M. R. HUTCHISON.

MECHANICALLY ACTUATED DIAPHRAGM HORN.

APPLICATION FILED MAY 5, 1909.

1,160,900.

Patented Nov. 16, 1915.

2 SHEETS—SHEET 1.

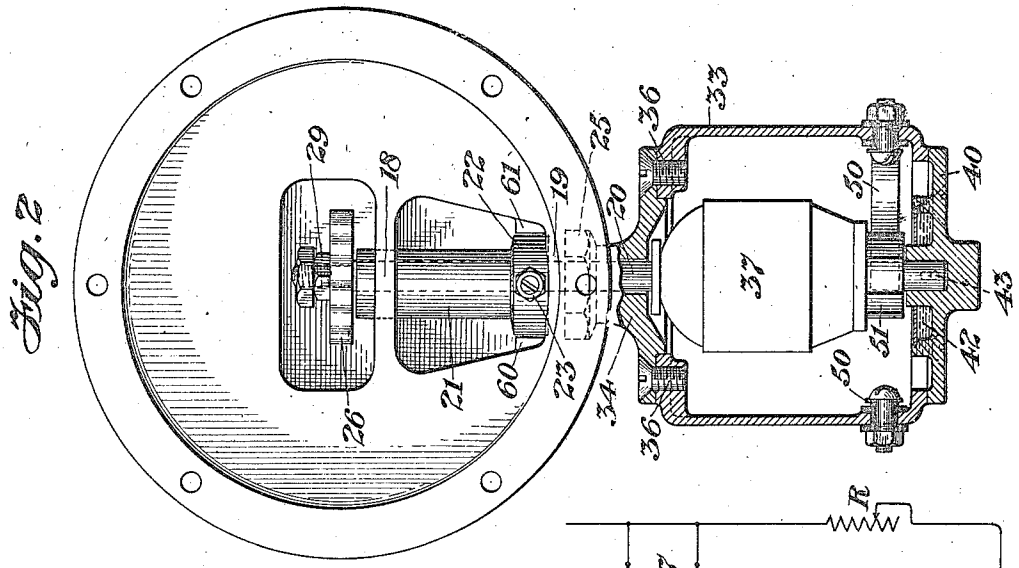

Fig. 2

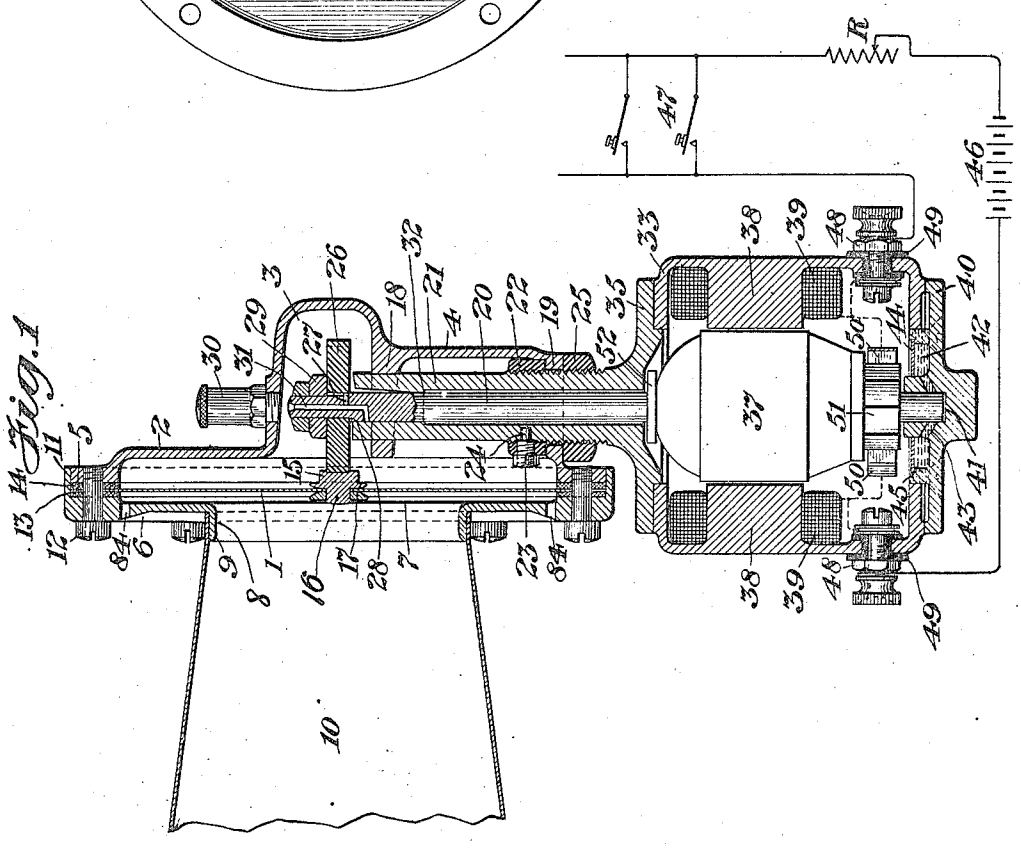

Fig. 1

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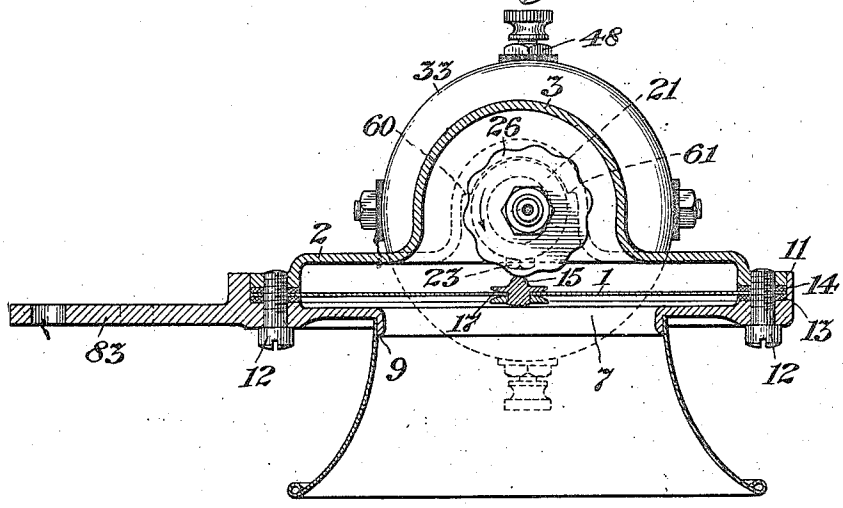
Fig. 3.



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UNITED STATES PATENT OFFICE.

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MECHANICALLY-ACTUATED DIAPHRAGM-HORN.

1,160,900. Specification of Letters Patent. Patented Nov. 16, 1915.

Application filed May 5, 1909. Serial No. 494,120.

To all whom it may concern:

Be it known that I, MILLER REESE HUTCHISON, a citizen of the United States, and a resident of Summit, in the county of Union and State of New Jersey, have invented certain new and useful Improvements in Mechanically-Actuated Diaphragm-Horns, of which the following is a specification.

My invention relates to that type of horn disclosed in my prior Patents 923,048, 923,049 and 923,122 and relate more particularly to the means for supporting and rotating the drive shaft. This drive shaft is preferably the armature shaft of an electric motor and the motor is preferably of a small cylindrical type adapted to run on low voltage currents.

One important object of my invention is to simplify and improve the means for securing the desired relative adjustment of the diaphragm and diaphragm vibrating means, and to do this I provide, as an important feature of my invention, a novel construction of diaphragm case, motor case and connection between the two whereby the desired adjustment may be secured by a rotation of one in respect to the other. With the shaft parallel or substantially parallel to the diaphragm, the motor case preferably has a portion encircling the shaft and presenting an eccentric surface engaging in a bearing rigid with the diaphragm case. The degree of eccentricity is determined by the maximum limits of desirable adjustment.

