June 26, 1956 S. E. LEVY 2,751,996

HORN FOR LOUDSPEAKERS

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FIG. 1.

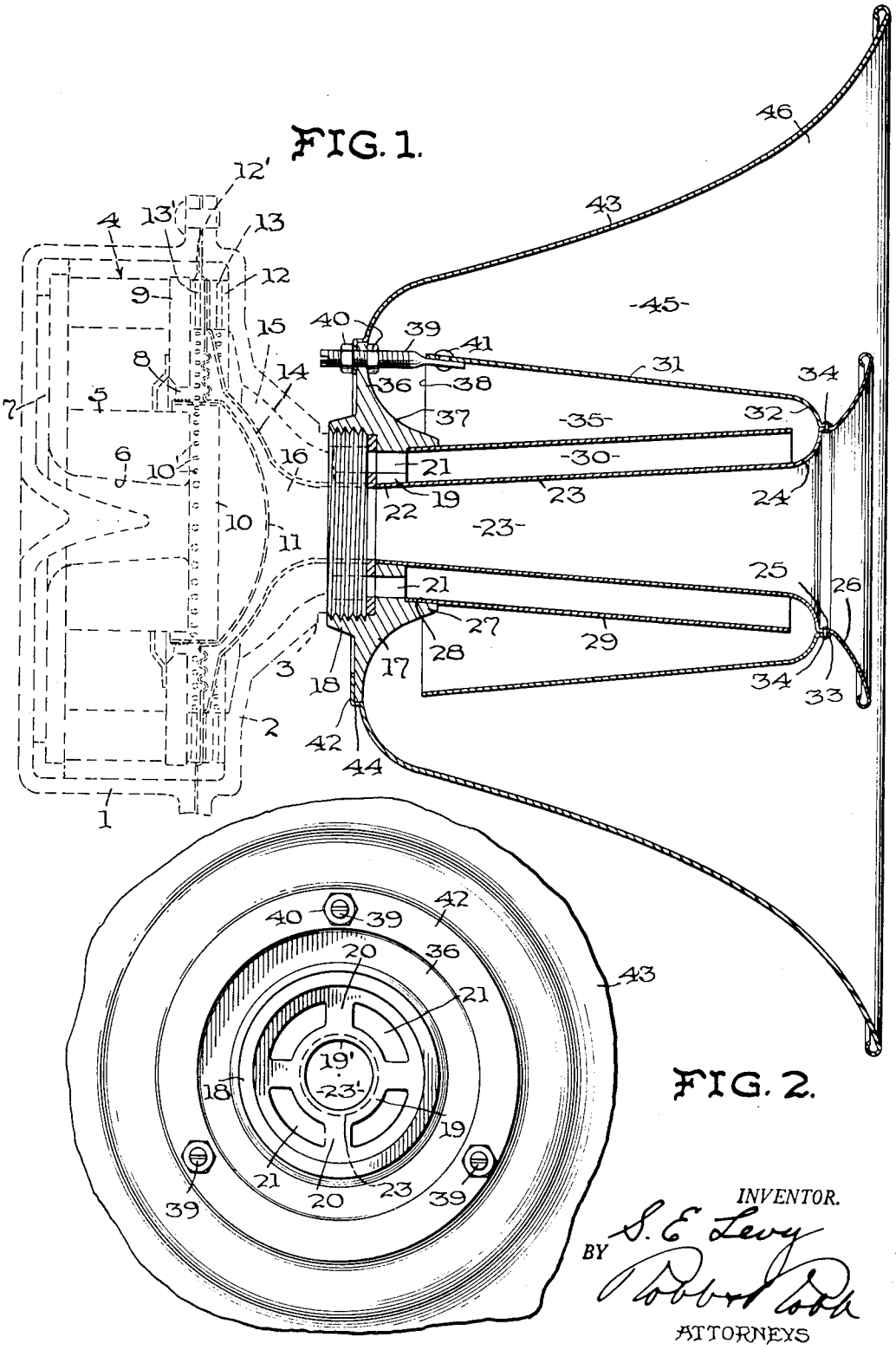


FIG. 2.

