Details

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Technical field

0001

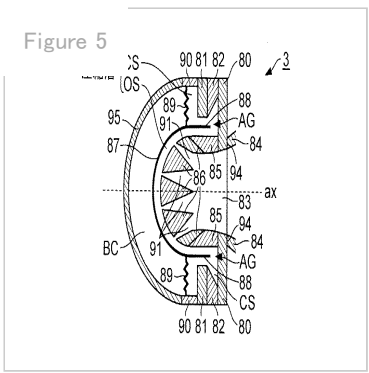
The present invention relates to a compression driver and a horn speaker .

Background technology

0002

A horn speaker is a compression driver with a horn added to improve the directivity of sound . FIG. 5 is a vertical cross-sectional view of the conventional horn speaker 3. In FIG. 5 , the throat portion 94 of the horn 84 is fixed to one end surface of the back plate 80. In the back plate 80, one bottom surface of the pole piece 85 is fixed to the end surface opposite to the horn 84 . A sound guiding hole 83 is formed in the center of the back plate 80 and the pole piece 85 so as to penetrate both of them and reach the throat portion 94 of the horn 84 . The bottom surface of the opposite side of the backplate 80 in pole piece 85 towards the sound conducting hole 83 sliding pots and recessed shape, a plurality of in this bowl-shaped surface slit having a 91 phase plug 86 is fitted. The slit 91, the space (i.e., sound conducting hole 83) of the front space and the phase plug 86 behind the phase plug 86 communicating the elongatedis that of not space. And behind the phase plug 86, there is a diaphragm at regular intervals.87 is supported. The diaphragm 87 is dome to form a curved half was true spherical shape has a cylindrical on its outer periphery a voice coil bobbin 88 is provided.

Figure 5



0003

On the end surface of the back plate 80 opposite to the horn 84, there is an annular magnet 82 and a top plate 81 having the same diameter as the back plate 80, and the annular magnet 82 is sandwiched between the back plate 80 and the top plate 81. There is. The annular magnet 82 has an N pole on one bottom surface (for example, the bottom surface on the back plate 80 side) and an S pole on the other bottom surface (for example, the bottom surface on the top plate 81 side).

0004

Of the top plate 81 the inner circumferential surface is small in the pole piece 85 at a spacing an outer circumferential surface is opposed. Then, a back plate 80, a ring magnet 82, a top plate 81, the phase plug 86, consisting of the pole piece 85. The magnetic of the loop , the ring magnet 82 is generated magnetic lines of round makes magnetic circuit constitutes a .. In this magnetic circuit, the diaphragm 87 is supported in a state where the voice coil bobbin 88 at the peripheral end is housed in the magnetic gapAG between the inner peripheral surface of the top plate 81 and the outer peripheral surface of the pole piece 85 .

0005

The configuration supporting the diaphragm 87 is as follows. First, the spacer ring 90 is fixed to the end surface of the top plate 81 opposite to the annular magnet 82 . An edge 89 is interposed between the inner peripheral surface of the spacer ring 90 and the outer peripheral portion of the diaphragm 87 . The edge 89 supports the diaphragm 87 role fulfill.

0006

In the horn speaker 3 having the above configuration, the magnetic flux generated by the annular magnet 82 passes through the magnetic gap AG between the top plate 81 and the pole piece 85. Then, when a current is passed through the voice coil in the voice coil bobbin 88, a driving force in a direction parallel to the central axis ax of the horn speaker 3 is applied to the voice coil bobbin 88, and the diaphragm 87 fixed to the voice coil bobbin 88 vibrates . .. The horn speaker 3 is line-symmetrical with respect to the central axis ax . When the diaphragm 87 vibrates, the air in the space OS between the diaphragm 87 and the phase plug 86 is pushed out or pulled back into the sound guide hole 83 through each slit 91 of the phase plug 86. Then, the air or pulled back or the extruded compressional waves are sound waves through the sound conducting hole 83 as, fired from the horn 84 is sound is.

