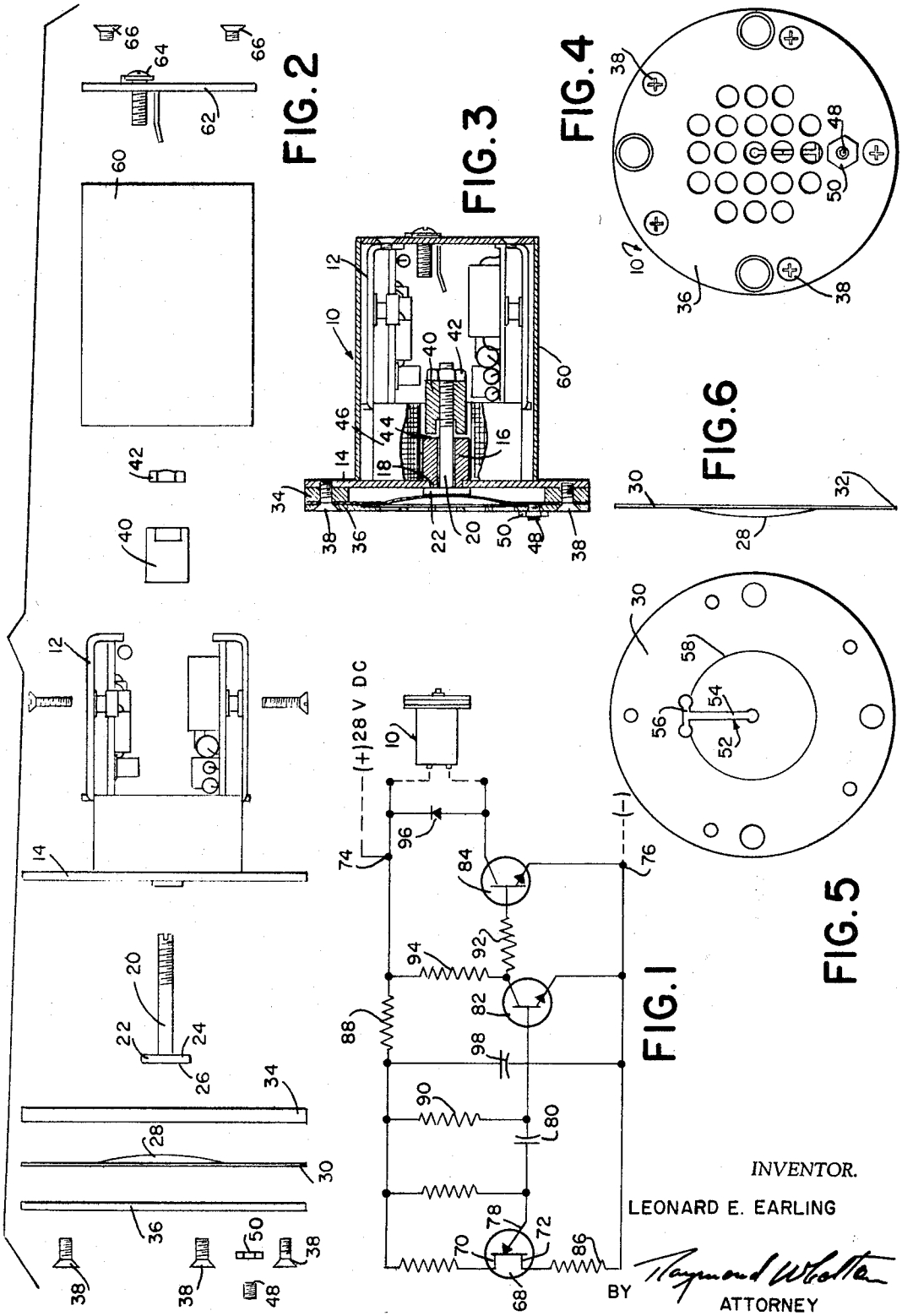
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SOUND GENERATOR

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SOUND GENERATOR

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ABSTRACT OF THE DISCLOSURE

A self-contained sound generator comprising a resilient diaphgram, a plunger, and means for driving the plunger. The intermediate portion of the diaphragm is slotted such that the form and thickness of the diaphragm are less critical than otherwise and operation is achieved using substantially less electrical energy and magnetic force.

