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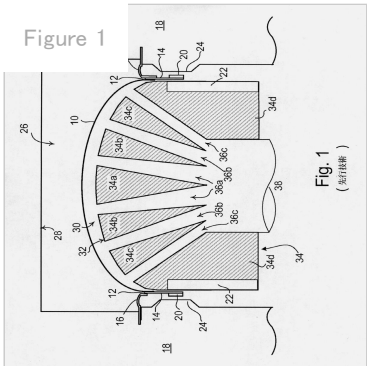
Technical field

0001
The present disclosure relates to electroacoustic transducers with bridged phase plugs .

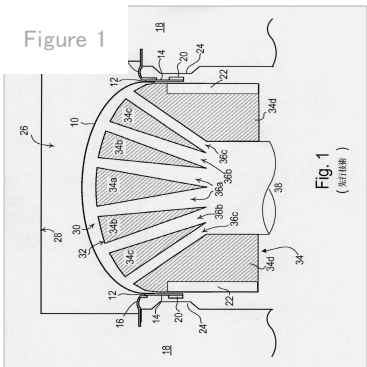
Background technology

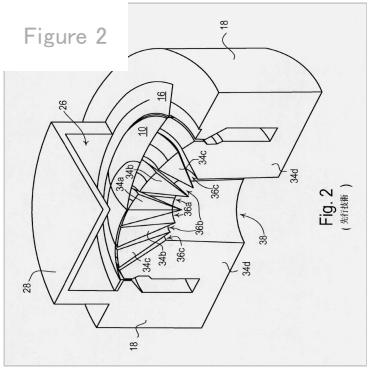
0002
Compression Drivers The electro-acoustic transducer type is, air in its interior movable in diaphragmfixed phase plug between compression cavity within the compression is. Phases in the plug passagewayis a slot but is referred to as the air from the compression cavity listening environment until, generally slow and and horn air through transmission to. The horn contributes to impedance matching between the air in the throat and the air in the free space of the listening environment and controls the directivity of the emitted sound .

0003
Some terms are 1 are defined with reference to and 2. For reference, the directions such as " vertex " and " bottom " or " top " and " bottom " are the drawings themselves, with the top and bottom margins of the drawing defining " top " and " bottom ". Is referenced. As built-in, the phase plug can be oriented in any direction. In the compression driver, the primary actuating element is referred to as the dome 10. In some examples, the dome is a simple spherical section . In some examples, the dome has a complex curvature . The ends of the dome are formed or joined within a cylindrical section called the skirt 12 . The skirt is coupled to a voice coil or bobbin 14 and surround 16 and in turn is fixed to the external structure 18. In some examples, surround is formed from an extension of the dome and is not separated. The voice coil 20 is wound around the bobbin and has a currentOr voltage is in the voice coil load if it is, the magnet 22 and the pole piece actuates the bobbin and the dome in response to 24. Above the dome is a rear cavity 26 whose boundary is defined by the rear cavity wall 28 . Below the dome is a front or compression cavity bounded by the dome interface surface 32 of the phase plug 34 . The operation of the dome compresses the air in the compression cavity. In the examples of FIGS. 1 and 2, the dome, skirt, bobbin, surround, voice coil, magnet, and piece are abstractly illustrated and are not intended to represent any particular design or technique.



0004
In a typical phase plug illustrated in FIGS. 1 and 2, one or more slots 36a, 36b, 36c start at the dome interface surface of the phase plug and are coupled to the throat 38 from the compression cavity 30 to the throat 38. until the compressed air is transmitting. A throat is defined as starting from a position where multiple slots are completely combined into a single passage. On the other hand, we mention these passages as a slot, 2 -dimensional section their presence in (e.g. Figure 1 for), which in three-dimensional phase plug reality the conical be shaped space, (this example The apex and bottom are bounded by slightly different radii and / or vertical positions of the cone (when the slots are tapered in width) as practiced in. In FIG. 2 , two slots 36a, 36b, and 36c are seen. In a given slot shape, the phase plug 34 consists of several concentric conical solids 34a-34c and an outer cylindrical solid 34d, all phased by a support (not shown) in the slot.Counterpoint is and held coupled to location. Slots 36a-36c connect the compression cavity 30 to the throat 38, which in turn connects to the horn.





