References Cited**
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2,227,289	12/1940	White et al.	340/388
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ABSTRACT: A compact sound generator which includes an insulating supporting base having an integrally formed bobbin, a passage extending through the bobbin and the support for accommodating therein a reciprocating plunger, an electrical winding on the bobbin which actuates the plunger upon energization, and a resilient sound-generating diaphragm strip mounted at opposite ends to the support with the unsupported intermediate span engageable by the plunger to generate the sound.

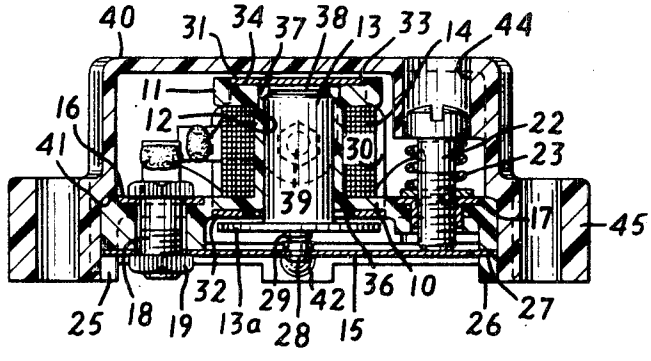


FIG. 1

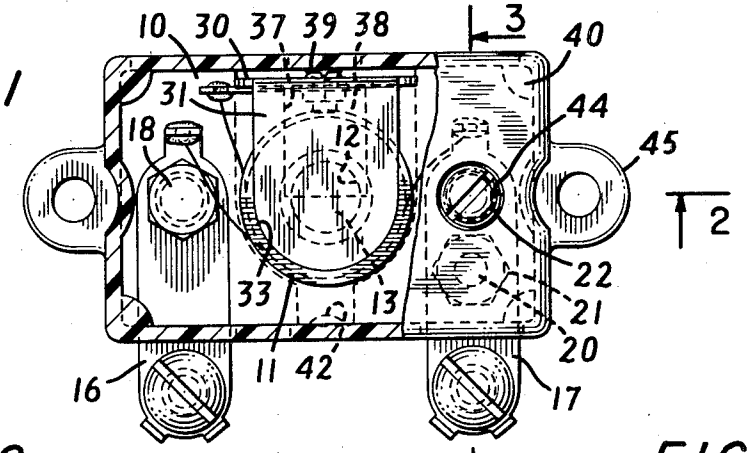


FIG. 2

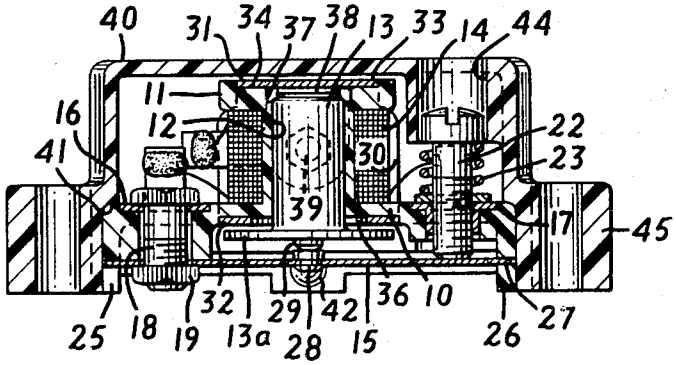


FIG. 3

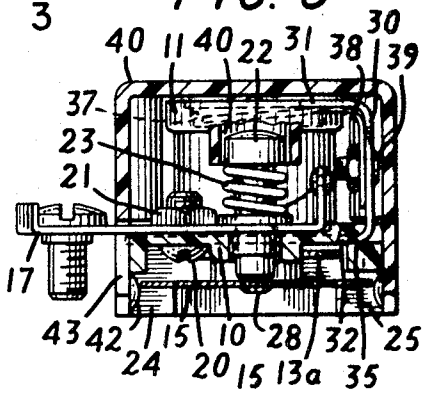
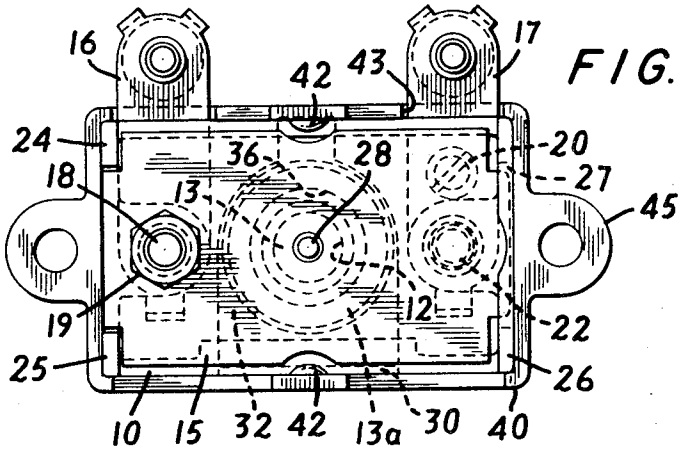


FIG. 4



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SOUND GENERATOR

This invention relates to sound generators and more particularly to a novel, compact sound generator of novel design.

