March 10, 1936. L. V. GROVER 2,033,426

SIGNALING HORN

Filed Feb. 24, 1933

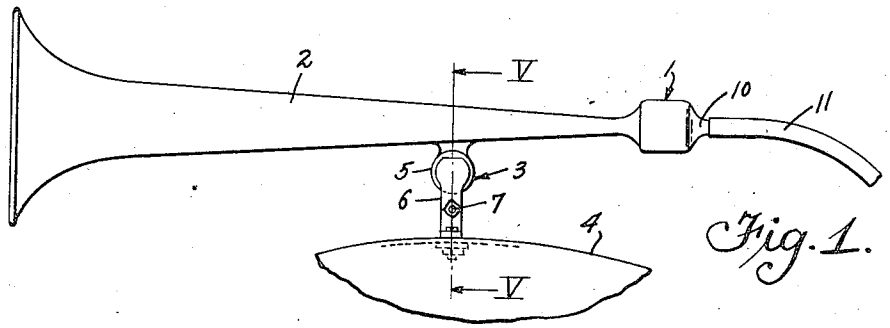


Fig. 1.

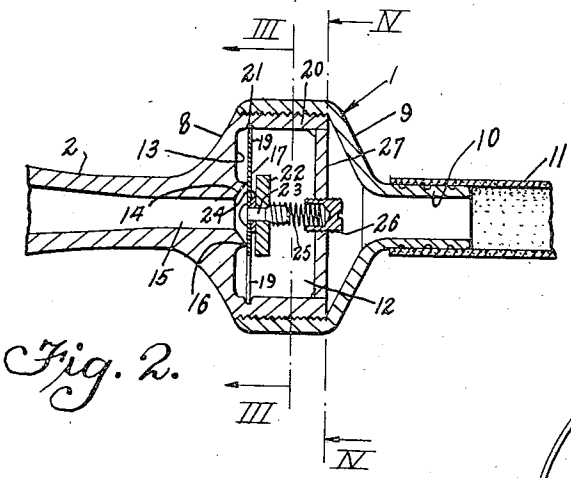


Fig. 2.

Fig. 4.

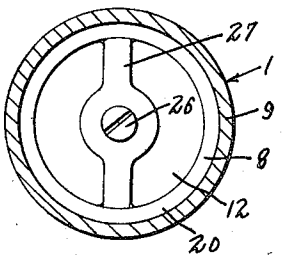
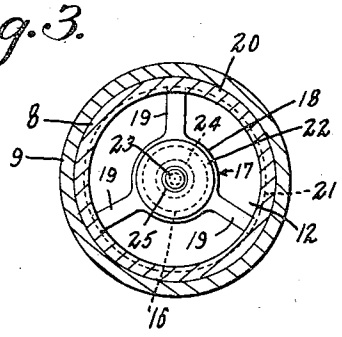


Fig. 3.



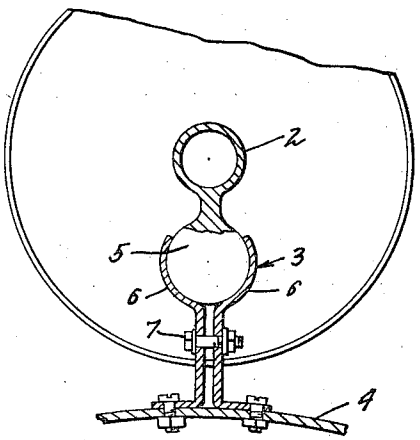


Fig. 5.

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SIGNALING HORN

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12 Claims. (Cl. 116—142)

This invention relates to signaling horns and particularly to air-operated horns. It is especially useful in automobile horns, utilizing as their motive power the vacuum created in the intake manifold of the automobile engine.

An object of the invention is to simplify the construction and reduce the cost of manufacture of air-operated horns.

Another object is to reduce the overall dimensions of the sound producing unit of a horn.

Still another object is to provide a simple construction of air-operated horns for permitting ready adjustment of the spring tension on the sound producing diaphragm.

Other objects and features of the invention will be apparent from the following detailed description which refers to the drawing.

In the drawing:

Figure 1 is a side elevational view of a complete horn in accordance with the invention shown mounted upon a fender of an automobile.

Fig. 2 is a side sectional view of the sound producing unit of the horn.

Fig. 3 is a cross sectional view of the sound producing unit, taken in the plane III—III of Fig. 2.

Fig. 4 is a cross sectional view of the sound producing unit, taken in the plane IV—IV of Fig. 2.