This invention relates to a sound generator of a type which has been found to be eminently suitable for a variety of uses including use aboard jet aircraft where its sound is distinctively audible in the presence of other sounds customarily encountered during operation.

The sound generator contemplated by the present invention is entirely self contained except for a current source, is light in weight, simple in operation, easily maintained, and enjoys an unusually long life as compared with any known devices having comparable capabilities.

It is among the objects of the present invention to provide a sound generator comprising a frame, a diaphragm having a peripheral portion secured to the frame and a resilient intermediate portion spaced from the frame and displaceable relative thereto to produce a sound, a plunger having opposed surfaces normally engaging the frame and diaphragm respectively, the diaphragm normally biasing the plunger into engagement with the frame, and means for intermittently driving the plunger in a direction away from the frame to displace the intermediate portion of the diaphragm. The device preferably includes a magnetic armature carried by the plunger, a winding carried by the frame for driving the armature, and means for energizing the winding. The intermediate portion of the diaphragm engaging the plunger is preferably convex. The intermediate portion of of the diaphragm contains a slot extending substantially radially from its center to an intersecting slot substantially perpendicular thereto. Stated differently, the intermediate portion of the diaphragm contains a substantially T-shaped slot having a radial portion extending from substantially the center of the diaphragm to an outwardly disposed intersecting portion. The sound generator is preferably provided with means for adjusting the flexibility of the diaphragm relative to the frame. The intermediate portion of the diaphragm adjacent the plunger preferably contains a convex portion having a periphery intersecting the outwardly disposed slot portion. The plunger is preferably nonmagnetic.

A more complete understanding of the invention will follow from a description of the accompanying drawings wherein:

FIG. 1 is a diagram of a circuit employed for actuation of the sound generator depicted in elevation;

FIG. 2 is an exploded view depicting the principal components of the sound generator;

FIG. 3 is a sectional elevation depicting the sound generator components of FIG. 2 in assembled relationship;

FIG. 4 is a front elevation of the sound generator of FIG. 3;

FIG. 5 is a front elevation of the diaphragm; and

FIG. 6 is a side elevation of the diaphragm.

The sound generator **10** depicted in the drawings provides a frame **12** having a forward plate **14** of magnetic material. A core **16** of magnetic material has a reduced forward end **18** staked to the plate **14** and rendered flush therewith. The core **16** contains a central opening to receive and guide a plunger **20** whose head **22** has a surface **24** normally engaging the plate **14** and a surface **26** normally engaging the convex surface **28** of a diaphragm **30**. The periphery **32** of the diaphragm **30** is sandwiched between a spaced ring **34** and a perforated front plate or grille **36**, all of which are clamped to the plate **14** by means of screws **38**.

As viewed in FIGS. 2 and 3, the right end of the plunger **20** is threaded to receive an internally threaded armature **40** and a locking nut **42** whereby the armature can be secured in any adjusted position to provide a proper gap **44** between its left end and the opposed end of the core **16**. Surrounding the core **16**, the frame **12** supports a winding **46**, upon energization of which, the magnetic armature **40** will be moved towards the left as viewed in FIG. 3 causing the head **22** of the non-magnetic plunger **20** to displace the bowed resilient diaphragm **30** to produce a distinctive sound, clearly audible in the environment for which the device is intended. Upon deenergization of the winding **46**, the inherent resiliency of the diaphragm restores the plunger to its initial position as depicted in FIG. 3 during which the opposed surfaces of the plunger **20** engage the diaphragm **30** and the plate **14** respectively. The return movement produced by the biasing effect of the diaphragm is likewise accompanied by the desired distinctive sound. The flexibility of the diaphragm relative to the frame is capable of adjustment by means of a set screw **48** threaded through the perforated front plate **36** and held in any desired adjusted position by means of a locking nut **50**.

As best shown in FIG. 5, the diaphragm **30** contains a slot **52** of substantially T-shape including a substantially radial portion **54** extending from the center of the diaphragm to an intersecting portion **56** substantially perpendicular to the radial portion and lying at a distance from the center of the diaphragm substantially equal to the radius of the peripheral portion **58** of the concavo-convex zone provided centrally of the diaphragm. As will be evident from FIG. 6, the lower end of the slot **54** and both ends of the slot **56** terminate in circular arcuate portions to preclude the formation of cracks in the diaphragm during its operation. By virtue of the presence of this slot formation, the form and thickness of the diaphragm become less critical than otherwise, the internal stresses in the deformed central portion of the diaphragm are reduced and operation is achieved using substantially less electrical energy and magnetic force than would be required otherwise. Moreover, the slot arrangement as designed results in no appreciable sacrifice in the acoustical output of the sound generator.

