April 20, 1965 A. C. GREGOROFF 3,179,932

ELECTRIC SOUNDING DEVICE

Filed Feb. 5, 1962

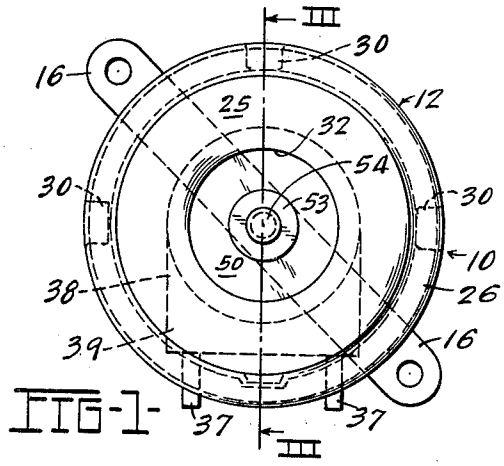


FIG-1-

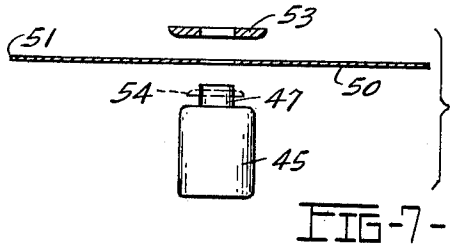


FIG-7-

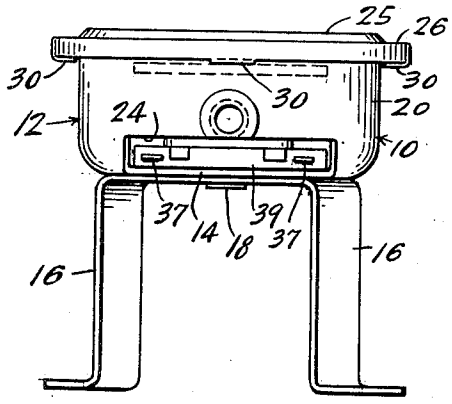


FIG-2-

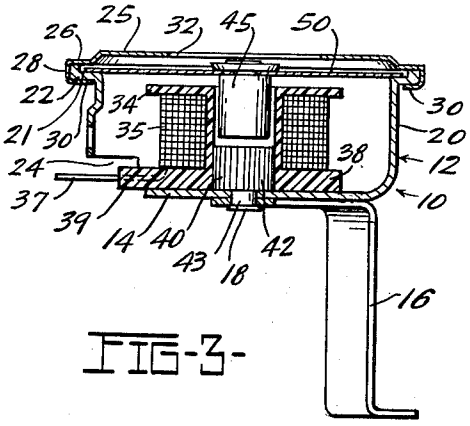


FIG-3-

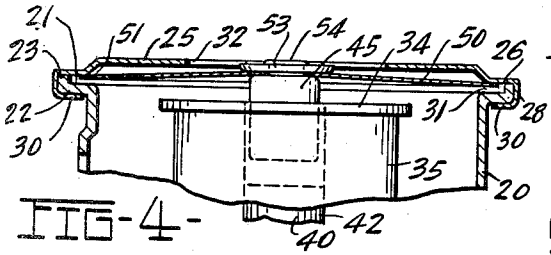


FIG-4-

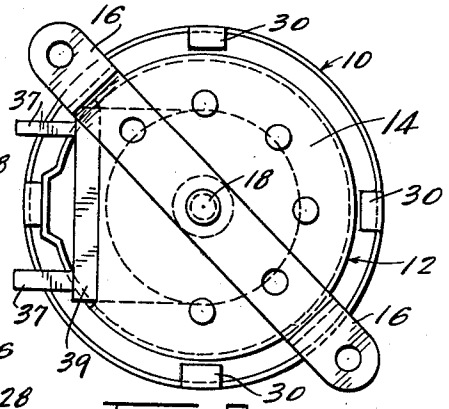


FIG-6-

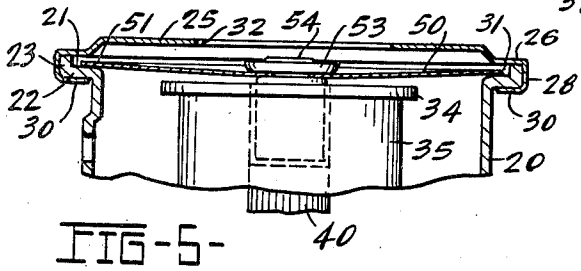


FIG-5-

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ELECTRIC SOUNDING DEVICE

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10 Claims. (Cl. 340—388)

This invention relates to horns of the diaphragm type and is particularly directed to synchronous alternating current electromagnetic horns.

An object of the present invention resides in the provision of a horn structure in which the diaphragm is arranged to produce high intensity sound out-put and improved harmonic content.

Another object of the invention is to provide a horn with a diaphragm that is free to float with respect to the horn casing and cover, so that the diaphragm strikes the cover to produce additional and more audible sound to that produced by flexure or vibration of the diaphragm.