The sound generator of the present invention embodies a support base on which a bobbin is integrally formed, a passage through the support base and the bobbin to receive a reciprocating plunger, an electrical winding on the bobbin which upon energization actuates the plunger, and a resilient sound-generating diaphragm strip mounted at opposite ends to the support base with the unsupported intermediate span engageable by the plunger.

Other features of the sound generator of the present invention include adjustable means carried by the support which engages a span of the diaphragm for varying the frequency and amplitude of vibration, a U-shaped return yoke to provide a return path for the magnetic flux developed in the plunger upon energization of the winding, means for slidably receiving the magnetic flux return element in the support base, means within the bobbin for accommodating a spring in constant engagement with the plunger through which the plunger is connected in series with the electrical winding, and a snap-locking cover for the base which facilitates mounting of the sound generator.

For a complete understanding of the present invention reference should be made to the detailed description which follows and to the accompanying drawings in which:

FIG. 1 is a plan view of the sound generator of the present invention with the cover partially broken away;

FIGS. 2 and 3 are cross-sectional views taken along the lines 2—2 and 3—3, respectively, of FIG. 1, looking in the direction of the arrows; and

FIG. 4 is a bottom view of the sound generator.

The sound generator of the present invention includes a support base **10** made of insulating material, preferably an insulating plastic material, a bobbin **11** integrally formed on and upstanding from the center of the support, a passage **12** extending through the bobbin and the support, a reciprocating plunger **13** accommodated within said passage, an electrical winding **14** on the bobbin and energizable to actuate the plunger, and a resilient sound-generating diaphragm strip **15** mounted at opposite ends to the support with the unsupported intermediate span engageable by the lower end of the plunger.

The support base **10**, as viewed in FIG. **1**, is generally rectangular in shape and has a pair of terminals **16**, **17** mounted to the top of the base, one on each side of the upstanding bobbin **11**. The terminal **16** is mounted in place by an electrically conductive screw **18** locked in place by an electrically conductive nut **19**. The electrically conductive screw **18** serves not only as a mounting for the terminal **16** but also as a mounting for one end of the diaphragm **15** and as an electrical connection between the terminal **16** and the diaphragm **15**.

The terminal **17** is mounted to the supporting base **10** by a screw **20** and a locking nut **21**. The terminal **17** has a threaded opening which receives a screw **22** made of insulating material. The lower end of the screw engages the diaphragm **15**. A spring **23** is accommodated on the screw intermediate the screwhead and the supporting base. The screw provides an adjustable means for exerting a variable force on the diaphragm to vary the frequency and amplitude of vibration of the diaphragm.

The support base **10** has a pair of depending legs **24** and **25** at one end and a continuous depending leg **26** at the other end. As best shown in FIG. **2**, one extended end of the diaphragm **15** is accommodated between the depending legs **24** and **25** and the other extended end of the diaphragm is accommodated within a slot **27** of the depending leg **26**.

The diaphragm **15** is made of a resilient conducting metal, for example a steel or aluminum sheet of approximately 0.006 to 0.008 inch thickness, having a bend line (not shown) intermediate the screw **18** and the plunger **13** so that the tendency is for the right end, as viewed in FIG. **2**, to be higher than the left end, with the result that the right end is biased upwardly when it is mounted as shown in FIG. **2**. The center of the diaphragm **15** carries a contact **28**, preferably made of silver-cadmium oxide, which is engageable with the lower end of the plunger **13**.

The particular design and mounting of the diaphragm **15** provides greater impact energies and thus increased sound generation produced by the impact of the reciprocating plunger **13**. The plunger **13** contains an enlarged lower head **13**which carries a contact **29**, preferably also silver-cadmium oxide, which engages the diaphragm contact **28**.

A magnetic flux conducting yoke **30** made of paramagnetic material preferably steel, is slidably received by the support base **10** and it provides a return path for the magnetic flux developed in the plunger upon energization of the coil. The yoke **30** has an upper arm **31** and a lower arm **32**. The upper arm is accommodated in an open ended recess **33** formed in the upper end of the bobbin **11**. When accommodated in the open ended recess, the arm **31** rests upon a shoulder **34**. The lower arm **32** of the yoke passes through a slot **35** in the support base and it has an annular opening **36** therein so that when properly positioned on the support base the opening **36** is aligned with the plunger **13** and the arm does not interfere with the reciprocation of the plunger.

The upper end of the bobbin has another open ended recess **37** (see FIG. **2**) which accommodates one end of an L-shaped leaf-type spring contact **38**. The spring contact **38** is affixed to the yoke **30** by a screw **39**.