INVENTOR.

BY S. E. Levy

Robert Cobb

ATTORNEYS

United States Patent Office

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HORN FOR LOUDSPEAKERS

Sidney E. Levy, White Plains, N. Y.

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6 Claims. (Cl. 181—27)

The present invention relates to loudspeaker horns, and more particularly to a novel loudspeaker horn having concentric tone arms or air columns for sound waves of different frequency bands.

In another application filed by me concurrently herewith, there is disclosed a loudspeaker driver unit of the 2-way or compound type which is so constructed that one band of sound frequency is generated from the front side of a diaphragm and directed to a throat, and another band of a different sound frequency is generated from the rear or reverse side of the diaphragm and is directed to a separate throat concentric with and acoustically isolated from the first throat.

It is a primary object of the present invention to provide a loudspeaker horn which is primarily adapted to be associated with the driver units of the aforementioned type and which is so constructed as to provide a separate tone arm or air column for each of the concentric bands of sound waves which emerge from the respective concentric throats of the driver unit.

A further object is to provide a loudspeaker horn assembly having a relatively short, straight central tone arm surrounded by and acoustically separate from a second sound transmission channel which is relatively long and reflexed, this tone arm and the second sound transmission channel being respectively adapted to conduct coaxially in the same direction sound waves of a relatively high frequency band and sound waves of a relatively low or intermediate band.

Another object is to provide a loudspeaker horn having a central tone arm which is relatively short and straight, an annular sound transmission channel surrounding the tone arm and being reflexed at least twice to provide a relatively long tortuous sound passage, whereby separate sound waves passing through the tone arm and the tortuous sound passage will be directed from the horn in the same direction and coaxially with relation to each other, and means providing concentric sound inlets for the tone arm and the tortuous sound passage, whereby sound waves of relatively high and relatively low frequency bands may be directed from separate or compound sources through the dual concentric inlets of the horn, and the resultant sound emitted from the horn will have a higher fidelity or a better balance of high and low frequency sound waves.

Another object is to provide a novel loudspeaker horn which is extremely simple to manufacture and assemble.

Other and further objects and advantages of the invention will be hereinafter described or will become apparent to those skilled in the art, and the novel features thereof will be defined in the appended claims.

In the drawing:

Fig. 1 is a longitudinal sectional view of a loudspeaker horn constructed in accordance with the present invention, this view also showing in broken lines one illustrative example of a driver unit for said horn and which is capable of generating compound sound waves and directing them in acoustically isolated paths to dual concentric throats communicating with the horn; and

Fig. 2 is a view in rear elevation of the loudspeaker horn of Fig. 1, with the outer margin portions of the horn broken away.

Like reference characters designate corresponding parts in the drawing and in the following description.

Referring to Fig. 1, there is shown in broken lines one illustrative form of loudspeaker driver which is suitable for use with the horn of the present invention. The driver unit forms no part of the present invention however, but is the subject matter of my copending application filed of even date herewith.

Generally, the driver includes a housing **1** having a closure **2**, this closure having an axially extended, reduced and screw-threaded neck **3**. Disposed within the housing **1** is a magnetic pot assembly **4** including a central pole-piece **5** having a central opening **6** therethrough in communication with a space **7** extending about the rear and sides of the pot assembly **4**, between the pot assembly and the housing. The pot assembly **4** has an air gap **8** between the pole-piece and an annular plate **9**. A voice coil **10** of a diaphragm **11** extends into the air gap, and the marginal edge of the diaphragm is clamped between a pair of annular spacers or washers **12**, **12'** interposed between the plate **9** and the inner face of the housing closure **2**, these spacers being suitably radially apertured, as at **13**, **13'**, respectively. The voice coil **10** is also provided with suitable radial apertures **10'**.

A separator member **14** has its marginal edge also clamped between the washers **12**, **12'** and extends forwardly in spaced relation to the inside face of the housing closure **2**. The separator **14** defines with the closure **2** a sound passage **15** which communicates with the zone behind the diaphragm **11** through the openings **13** through the washer or spacer **12**. Also, the separator defines with the forward face of the diaphragm a second sound passage **16** which is acoustically isolated from and concentric with the sound passage **15**.