Fig. 5 is a sectional view through the supporting member of the horn, taken in the plane V—V of Fig. 1.

Referring to Fig. 1, a complete horn in accordance with the invention comprises a sound unit designated generally at 1, having a forwardly projecting, outwardly tapered amplifying horn 2 formed integrally with the sound producing unit 1. The entire device is preferably supported by a ball and socket bracket 3 from the fender or other part of an automobile, designated at 4. The bracket 3 (referring to Fig. 5), comprises a ball 5 which may be formed integrally with the horn 2 and positioned near the center of gravity of the entire unit. The ball 5 in turn fits within and is clamped by a pair of socket members 6 which may be contracted about the ball 5 by tightening a bolt 7. The lower ends of the socket member 6 are extended below the bolt 7 and turned outwardly to facilitate their attachment to a fender or other suitable supporting member, as disclosed in the drawing.

Referring now to Fig. 2, the sound unit proper comprises a case defining a closed chamber 12, and the case is preferably formed in two pieces, one piece 8 being formed integrally with the horn 2 and constituting the front and side walls of the chamber, the rear piece 9 being screwed upon the exterior of the piece 8 and constituting the rear wall of the chamber. The piece 9 may be tapered inwardly and rearwardly, as shown, and terminated in a nipple 10 for the attachment of an air hose 11 extending to the intake mainfold of the engine or to any suitable suction device.

The piece 8, constituting the front wall of the chamber 12 is substantially flat over the major portion of its inner surface, as indicated at 13, but is provided at the center with a rearwardly projecting annular shoulder 14 surrounding the sound-emitting aperture 15 which extends from the chamber 12 forwardly into the horn 2 and constitutes the sound throat of the device. The inner surface of the annular shoulder 14 is tapered outwardly to form an edge 16 at the inner orifice of the aperture 15. The radial thickness of the shoulder 14 is such that the diameter of the orifice at the edge 16 is substantially twice the diameter of the throat 15. The edge 16 lies in a plane substantially parallel to the front wall 13 of the chamber 12.

The orifice defined by the edge 16 is normally closed by a flat diaphragm 17 which contacts therewith. This diaphragm 17 is preferably constructed of some thin, resilient material, such as phosphor-bronze, and comprises a central, substantially solid circular portion 18 of slightly larger diameter than the annular edge 16 against which it rests, and a plurality of arms 19 formed integrally with the central portion 18 and extending out to the lateral wall 20 of the chamber 12, this wall 20 constituting a portion of the front case member 8.

The extreme outer ends of the diaphragm arms 19 are disposed within an annular V-shaped groove 21 formed in the casing wall 20 and surrounding the central axis of the unit, this groove lying substantially in the plane of the edge 16 as shown in Fig. 2. The side surfaces of the groove 21 are relatively inclined in order to contact the diaphragm arms 19 only at their outermost edges, so that no part of the supporting wall 20 will engage the rear face of the diaphragm at any time, and to thus maintain the entire arms 19 in readiness to deflect laterally whenever the central diaphragm portion 18 moves away from the edge 16, without permitting lateral shifting or displacement of the extreme outer ends of the arms.

The diaphragm may be inserted within its

retaining groove 21, by flexing the resilient arms 19 relative to the central portion 18, sufficiently so that the arms may be shifted forwardly along the inner bounding surface of the wall 20, and the arms 19 will eventually snap into the groove 21 and will straighten out. When the arms 19 thus return to normal undeflected position, the outer extremities thereof may fit rather snugly within the groove 21, and the entire diaphragm structure should normally lie flat with the central portion 18 thereof in substantial contact with the rearwardly projecting edge 16. But in spite of the fact that the outer arm ends may be thus snugly confined when the diaphragm is inactive, these arm ends by virtue of their independence and disconnection from each other, will move inwardly toward the diaphragm center without being undesirably laterally shifted, whenever the diaphragm is deflected even to the slightest extent, thereby permitting both bodily rotation of the entire diaphragm and unobstructed deflection of the diaphragm supporting arms when the device is in action.

It will therefore be observed, that because of the fact that only the extreme outer edges of the arms coact with or pivot upon the adjacent side surface of the groove 21, and since these arms are not subjected to any clamping effect whatsoever when the diaphragm is being deflected, the arms 19 are perfectly free to flex throughout their entire lengths and thus permit the central portion 18 of the diaphragm to vibrate relative to the edge 16 of the throat without undesirable external obstruction of any kind, when the diaphragm is in operation. This freedom of deflection results in pleasingly mellow tones, and the adaptability of the diaphragm to rotate bodily after slight deflection of the supporting arms thereof, also permits the diaphragm to automatically find a natural seating at the edge 16 during normal operation.