Another object of the invention is to provide a horn with an improved horn casing and cover assembly arranged to provide clearance for the periphery of the diaphragm so that it is free to float during actuation.

Another object of the invention is to provide a new and improved highly efficient horn having few, easily and inexpensively fabricated parts capable of mass production and assembly.

Generally speaking, the device of the present invention comprises a generally cup-shaped casing or housing having integral bottom and side walls and an open end defined by a shoulder formed by a peripheral or radial flange terminating in an outwardly projecting or axial rim, a diaphragm spanning the open end of the casing, an open cover having a flanged edge secured to the rim of the casing so as to retain as well as provide clearance for the periphery of the diaphragm, and mounting means for the device which may be in the form of a U-shaped bracket. The means to actuate the diaphragm include an electromagnetic coil on a reel or bobbin, which may be provided with a core anchoring member having an integral extension by which the coil is fixed within the casing and by which the bracket is attached to the casing, and an armature reciprocable in the coil and rigidly fixed to the diaphragm to flex or vibrate the latter in synchronism with an alternating current connected across the coil.

The above mentioned and other features and objects of this invention and the manner of attaining them will become more apparent and the invention itself will be best understood by reference to the following description of an embodiment of the invention taken in conjunction with the accompanying drawing, wherein:

FIG. 1 is a front elevation of a horn incorporating the present invention;

FIG. 2 is a side elevation of the horn shown in FIG. 1;

FIG. 3 is a sectional detail view taken substantially on a line III—III of FIG. 1 or 2;

FIG. 4 is an enlarged fragmentary sectional detail view of the upper portion of the structure shown in FIG. 3 showing the diaphragm outwardly flexed and its edge in engagement with the cover;

FIG. 5 is a view similar to FIG. 4 but showing the diaphragm inwardly flexed;

FIG. 6 is a rear elevation of the horn shown in FIGS. 1 and 2 showing the cover attaching means and the terminals for connecting the coil into an electric alternating current circuit; and

FIG. 7 is an enlarged and expanded view of the diaphragm and armature, illustrating the means for securing these parts together.

Referring to the drawing, which illustrates a diaphragm horn incorporating the present invention, the horn indicated generally at **10** is inclusive of a cup-shaped casing or housing **12**, to the bottom wall **14** of which a bracket **16** may be attached by a rivet member **18**, which bracket may be of generally U-shape as shown in FIG. 2. The casing **12** may have a cylindrical side wall **20** extending from bottom wall **14** and terminating in an open end defined by a shoulder or seat **21** formed by a radial outwardly extending flange **22** and an axially outwardly projecting annular rim **23**. A generally rectangular opening **24** may be provided in casing **12** at the juncture of bottom wall **14** and side wall **20** for introduction of an electrical connection.

A dished cover type retainer or ring **25** for the open end of casing **12** may have a radially extending portion **26** in engagement with rim **23** and an axial flange **28** snugly fitting the periphery of flange **22**. The cover **25** may be secured to the casing **12** by means of a plurality of spaced ears **30** (see FIG. 6) integral with flange **28** which ears **30** are bent into engagement with the outer under surface of flange **22** subsequent to assembly with the casing **12**. As thus assembled (see FIGS. 4 and 5), an inwardly open channel or annular pocket **31** is provided between casing flange **22** and the cover or retaining member **26**. This retaining cover **25** is centrally apertured at **32** to provide a sound emitting port.

Located in the bottom of casing **12** is a spool bobbin, or reel **34** of dielectric plastic material on which is wound a plurality of turns of wire to form a coil **35**, to the terminal ends of which are attached terminal connectors **37**. The base **38** of spool **34** has a lateral extension **39** which may project from opening **24** in casing **12**. The inner ends of terminals **37** may be imbedded in extension **39** and the outer ends of these terminals extend beyond the casing side wall **20** for ready attachment into an alternating current electrical circuit for energizing coil **35**. Within the bore of spool **34** adjacent the base **38** thereof may be a magnetic metal core member **40** having a knurled outer surface **42** for press fit into one end of the central aperture of the spool. Projecting from this core member **40** may be an attaching portion **43** of reduced diameter and a length to pass through a central aperture in the bottom **14** of casing **12** and an aligned aperture in bracket **16**. Thus, the coil **35**, casing **12** and bracket **16** are attached together by a common means which may be welded or riveted or peened at **18** to complete the assembly.

Within the outer end of spool **34** is an armature **45** capable of being reciprocated in synchronism with the alternations of the electric alternating current to which the coil **35** is connected. Armature **45** may be formed with an extension **47** of reduced diameter to which is attached a diaphragm **50** apertured at **51** to receive extension **47**. As particularly shown in FIG. 7, the armature and diaphragm assembly includes a reinforcing washer **53** attached to the outer face of diaphragm **50** by spot welding or peening over the end **54** of the extension **47** as for a rivet. Diaphragm **50** is located in the open end of casing **12** so that in rest position the marginal edge thereof is positioned on the shoulder **21**, there being clearance both axially and radially between the periphery of the diaphragm **50** and the casing **12** and its retaining cover **25**, as well as between the armature **45** and the central aperture of the reel or spool **34** and core member **40**.