Problems to be solved by the invention

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An object of the present invention, all of the compression driver operating range over a highly efficient les level smooth in output response provides is to provide an electro-acoustic transducer comprising a bridge phase plug.

Means to solve problems

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Generally, in some embodiments, the electroacoustic transducer has an electromagnetically drivenmovable dome, a phase plug with a body and a dome interface surface, and a compression cavity formed between the dome and the dome interface surface. , Is equipped. Phase plug at least first and second annular slot the equipped with, slots book and phase plug as a starting end dome interface surface bodyextends to a first depth in the section. The first and second annular slots are separated in the dome interface surface by bridge elements and coupled to the first bridge passage at a first depth below the dome interface surface . The phase plug also includes an outlet slot connecting the bridge passage to the throat at a second depth within the body of the phase plug .

0007

The embodiment may include one or more of the following features: The first and second slots have substantially equal cross-sectional areas . The exit slot may have a cross-sectional area substantially equal to the total cross-sectional area of the first and second slots in the first bridge passage. The exit slot has a cross-sectional area that increases exponentially over the length of the exit slot from the bridge passage to the throat, starting from the first bridge passage . First and second slots of the phase plug center axis the first and second from the radial distance is placed at a position corresponding to the first and second radial distances are generated in the compression cavity by the operation of the dome standing wave the It may correspond to the first and second positions to be zero. The exit slot starts at a position along the first bridge passage, which is within the loop containing the first bridge passage, the first and second slots, and part of the compression cavity coupled to the first and second slots . It may correspond to the position where the standing wave of is set to zero.

0008

The audio coil may be connected to the dome and elastic surround may connect the dome to the surrounding structure . Dome face surface including (dome-facing surface) housing may form a rear cavity between the dome and the dome face surface. The horn may be connected to the output opening of the phase plug . The phase plug also includes a third slot, the third slot has a dome interface surface as a starting end, and extends to a third depth in the body of the phase plug, and the third slot is a third slot on the dome interface surface. It is separated from the two slots by a second bridge element and is coupled to the first bridge passage at a third depth by a second bridge passage, with the exit slot starting at the second bridge passage. The phase plug also includes the third and fourth slots, the third and fourth slots starting from the dome interface surface and extending into the body of the phase plug at a third depth, the third and third. The four slots are separated on the dome interface surface by the second bridge and are connected by the second bridge passage at a third depth below the dome interface surface, and the second slot and the first bridge passage are connected on the dome interface surface. A third bridge element separates the third slot from the second bridge passage and is joined by a third bridge passage at a fourth depth below the third bridge element. The first depth and the third depth are almost equal. The dome is convex or concave with respect to the phase plug .

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Advantages include providing a smooth output response at a highly efficient level over the entire operating range of the compression driver.

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Other features and advantages will become apparent from the specification and claims.

A brief description of the drawing

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It is a figure which showed the front cross section of the conventional compression driver.

The isometric view of the cross section of the conventional compression driver is shown.

It is a figure which showed the front cross section of the compression driver provided with the bridge phase plug.

It is a figure which showed the front cross section of the compression driver provided with the bridge phase plug.

An isometric view of a cross section of a compression driver with a bridge phase plug is shown. FIG. 5 shows a front cross section of an alternative embodiment of a compression driver with a bridge phase plug .

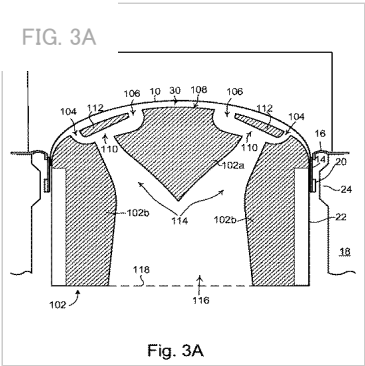
FIG. 5 shows a front cross section of an alternative embodiment of a compression driver with a bridge phase plug.

It is a figure which showed the assembled compression driver and a horn. It is the figure which showed the front cross section of the compression driver which provided with the bridge phase plug and the reversing dome.