Because of the small size of the diaphragm 17 it is desirable to increase its inertia by the addition of a weight thereto. Such a weight is provided by a metal washer 22 which is riveted to the center of the diaphragm with a rivet 23. A smaller washer 24 is inserted between the diaphragm and the washer 22 to prevent the washer 22 from interfering with the free flexing of the diaphragm. The rear end of the rivet 23 preferably projects beyond the rear surface of the washer 22 to constitute a pin for supporting the forward end of a spiral tensioning spring 25. The rear end of spring 25 is supported in a hollow screw 26 which is threaded into a cross member 27 secured at its outer ends to the wall 20.

The cross member 27 may be secured to the wall 20 in any desired manner, as by soldering it in place, and is inserted in position after the diaphragm 17 has been assembled in the case. The screw 26 permits adjustment of the force exerted by the spring 25 against the rear side of the diaphragm assembly, this adjustment being made by turning the screw 26 in or out. Such adjustment can be very easily made at any time by reason of the fact that the screw 26 is centrally positioned with respect to the air nipple 10. Hence it may be turned by merely removing the hose 11 from the nipple 10 and inserting a screw-driver through the nipple into the head of the screw 26.

To operate the horn, suction is applied through the hose 11 from any desired source, such as the intake manifold of an engine, the application of suction being controlled by any desired type of control valve in the suction line. As a result of applying suction to the chamber 12, the atmospheric pressure which is applied to the front of the diaphragm 17 through the horn 2 and aperture 15 lifts the diaphragm away from the seat constituted by the edge 16. This immediately increases the pressure within the chamber 12 and the spring 25 forces the diaphragm back against the seat. This movement of the diaphragm occurs very rapidly as a vibration producing a distinctive note. The pitch and volume of the sound produced may be varied within certain limits by varying the position of the adjusting screw 26 to increase or decrease the spring pressure forcing the diaphragm against its seat or may be determined by the size of shoulder 16 and aperture 15.

A most important feature of my invention is the supporting of the diaphragm in the particular manner described. Heretofore diaphragms have been supported by clamping the outer edges of the diaphragm between more or less solid surfaces which interfered with free flexing of the diaphragm. As a result it has been necessary to make the diaphragms of relatively large diameter to obtain necessary resilience. Because of the fact that the outer edges of the diaphragm arms in my construction touch the rigid supporting structure (the wall of the groove 12) only at their extreme outer edges, no impediment to the free flexing of the diaphragm arms is introduced and they can be made much shorter than if the outer ends of the arms were rigidly clamped. As a result of my construction it is possible to make a very satisfactory sound producing unit 1 (Fig. 1) having an overall diameter of not more than an inch and a half, or even less. Supporting the outer edges of the diaphragm in a groove in the case also greatly simplifies the construction of the device and thereby reduces the cost of manufacture.

It is to be understood that although I have disclosed the aforementioned manner of supporting a diaphragm by positioning the outer edges thereof in a groove in the case in connection with a pneumatic horn, such construction broadly is not limited to pneumatic horns, but can be used in other sound producing units having a diaphragm vibrated magnetically, mechanically, or in any other way.

Although in the device disclosed the horn 2 is formed integrally with the forward wall of the sound producing unit, it is to be understood that I am not limited to this construction and that the horn may be made as a separate part and secured by screw-threads or in any other desired manner to the portion 8 of the casing.

Having fully described the preferred embodiment of this invention, it is to be understood that I do not limit myself to the exact construction herein set forth, which may obviously be varied in detail without departing from the spirit of this invention, but only as set forth in the appended claims.

I claim:

1. In an air-operated horn, a case defining a closed chamber having a front wall with a central aperture therein defining the throat of a sound emitting and amplifying horn, said wall extending rearwardly immediately surrounding the aperture to constitute an annular shoulder defining the inner orifice of said central aperture; the inner surface of said annular shoulder being tapered outwardly and rearwardly to form

a knife edge at said orifice, the throat tapering outwardly to said orifice and having a diameter at its smallest part substantially half the diameter of the orifice, a diaphragm supported in said chamber, and means for normally resiliently forcing the front face of the diaphragm into engagement with said annular shoulder to seal said orifice, said chamber being provided with an exhaust duct for exhausting air from said chamber.