The frame **12** is enclosed by a tubular housing **60** whose closure **62** carrying electrical terminals **64** is secured to the frame by means of screws **66**. Within the housing are contained all of the electrical components depicted in the circuit diagram of FIG. 1 so that the sound generator is entirely self-contained except for a source of electrical energy.

The generator is a pulse driven device producing intermittent sounds and the circuit depicted in FIG. 1 has been designed to produce operation at approximately seven cycles per second. The circuit includes a uni-junction transistor **68** serving as the oscillator for the pulse generator. It will not conduct any appreciable current with voltage applied between the bases **70** and **72** unless certain conditions are satisfied in the emitter circuit. The conditions for conduction require that the emitter voltage and relative base voltages be at a particular ratio under which circumstances the device will conduct from

the emitter to one of the bases. Assuming that 28 volts D.C. is applied to the circuit at the terminals 74 and 76, a particular voltage will appear between the bases 70 and 72. The voltage at the emitter 78 depends upon the charge existing on the capacitor 80. Upon energization of the circuit, the capacitor 80 will be charged to produce a forward bias on the transistor 82 causing it to shunt the base circuit of the transistor 84 so as to render it non-conductive. Upon conduction of the uni-junction transistor 68, the adjacent terminal of capacitor 80 will be effectively connected to the negative side of the line through a resistor 86, resistor 88 and resistor 90. With the transistor 82 cut off, forward bias is applied to the transistor 84 through its base circuit involving a resistor 92 and a load resistor 94 for the collector of the transistor 82. Accordingly, transistor 84 will conduct while the capacitor 80 is discharging. While transistor 84 is conducting, current will be supplied through the coil of the sound generator by way of the collector emitter elements of the transistor 84. Upon discharge of the capacitor 80, the uni-junction transistor 68 reverts to a non-conductive state and the charge process for capacitor 80 begins again. The rectifier 96, in parallel with the winding of the sound generator, provides a path for field collapse current and protects the transistor 84 from surge voltages which might otherwise exceed its rating.

The capacitor 98 and the resistor 88 provide a filter network to prevent transients or sudden changes in voltage of the power supply from influencing the pulse rate of the oscillator circuit.

I claim:

1. A sound generator comprising a frame, a diaphragm having a peripheral portion secured to said frame and a resilient intermediate portion spaced from said frame and displaceable relative thereto to produce a sound, the intermediate portion of said diaphragm containing a slot extending substantially radially from its center to an intersecting slot substantially perpendicular thereto, a plunger having opposed surfaces normally engaging said frame and diaphragm respectively, said diaphragm normally biasing said plunger into engagement with said frame, and means for intermittently driving said plunger in a direction away from said frame to displace the intermediate portion of said diaphragm.

2. A sound generator comprising a frame, a diaphragm having a peripheral portion secured to said frame and a resilient intermediate portion spaced from said frame and displaceable relative thereto to produce a sound, the intermediate portion of said diaphragm containing a substantially T-shaped slot having a radial portion extending from substantially the center of the diaphragm to an outwardly disposed intersecting portion, a plunger having opposed surfaces normally engaging said frame and diaphragm respectively, said diaphragm normally biasing said plunger into engagement with said frame, and means for intermittently driving said plunger in a direction away from said frame to displace the intermediate portion of said diaphragm.

3. A sound generator according to claim 2 including means for adjusting the flexibility of said diaphragm relative to said frame.

4. A sound generator according to claim 2 wherein the intermediate portion of said diaphragm adjacent said plunger is convex.

5. A sound generator according to claim 2 wherein the intermediate portion of said diaphragm adjacent said plunger contains a convex portion having a periphery intersecting said outwardly disposed slot portion.

6. A sound generator according to claim 2 including a magnetic armature carried by said plunger, a winding carried by said frame for driving said armature, and means carried by said frame for energizing said winding intermittently.

7. A sound generator according to claim 6 wherein said plunger is non-magnetic.

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