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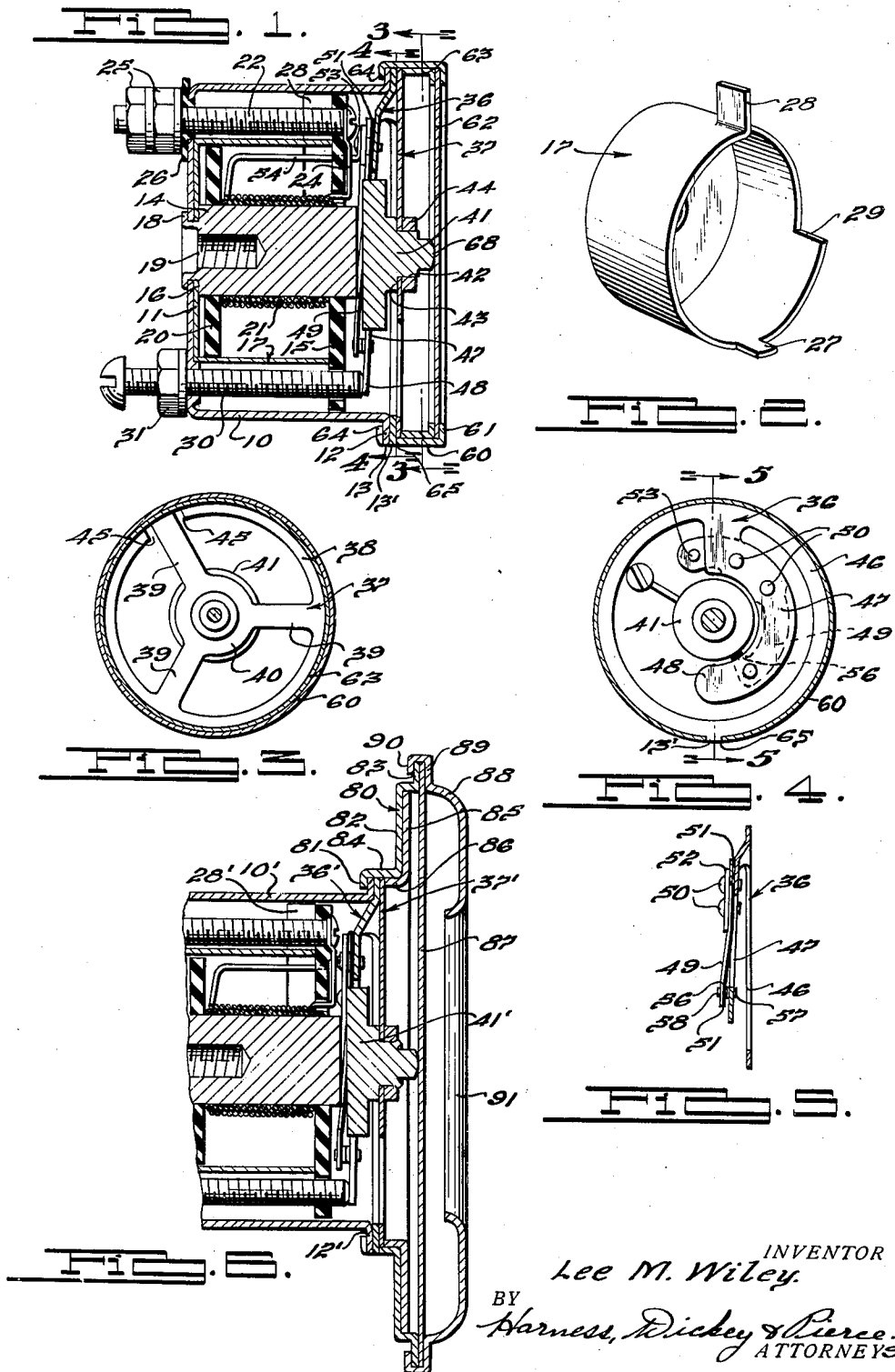
L. M. WILEY