A further important object of my invention is to provide a simple and rigid support for the motor and the shaft thereof, so that if said motor be of the cylindrical type, the armature shaft may lie comparatively close to the diaphragm, and a cam or other diaphragm vibrating rotor of an efficient size may engage with a comparatively low wear-piece. To secure this object, I mount the motor proper beyond but adjacent to the periphery of the diaphragm and provide the motor case with an extension projecting radially adjacent to the surface of the diaphragm and presenting a bearing for the shaft adjacent to the cam or other rotor and to the center of the diaphragm. Preferably the diaphragm case supports this extension at a point close to said bearing and thus resists the reaction due to cam thrusts and return swings of the diaphragm.

Other objects and features of more or less importance will appear in connection with a detailed description of a preferred embodiment of my invention and the appended claims, but I do not herein claim any invention residing in the method of operation or in certain features of the construction including the form or design of the rotor. These are set forth and claimed in my divisional application Serial No. 571,188 filed July 9, 1910.

Reference is to be had to the accompanying drawings showing one embodiment of my invention, in which similar reference characters indicate corresponding parts in the several views.

In these drawings: Figure 1 is a vertical central section of the horn and motor assembled, the battery connections being diagrammatically indicated; Fig. 2 is a face view of the device, the resonator case and diaphragm being removed and the motor case being shown in vertical section; and Fig. 3 is a central transverse section at right angles to the plane of Fig. 1.

The general organization of the parts is shown in Figs. 1, 2, and 3. The diaphragm 1 is clamped at the edges between two sections of an inclosing case. The rear section 2 is formed with rear walls approximately parallel with the diaphragm, except where it is enlarged, as at 3 and 4, to form inclosing chambers for the cam, cam shaft, and bearings. The front face is formed with an annular clamping surface 5. The front cover or resonator section 6 of the diaphragm case is parallel with the diaphragm and far enough away from it to permit maximum vibration of the diaphragm without engagement with the case. It is formed with the central opening 7 of large diameter so as to expose a large part of the effectively vibrating part of the diaphragm. The opening is surrounded by an annular flange 8, which may be flared toward the open end, as indicated at 9. The resonator 10 is secured to this flange preferably by spinning the material against the outer wall thereof or by brazing or by both. The periphery of section 6 is formed with a flange 11 fitted over the rear section 2 of the diaphragm case. As shown in the drawings, the clamping surfaces are of ample width and thickness to apply the clamping pressure of the screws

12 evenly about the periphery of the diaphragm. The quality of the note is improved and destructive vibration and cutting action of the diaphragm is prevented by washers 13 and 14 arranged between the diaphragm and the clamping faces of each section of the case. These washers may be of non-vibratory material such as cork, wood, or hardened fiber.

The diaphragm 1 is provided with a wear piece 15 formed with a shank 16 riveted over a washer 17.

The section 2 of the diaphragm case is formed with webs 18, 19, having alined openings for support of the cam shaft 20. The latter is mounted in a bearing sleeve 21 with its axis eccentric to but preferably parallel with the axis of said bearing 21, as shown more clearly in Figs. 2 and 3. When said bearing is rotated, the axis of the shaft moves in a circular path approximately parallel with the axis of the sleeve. In practice, I find that the radius of this eccentricity need not be much greater than the amplitude of vibration of the diaphragm, in order to give a throw amply sufficient for all required adjustment of the cam shaft with respect to the diaphragm.

The sleeve bearing 21 is held in a desired position of longitudinal adjustment by means of a screw collar 22 engaging the end wall of the casing. This collar is locked in position by means of a screw key 23, screw threaded into collar 22 and having a stud 24 engaging a recess in sleeve 21.

There is a coöperating lock nut 25 outside of the casing which may be loosened to permit rotary adjustment of the sleeve bearing 21 and the cam shaft 20 carried thereby and which may be tightened to rigidly clamp said bearing against both longitudinal and rotary movement. The cam 26 is keyed to the cam shaft 20 by pin 27 and is clamped against shoulder 28 by locknuts 29.

Oil for lubricating the shaft 20 and also the contact between cam 26 and wear piece 15, is supplied through an oil passage or reservoir 30. Part of the oil is thrown by centrifugal force from the rapidly revolving cam against the projection 15 and part of it finds its way through the opening 31 arranged longitudinally of the shaft 20 and extending down to the bearing point of the latter upon sleeve 21. In order to avoid too great friction, the interior of sleeve 21 is cut away so as to be out of contact with the shaft 20 from the point 32 downward.