During operation of the driver unit, as more specifically outlined in the aforementioned companion application, sound generated by the rear face of the diaphragm is conducted through the sound passage **15**, and sound generated by the front face of the diaphragm is conducted through the sound passage **16**. The separator **14** at its forward end is suitably spaced from the neck **3** of the closure **2** so that the sound passages **15** and **16** terminate at their forward ends in dual concentric throats through which the separate sound waves generated by the opposite sides of the diaphragm may pass into the horn of this invention.

This horn includes a support or head **17** having an interiorly threaded hollow hub **18**, this threaded hub **18** being adapted to be mounted on the threaded neck **3** of the driver unit just described.

The interior of the head **17** is shaped in the form of a spider **19** having a central opening **19'** therethrough and having a suitable number of radial ribs **20** forming a plurality of arcuate openings **21** therebetween and isolated from the central opening **19'**. The inner periphery of the spider **19** is preferably provided with a seat **22** in which the inner end of an axially extended, slightly diverging, straight tone arm **23** of circular cross-section is suitably secured by means of a press fit, cementing, or the like. This tone arm **23** defines a straight sound passage **23'** leading from the central opening **19** through the spider.

Adjacent to the forward end of the tone arm **23**, it is flared outwardly, as at **24**, and formed with a slight longitudinally extended shoulder **25**. The tone arm is then abruptly flared or belled radially as at **26** to form

a mouth. Thus, the tone arm 23 constitutes a sound conducting channel 23' which is straight and relatively short, as is generally required for relatively high frequency sound waves.

The forward side of the head 17 is axially extended as at 27 and provided on the inner periphery of the extension 27 with an annular seat 28 in which the inner end of a circular, axially extended partition 29 is suitably mounted as by a press fit, cementing, or otherwise. This partition 29 is generally parallel with respect to the outer surface of the tone arm 23, and extends forwardly to a point adjacent to the flare 24 of the tone arm, but terminates in axially spaced relation to the shoulder 25. Thus, a sound conducting channel 30 is provided between the tone arm and the inner periphery of the partition 29, which channel communicates with the arcuate openings 21 between the ribs 20 of the spider 19.

An annular reflector partition 31 having its forward end arched inwardly, as at 32 and having a longitudinally extended flange 33 on its extreme forward end, is secured to the shoulder 25 of the tone arm 23 by any suitable means such as by a number of rivets 34 or the like. This reflector 31 gradually increases in diameter towards its rear end and defines with the outer periphery of the partition 29 a re-entrant sound channel 35 of annular cross-section.

The head 17 is radially extended as at 36 and formed with an arcuate forward face 37, and the free end 38 of the reflector 31 is preferably supported in spaced relation to the head portion 36 by means of a suitable number of spade bolts 39, or the like, these bolts 39 passing through apertures in the head portion 36 and being adjustably secured thereto by means of lock nuts 40. A rivet 41 or other suitable fastener means is utilized to secure each spade bolt 39 to the rear end 38 of the reflector 31.

Mounted on the portion 36 of the head 17 and clamped beneath the outer or rearward lock nut 40 is a terminal flange 42 which projects radially inwardly from the rear end of a belled member 43. Adjacent to the flange 42, the belled member 43 is formed complementally to the head portion 36, as at 44, and the belled member is curved forwardly in such a manner as to merge with the arcuate face 37 of the head 17 and so as to flare way from the reflector 31 in a forward direction, thus defining with the reflector 31 an expanding annular, belled sound channel 45 terminating at its forward end in a widely flared mouth 46.

The sound channels 30, 35 and 45 together form a relatively long and wide-mouthed sound passage, and by reason of the fact that high frequency sound waves are normally cancelled when the path of sound travel is reflexed, this long, wide, reflexed passage is primarily suited for the transmission of sound waves of the relatively low or intermediate frequency bands.

On the other hand, the relatively short, straight, narrow sound passage 23' of the tone arm 23 is primarily suited for transmission of sound waves of the relatively high frequency bands.