2,193,544

HORN UNIT AND MOUNTING THEREOF

Filed April 16, 1937

2 Sheets-Sheet 1



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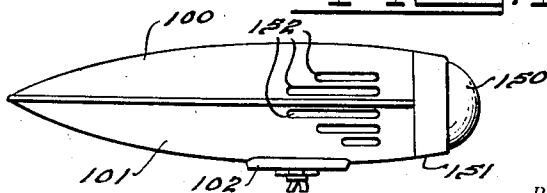
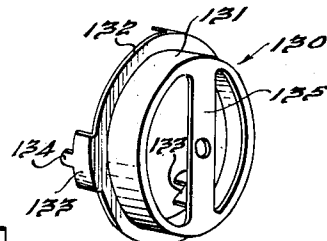
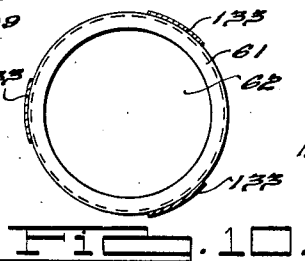
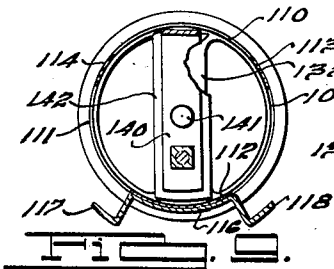
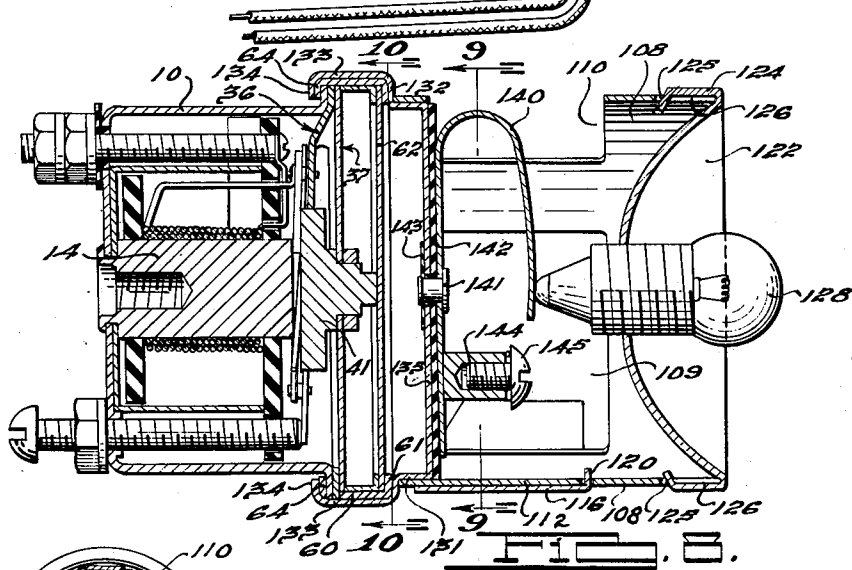
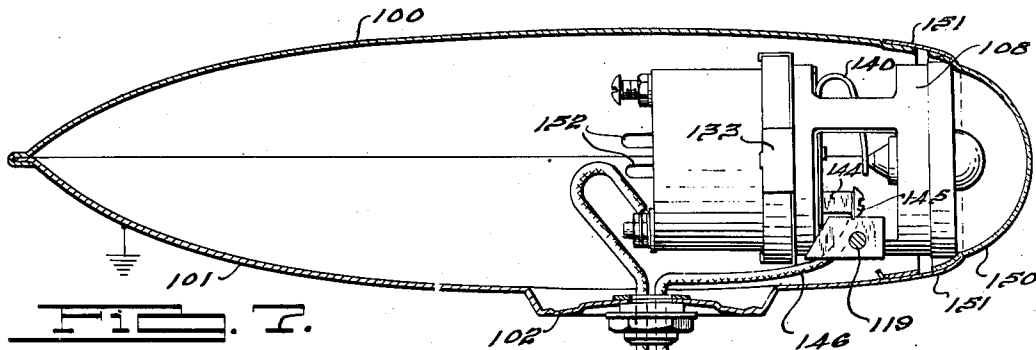
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HORN UNIT AND MOUNTING THEREOF

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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

2,193,544

HORN UNIT AND MOUNTING THEREOF

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Application April 16, 1937, Serial No. 137,221

10 Claims. (Cl. 177-7)

The present invention relates to electromagnetic horns and means for mounting the same.

One object of the invention is to provide a power unit for a horn of improved construction, which unit is characterized by its small size, compact, simple construction, and the ease with which it may be assembled.

Another object of the invention is to provide a horn assembly in which all of the relatively moving parts are fixed in proper spaced relation independently of variations in dimensions of the casing.

Another object of the invention is to provide a horn unit in which the maximum possible magnetic effect and sound is produced by a relatively small electromagnet.