In the form shown herein, the bearing sleeve 21 is extended outside of the case and is utilized as a support for the motor case 33. As shown more clearly in Fig. 2, this case is concentric with the cam shaft 20, while the bearing sleeve is slightly eccentric thereto, as indicated at 34, though this eccentricity may be so small as to be practically unnoticeable to the eye from the exterior. The end of the sleeve 21 is formed as an end wall 35 of the motor case 33 and is secured to the latter by screws 36, 36.

On the cam shaft 20 is mounted the motor armature 37 revolving between pole-pieces 38, 38, formed as integral projections of the shell or case 33 and energized by field windings 39, 39. The case 33 is closed in at the bottom by an inclosing wall 40 formed with a journal 41 for the lower end of shaft 20. Surrounding this is an annular cavity 42, supplying lubricating oil or grease through passages 43. The lubricant is held in position by means of a disk 44, engaging the annular shoulder 45. The current for operating the motor is derived from battery 46 controlled by circuit closers, as at 47, and, if desired, regulated by an adjustable resistance R. This circuit is connected to binding posts 48, 48, leading within the case 33 and insulated therefrom by bushings 49, 49. As diagrammatically indicated by dotted lines in Fig. 1, the current is supplied in parallel to the field windings 39, 39 and to the brushes 50, 50 of commutator 51 supplying armature 37. Above the armature 37, upon the armature shaft 20, adjacent the end of sleeve 21, is arranged a collar 52, whereby the drip of excess oil is thrown off centrifugally on the sides of the case 33 and so is prevented from saturating the armature and leaking down on the commutator, thereby impairing the contact of the commutator bars therewith.

By reference particularly to Fig. 3, it will be seen that the adjustment of the cam shaft to and from the diaphragm may be accomplished by rotating the eccentric sleeve 21 through a quarter rotation in either direction from the medial position shown in said Fig. 3 and that rotation through a semi-circumference from said position will bring the axis of the cam shaft to a position where it is exactly the same distance perpendicularly from the diaphragm, but is on the left hand side of the axis of sleeve 21. In certain cases, it is confusing to unskilled users to have an adjustment of this kind wherein a continuous rotation in one direction acts as an adjustment toward the diaphragm through a half revolution, and then as an adjustment away from the diaphragm during the other half revolution. I may avoid this by arranging the seats 60, 61, shown in full lines in Fig. 2 and in dotted lines in Fig. 3, adjacent the collar 22 so as to be engaged by the head of screw 23, thereby limiting the rotary adjusting movement to a half revolution, in which all rotary movement in one direction carries the cam shaft toward the diaphragm and all rotary movement in the other direction carries the cam shaft away from the diaphragm.

In practice, I prefer to make the dia-

phragm and the wear piece thereon light in weight, thereby decreasing inertia as far as may be consistent with the requirements of stiffness and durability. The diaphragm is preferably of fine quality rolled steel, such as vanadium nickel steel, and may be used either tempered or annealed, though the tempered diaphragm gives a better note.

The resonator is preferably constructed as shown in my Design Patent No. 39,801, granted February 2, 1909.

By way of illustration, I may say that I have used successfully a steel diaphragm 5 to 6 inches in diameter, .02 to .03 inches in thickness, clamped ½ inch about the edge, in connection with a rotary cam having the proportions shown in the drawings and made of highly tempered steel. A desirable motor for use on ignition batteries of automodiles is a direct current shunt wound motor adapted to operate on five to seven volts.

The possible reactions and the possible variations of adjustment, spacing, and speed of the cam and also of the relative velocities, amplitudes of vibrations, elasticities, and inertias of the diaphragm, as well as the modifying effects of the resonator may be many and complex as set forth in my copending application Serial No. 373,946, filed May 16th, 1907 (Patent No. 923,049) and in my application Serial No. 571,188, filed July 9th, 1910, which is for subject matter divided out of this application, nevertheless, it will be found that when a suitable design of cam, diaphragm, wearpiece and motor power has been provided, such, for instance, as shown herein and more fully explained in my said divisional application, the remaining complexities may be taken care of by adjustment of the cam to and from the diaphragm. In practice, the locknut 25 is loosened and the current is turned on. With the motor case as a handle, the sleeve 21 is rotated and the cam is thereby adjusted to and from the diaphragm until the proper operation is made evident by the great increase in volume and improvement in quality of the tone. The locknut is then tightened and the device may be continued in use indefinitely.