Thus, the horn of this invention, by reason of having independent sound channels, can conduct high frequency sound waves and low frequency sound waves from two separate diaphragms, or from different surfaces of the same diaphragm, in acoustically isolated sound channels and emit the sounds in the same direction and on the same axis, through a speaker horn which is no longer than that suitable for high frequency sound transmission alone, and with attendant higher fidelity of sound reproduction and a better balance between the high and low frequency sound waves which are reproduced.

While the specific details of one illustrative embodiment have been herein shown and described, the invention is not confined to such details, since changes and alterations may be resorted to without departing from the spirit of the invention as defined in the appended claims.

I claim:

1. A loudspeaker horn of the class described, comprising a support, said support having a hollow hub adapted to be connected to a driver unit and also having concentrically arranged laterally spaced sound inlets opening into said hollow hub, a hollow, straight tone arm connected to said support and forming a sound passage communicating with one of said inlets and having an outlet spaced from said inlet, and means also connected to said support and concentrically disposed about said tone arm for defining a relatively long, reflexed sound passage communicating with the other of said inlets and having an outlet spaced from said inlet.

2. A loudspeaker horn as defined in claim 1, wherein the means defining the relatively long, reflexed sound passage comprises an annular partition disposed about said tone arm in spaced relation thereto, an annular reflector disposed about said partition in spaced relation thereto and connected at one end to said tone arm and defining with said partition a re-entrant channel, the other end of said reflector being spaced from the support aforesaid, and an annular belled member surrounding said reflector in spaced relation thereto and defining the outlet aforesaid in the form of a belled mouth for said reflexed sound passage opening in the same direction as the sound passage through the tone arm.

3. A loudspeaker horn as defined in claim 1, wherein said support includes a member having a central opening therethrough, said member also having an opening therethrough spaced from said central opening, said tone arm being mounted at one end in said member, with the sound passage through the tone arm communicating with the central opening through said member, and the means defining the reflexed sound passage includes a partition defining with said tone arm a sound passage communicating with the opening through said member which is spaced from said central opening.

4. A loudspeaker horn as defined in claim 1, wherein said support includes a member having a central opening therethrough, said member also having another opening therethrough concentric with said central opening, means on said support for supporting one end of said tone arm, with the sound passage through said tone arm communicating with the central opening through said member, a partition encircling said tone arm, means on said support for supporting one end of said partition, said partition defining with said tone arm a sound passage therebetween in communication with the other opening through said member, and the means defining the reflexed sound passage includes a longitudinally extended reflector mounted at one end on said support in spaced relation thereto and mounted at its other end on said tone arm and being disposed about said partition so as to define with said said partition a re-entrant sound passage communicating with said sound passage between the partition and the tone arm, and a belled member surrounding said reflector and mounted on said support for defining the outlet aforesaid in the form of a belled mouth communicating with the re-entrant sound passage.

5. A loudspeaker horn of the class described, comprising a support having concentric laterally spaced sound wave inlets therein, a relatively short tone arm connected to said support and having a straight sound passage therethrough in communication with one of the inlets in said support, and a plurality of walls of circular cross-section carried by said support and defining a relatively long sound passage therethrough, one of said walls merging with the outer periphery of said tone arm and another of said walls merging with said support and forming reverse bends in said long passage.

6. A loudspeaker horn of the class described, comprising a support having a pair of concentric openings therethrough, means on said support adapted to connect the same to a driver having dual concentric throats for emitting acoustically isolated sound waves, a central longitu-

dinally extended hollow tone arm carried by said support and defining a sound passage in communication with one of the openings through the support, a partition of circular cross-section disposed about the outer periphery of said tone arm and connected to said support, said partition and said tone arm defining a second sound passage therebetween in communication with the other opening through said support, a reflector of circular cross-section engaged at one end with the tone arm, the other end of said reflector being spaced from said support, said reflector being disposed about the outer periphery of said partition and forming therewith a re-entrant sound passage communicating with the sound passage between the tone arm and the partition, and a belled member of circular cross-section mounted at one end on said support and disposed about the outer periphery of said reflector and defining therewith a belled mouth therebetween in communication with said re-entrant sound passage, and means securing one end of the belled member to said support.

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