As hereinbefore indicated, the diaphragm **50** is free to float so that it can strike the edge of the portion **21** and **26** of the housing and cover, respectively, in addition to being flexed or vibrated in response to the reciprocation of the armature **45** when the coil **35** is energized. Such action is particularly illustrated in FIGS. 4 and 5 wherein it will be noted that as the armature **45** is attracted

toward the core **40** the diaphragm **50** is flexed toward the coil **35** (FIG. 5) and during the return stroke of the armature, the diaphragm is flexed away from the coil (FIG. 4), while additionally, the edge **51** of the diaphragm **50** is free to move axially between the seat **21** and cover portion **26** and strike them to produce more audible sounds. This action increases the harmonic content as well as the intensity of sound out-put horns of known construction in which the edge of the diaphragm is restricted or rigidly clamped between the casing and its retaining cover or ring.

While there is described above the principles of this invention in connection with specific apparatus, it is to be clearly understood that this description is made only by way of example and not as a limitation of the scope of this invention.

What is claimed is:

1. An alternating current electric horn comprising:
(*a*) a cup-shaped casing having a radial outwardly extending flange at its open end,
(*b*) a dished apertured cover attached to said casing having a radially extending marginal portion spaced axially of said casing flanged to form an annular pocket,
(*c*) a diaphragm having its peripheral edges freely and loosely received and movable axially in said annular pocket to allow a predetermined free axial movement of said diaphragm, and
(*d*) electrically energized means in said casing for actuating said diaphragm to produce an audible signal resulting in part from the diaphragm striking said cover and said flange.

2. An electromagnetically operated horn comprising:
(*a*) a cup-shaped casing having an open end defined by an outwardly extending radial flange terminating in an axial rim,
(*b*) a diaphragm in the open end of said casing,
(*c*) a diaphragm retaining ring on said casing in engagement with said rim to provide axial clearance for the peripheral edges of said diaphragm to allow a predetermined free axial movement of said diaphragm, and
(*d*) electromagnetic means in said casing to vibrate said diaphragm and cause its said peripheral edges to strike said flange and said ring.

3. An electromagnetically operated horn according to claim 2 in which the means to vibrate said diaphragm comprises an electrical coil, and an armature in said coil having its outer end fixed intermediate of the edges of said diaphragm.

4. An electromagnetic alternating current sound producing device comprising:
(*a*) a housing having an opening and
(1) a seat around said opening
(*b*) an alternating current electromagnet mounted in said housing with its axis aligned with said opening,
(*c*) a diaphragm covering said opening and having its peripheral edge loosely engaging said seat,
(*d*) means spaced from said seat for loosely retaining said diaphragm in said opening to allow a predetermined free axial movement of said diaphragm, and
(*e*) armature means attached to said diaphragm aligned with said axis of and adjacent to said electromagnet.

5. A device according to claim 4 wherein said housing is cup-shaped, said seat and diaphragm are circular, and said axis of said electromagnet is coaxial therewith.

6. A device according to claim 4 including a mounting bracket for said housing, and common means for assembling said electromagnet and bracket with said housing.

7. A device according to claim 4 wherein said means for retaining said diaphragm comprises an apertured cover for said seat around the opening in said housing.

8. A synchronous alternating current driven diaphragm horn comprising:
(*a*) a cup-shaped casing having an open end defined by a radial flange terminating in an outwardly offset axial rim,
(*b*) a diaphragm in the open end of said casing with its periphery spaced inwardly of said rim,
(*c*) an apertured cover for said casing having a radial flange engaging said rim to form an annular pocket so as to provide axial clearance for said diaphragm,
(*d*) an electromagnetic coil assembly including a terminal block fixed in said casing,
(*e*) terminals mounted in said terminal block and projecting from said casing,
(*f*) an armature in said coil assembly attached to the center of said diaphragm, and
(*g*) means to energize said coil to reciprocate said armature and said diaphragm so that said diaphragm vibrates and strikes both of said flanges.

9. An alternating current operated horn of the diaphragm type comprising:
(*a*) a casing having a flanged open end,
(*b*) a diaphragm spanning the open end of said casing,
(*c*) an apertured cover for the open end of said casing,
(*d*) means spacing said cover from said flange to form an annular slot to provide radial and axial clearance for the periphery of said diaphragm,
(*e*) an aperture in the side of said casing adjacent the bottom thereof,
(*f*) an electromagnet in said casing,
(*g*) a terminal block projecting from said electromagnet and through said aperture,
(*h*) terminals extending from said terminal block for connection to a source of current for energizing said electromagnet, and
(*i*) an armature fixed to said diaphragm for oscillation by said electromagnet whereby said diaphragm is vibrated and moved axially into and out of engagement with said cover and said flanged open end of said casing.

10. A device according to claim 9 and further including a mounting bracket, and common means for securing said electromagnet in said casing and said bracket to said casing.

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NEIL C. READ, *Primary Examiner.*