While I have herein fully shown and described, and have pointed out in the appended claims certain novel features of construction, arrangement, and operation which characterize my invention, it will be understood by those skilled in the art that various omissions, substitutions, and changes in the forms, proportions, sizes, and details of the device and of its operation, may be made without departing from the spirit of my invention.

I claim:

1. In an alarm or signaling apparatus, a diaphragm and a rotary vibrator therefor, in combination with a drive shaft for the latter and a bearing for said shaft, said bearing being provided with an external bearing surface, having an axis eccentric to the axis of said shaft, whereby rotation of said bearing on its bearing surface operates to adjust said shaft of said vibrater nearer to or farther from said diaphragm, together with a locking nut screw threaded over said shaft bearing for holding the same in a desired position of adjustment.

2. In an alarm or signaling apparatus, a horn or resonator and a diaphragm therefor, a rotary cam, a case for said diaphragm, in combination with a drive shaft for the latter and a bearing for said shaft, said bearing being provided with an external bearing surface, having an axis eccentric to the axis of said shaft, whereby rotation of said rotary bearing on its bearing surface operates to adjust said shaft of said vibrator nearer to or farther from said diaphragm, together with a locking nut screw threaded over said shaft bearing for holding the same in a desired position of adjustment.

3. In an alarm or signaling apparatus of the class described, a diaphragm, rotary mechanical means for vibrating said diaphragm, and a dust tight case for the rear of said diaphragm inclosing said vibrating means, in combination with an electric motor, a dust tight case inclosing said motor, provided with an extension or sleeve secured to and having a dust tight joint with said diaphragm case, said projection or sleeve having an exterior bearing surface eccentric to the axis of said motor.

4. In an alarm or signaling apparatus of the class described, a diaphragm, rotary mechanical means for vibrating said diaphragm, and a dust tight case for the rear of said diaphragm inclosing said vibrating means, in combination with an electric motor, a dust tight case therefor provided with an extension or sleeve projecting into and having a dust tight joint with said diaphragm case, and said extension or sleeve having an exterior bearing surface eccentric to the axis of said motor, and means for locking said sleeve in a desired position of rotary adjustment.

5. An alarm or signaling device of the class described, comprising a diaphragm and a power shaft for vibrating said diaphragm, a sleeve in which said shaft is mounted having an exterior bearing surface eccentric to the axis of said shaft, said sleeve being mounted in bearings concentric with its own axis, and means for locking said sleeve in any desired position of rotary adjustment.

6. In an alarm or signaling device of the class described, an electric motor having an armature shaft and a dust tight case provided with an extension or sleeve for the armature shaft, said extension being formed

with an exterior bearing surface eccentric to said shaft, in combination with a vibratory diaphragm, means for vibrating it and a dust-tight case for the rear of said diaphragm, said case being formed with cylindrical bearings for said eccentric bearing surface of the sleeve of the armature shaft.

7. In an alarm or signaling device of the class described, an electric motor having an armature shaft and a dust tight case provided with an extension or sleeve for the armature shaft, said extension being formed with an exterior cylindrical bearing surface eccentric to said shaft, in combination with a vibratory diaphragm, means for vibrating it and a dust tight case for the rear of said diaphragm, said case being formed with a cylindrical bearing for said eccentric bearing surface of the sleeve of the armature shaft, together with a fixed collar and a coöperating nut on said sleeve adapted to clamp the wall of the case about the opening for the sleeve of said motor shaft.