Another object of the invention is to improve the details of construction of a horn including the circuit interrupter mechanism for the electromagnet and the armature and diaphragm mountings.

Another object of the invention is to provide a power unit for a horn which is readily adapted for assembly with diaphragms of different sizes and for mounting in different types of casings, either alone or in conjunction with other instrumentalities, such as a lamp.

Another object of the invention is to provide an improved and simplified structure combining a horn and lamp in a single casing.

Other objects and advantages of the invention will become apparent from the following specification, the accompanying drawings, and the appended claims.

In the drawings:

Figure 1 is a central longitudinal section through the improved horn unit;

Fig. 2 is a perspective view of the cup shaped stamping that surrounds the electromagnetic coil.

Fig. 3 is a section taken on the line 3-3 of Fig. 1;

Fig. 4 is a section taken on the line 4-4 of Fig. 1;

Fig. 5 is a section taken on the line 5-5 of Fig. 4;

Fig. 6 shows the improved horn unit assembled in conjunction with a diaphragm of larger size than that shown in Fig. 1;

Fig. 7 shows the improved horn unit embodied in a combined horn and light mounted in a single casing;

Fig. 8 is a longitudinal section through the horn and light unit shown in Fig. 7;

Fig. 9 is a section taken on the line 9-9 of Fig. 8;

Fig. 10 is a section taken on the line 10-10 of Fig. 8;

Fig. 11 is a perspective view of the element utilized to connect the horn and light casings; and

Fig. 12 is a side elevational view of the completed horn and light unit.

Referring to the drawings, and particularly Fig. 1 thereof, the improved horn unit comprises a casing 10 of generally cylindrical form, having a closed end wall 11 and being provided at the opposite end with an outwardly extending flange 12. The flange 12 is circular except for a minor projection 13, the purpose of which is set forth hereinafter.

Mounted within the casing is an electromagnet assembly comprising a core piece 14 which projects through an opening in and is supported at one end by a disc 15 of insulating material which is of substantially the same external configuration as the inside of the casing 10. The opposite end of the core piece 14 is provided with a shoulder 16 which seats against the inner side of the end wall of a cup shaped stamping 17. This end of the core piece is provided with a central axial tubular extension 18 which projects through an opening in the end wall of the cup and is adapted also to project through a corresponding opening in the end wall of the casing, whereupon it is flanged to lock the core piece and cup to the casing. When the core piece is locked to the casing as described, the edge of the cup shaped stamping seats against the disc 15 and holds it in properly spaced position with respect to the end wall 11 of the casing 10. The core piece may in addition be provided with a tapped hole 19 which may be used for mounting purposes if desired.

Positioned upon the core piece 14, within the cup 17 and adjacent the end wall thereof, is a second insulating disc 20, which, together with disc 15 and the core piece, forms a spool-like structure to confine the electrical coil 21 of the electromagnet. This coil is shown only as of a few turns for illustrative purposes. Actually it completely fills but does not make contact with the cup 17.

An exterior terminal is provided for one end of the coil 21. This terminal assembly includes a bolt 22 which extends through a suitable opening in the end wall 11 of the casing exteriorly of the cup 17 and through a corresponding opening in the disc 15. One terminal 24 of the coil 21 is

secured beneath the head of the bolt. Suitable nuts 25 are provided upon the projecting extremity of bolt 22 for holding the bolt and the disc 15 in position and for securing to the bolt the exterior electrical wiring. A suitable washer 26 is provided to insulate the bolt 22 from the casing 11.

As best shown in Fig. 2, the cup 17 is provided with a projection 27 adapted to extend through a suitable opening, not shown, in the disc 15 to prevent relative rotation of disc and the cup. Since the cup is locked to the casing by the flanged over projection 18 of the core piece 14, this prevents relative rotation of the disc 15 and casing 10. The cup is also provided with a struck out tongue 23 which projects in contact with the rear face of disc 15 along side of but not touching bolt 22. This tongue supports the edge of the disc 15 against the load applied thereto by the bolt 22 and thereby prevents tilting of the disc with respect to the cup. Preferably the slot 29 from which the tongue 23 is struck is made of greater peripheral length than the length of the tongue in order to provide clearance for the last turn of the coil 21. This is advisable to insure that no contact occurs between the coil and the cup. Any suitable insulating sleeve may be placed between the coil and the core 14, if desired, but this is not necessary as the coil is covered with lacquer and the inner turns are immovable with respect to the core.