0007

The horn speaker 3 is provided with a back cover 95 that covers the diaphragm 87 on the opposite side of the phase plug 86 with the diaphragm 87 interposed therebetween . In the horn speaker 3, when the diaphragm 87 vibrates at a certain frequency , the sound wave traveling from the diaphragm 87 to the phase plug 86 and the sound wave traveling to the back cavity BC surrounded by the diaphragm 87, the edge 89, the spacer ring 90 and the back cover 95 are generated. , A standing wave is generated in the space OS, the surrounding space communicating with the space OS, and the back cavity BC . Due to this standing wave, peaks and dips appear in the frequency characteristics that should be originally flat , causing deterioration of the sound quality of the horn speaker 3 . Therefore, various techniques for suppressing the generation of standing waves have been proposed.

0008

For example, in the technique disclosed in Patent Document 1, the generation of standing waves is suppressed by providing a sound absorbing material in the back cavity . In the technique disclosed in Patent Document 2, the cross-sectional area and position of each slit of the phase plug are changed to suppress the generation of standing waves.

Prior art

0009

JP 56-140799 JP

Patent No. 5017360 Publication

Problems to be solved by the invention

0010

However, if a sound absorbing material is provided as in the technique disclosed in Patent Document 1, it also affects sound waves in a frequency band other than the frequency of the standing wave to be suppressed . This is because the sound absorbing material also absorbs sound waves in a frequency band other than a specific frequency . Further, if the cross-sectional area or position of each slit of the phase plug is changed even a little, the frequency characteristic changes significantly, and it becomes difficult to change the cross-sectional area or position of each slit while maintaining the frequency characteristic. Therefore, changing the cross-sectional area and position of each slit as in the technique disclosed in Patent Document 2 requires many simulations and trial manufactures of the horn speaker, and as a result, it becomes difficult to design the phase plug. Become.

0011

The present invention has been made in view of the above-described problems, and in a horn speaker, it does not affect sound waves in a frequency band other than a specific frequency, and a phase plug can be easily designed while still having a standing wave. The purpose is to provide a technique capable of suppressing the occurrence.

Means to solve problems

0012

In order to solve the above problems, the present invention provides a compression driver including a phase plug having an opening at the position of the antinode of a standing wave to be suppressed generated at least one of the compression layer and the slit. .. The compression layer refers to a space that communicates with the space OS and the space OS. The space communicating with the space OS refers to a space CS surrounded by a voice coil bobbin 88, a pole piece 85, a back plate 80, an annular magnet 82, a top plate 81, an edge 89, and a spacer ring 90.

0013

Various modes can be considered as specific modes of the opening. First, there is an embodiment in which the phase plug is provided with a recess that opens at the position of the abdomen where the amplitude of the standing wave generated when the opening is not provided is maximized. The standing wave is generated by providing a recess in the antinode position of the standing wave whose length from the opening to the bottom is an odd multiple of 1/4 of the wavelength of the standing wave. Can be suppressed. Second, a hole whose length is a multiple of 1/2 the wavelength of the standing wave is provided in the phase plug, and one of the open ends of the hole is provided at the antinode position of the standing wave. An embodiment in which the other is provided at the position of the node of the standing wave can be mentioned. Also in this aspect, the generation of the standing wave can be suppressed.

0014

Since the sound absorbing material is not used in the present invention, it does not affect the sound wave in the frequency band other than the frequency of the standing wave to be suppressed. Further, in the present invention, since the cross-sectional area and the position of each slit of the phase plug are not changed, the design of the phase plug is easy. Therefore, according to the present invention, it does not affect sound waves in frequency bands other than a specific frequency, and it is possible to suppress the generation of standing waves while being easy to design.

0015

As another aspect of the present invention, there is provided a horn speaker having a horn that radiatessound waves into space and a compression driver according to any one of the above aspects.

A brief description of the drawing

0016

It is a vertical sectional view of the horn speaker 1 of 1st Embodiment of this invention.

It is a figure which illustrates the standing wave of the suppression target generated in the space OS of the horn speaker 1.

It is a vertical sectional view of the horn speaker 2 of the 2nd Embodiment of this invention.

It is a figure which illustrates the standing wave of the suppression target generated in the space OS of the horn speaker 2.

It is a vertical cross-sectional view of the conventional horn speaker 3.

Example

0017

Hereinafter, embodiments of the present invention will be described with reference to the drawings.

<First Embodiment>

FIG. 1 is a vertical sectional view of the horn speaker 1 according to the first embodiment of the present invention. In FIG. 1 , the same components as those in FIG. 5 are designated by the same reference numerals. As is clear from comparing FIGS . 1 and 5 , the horn speaker 1 differs from the horn speaker 3 in that the phase plug 86 includes the recess 10. Hereinafter, the recess 10 will be mainly described.

Figure 1

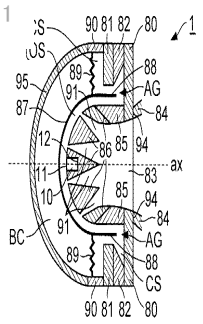
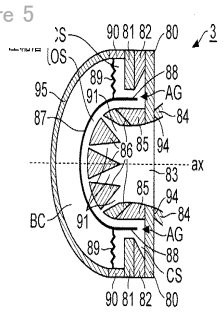


Figure 5



0018

Recess 10 is cylindrical is shape, ax central axis of the horn speaker 1 near open toward the diaphragm 87. The recess 10 is provided along the central axis ax.

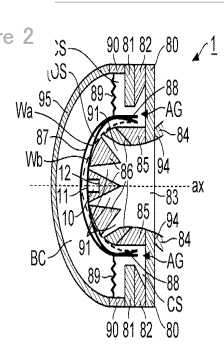
0019

The distance from the opening 11 of the recess 10 to the bottom 12 (hereinafter referred to as the length of the recess 10) is an odd multiple of the length of 1/4 of the wavelength of the standing wave to be suppressed.

0020

FIG. 2 is a diagram illustrating a standing wave of sound generated in the space OS when the phase plug 86 is not provided with the recess 10, that is, a standing wave to be suppressed. Figure 2 of the solid lineshown in waveform Wa is the time in the sound pressure distribution shows a dashed waveform Wb shown in the solid line waveform Wa half period shows a sound pressure distribution at the time shifted. Due to the symmetry of the horn speaker 1, the amplitude of the standing wave becomes maximum near the central axis ax. That is, the vicinity of the central axis ax is always belly. That is, the opening 11 of the recess 10 is provided at the position of the antinode of the standing wave to be suppressed.

Figure 2



0021

The recess 10 suppresses the generation of a standing wave in the space OS. The reason is as follows. Near the opening portion 11 medium (air) in the vicinity of the central axis ax sound pressure changes by vibration is. As a result, inside the recess 10, sound waves are generated from the opening 11 toward the bottom 12. When this sound wave reaches the bottom 12, it is reflected at the bottom 12 . Reflected by the bottom 12 rigid wall because it is reflected by, reflected waves phase is wave and directed from the opening 11 to the bottom 12 −phase becomes. The sound wave reflected by the bottom portion 12 travels through the recess 10 and reaches the vicinity of the opening 11.

0022

Since the length of the recess 10 is an odd multiple of the length of 1/4 of the wavelength of the standing wave to be suppressed, the path length of the sound wave transmitted through the recess 10 and returned to the vicinity of the opening 11 is the target of suppression. It is an odd multiple of the length of 1/2 of the wavelength of the standing wave of. Therefore, the sound wave that has traveled through the recess 10 and returned to the vicinity of the opening 11 has a phase opposite to the phase of the sound pressure change in the vicinity of the opening 11 . In the vicinity of the opening 11 of the recess 10, sound waves having opposite phases are superimposed on each other, so that the sound pressure is weakened. Therefore, in the vicinity of the opening 11 of the recess 10, the generation of standing waves in the space OS is suppressed. Since the recess 10 suppresses the generation of a standing wave in the space OS, the generation of a standing wave in the surrounding space communicating with the space OS is also suppressed.

0023

In the present embodiment, the recess 10 is provided along the central axis ax, but the position where the recess 10 is provided is not limited to this, and may be any position as long as it is the position of the antinode of the standing wave to be suppressed. Since each slit 91 of the phase plug 86 communicates with the space OS, the dense wave of air due to the standing wave generated in the space OS is also transmitted to each slit 91 of the phase plug 86, and the standing wave is also transmitted in each slit 91. Occurs. Therefore, the recess 10 may be provided at the position of the antinode of the standing wave to be suppressed in each slit 91 of the phase plug 86. The position of the antinode of such a standing wave may be determined by an experiment , a simulation, or the like. Further, in the present embodiment, the phase plug 86 is provided with only one recess 10, but a plurality of recesses 10 may be provided. By providing the phase plug 86 with a plurality of recesses 10 having different lengths, it is possible to simultaneously suppress the generation of a plurality of standing waves having different wavelengths. Further, in the present embodiment, the concave portion 10 has a cylindrical shape, but the shape of the concave portion 10 is not limited to this. As long as the length of the recess 10 is an odd multiple of 1/4 of the wavelength of the standing wave to be suppressed, the shape of the recess 10 may be any shape as long as the generation of the standing wave can be suppressed.

0024

<Second Embodiment>

FIG. 3 is a vertical sectional view of the horn speaker 2 of the second embodiment of the present invention. In FIG. 3 , the same components as those in FIG. 5 are designated by the same reference numerals. As is clear from a comparison between FIGS . 3 and 5 , the horn speaker 2 differs from the horn speaker 3 in that the phase plug 86 has a hole 20. Hereinafter, the hole 20 will be mainly described.

Figure 3

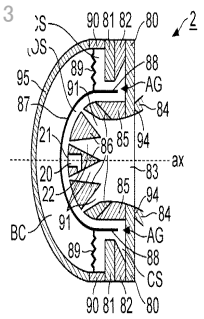
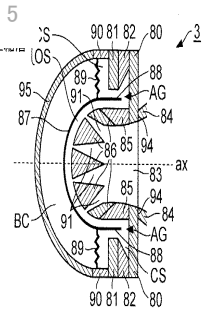


Figure 5



0025

The phase plug 86 is provided with an opening toward the diaphragm 87 and an opening toward the slit 91 of the phase plug 86, and these openings communicate with each other in the phase plug 86 to form a hole 20. Of the two openings provided in the phase plug 86, the opening end 21 facing the diaphragm 87 is located near the central axis ax of the horn speaker 2.

0026

The distance from the opening end 21 to the other opening end 22 (hereinafter referred to as the length of the hole 20) is a multiple of 1/2 the wavelength of the standing wave to be suppressed by the space OS.

0027

FIG. 4 is a diagram illustrating a standing wave of sound generated in the space OS when the phase plug 86 is not provided with the hole 20, that is, a standing wave to be suppressed. The waveform Wc shown by the solid line in FIG. 4 shows the sound pressure distribution at a certain time, and the waveform Wd shown by the broken line shows the sound pressure distribution at the time when the solid line waveform Wc is shifted by half a cycle. Similar to FIG. 2 , due to the symmetry of the horn speaker 2, the amplitude of the standing wave becomes maximum near the central axis ax. That is, the vicinity of the central axis ax is always belly. That is, the opening end 21 of the hole 20 is provided at the position of the antinode of the standing wave to be suppressed. On the other hand, the opening end 22 of the hole 20 is provided at a node position where the amplitude of the standing wave to be suppressed is minimized.

Figure 2

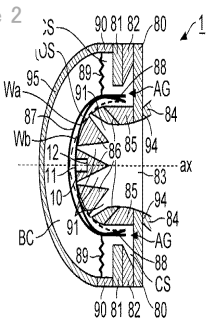
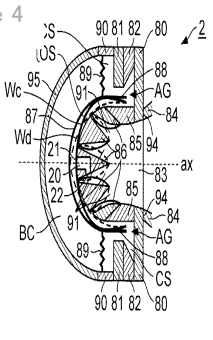


Figure 4



0028

The hole 20 suppresses the generation of a standing wave in the space OS. The reason is as follows. The medium (air) near the opening end 21 is vibrated by the change in sound pressure near the central axis ax. As a result, a sound wave from the opening end 21 to the opening end 22 is generated inside the hole 20. When this sound wave reaches the opening end 22, it is reflected at the opening end 22. Since the reflection by the opening end 22 is the reflection by the opening end, the phase of the reflected sound wave is opposite to that of the sound wave from the opening end 21 to the opening end 22. This sound wave travels through the hole 20 and reaches the vicinity of the opening end 21.

0029

Since the length of the hole 20 is a multiple of 1/2 the wavelength of the standing wave to be suppressed, the path length of the sound wave traveling in the hole 20 and returning is the standing wave to be suppressed. It is an even multiple of the length of 1/2 of the wavelength of , that is, a multiple of the wavelength. Therefore, the sound wave that has traveled

through the hole 20 and returned to the vicinity of the opening end 21 has a phase opposite to the phase of the sound pressure change in the vicinity of the opening end 21. In the vicinity of the opening end 21 of the hole 20, sound waves having opposite phases are superimposed on each other, so that the sound pressure is weakened. Therefore, in the vicinity of the opening end 21 of the hole 20, the generation of a standing wave in the space OS is suppressed. Since the holes 20 suppress the generation of standing waves in the space OS, the generation of standing waves in the surrounding space communicating with the space OS is also suppressed.

0030

In the present embodiment, the opening end 21 of the hole 20 is provided near the central axis ax, but the position where the hole 20 is provided is not limited to this, and the opening end 21 is located at the position of the antinode of the standing wave to be suppressed. As long as the opening end 22 is provided at the position of the node of the standing wave, the hole 20 may be provided at any position. For example, an opening end 21 and an opening end 22 may be provided at the antinode position and the node position of the standing wave to be suppressed in each slit 91 of the phase plug 86, respectively. The position of the antinode and the position of the node of the standing wave may be determined by experiments or simulations. Further, in the present embodiment, the phase plug 86 is provided with only one hole 20, but a plurality of holes 20 may be provided. By providing the phase plug 86 with a plurality of holes 20 having different lengths, it is possible to simultaneously suppress the generation of a plurality of standing waves having different wavelengths. Further, as long as the length of the hole 20 is a multiple of 1/2 the wavelength of the standing wave to be suppressed, the shape of the hole 20 may be any shape as long as the generation of the standing wave can be suppressed.

0031

<Modification Example>

(1) The first embodiment and the second embodiment may be combined. By making the wavelength of the standing wave corresponding to the length of the recess 10 different from the wavelength of the standing wave corresponding to the length of the hole 20, the generation of standing waves of a plurality of typesof wavelengths is suppressed at the same time. it can.

0032

(2) In each of the above embodiments, the diaphragm 87 has a dome shape, but the shape of the diaphragm 87 is not limited to the dome shape. For example, when the present invention is applied to a flat speaker , the diaphragm 87 becomes flat.

0033

(3) to the horn speaker, the diaphragm 87 sound emitting surface release sound direction are convexly curved with respect to the front and type, curved concavely with respect to the sound radiating surface sound emission direction of the diaphragm 87 There is a rear type . Although the horn speakers of each of the above embodiments are all rear type, the present invention may be applied to front type horn speakers.

0034

(4) The compression driver alone may be provided by removing the horn 84 from the horn speaker of each of the above embodiments .

0035

1,2,3 ... Horn speaker, 10 ... Recess, 11 ... Opening, 12 ... Bottom, 20 ... Hole, 21,22 ... Open end, 80 ... Back plate, 81 ... Top plate , 82 ... ring magnet, 83 ... sound hole, 84 ... horn, 85 ... pole piece, 86 ... phase plug, 87 ... diaphragm, 88 ... voice coil bobbin, 89 ... edge, 90 ... Spacer ring, 91 ... slit, 94 ... throat part, 95 ... back cover, ax ... central axis, OS ... space, AG ... magnetic gap, BC ... back cavity, Wa, Wb, Wc, Wd ……Waveform.