8. In an alarm or signaling device of the class described, a diaphragm, a vibrator for said diaphragm, a casing for said vibrator, a shaft on which said vibrator is mounted, driving means for said shaft, a casing for said driving means, an extension formed thereon, through which said shaft extends, means for pivotally securing said extension to said vibrator casing, and for varying the position of the shaft and the vibrator relatively to the diaphragm by turning the driving means casing about the axis of said extension, relatively to the vibrator casing and means for limiting the arc of the turning movement so that all turning movement in one direction moves the vibrator toward said diaphragm and all turning movement in the other direction moves the vibrator away from said diaphragm.

9. In an alarm or signaling device of the class described a diaphragm, a vibrator therefor, a casing for said vibrator, a shaft on which said vibrator is mounted, driving means for said shaft, a support for said shaft provided with an eccentric bore through which said shaft extends, means for pivotally securing said support to said vibrator casing, whereby rotary motion of said support about its own axis varies the relative positions of said vibrator and said diaphragm, and means for limiting relative rotary motion between said casings, whereby the rotary motion in one direction moves the vibrator toward, and rotary motion in the other direction moves the vibrator away from said diaphragm.

10. In an alarm or signaling apparatus, a horn or resonator and a diaphragm therefor, in combination with a rotary cam, a driving shaft, a case in the rear of said diaphragm inclosing said rotary cam and shaft, and an eccentrically pivoted bearing for said cam shaft, a portion of said bearing being disposed within a circular opening in the wall of said case.

11. In an alarm or signaling apparatus, a diaphragm, a casing on the rear of said diaphragm, a shaft projecting into said casing, a cam mounted on said shaft for vibrating said diaphragm, driving means for said shaft, a casing therefor and means for rotatably securing the casing of said driving means to said diaphragm casing and for varying the position of said cam relative to said diaphragm, by rotating one casing relatively to the other.

12. In an alarm or signaling apparatus, a diaphragm, a casing for the rear of said diaphragm, a vibrator for said diaphragm located in said casing, a shaft for actuating said vibrator, a motor for driving said shaft, a casing for said motor, a cylindrical extension on said motor casing, provided with an eccentrically located bearing for said shaft and means for rotatably securing said extension to said diaphragm casing whereby the position of said vibrator may be adjusted relatively to said diaphragm by turning said motor casing about the axis of said extension.

13. In an alarm or signaling apparatus, a diaphragm, a casing for the rear of said diaphragm and having an opening therein, a vibrator for said diaphragm located within said casing, a driving shaft for said vibrator, driving means for said shaft, a bearing member for said shaft, and means for rotatably securing said member in the opening of said diaphragm casing about an axis eccentric to the axis of the shaft whereby the position of the vibrator may be adjusted relatively to the diaphragm by rotating said member about its own axis.

14. In an alarm or signaling apparatus, a diaphragm, a case for the rear of the diaphragm and having a cylindrical aperture, a vibrator for the diaphragm located in the case, a motor for actuating said vibrator and having a case including a cylindrical portion disposed within said aperture, and means for normally preventing rotation of said motor case about the axis of said cylindrical portion.

15. In an alarm or signaling apparatus, a diaphragm, a case for the rear of said diaphragm and having a circular aperture therethrough, a motor including a case having a cylindrical portion projecting into said aperture and constituting a bearing for the armature shaft of said motor, a vibrator for the diaphragm located in the diaphragm case and carried by said armature shaft, and means having threaded engagement with said motor case for normally preventing relative movement of said motor case and said diaphragm case.

16. In an alarm or signaling apparatus,

a diaphragm, a case for the rear of said diaphragm and having an aperture therethrough, a motor having a cylindrical portion projecting into said aperture and constituting a bearing for the armature shaft of the motor and normally prevented from endwise movement out of said aperture, and a collar having threaded engagement with said cylindrical portion and abutting against said diaphragm case for normally preventing bodily rotation of said motor in respect to said diaphragm case.

17. In a horn, an electric motor having an inclosing shell provided with an open end, a removable cap across the open end and provided with a bearing for the motor shaft, a casing member having an opening within which said shell is rotatably mounted, a diaphragm having its marginal edges secured to said member, and means on the motor shaft for vibrating the diaphragm and adjustable toward and from said diaphragm upon a bodily rotation of said motor.

