US009271060B2

(12) **United States Patent**
Kim

(10) **Patent No.: US 9,271,060 B2**
(45) **Date of Patent: Feb. 23, 2016**

(54) **FLAT TYPE SPEAKER HAVING VIBRATION-LEAD PLATE ATTACHED ON TOP OF VIBRATION PLATE**

(75) Inventor: **Dong-Man Kim**, Seoul-si (KR)

(73) Assignee: **EXELWAY INC.**, Seoul-si (KR)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 331 days.

(21) Appl. No.: **13/985,145**

(22) PCT Filed: **Feb. 13, 2012**

(86) PCT No.: **PCT/KR2012/001038**

§ 371 (c)(1),
(2), (4) Date: **Oct. 21, 2013**

(87) PCT Pub. No.: **WO2012/111944**

PCT Pub. Date: **Aug. 23, 2012**

(65) **Prior Publication Data**

US 2014/0037114 A1 Feb. 6, 2014

(30) **Foreign Application Priority Data**

Feb. 16, 2011 (KR) 10-2011-0013784

(51) **Int. Cl.**

H04R 19/02	(2006.01)
H04R 1/06	(2006.01)
H04R 9/04	(2006.01)
H04R 7/24	(2006.01)
H04R 1/00	(2006.01)
H04R 9/06	(2006.01)

(52) **U.S. Cl.**

CPC .. ***H04R 1/00*** (2013.01); ***H04R 1/06*** (2013.01); ***H04R 7/24*** (2013.01); ***H04R 9/047*** (2013.01); ***H04R 9/06*** (2013.01)

(58) **Field of Classification Search**

CPC H04R 7/04; H04R 7/20; H04R 9/02; H04R 9/025; H04R 9/046; H04R 9/047
USPC 381/400, 409, 412, 431; 181/171, 173
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

2003/0103642	A1*	6/2003	Kam	H04R 9/047 381/431
2008/0205686	A1*	8/2008	Tagami	H04R 9/025 381/398
2012/0008816	A1*	1/2012	Liu	H04R 9/063 381/401

FOREIGN PATENT DOCUMENTS

JP	10-191494	7/1998
JP	2010-272988	12/2010
KR	10-2004-0078627	9/2004

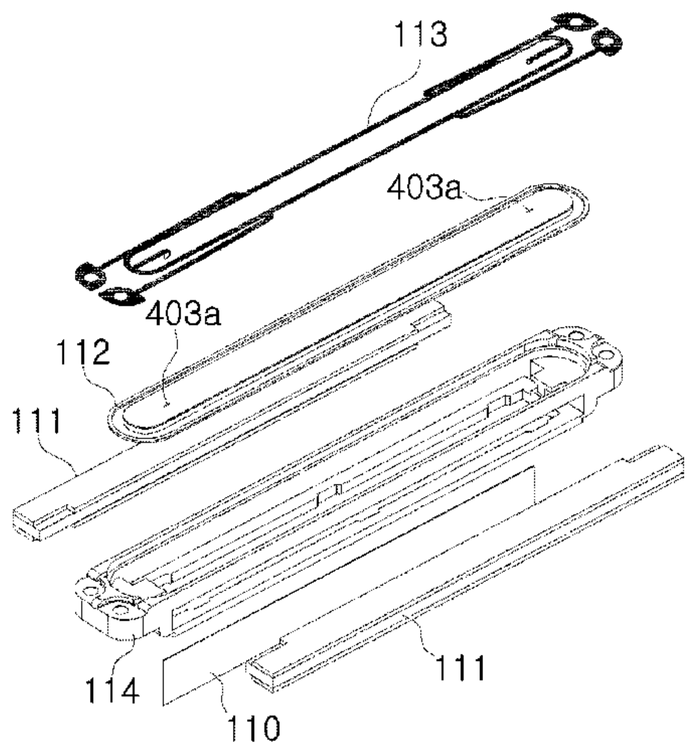
* cited by examiner

Primary Examiner — Jesse Elbin
(74) *Attorney, Agent, or Firm* — Occhiuti & Rohlicek LLP

(57) **ABSTRACT**

A flat-type speaker includes a voice coil plate, a pair of magnetic bodies having a magnet and a yoke formed side by side, separated at a predetermined interval; the voice coil plate being in a space between the magnetic bodies, and having printed thereon a voice coil with a spiral pattern; a vibration-lead plate having physically separated first and second vibration-lead plates, each having +, – terminals formed on the front ends thereof, the first and the second vibration-lead plates each equipped with a coil plate spline, which adheres to the upper end of the voice coil plate, and at least one wing spline having one end thereof connected to the coil plate spline and the other end connected to the terminals; and a vibration plate, which vibrates from the vibration received from the voice coil plate, while being contacted to the upper end portion of the vibration-lead plate.

6 Claims, 4 Drawing Sheets



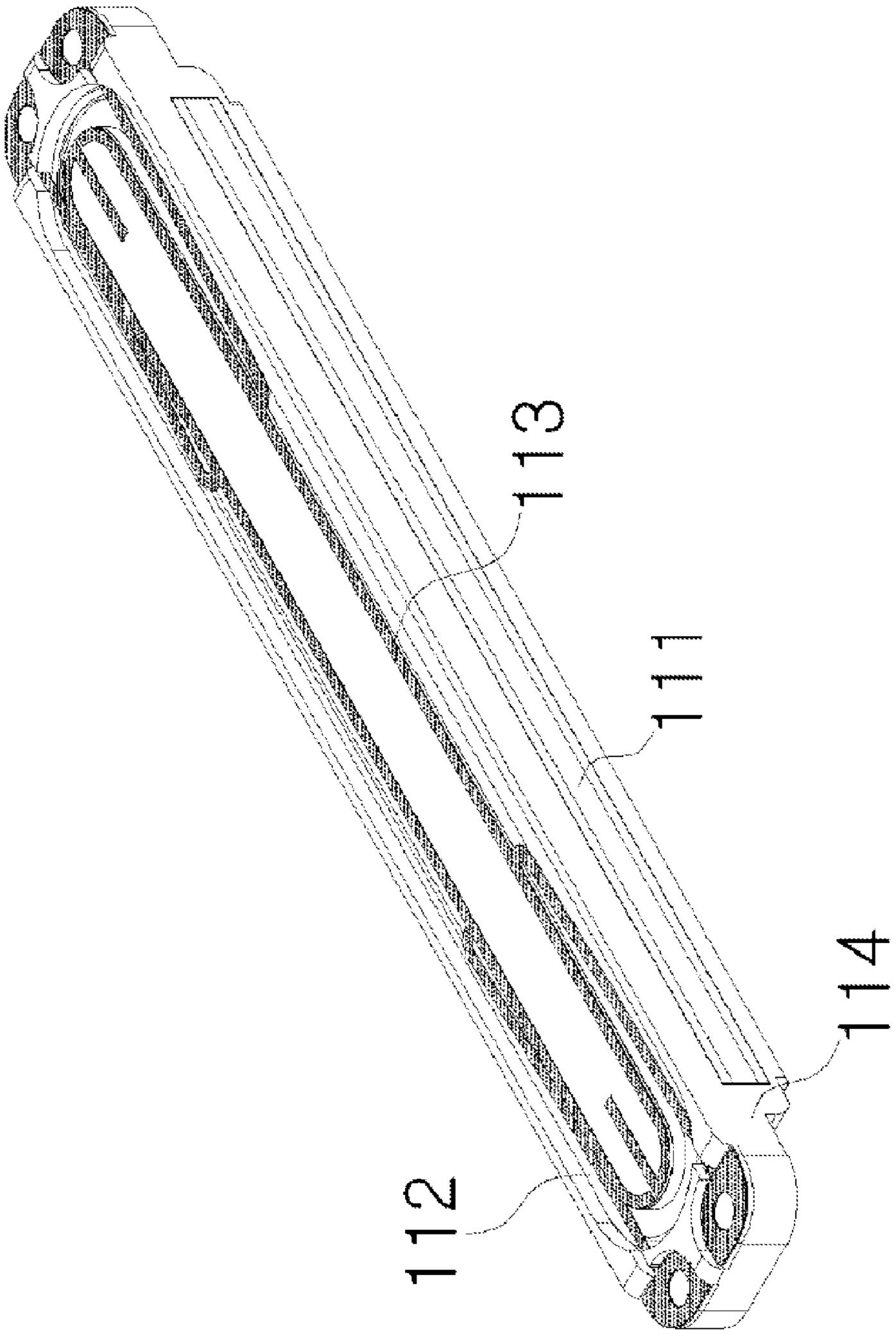


FIG. 1

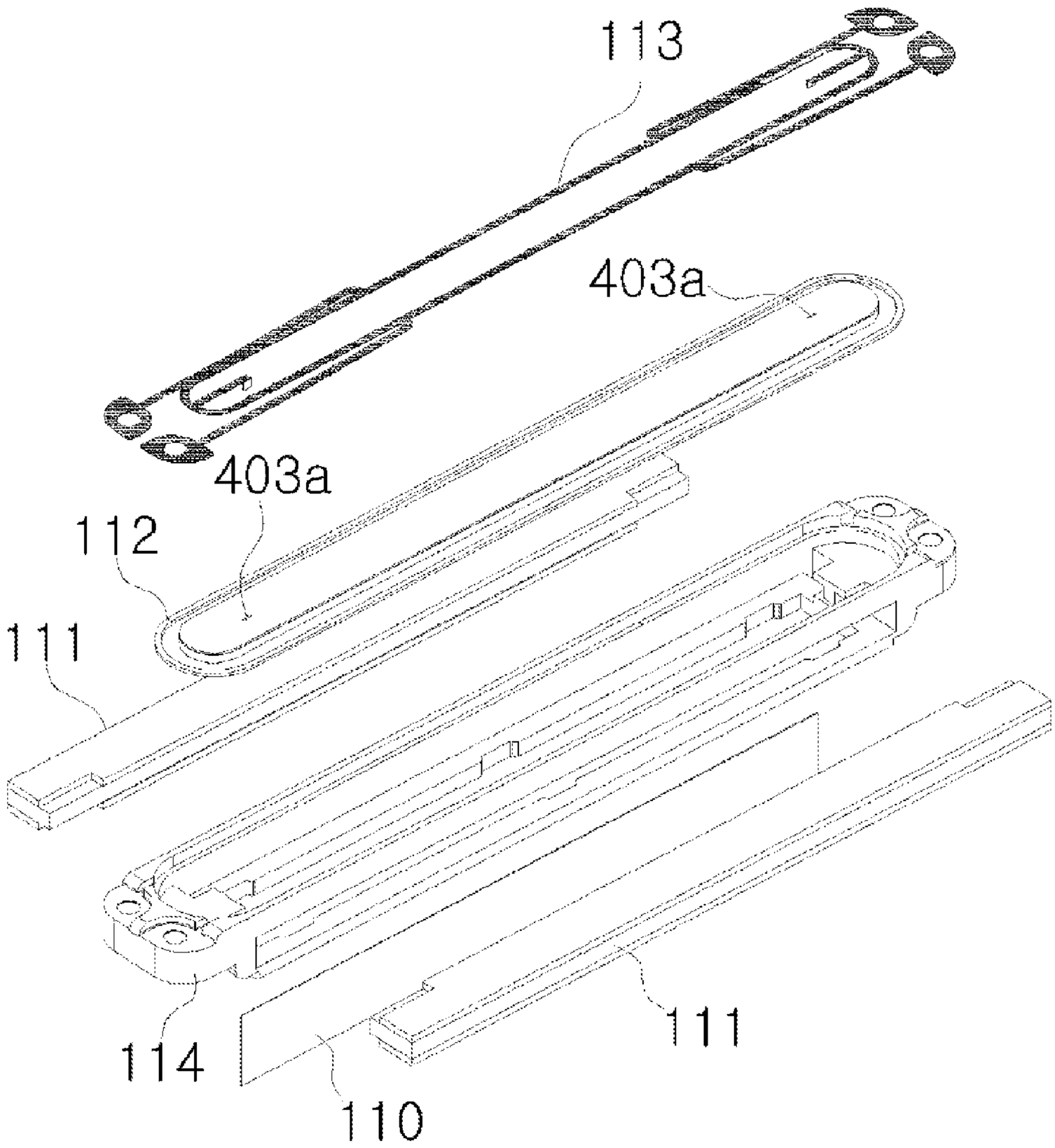


FIG. 2

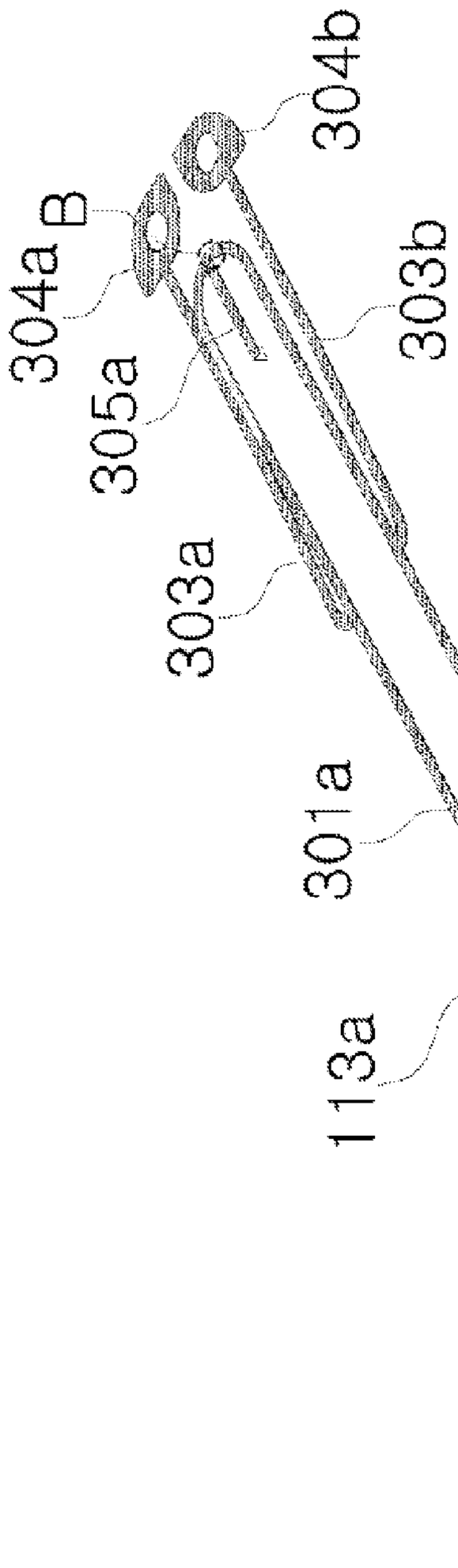

304b
304a B
303b
305a
303a
301b
113b
301a
113a
302b
305b
302a
304a A
304b

FIG. 3

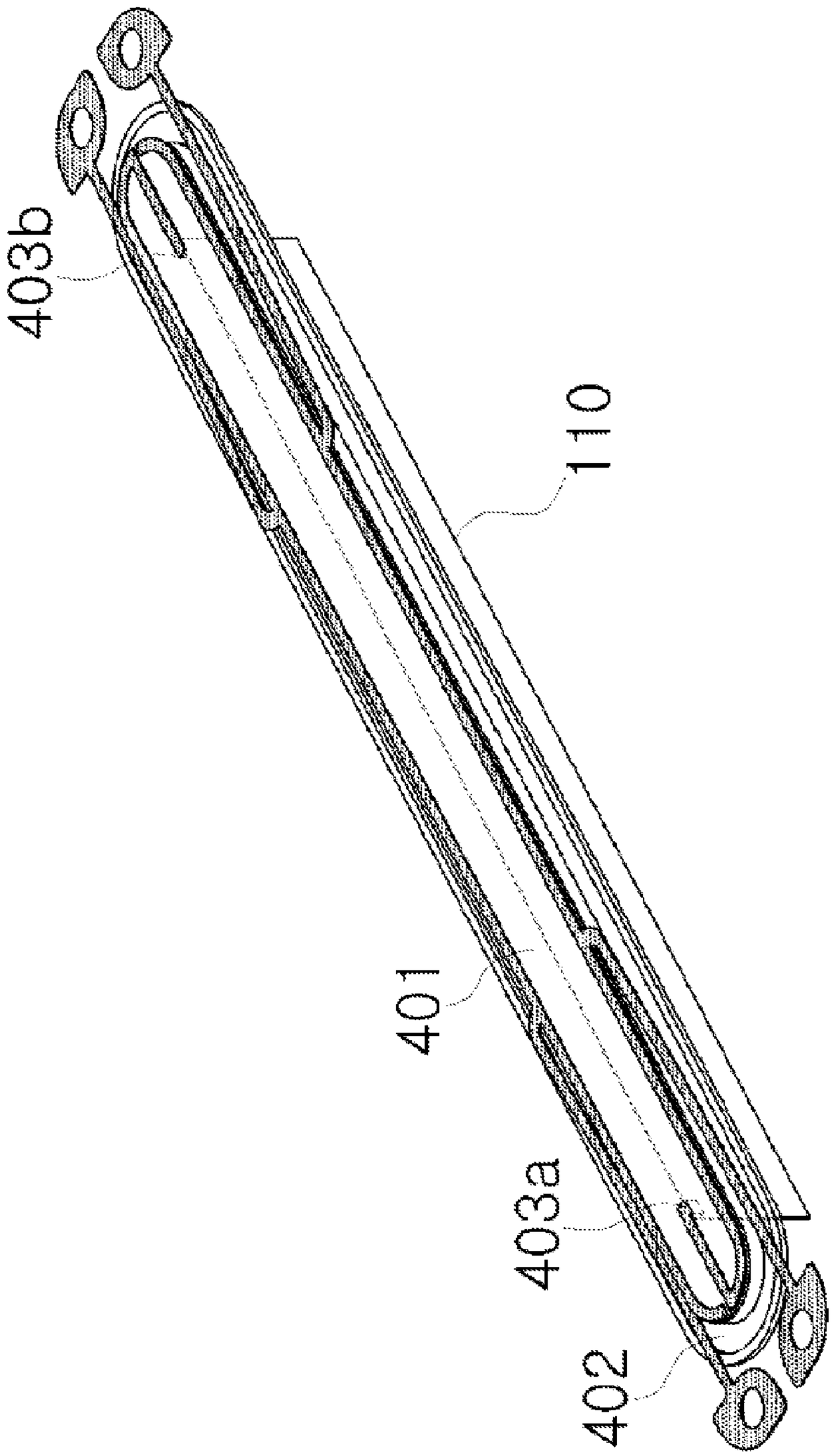


FIG. 4

FLAT TYPE SPEAKER HAVING VIBRATION-LEAD PLATE ATTACHED ON TOP OF VIBRATION PLATE

CROSS REFERENCE TO RELATED APPLICATION

This application is the national phase under 35 USC 371 of international application no. PCT/KR2012/001038, filed Feb. 13, 2012, which claims the benefit of the priority date of Korean application no. 10-2011-0013784, filed Feb. 16, 2011. The contents of the aforementioned applications are incorporated herein in their entirety.

TECHNICAL FIELD

The present invention relates to a flat type speaker and, more particularly, to a flat type speaker having damper-lead plates mounted on the top of a vibration plate, which can improve vibration efficiency by mounting the damper-lead plates on the top of the vibration plate, reduce a production process by eliminating lead wires through the direct soldering of the damper-lead plates to a voice coil, and improve the deterioration of quality due to the disconnection of a lead wire.

BACKGROUND ART

A speaker is equipped with a voice coil and a vibration plate interposed between magnets, and the speaker generates sound when the vibration plate is vibrated by a movement of the voice coil.

A flat type speaker includes a flat type voice coil and magnets disposed on both sides of the flat type voice coil and spaced apart from each other at a specific interval. In this flat type speaker, induced electromotive force is generated according to Fleming's left-hand law and Lorentz's force, a frequency according to a voice is formed, and the frequency vibrates the vibration plate, thereby being reproduced into sound.

The voice coil is wound in an oval form or patterned and printed on one or both sides of a plate type coil base, thus forming a voice coil plate.

A vibration plate is attached to the top of the voice coil plate in a length direction. The vibration plate is vibrated in response to a movement of the voice coil plate, thereby generating sound.

Furthermore, the voice coil formed in the voice coil plate is bonded to both terminals of a base frame that forms the outside of + and − lead wires, thereby forming a circuit.

In a conventional voice coil plate, however, a contact area with the vibration plate is small because the voice coil plate is adhered to the vibration plate in an upright state. As a result, the transfer of vibration energy is limited.

Furthermore, since the lead wires formed in the voice coil plate are bonded to the base frame, a problem in which the bonding is broken because the voice coil plate is moved up and down, but the base frame is fixed is frequently generated.

Furthermore, in general, the lead wires of the voice coil plate are connected to the terminals of the base frame using a soldering method, but this method is problematic in that the quality of the speaker is deteriorated.

DISCLOSURE

Technical Problem

Accordingly, the present invention has been made to solve the conventional problems, and an object of the present invention is to transfer more sound energy by mounting damper-lead plates on the top of a vibration plate, in particular, in the edge space of the vibration plate.

Another object of the present invention is to eliminate a problem in which lead wires are connected by soldering for electrical connection from a voice coil to the terminals of a base frame, reduce a manufacturing process by implementing electrical connection through direct soldering to the voice coil, and solve a quality deterioration problem attributable to the connection of the lead wires.

Technical Solution

To achieve the above objects, a flat type speaker having damper-lead plates mounted on a vibration plate according to the present invention includes a pair of magnetic bodies spaced apart from each other at a specific interval, formed side by side, and each having a magnet and yokes formed therein; a voice coil plate inserted into an interval between the magnetic bodies and having a voice coil spirally patterned and printed formed therein; damper-lead plates including first and second damper-lead plates physically separated and having + and − terminals formed at the respective front ends of the damper-lead plates, wherein each of the first and the second damper-lead plates includes a coil plate spline adhered to the top of the voice coil plate and one or more wing splines having one end connected to the coil plate spline and the other end connected to the + or − terminal; and a vibration plate vibrated in response to the vibration of the voice coil plate with the vibration plate coming in contact with a top of the damper-lead plates.

Here, the wing splines preferably are implemented so that they are brought in contact with a bottom of the vibration plate.

Here, the first and the second damper-lead plates may be made of conductive and metallic materials, and the second damper-lead plate may be symmetrical to the first damper-lead plate and rotated by 180 degrees from the first damper-lead plate.

Here, the first and the second damper-lead plates may be made of insulating materials and formed of one body, and the first and the second damper-lead plates may be coated with conductive materials in such a way as to be electrically separated.

Each of the first and the second damper-lead plates preferably may include a lead block connected to the front end of the voice coil by soldering at a front end on one or the other side of the coil plate spline or at front ends on both sides of the coil plate spline.

The width of the coil plate spline preferably may be smaller than or equal to the thickness of the voice coil plate, and the width of the lead block preferably may be greater than the width of the coil plate spline.

Advantageous Effects

In accordance with the construction of the present invention, more sound energy can be transferred by mounting the damper-lead plates on the top of the vibration plate, in particular, in the edge space of the vibration plate. Furthermore, a problem in which lead wires are connected by soldering for electrical connection from the voice coil to the terminals of the base frame can be eliminated, a manufacturing process can be reduced by implementing electrical connection through direct soldering to the voice coil, and a quality deterioration problem attributable to the connection of the lead wires can be solved.

DESCRIPTION OF DRAWINGS

FIG. **1** is a perspective view of a flat type speaker having damper-lead plates mounted on the top of a vibration plate according to the present invention.

FIG. **2** is an exploded perspective view of the flat type speaker having damper-lead plates mounted on the top of a vibration plate according to the present invention.

FIG. **3** is a perspective view of the damper-lead plates according to the present invention.

FIG. **4** is a perspective view of the connection structure of the voice coil plate and the damper-lead plates according to the present invention.

MODE FOR INVENTION

Hereinafter, the construction and effects of a flat type speaker having damper-lead plates mounted on the top of a vibration plate according to the present invention are described with reference to the accompanying drawings.

FIG. **1** is a perspective view of a flat type speaker having damper-lead plates mounted on the top of a vibration plate according to the present invention, and FIG. **2** is an exploded perspective view of the flat type speaker having damper-lead plates mounted on the top of a vibration plate according to the present invention.

As shown in FIG. **1** and FIG. **2**, the flat type speaker having damper-lead plates mounted on the top of a vibration plate according to the present invention includes a voice coil plate **110** on which a voice coil wound or patterned and printed in a track form is patterned and printed, a pair of magnetic bodies **111** spaced apart from each other at a specific interval on the left and right of the voice coil plate **110**, a vibration plate **112** connected to the top of the voice coil plate **110** and transferring vibration energy in a sound form, a pair of damper-lead plates **113** mounted on the top of the vibration plate **112** and configured to assist up and down movements of the voice coil plate **110** and to have leads electrically connected to the voice coil formed therein, and a base frame **114** made of synthetic materials, which forms the outside and with which various parts can be combined.

Each of the magnetic bodies **111** can include a magnet at the center thereof and yokes or magnet plates combined on and below the magnet. The pair of magnetic bodies **111** are spaced apart from each other at a specific interval and formed side by side, and the voice coil plate **110** is inserted into the interval between the formed magnetic bodies **111**.

The flat type speaker of the present invention includes the voice coil plate **110** and the magnetic bodies **111** disposed on both sides of the voice coil plate **110** with a specific interval interposed therebetween. When a current flows in the voice coil, induced electromotive force is generated according to Fleming's left-hand law and Lorentz's force, and the voice coil plate **110** is moved up and down in response to the induced electromotive force.

Here, the vibration plate **112** formed on the voice coil plate **110** is vibrated while operating in conjunction with the up and down movements of the voice coil plate **110**.

The damper-lead plates **113** are configured to be mounted on the top of the vibration plate **112**, and the mounting structure is described in more detail below with reference to FIGS. **3** and **4**.

The damper-lead plates **113** include two plates having a symmetrical structure in such a manner that the two plates are physically separated from each other and configured to face each other in the state in which one of the two plates is rotated by 180 degrees. Each of the damper-lead plates **113** is configured to have + and − terminals for power connection formed at both ends thereof, and the + and − terminals are mounted on both ends of a previously fabricated base frame **114**.

Thus, the vibration of the damper-lead plates **113** having a damper function is added to the vibration of the vibration plate **112** vibrated in response to the vibration of the voice coil plate **110**, so that more sound energy is transferred. Furthermore, the + and − terminals are formed at both ends of the damper-lead plates **113**, and the power wire of the voice coil **110***a* is connected to one side of the damper-lead plates **113** by soldering. Accordingly, the damper-lead plates **113** function as lead wires for connecting the voice coil **110***a* and + and − terminals mounted on the base frame **114**.

The structure of the damper-lead plates and the mounting structure of the damper-lead plates, the vibration plate, and the voice coil plate to be implemented by the present invention are described in detail below with reference to FIGS. **3** and **4**.

FIG. **3** is a perspective view of the damper-lead plates according to the present invention, and FIG. **4** is a perspective view of the connection structure of the voice coil plate and the damper-lead plates according to the present invention.

The damper-lead plates **113** are mounted on the top of the vibration plate **112**, and the damper-lead plates **113** function to maximize sound energy output by vibrating more vibration energy along with the vibration plate **112**. Furthermore, the + and − terminals are formed at both ends of the damper-lead plates **113**, and the damper-lead plates **113** are formed of metal plates (or formed by coating insulating material plates with conductive material). Accordingly, soldering connection with lead wires that was used for circuit connection with an existing voice coil can be eliminated, a failure due to the disconnection of a lead wire can be prevented by replacing the role of the lead wires with the metal plates, and difficulties in the process can be solved.

Various splines that form the damper-lead plates **113** mean slim, long, and thin plates, such as metal, in a dictionary definition.

Referring to FIGS. **3** and **4**, the damper-lead plates **113** of the flat type speaker according to the present invention include a pair of a first damper-lead plate **113***a* and a second damper-lead plate **113***b* on the left and right.

The first and the second damper-lead plates **113***a* and **113***b* are physically separated from each other (A, B) and are formed of metallic thin films having conductivity. One of the first and the second damper-lead plates **113***a* and **113***b* forms a circuit using the + terminal, and the other thereof forms a circuit using the − terminal.

Alternatively, although not shown, the first and the second damper-lead plates **113***a* and **113***b* can be integrally formed physically and made of insulating materials. Here, the first and the second damper-lead plates **113***a* and **113***b* can be coated with conductive materials so that they are electrically separated. As a result, one of the first and the second damper-lead plates **113***a* and **113***b* can form the circuit using the + terminal and the other thereof can form the circuit using the − terminal.

The second damper-lead plate **113***b* is rotated by 180 degrees from a line vertical to a reference line, that is, a specific parallel slant line in the length direction of the first damper-lead plate **113***a*, in the state in which the second damper-lead plate **113***b* is symmetrical to the first damper-lead plate **113***a* on the basis of the reference line.

The reason why the first and the second damper-lead plates **113***a* and **113***b* are symmetrical to each other left and right and up and down is to take advantages of a production process

by making the first and the second damper-lead plates **113***a* and **113***b* substantially have the same structure. This reason is for equally maintaining the transfer of vibration energy on the left and right sides along with the vibration plate **112**, but there is no problem although the first and the second damper-lead plates **113***a* and **113***b* have different structures.

The first damper-lead plate **113***a* includes a vibration plate spline **301***a*, first and second wing splines **302***a* and **303***a*, a pair of terminals **304***a*, and a lead block **305***a*, which are integrally coupled seamlessly. Likewise, the second damper-lead plate **113***b* includes a vibration plate spline **301***b*, first and second wing splines **302***b* and **303***b*, a pair of terminals **304***b*, and a lead block **305***b*, which are integrally coupled seamlessly.

The vibration plate splines **301***a* and **301***b* are parts adhered to the outer line of the main body **401** of the vibration plate **112**. The wing splines **302***a*, **303***a* and **302***b*, **303***b* are protruded from one points of the vibration plate splines **301***a* and **301***b*, bent in opposite directions, and then placed on the edge (**402**) parts of the vibration plate **112** in a non-contact state, thus perform a damper function.

The vibration plate splines **301***a* and **301***b* and the wing splines **302***a*, **303***a* and **302***b*, **303***b* are lengthily formed in a length direction with a slim width.

One end of each of the vibration plate splines **301***a* and **301***b* is configured to be protruded in such a way to be oriented downward in a '¬' form. Blocks each having the '¬' form are called the lead blocks **305***a* and **305***b*.

The lead blocks **305***a* and **305***b* are integrally formed with the vibration plate splines **301***a* and **301***b* and configured to penetrate vibration plate holes **403***a* and **403***b* formed in the main body **401** of the vibration plate **112**.

The lead blocks **305***a* and **305***b* that penetrate the vibration plate holes **403***a* and **403***b* function as the central guide of the voice coil plate **110** and also function as a + and − connection function through soldering with the voice coil **110***a* of the voice coil plate **110** placed under the vibration plate **112**.

The terminals **304***a* and **304***b* are formed at the front ends of the wing splines **302***a*, **303***a* and **302***b*, **303***b*.

The terminals **304***a* and **304***b* are mounted on a power terminal pole formed in the base frame **114**. One of the terminals **304***a* and **304***b* is used as a + terminal, and the other thereof is used as a − terminal.

The lead blocks **305***a* and **305***b* are connected to the + and − wire parts of the voice coil **110***a* of the voice coil plate **110** by soldering. The lead blocks **305***a* and **305***b* are integrally connected to the first and the second damper-lead plates **113***a* and **113***b* and connected to the terminals **304***a* and **304***b* formed at the front ends of the first and the second damper-lead plates **113***a* and **113***b*, thereby completing electrical connection up to the voice coil **110***a* and the terminals **304***a* and **304***b*.

Existing connection between a voice coil and the terminal pole of a base frame was implemented by a process of soldering lead wires. In this case, a work process is problematic, and a phenomenon in which a lead wire is broken because the terminal pole of the base frame is fixed and a voice coil plate is moved up and down can be generated. The damper-lead plates **113** of the present invention can supplement the conventional problem.

As described above, the damper-lead plates **113** are configured to be connected to the vibration plate **112** in the form of a sheet spring in such a way as to transfer more sound energy to the vibration plates **112**, thereby being capable of improving the quality of the speaker. Furthermore, the damper-lead plates **113** are formed of metallic thin films, the terminals **304***a* and **304***b* are formed on both sides of the damper-lead plates **113**, and the lead blocks **305***a* and **305***b* are formed at locations corresponding to the voice coil. Accordingly, the efficiency of a production process can be improved and quality can be maintained because a process of connecting the voice coil and the lead wires of the base frame is eliminated.

While preferred embodiments of the present invention have been described with reference to the accompanying drawings, those skilled in the art to which the present invention pertains will understand that the present invention may be implemented in other detailed forms without departing from the technical spirit or essential characteristics of the present invention. Accordingly, the aforementioned embodiments should not be construed as being limitative, but should be construed as being only illustrative from all aspects. Furthermore, the scope of the present invention is defined by the appended claims rather than the detailed description, and it should be understood that all modifications or variations derived from the meanings and scope of the present invention and equivalents thereof are included in the scope of the appended claims.

The invention claimed is:

1. A flat type speaker having damper-lead plates mounted on a vibration plate, comprising:

a pair of magnetic bodies spaced apart from each other at a specific interval, formed side by side, and each having a magnet and yoke formed therein;

a voice coil plate inserted into an interval between the magnetic bodies and having a voice coil spirally patterned and printed formed therein;

a vibration plate brought in contact with a top of the voice coil plate and vibrated in response to a vibration of the voice coil plate; and

first and second damper-lead plates adhered to a top of a main body of the vibration plate and arranged in parallel, each of the first and second damper-lead plates comprising a vibration plate spline having a slim and long plate form, and one or more wing splines having one end connected to the vibration plate spline and having a slim and long plate form.

2. The flat type speaker of claim **1**, wherein:

a lead block having a '¬' form is formed at one end of the vibration plate spline,

the lead blocks are configured to penetrate vibration plate holes formed in the vibration plate and connected to the voice coil by soldering, and

a + or − terminal is formed at one end of the wing spline.

3. The flat type speaker of claim **1**, wherein:

a pair of the wing splines are extended from the vibration plate spline and bent in opposite directions, and

a + or − terminal is formed at a front end of each of the pair of the wing splines.

4. The flat type speaker of claim **1**, wherein the wing spline is placed on an edge of the vibration plate.

5. The flat type speaker of claim **1**, wherein:

the first and the second damper-lead plates are made of conductive and metallic materials, and

the second damper-lead plate has a symmetrical structure rotated by 180 degrees from the first damper-lead plate.

6. The flat type speaker of claim **1**, wherein:

the first and the second damper-lead plates are made of insulating materials and formed of one body, and

the first and the second damper-lead plates are coated with conductive materials in such a way as to be electrically separated.

* * * * *