The casing is also provided with an adjusting screw 30 which is threaded into the end wall 11 and projects through a suitable opening in the disc 15 for a purpose to be described hereinafter. A lock nut 31 is provided for locking the adjusting screw in any desired position. The power unit per se is completed by a circuit interrupter for the coil 21 and a movable armature, which devices, in the present construction, are supported upon resilient sheet metal plates, indicated generally at 36 and 37, respectively. When the power unit is assembled, these plates are simply seated against the flange 12 in overlapping relation, with the result that they are properly positioned with respect to each other independently of the casing.

The armature supporting plate 37, as best shown in Fig. 3, is in the form of a spider comprising an annular ring portion 38, a plurality of spokes 39, and an apertured hub portion 40. The annular portion 38 is adapted to seat against the marginal portions of the interrupter supporting member 36 to properly position the armature with respect to the interrupter mechanism. An armature 41 is provided with a cylindrical projection 42 adapted to fit the aperture in the hub of the spider and a shoulder 43 which seats against one side of the hub. A retaining ring 44 is then welded or otherwise secured to the cylindrical portion 42 to lock the armature to the spider 37. Preferably the spider is formed of high grade spring steel. While the spider 37 may have a continuous annular ring portion 38 connected to each of the spokes 39, it is found that a larger volume of sound is produced for a given amount of power if the ring portion 38 is broken, as shown at 45 in Fig. 3, and separated at that point from one of the spokes. The spoke which is separated will be free to move in the direction of its length to permit a greater amplitude of vibration but is still held against flange 12 of the casing so that movements of the armature will be properly guided.

As shown best in Figures 4 and 5, the inter-

rupter supporting plate 36 comprises an annular portion 46 adapted to seat against the shoulder 12 of the casing. This annular portion is circular except for a minor projection 13' which corresponds in location and size with the projection 13 on flange 12 of the casing. The interrupter support 36 is further provided with a contact supporting finger 47 which projects inwardly from the annular portion 46 and extends in a circular path around the periphery of the armature 41. A movable contact element 49 of flexible sheet metal is riveted at 50 to one side of the finger 47 with a layer 51 of insulating material between the element 49 and the finger 47. A second layer 52 of insulating material is provided between the rivet heads and the element 49, with the result that the element 49 and finger 47 are electrically insulated from each other. The movable contact element 49 is generally semi-circular in shape and conforms generally to the size and shape of the finger 47. The opposite terminal 54 of the armature coil 21 is connected to the movable contact element at 53 in any desired manner. The opposite end of the movable contact member 49 is provided with a projection 56 which extends into the path of movement of the armature 41, with the result that the armature upon movement thereof towards the electromagnet deflects the movable contact member 49 away from the finger 47. It will be noted that as shown in Figure 5 the insulating layer 51 overlies the projection 56 of the movable contact element, with the result that the armature makes contact with the insulating layer rather than the metallic portion of projection 56.

The finger 47 and movable contact element 49 are provided with a pair of contact elements 57 and 58, respectively, which are normally in electrically conductive engagement with each other. For this purpose, the insulating layer 51 is provided with a suitable aperture through which contact elements 57 and 58 may make contact.

One terminal of the exterior electrical circuit is connected to the bolt 22 by means of nuts 25, as previously described, and the other terminal is grounded to the casing 10. When the external circuit is closed, the current flows from the bolt 22 to the terminal 24 of the coil 21, through the coil and the opposite terminal 54 thereof to the movable contact element 49. From that point, if the contact elements 57 and 58 are in engagement, the current flows through such elements to the finger 47 and thence to the annular portion 46 of the interrupter support 36, which annular portion is grounded to the casing at flange 12 of the latter. Such a current energizes the electromagnet and draws the armature 41 to the left, as viewed in Fig. 1. After a predetermined movement of the armature, it engages the projection 56 on the movable contact member 49, and deflects the latter to break the circuit at contacts 57 and 58. Thereupon the armature is retracted by the inherent resiliency of the spring steel spider element 37 which supports the armature. Upon retraction of the armature, the circuit is again closed at contacts 57 and 58 by reason of the inherent resiliency of the movable contact member 49. It is apparent therefore that the armature will oscillate rapidly towards and from the core of the electromagnet and will continue to do so, so long as the exterior circuit is closed. The terminals 24 and 54 of coil 21 extend through suitable openings, not shown, in the disc 15.