18. In a horn or signaling device, including a resonator, an annular casing member having an opening therethrough, a diaphragm clamped to said member, a rotary electric motor having a diaphragm vibrator and a cylindrical casing portion rotatably mounted in said opening to permit the bodily adjustment of the motor and vibrator toward and from the plane of the diaphragm, and a lock nut threaded upon said cylindrical casing portion and adapted to abut against said casing member, to normally prevent bodily rotation of the motor.

19. A horn or signaling device having a diaphragm, a casing member presenting an opening and a rotor carried by the armature shaft for vibrating said diaphragm, a rotary electric motor, said motor having a shell presenting a cylindrical portion disposed within said opening and rotatable to secure adjustment of said motor toward and from the plane of said diaphragm, a bearing rigid with said shell and serving to support the armature shaft of said motor intermediate the rotor and armature, and a removable wall at the opposite end of said motor shell and having a socket adapted to receive and support the opposite end of said armature shaft.

20. In a horn, an electric motor having an inclosing shell having an end wall provided with a bearing for the motor shaft, a casing member having an opening within which said shell is rotatably mounted, a diaphragm having its marginal edges secured to said member, a wheel on the motor shaft having projections and a power transmitting member intermediate said wheel and diaphragm, said projections operating against said member to vibrate said diaphragm.

21. In a horn, an electric motor having an inclosing shell provided with a cylindrical portion at one end, an end wall at the opposite end of the shell and provided with a bearing for the motor shaft, an apertured diaphragm casing member receiving said cylindrical portion, a diaphragm having its marginal edges secured to said member, a projection on the intermediate portion of the diaphragm, a toothed wheel on the motor shaft operating against the projection to vibrate the diaphragm, said motor shaft and said toothed wheel being adjustable toward and from the diaphragm by a bodily rotation of said motor within said casing.

22. A device of the class described, comprising a diaphragm, a rotor for vibrating said diaphragm, and a rear casing inclosing said rotor and forming with said diaphragm a closed chamber, in combination with means for supporting and rotating said rotor with its axis in approximate parallelism with the diaphragm, comprising a rotary electric motor, having an encircling iron shell forming part of the magnetic circuit of the field, a closure for the lower end of said shell, including a step-bearing for the armature shaft, a closure for the upper end of said shell provided with an axial extension formed internally with a bearing for the armature shaft adjacent the upper end thereof, and provided externally with bearing portions adjacent the motor, and adjacent the upper end for engagement with said casing at spaced points, and means for securing said extension rigidly to said casing at one of said points.

23. A device of the class described comprising a diaphragm, a rotor, a rear casing inclosing said rotor and supporting said diaphragm and means for supporting and rotating said rotor with its axis in approximate parallelism with the diaphragm, comprising a rotary electric motor having an encircling shell beyond but adjacent to the periphery of the diaphragm, a step-bearing for the armature shaft, an axial extension formed internally with a bearing for the armature shaft adjacent the upper end thereof, and provided externally with bearing portions adjacent the motor, and adjacent the upper end for engagement with said casing at spaced points, and means for securing said extension rigidly to said casing at one of said points.

24. An alarm or signaling device comprising a diaphragm, a rotor for vibrating said diaphragm, a rear casing member supporting said diaphragm, a rotary electric motor having a cylindrical shell disposed beyond but adjacent to the periphery of the diaphragm with its axis parallel to the latter, said shell having an extension projecting radially of the diaphragm and including a bearing for the armature shaft adjacent to said rotor, and means for rigidly connecting

said extension to said rear casing member.

25. An alarm or signaling device comprising a diaphragm, a rotor for vibrating said diaphragm, a rear casing member supporting said diaphragm, a rotary electric motor having a cylindrical shell disposed beyond but adjacent to the periphery of the diaphragm with its axis parallel to the latter, said shell having an extension projecting radially of the diaphragm and including a bearing for the armature shaft adjacent to said rotor, and means for rigidly connecting said extension to said rear casing member at a point adjacent to said bearing and at a point adjacent to the periphery of the diaphragm.

Signed at New York city, in the county of New York and State of New York, this 4th day of May, A. D. 1909.

MILLER REESE HUTCHISON.

Witnesses:

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