Example

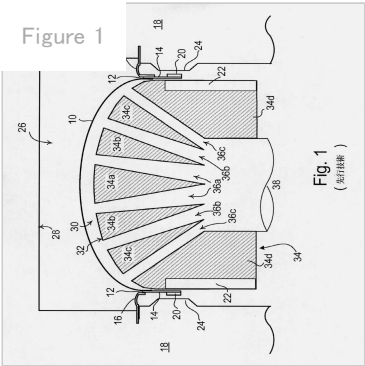
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116 . Further, in this embodiment, the cross-sectional area of the outlet slot 114, the driver of the target was shielded on the basis of the frequency has increased exponentially from the bridge to the throat. Exponential curve may be any that is added to the compressed driver acoustic path length of the horn diffraction slot to be reduced before reaching the auxiliary to. More generally, the total area of the slot changes smoothly along the length from the compression cavity to the throat and is generally constant or monotonously increasing towards the throat . Arrangement, proportions this combination of and curvature were over a wide range of frequencies in the throat, at least the dome 10 is a piston smooth when operating as a frequency response in consequenceto.



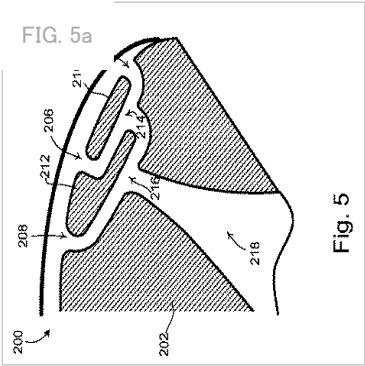
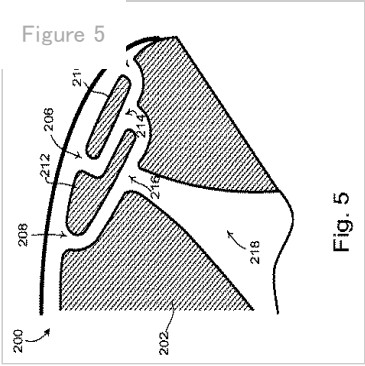
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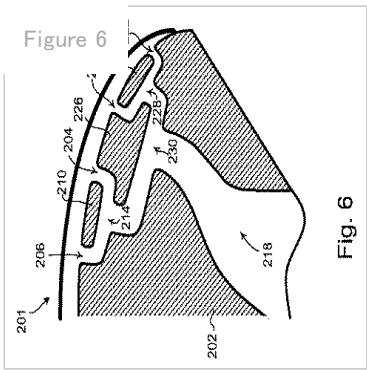
Balanced bridge phase plugs have the added benefit of controlling loop resonance over traditional multi-slot phase plugs. In the conventional phase plug of FIG. 1 , the loop resonance wave may exist between the slots , that is, the resonance wave may exist between the slots 36a and 36b, and those slots are of two slots. It is coupled by a short region of the compression cavity 30 between the openings. Such "loops" and the resonant waves within them are complex three-dimensional shapes, not the simple pathsimplified by the two-dimensional cross-sections discussed . The bridge passage 110 between slots 104 and 106 significantly shortens the loop between those two slots and raises the resonance frequency of the loop . Increase in the resonant frequency of the loop, the frequency, the loop resonance converter of responses cause peaks and dips are more human (dips) insensitive tends to move to the range. Since the loop resonance is not powerful, more at higher frequencies accidental specific attenuationThere is also a tendency to become. In addition, by increasing the resonance frequency of any loop resonance, the balance bridge design also reduces the pressure imbalance between the slots that excite the loop resonance in the first place .