The tone of the horn depends upon the period 75.

of oscillation of the armature 41, which in turn depends upon a number of factors, including the weight or mass of the armature, the strength of the electromagnet, the stiffness of spider 37, and the normal spacing between the armature and projection 56 on the movable contact member 49. The volume of the sound produced depends upon the amplitude of the oscillation. Accordingly, it is apparent that the greatest volume of sound for an electromagnet of the given strength will be produced when the period of oscillation of the armature, as induced by the electromagnet, corresponds to the natural period of vibration of the armature as determined by the stiffness of the spider spring 37. Accordingly, it is exceedingly important that the normal spacing between the armature 41 and the projection 56 be so fixed as to induce an oscillation of the armature having a period corresponding to the natural period of oscillation. The structure above described is peculiarly adapted to provide a fixed and accurate normal spacing between the armature and the projection 56 by reason of the fact that the armature spider 37 and the interrupter support 36 are positioned in contact with each other face to face and hence are inherently spaced from each other a fixed distance. In addition to the above, the adjusting screw 30, previously described, engages the extremity 48 of the finger 47 and is adapted to simultaneously adjust the normal position of both contact elements 57 and 58 with respect to the normal position of the armature. Since the movable contact element 47 is carried by the finger 49, adjustment of the latter by means of adjusting screws 30 adjusts the position of both of these members simultaneously without changing the pressure of contact between contact elements 57 and 58. The adjusting screw 30 performs the additional function of preventing follow-up movements of the finger 47 when the movable contact member 49 is deflected by the armature.

The amplitude of vibration of the armature and therefore the volume of the sound are also materially increased by two other novel features of the construction. The first of these is the cup shaped stamping which performs among others the important function of increasing the number of lines of flux and therefore the force exerted by the electromagnet on the armature. The second novel feature mentioned resides in the construction of the armature supporting spider and particularly the provision of what may be termed a loose spoke in the spider. The spider construction, involving as it does, radial supporting spokes, insures proper alignment of the armature during oscillation, and the provision of one loose spoke materially increases the freedom of oscillation without destroying the guiding effect. In this connection it should be noted that if the spokes were all connected to the ring 38, the spokes would be placed under tension when they were deflected. Disconnecting one of the spokes from the ring enables it to slide in and out toward the axis as the armature oscillates, thereby relieving the tension which otherwise would resist oscillation.

All of these features contribute to increase the efficiency of the horn, with the result that less electrical current is required to produce a given audible output.

The power unit described above is so designed that it may be readily adapted to a number of different diaphragm or casing assemblies. The first of these assemblies is shown best in Figures

1 and 2 and comprises an assembly of the power unit in conjunction with a small diaphragm of substantially the same diameter as the casing 10. This small diaphragm assembly includes a cylindrical band 60 of sheet metal having an inturned flange 61 at one end thereof. A flexible sheet metal diaphragm 62 is fitted within the band 60 and seats against the inturned flange 61 of the latter, and an annular spacer member 63 is pressed into the opposite end of the band 60 to lock the diaphragm in position. When the diaphragm assembly is mounted upon the power unit, the band 60 is fitted over the peripheries of the casing flange 12 and the interrupter and armature supports 36 and 37, as best shown in Figure 1, until the spacer 63 seats against the armature spider 37. Thereafter, the left hand end of the band 60 is spun inwardly over flange 12 of the casing 10 to lock the parts in position. If desired, in place of a continuous spun flange 64, the band 60 may be provided with circumferentially spaced tongues which are simply bent over the casing flange 12 to hold the parts in position. It is apparent that the diaphragm assembly secures the armature and interrupter mechanism in position and that the spacer 63 properly positions the diaphragm with respect to the armature. The diaphragm may just contact the projection 68 on the armature although a small clearance between these two members is preferable. As shown in Figure 4, the projections 13 and 13' on the casing flange 12 and the interrupter support 36, respectively, extend into a small slot 65 formed in band 60. This arrangement prevents relative rotation between the interrupter support and the casing.

It will be noted that the horn assembly described above is exceedingly simple and compact and can be readily assembled. While the diaphragm retaining flange 61 is shown as a simple retaining flange, it is apparent that it may be given any desired form, to provide an ornamental front grille or the like for the diaphragm. While it is preferred to mount the armature upon spider 37 independently of the diaphragm 62, it is apparent that if desired the armature 41 may be mounted directly upon the diaphragm 62, in which event the spider 37 will be eliminated and the diaphragm positioned at the illustrated location of the armature spider. In this event, any suitable retaining ring similar to annular band 60 will be provided to secure the diaphragm and armature support in position.