2. A sound producing unit comprising a diaphragm of thin resilient material and supporting means therefor comprising an annular case member positioned about the periphery of the diaphragm and of slightly smaller inside diameter than the overall diameter of said diaphragm, said case member having a groove therein to receive and freely support the edge of said diaphragm, and the walls of said groove being inclined to contact said diaphragm only at its edge, whereby no part of the diaphragm supporting structure contacts any portion of the rear or front faces of the diaphragm.

3. A sound producing unit comprising a diaphragm having a central portion to be vibrated and outwardly extending arms for flexibly supporting said central portion, an annular case member positioned about the diaphragm and having a groove therein for receiving and freely supporting the outer edges of said outwardly projecting arms, and the walls of said groove being inclined to contact said outwardly projecting arms only at their peripheral edges, whereby no part of the diaphragm supporting structure contacts any portion of the rear or front faces of the projecting arms.

4. In an air-operated horn, a sound producing unit comprising a hollow case member having a diaphragm therein, an aperture in the case on one side of said diaphragm having an orifice cooperating with said diaphragm for producing sound in response to flow of air into said case through said aperture, means back of said diaphragm for resiliently forcing said diaphragm toward said orifice, including an adjusting screw for varying the force applied to the diaphragm, and an exhaust nipple on the rear side of said case and in alignment with said adjusting screw, whereby said screw may be adjusted without disassembling said unit by inserting a screw driver through said exhaust nipple.

5. A device as described in claim 4, further characterized in that said case member is tubular and that said aperture, diaphragm, means for resiliently forcing the diaphragm toward the orifice, adjusting screw and exhaust nipple are all positioned symmetrically with respect to the axis of the tubular case member.

6. A signaling horn construction comprising a sound unit case consisting of two tubular members threaded together, the inner of said two threaded members having an end wall constituting the front wall of said unit and having a central aperture therein for the emission of sound and the admission of air to operate said device, a diaphragm and diaphragm-adjusting means completely supported from said inner member, said outer tubular member having an end wall constituting the rear wall of said sound unit case and having an air exhaust nipple extending from the center thereof.

7. In a sound producing unit, a casing forming a chamber and having an orifice communicable with said chamber, said casing having an annular knife edge projecting into said chamber at the end of said orifice, the inner bounding surface of said orifice tapering outwardly toward said edge so as to materially enlarge the diameter of the orifice at said edge, a diaphragm cooperable with said edge, and resilient means for normally urging said diaphragm toward said edge, said diaphragm being deflectable away from said edge and in opposition to said resilient means.

8. In a sound producing unit, a casing forming a chamber and having an orifice communicating with said chamber, an inwardly projecting shoulder surrounding said orifice and locating the end of said orifice within the medial portion of said chamber, a diaphragm normally positioned against said shoulder and having a plurality of radial arms extending toward said casing, and means associated with said casing and cooperating with the outer extremities of said arms to permit free pivoting during deflection of said arms while preventing lateral displacement of said arm ends.

9. In a sound producing unit, a casing forming a chamber and having a central orifice communicating with said chamber, said casing also having an internal annular groove spaced from and surrounding said orifice, and a diaphragm having a central portion cooperable with said orifice, said diaphragm having outwardly projecting independent and disconnected radial arms coacting with said groove so as to prevent lateral shifting of the arm ends while permitting lateral deflection of all portions of said arms and bodily rotation of the diaphragm structure during vibration of the latter.

10. In a sound producing unit, a casing forming a chamber and having an orifice and an annular internal V-shaped groove spaced from said orifice and surrounding the axis thereof, and a one-piece diaphragm having a central portion cooperable with said orifice, said diaphragm having integral radially projecting independent and disconnected arms coacting only at their extreme outer edges directly with the side walls of said groove so as to permit both free lateral deflection of all portions of said arms and bodily rotation of the diaphragm structure during vibration of the latter.

11. In a sound producing unit, a casing forming a chamber having an annular projection directly surrounding an orifice and also having an annular V-shaped groove surrounding and spaced from said projection, and a one-piece diaphragm having a weighted central portion cooperable with said projection and having integral resilient arms radiating from said central portion and extending into said groove, the sloping sides of said groove being engageable only with the extreme outer edges of said arms so as to permit free lateral flexing of said arms throughout their entire lengths during vibration of the diaphragm.

12. In a sound producing unit, a casing forming a chamber having a central orifice and having an internal V-shaped groove spaced from said orifice, and a diaphragm having a weighted central portion cooperable with said casing at said orifice, said diaphragm having integral outwardly projecting arms normally contacting only with the side walls of said groove and being releasable from said groove side walls to permit rotation of the diaphragm when said arms are deflected laterally.

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