0018

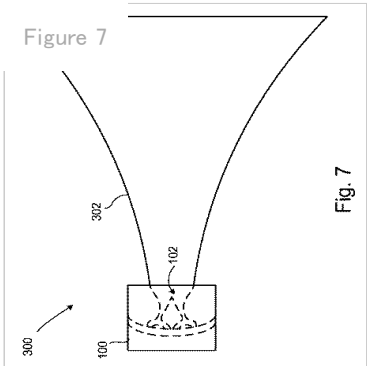
Two alternative bridge phase plug designs 200 and 201 are individually illustrated in FIGS. 5 and 6 (only the right half of each section is shown). In FIG. 5a, the first slot 204 and the second slot 206 are formed by the first bridge element 210, coupled with the first bridge passage 214, and the second bridge passage 216 around the second bridge element 212. It is connected to the third slot 208 in order through. The exit slot 218 is coupled to the second bridge passage. Alternatively, the two internal slots 206 and 208 may be coupled first. In FIG. 6 , the first bridged slots 204 and 206 are formed by the bridge element 210 and are connected to the first bridge passage 214 as before, while the third slot 220 and the fourth slot 222 are It is formed by an additional bridge element 224 and is coupled to a second bridge passage 228. The two bridge passages 214 and 228 are separated by a third bridge element 226 and are coupled to a third bridge passage 230 coupled to the exit slot 218. Each of these designs may be a compression driver design in particular favorability , depending on the number and number of nodes in the important axisymmetric standing wave, which tends to be a function of the diameter of the dome and compression cavity .





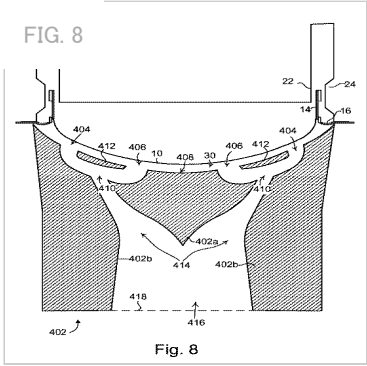
0019

Assembled loudspeaker section of 300 Figure 7 is shown in. The loudspeaker includes a compression driver 100 coupled to the exponential horn 302. Conical , hyper Borikku, and tracts other such Rick (tractric) horn shape is also suitable. The bridge phase slot 102 described above is located within the compression driver 100 and includes a phase plug throat communicating with the start end of the horn. As mentioned above, the throat has an exponential curve compatible with the curvature of the horn and is based on the targeted cutoff frequency of the finished loudspeaker.



0020

Another embodiment 400 is 8 is shown in. In some examples, the structure of the dome and the motor is reversed so that the convex surface of the dome 10 faces the concave surface of the phase plug 402. Inthe example of FIG. 8 , the structure of the entire dome and the motor is reversed. In another example, the dome is reversed and the motor configuration remains on the side of the phase plug of the structure. In the dome reversal design, the dome interface surface 408 surface normal is divergent and, on the other hand, in the conventional phase plug, as shown in FIG. 3, the surface normals of the sphere dome interface surface became section Concentrated on one point in the center. If each slot forms a relatively straight path from face 408 to throat 416, their length increases with increasing slot radius. In a bridge phase plug as shown, slots 404 and 406 are start ends in a plane, are coupled in a bridge passage 410, and are separated by a bridge element 412. The exit slot 414 connects the bridged slot to the throat 416 terminated at the opening 418. By bending the slots to form a bridge, the effective length of the slots close to the centerline is increased and all slots are of similar length , independent of their respective starting radii .



0021

Other implementations are within the scope of the following claims and other claims to which the applicant may be entitled .

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10 . . . Dome, 12 . . . Skirt, 14 . . . Bobbin, 16 . . . Surround, 20 . . . Voice coil, 22 . . . Magnet, 24 . . . Pole piece, 26 . . . Rear cavity , 28 . . . Rear cavity wall, 30 . . . Compressed space, 32 . . . Dome interface surface, 34 . . . Phase plug, 38 . . . Throat, 100 . . . Compression driver, 102, 200, 201 . . . Bridge phase plug, 104, 106 . . . Slot, 108, 408 . . . Dome interface surface, 110, 410 . . . Bridge passage, 112 . . . Bridge element, 114, 218, 414 . . . Exit slot , 116, 416 . . . Throat, 118 . . . Opening, 204 . . . 1st slot, 206 . . . 2nd slot, 208, 220 . . . 3rd slot, 210 . . . 1st bridge element, 212 . . . 2nd bridge element, 214 . . . 1st bridge passage, 216, 228 . . . 2nd bridge passage, 222 . . . 4th slot, 224 . . . Additional bridge element, 226 . . . 3rd bridge element, 230 . . . 3rd bridge passage, 300 . . . Loudspeaker, 302 . . . Exponential horn