In Fig. 6 the power unit is shown assembled in conjunction with a diaphragm of substantially larger diameter than the casing of the power unit. In this modification of the invention, the power unit per se, including the casing 10', the electromagnet, the interrupter support 36', the armature support 37', the armature 41', and the electrical circuits are identical to the structure shown and described in connection with Figures 1 to 5, inclusive. In this assembly, however, in place of the cylindrical band 60 shown in Figure 1, there is provided a stepped ring 80 having three axially spaced radially extending shoulders formed at 81, 82, and 83, respectively. These shoulders are of progressively increasing diameter. Shoulder 81 is adapted to seat against the rear face of casing flange 12', which corresponds to the flange 12 shown in Figure 1, and the interrupter support 36' and armature spider 37' are fitted within the cylindrical portion 84 of ring 80 between shoulders 81 and 82 and seat against the flange 12'. Thereafter, an annular clamping

ring 85 having a cylindrical flange 86 is pressed into the cylindrical portion 84 of ring 80 to lock the latter to the casing 10'. A relatively large flexible diaphragm 87 is then seated against the shoulder 83 of ring 80 and clamped thereto by means of a sheet metal cover plate 88. The cover plate 88 has a shoulder 89 adapted to seat against the periphery of the diaphragm and the margin of the cover plate is flanged over the shoulder 83 of ring 80 at 90 to secure the diaphragm and cover plate in position. The cover plate may be of any desired configuration, but should be provided with a suitable opening for the egress of sound, such as the opening 91.

It is apparent that the assembly of the improved power unit, in conjunction with a diaphragm of any desired size, may be accomplished by the means shown in Figure 6 without the necessity of any change whatsoever in the construction of the power unit itself. Preferably the power unit is made of extremely small size in order to increase its range of usefulness. It is found, however, that in spite of the small size of the power unit, it is possible to operate a relatively large diaphragm thereby, particularly if the spacing between the armature and the projection on the movable contact member is so determined as to induce a period of oscillation of the armature equal to the natural period of vibration as determined by the stiffness of the armature supporting spider.

In Figures 7 to 12 is shown the manner in which the improved power unit of this application may be utilized in conjunction with a lamp, wherein a horn and lamp are combined within a single casing. In this construction, the horn unit is provided with the small size diaphragm, the assembled power unit and diaphragm being identical in all respects to that shown in Figure 1. The use of the small size diaphragm is of advantage where, as in Figures 7 to 12, it is desired to mount the horn within a small torpedo shaped lamp casing of a size adapted for use on bicycles and the like.

Referring particularly to Figures 7 to 12, the casing for the combined horn and light is of generally torpedo shape and is formed of a pair of complementary sheet metal sections 100 and 101. The lower section 101 is provided with an embossed portion 102 by means of which it may be mounted upon a fender or other portion of a bicycle or the like.

Mounted within this casing is the complete horn unit shown in Figure 1 of the drawings, in conjunction with a head light assembly structure. The light assembly comprises a substantially cylindrical sheet metal member 108 provided with three circumferentially spaced cut away portions or apertures 109, 110, and 111, respectively, intermediate the ends of the cylinder. These apertures are separated by unbroken connecting portions 112, 113, and 114. Secured to the connecting portion 112 in any desired manner, such as by welding, is a supporting bracket 116, shown best in Figure 9. This bracket is provided with a pair of apertured feet 117 and 118 adapted to seat against the interior of the casing member 101; and bolts 119 are provided extending through suitable holes, not shown, in the casing member 101 and the apertures in the bracket feet 117 and 118 to fix the cylindrical member 108 in position in the casing. As shown in Figure 8, the bracket member 116 may be provided with a bent over tongue 120, which extends through a suitable slot in the connecting por-

tion 112 of the cylindrical member. This assists in locating the bracket in the proper position with respect to the cylinder prior to attachment thereof.

The forward or right hand end of the cylindrical member 108, as viewed in Figure 8, is provided with a lamp bulb support and reflector 122, comprising a semi-spherical sheet metal member having a rearwardly directed peripheral flange 124. Suitable tongues 125, formed on the flange 124, are adapted to engage in bayonet slots 126 in the cylindrical member 108 to secure the member 122 in position. A conventional lamp bulb 128 is threaded centrally into the spherical portion of member 122.

At the opposite end of the cylindrical member 108, there is provided a sheet metal attaching member, indicated generally at 130, and shown best in Figure 11. Member 130 is provided with a cylindrical portion 131 which is press fitted into the end of the cylindrical member 108 and is provided at one end with an outwardly extending flange 132 adapted to seat against the extremity of the cylindrical member 108. A plurality of circumferentially spaced tongues 133 extend axially from the periphery of flange 132 in telescoping relationship to the annular ring member 60 of the horn assembly and the extremities 134 of tongues 133 are bent inwardly and engage behind the flange or tongues 64 of ring member 60 to securely connect the horn structure and the lamp assembly.

Connecting element 130 described above is initially formed as a cup-shaped member, whereupon portions of the bottom of the cup are cut away to leave a diametrically extending web 135 shown best in Figure 11. To this web is secured a spring contact strip 140 of generally U-shape, one side of the U-shaped spring contact strip being riveted to the web 135 by means of a rivet 141. A layer of insulating material 142 is positioned between the spring contact strip 140 and web 135 and a second insulating layer 143 is provided between one head of the rivet 141 and the web 135 to completely insulate the spring contact strip 140 from the web. A terminal block 144 is secured in any desired manner to the contact strip 140, as by brazing or otherwise, and a terminal screw 145 is provided in block 144 to provide a means for attaching the non-grounded terminal 146 of the outside electrical circuit.

When the combined horn and light are assembled in the torpedo casing, a suitable lens 150 is secured to the open end of the casing by means of a bezel 151 in the usual manner. As best shown in Figure 12, the casing is provided with a plurality of longitudinally extending slots 152, through which the sound from the horn may pass unimpeded.

It is apparent, in view of the above, that there is provided, in accordance with this form of the invention, an exceedingly simple combined horn and light of such small dimensions that it is readily adapted for use in conjunction with a relatively small diameter torpedo shaped casing. In practice, combined horn and light units of the type shown in Figures 7 to 12, inclusive, are manufactured in which the maximum diameter of the torpedo casing is approximately two inches. It is apparent, however, that the invention is equally applicable to larger size torpedo shaped horn and light units, such as the type utilized on automobiles. In such a case, the horn may be provided with a larger size diaphragm, such as that shown in Fig. 6, and the cylindrical member

108 of the light assembly made of correspondingly greater diameter.

It is apparent that in accordance with the present invention there is provided an exceedingly simple and compact power unit for an electric magnetic horn, which is so designed that it is readily adaptable to various types and sizes of diaphragm and casing installations. Moreover, it is apparent that the horn unit of the present invention embodies a number of improved characteristics, including a positive fixing of the relative spacing between the moving parts independently of any variations in the size or distortion of the casing. The horn unit is exceedingly rugged, foolproof, and inexpensive to manufacture.

While several forms of the invention have been shown and described, it is apparent that others are available within the spirit of the foregoing specification, the accompanying drawings, and within the scope of the appended claims.

What is claimed is:

1. In a horn assembly, a casing member open at one end, an electromagnet in said casing, means fixedly associated with said casing forming a shoulder facing the open end thereof, a circuit interrupter support seated against said shoulder, a flexible sheet metal member seated against said shoulder in overlapping relation to said support, an electromagnetic armature carried by said member, said armature being adapted to be attracted by said electromagnet, and an interrupter for the electromagnet circuit including a contact element and a flexible contact member independently secured to said support, said flexible contact member having a portion normally in engagement with said contact element and having means projecting into the path of movement of the armature whereby movement of the armature toward the electromagnet effects separation of said portion and said contact element, and means for flexing a portion of said interrupter support for simultaneously adjusting the normal position of both said contacts toward or away from said armature.

2. In a horn assembly, a substantially cylindrical casing having an outwardly extending flange at one end, an electromagnet in said casing, a pair of flexible sheet metal members seated against said shoulder in overlapping relation, a circuit interrupter for said electromagnet carried by one of said sheet metal members, and an armature carried by the other member, means for securing said sheet metal members to said shoulder, and means for flexing the sheet metal member carrying said interrupter to adjust said interrupter.

3. A horn including a casing, an electromagnet in the casing, an armature movably carried by the casing and adapted to be operated by said electromagnet, said casing having an annular shoulder, a sheet metal member seated at its marginal portions against said shoulder and having its central portion cut away to receive said armature, said sheet metal member having an inwardly extending portion adapted to be flexed independently of said marginal portions, a flexible contact member secured to but electrically insulated from said first mentioned member at the point of attachment, a contact portion on said flexible contact member normally in electrically conductive engagement with said inwardly extending portion of said sheet metal member, means on said flexible contact member projecting into the path of movement of said armature

whereby movement of said armature toward said electromagnet deflects said flexible contact member to effect separation of said contacts, and means for deflecting said inwardly extending portion of said sheet metal member to simultaneously adjust the normal position of both said contacting portions of said members toward and away from said armature.

4. In a horn assembly, a casing member open at one end, an electromagnet in said casing, means fixedly associated with said casing forming a shoulder facing the open end thereof, a circuit interrupter support seated against said shoulder, a flexible member having radially extending arms seated against said shoulder, an armature carried by said arms coaxially of and in proximity to said electromagnet, a diaphragm assembly seated against said shoulder, said diaphragm assembly including a diaphragm, means for holding said circuit interrupter support, said armature supporting member, and said diaphragm assembly against said shoulder in overlapping relation.

5. In a horn assembly, a casing member open at one end, an electromagnet in said casing, means fixedly associated with said casing forming a shoulder facing the open end thereof, a flexible circuit interrupter support seated against said shoulder, a flexible armature supporting member seated against said shoulder, a diaphragm assembly seated against said shoulder said diaphragm assembly including a diaphragm, means for holding said circuit interrupter support, said armature supporting member, and said diaphragm assembly against said shoulder in overlapping relation, an armature carried by said flexible armature supporting member and adapted to engage and vibrate said diaphragm, and an interrupter for the electromagnet circuit, including a contact element and a movable contact member independently secured to said interrupter support, said movable contact member having a contact element normally in engagement with said first mentioned contact element, and said movable contact member having means projecting into the path of movement of the armature, whereby movement of the armature toward the electromagnet effects separation of said contact elements, and means for flexing said interrupter support for adjusting the point of contact between said armature and said means on said movable contact member.

6. In a horn assembly, a substantially cylindrical casing having an outwardly extending flange at one end, an electromagnet in said casing, a pair of sheet metal members seated against said flange in overlapping relation, a circuit interrupter for said electromagnet carried by one of said sheet metal members and an armature carried by the other member, and means for securing said sheet metal members to said flange, said last named means comprising a diaphragm assembly including a diaphragm adapted to be operated by said armature.

7. In a horn a cup shaped casing member open at one end, an electromagnetic core piece in the casing member extending axially thereof and secured at one end to the opposite end wall of said casing member, a disc of insulating material carried by the opposite end of said core, an electrical winding on the core between said disc and said end wall of the casing member, a tubular sheet metal spacer surrounding said coil between the disc and said end wall, means for securing said disc against the end of said tubular member,

a movable armature and a circuit interrupter mechanism each carried by said casing on the opposite side of said disc from said tubular member.

- 5 8. In a horn, a casing, an electromagnet in the casing, a flexible spider having a plurality of radially extending spokes, an armature carried at the hub of said spider, means for fixedly connecting certain of said spokes at their outer ends
10 to the casing, and means for supporting and guiding the outer end of another spoke for movement toward and from said hub in the plane of said spider.

9. In a horn, a cup-shaped casing, an electro-
15 magnet having a winding substantially filling said casing, said winding and the said casing being co-axial, an armature resiliently supported adjacent the other end of said core, a current
20 interrupter comprising a pair of arcuately shaped flexible fingers each extending through a substantial arc around the armature in the annular space between the armature and the side wall
25 of the casing in substantially the transverse plane of the armature and independently thereof, one end of each of said fingers being supported with respect to the casing and said fingers having

their free end portions overlapped and normally in electrical contact with each other, and means for separating said contacts upon a predetermined movement of the armature towards said core.

- 5 10. In a horn, a cup-shaped casing, an electromagnet having a winding substantially filling said casing, said winding and the said casing being co-axial, an armature resiliently supported
10 adjacent the other end of said core, a current interrupter comprising a pair of arcuately shaped resilient fingers extending through a substantial arc around the armature in the annular space
15 between the armature and the side wall of the casing in substantially the transverse plane of the armature and independently thereof, said
20 fingers having free end portions overlapped and normally in electrical contact with each other, means on said armature for engaging one of
25 said fingers and separating said contacts upon a predetermined movement of the armature towards said core, and means for deflecting both of said fingers simultaneously to adjust the point at which said means on the armature engages said one finger.

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