The winding **14**, the magnetic flux return yoke **30** and the contact **38** are enclosed within a cover **40**, preferably made of insulating plastic material, which snap locks onto the support base **10**. The cover **40** has internal shoulders **41** which are adapted to seat against the upper surface of the support base. Also, the front and rear walls of the cover have integrally formed thereon small projections **42** which interlock with the lower edges of the support base.

The cover **40** has cutout portions **43** through which the terminals **16** and **17** extend to be accessible, an opening **44** in the top which makes it possible to adjust the screw **22** without removing the cover, and integral bosses **45** which permit the sound generator assembly to be mounted to another surface.

The diaphragm **15**, the plunger **13**, the contact **38** and the winding **14** are electrically connected in series so that when the plunger **13** is in its lowermost position and the contacts **28** and **29** are closed the application of an electrical potential across the terminals **16** and **17** will complete a circuit to energize the winding **14** through the diaphragm, the plunger and the contact **38**. This electrical circuit is broken by the upward displacement of the plunger, permitting the plunger to drop back into engagement with the diaphragm. Since the contact **38** remains in engagement with the upper end of the plunger, the recess in which it is accommodated must be deep enough to permit the free end of the contact **38** to move with the reciprocation of the plunger.

The invention has been shown and described in single preferred form and by way of example only, and obviously many modifications and variations are possible within the spirit of the invention. For example, the electrically conductive screw **18** and nut **19** can be modified to include other conductive fasteners such as eyelets and rivets. Similarly, other types of fasteners (not necessarily metallic or conductive) can be substituted for the screw **20** and locking nut **21**, and other electrically conductive fastening devices, such as eyelets, rivets or welding, can be substituted for the screw **39**. The invention should not be limited, therefore, to any particular form or embodiment except insofar as such particular form or embodiment is expressly set forth in the claims

I claim:

1. A sound generator comprising a support base, a resilient sound-generating diaphragm strip mounted at opposite ends to the support with an unsupported intermediate span, a bobbin integrally formed on the support, a passage through the bobbin and the support, a plunger accommodated within said passage and free to reciprocate within the passage and to thereby engage and disengage the unsupported span of the diaphragm, and an electrical winding on the bobbin energizable to actuate the plunger and cause it to reciprocate.

2. A sound generator as set forth in claim 11 in which the diaphragm is connected in series with the plunger to complete the electrical circuit to energize the winding when the plunger engages the diaphragm, and including a spring contact in constant engagement with the end of the plunger opposite the end which engages the diaphragm and connected in series with the plunger and the diaphragm to energize the winding.

3. A sound generator as set forth in claim 1 including adjustable means carried by the support and engageable with a span of the diaphragm intermediate the plunger and a mounted end of the diaphragm for exerting a variable force on the diaphragm to vary the frequency and amplitude of vibration of the diaphragm.

4. A sound generator as set forth in claim 1 in which said adjustable means is an adjustable threaded screw having one end engageable with said diaphragm.

5. A sound generator as set forth in claim 1 including a magnetic flux return yoke having a pair of arms and means formed in the support for slidable receiving the yoke so that the arms of the yoke are located at opposite ends of said passage.

6. A sound generator as set forth in claim 1 in which said means formed in the support for slidably receiving the arms of the magnetic flux return yoke includes an open-ended recess formed in the end of the bobbin for receiving one of the arms, a shoulder within said recess against which one of the arms of the magnetic flux return yoke slidably engages, and a guide slot spaced apart from said shoulder for slidably receiving the other arm of said magnetic flux return yoke.

7. A sound generator as set forth in claim 1 in which one of the arms of the magnetic flux yoke has an opening therein to receive the plunger and permit it to reciprocate freely.

8. A sound generator as set forth in claim 1 including a leaf-type contact spring in constant engagement with the end of the plunger opposite the end which engages the diaphragm and connected in series with the plunger and the diaphragm to energize the winding and a recess formed in the end of the bobbin for accommodating the leaf-type contact spring intermediate the plunger and one of the arms of the yoke to enable the leaf contact spring to maintain contact with the plunger.

9. A sound generator as set forth in claim 1 in which said support includes an extended base on which the bobbin upstands at the center and depending legs at opposite ends of said base, and including terminals mounted on said base on opposite sides of said bobbin, an electrically conductive mounting which serves both as a mounting for one end of the diaphragm and as an electrical connection between a terminal and the diaphragm and a slot formed in the opposite leg of the base for receiving the opposite end of the diaphragm.

10. A sound generator as set forth in claim 1 including a cover snap locking with said base and having integrally formed bosses thereon for mounting the sound generator.

11. A sound generator as set forth in claim 1 wherein the support base is made of insulating material.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,631,481 Dated December 28, 1971

Inventor(s) Rein Haus

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 2, line 7, "13" should read --13a--. Column 3, line 1, the claim reference numeral "11" should read --1--. Column 3, line 19, "slidable" should read --slidably--.

Signed and sealed this 6th day of June 1972.

(SEAL)
Attest:

EDWARD M.FLETCHER, JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents