



(11) **EP 1 836 873 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention
of the grant of the patent:
26.05.2010 Bulletin 2010/21

(21) Application number: **06701632.9**

(22) Date of filing: **11.01.2006**

(51) Int Cl.:
H04R 9/02 (2006.01)

(86) International application number:
PCT/IT2006/000010

(87) International publication number:
WO 2006/075349 (20.07.2006 Gazette 2006/29)

(54) **LOUDSPEAKER WITH COOLING SYSTEM TO INCREASE THE OUTPUT POWER**

LAUTSPRECHER MIT KÜHLSYSTEM ZUR STEIGERUNG DER AUSGANGSLEISTUNG

HAUT-PARLEUR A SYSTEME DE REFROIDISSEMENT PERMETTANT D'ACCROITRE LA
PUISSANCE DE SORTIE

(84) Designated Contracting States:
DE DK ES FR GB NL

(30) Priority: **12.01.2005 IT FO20050001 U**

(43) Date of publication of application:
26.09.2007 Bulletin 2007/39

(73) Proprietor: **Cinanni, Dario**
I-89036 Brancaleone (IT)

(72) Inventor: **Cinanni, Dario**
I-89036 Brancaleone (IT)

(74) Representative: **Mittler, Enrico**
Mittler & C. S.r.l.
Viale Lombardia, 20
20131 Milano (IT)

(56) References cited:
CA-A1- 2 245 351 CA-A1- 2 270 726

- **PATENT ABSTRACTS OF JAPAN** vol. 2003, no. 12, 5 December 2003 (2003-12-05) & JP 2004 186898 A (SONY CORP), 2 July 2004 (2004-07-02)
- **PATENT ABSTRACTS OF JAPAN** vol. 1996, no. 05, 31 May 1996 (1996-05-31) & JP 08 009493 A (SONY CORP), 12 January 1996 (1996-01-12)

Note: Within nine months of the publication of the mention of the grant of the European patent in the European Patent Bulletin, any person may give notice to the European Patent Office of opposition to that patent, in accordance with the Implementing Regulations. Notice of opposition shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).

EP 1 836 873 B1

Description

BACKGROUND OF THE INVENTION

[0001] 1. Cross-References to Related Application.

[0002] This application claims priority to IT Utility Model Application, Serial No. FO2005U000001 filed Gen 12, 2005.

[0003] 2. Field of the Invention.

[0004] This invention relates generally to a dynamic loudspeaker with recycle system having a sufficient air movement.

[0005] 3. Related Art.

[0006] To the actual state of technique applying to the clamps of a loudspeaker an high level electric signal causes damage due to thermal limits (components' overheating) and mechanics limits (excursion of the mobile parts elevated). Moreover the maximum power handle by a loudspeaker is proportional to the maximum temperature that its voice coil can reach. Overheating components loudspeaker also causes another problem: the power compression, that represent the reduction of power during the loudspeaker action in the time.

[0007] The power compression problem (as illustrated in CHART 1) describes the voice coil temperature and electric power plots of a loudspeaker under maximum power. Test period: 60 seconds. Type of applied signal: 120 Hz sinusoid. Applied power: 154 watts. - The electric charts values are measured with SpeakerLAB: automatic system of measure for loudspeaker thermal and power test, projected and built by the same author-

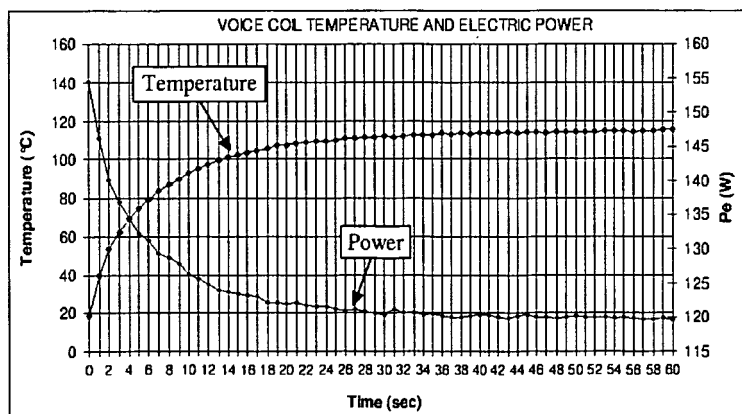


CHART 1 Electric power compression of a woofer without recycle system

[0008] Test start at voice coil temperature of 18 °C, after 1 minute report 115 °C; in the same time the electric power start at value of 155 Watts, after 1 minute report a value of 119 Watts.

[0009] TABLE 1 shows the difference between final and initial value of temperature (ΔT) and power values (ΔP).

TABLE 1

	VARIATION
ΔT [°C]	+97
ΔP [W]	-36

[0010] CHART 1 represent the electric power compression while CHART 2 shows acoustic power compression of the loudspeaker.

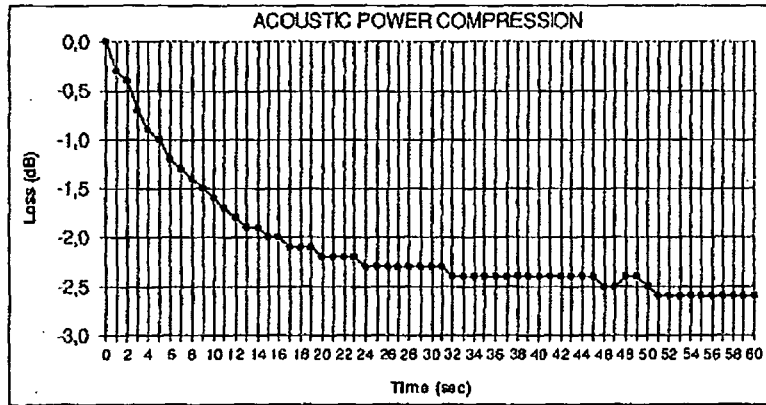


CHART 2 Acoustic power compression of the woofer without recycle system

[0011] Contemporarily the previous measure, microphone -at 1 meter on loudspeaker axis- records a 2.6 dB loss (TABLE 2).

TABLE 2

	VARIATION
PC [dB]	-2.6

[0012] The loudspeaker used in tests is a standard woofer, with support 8 of the voice coil lengthened, it provided with holes 3 in the back pole plate 2 and in front pole plate 4, but without cap 1 (as illustrated in FIG. 1 and FIG. 2).

[0013] Recycling airflow systems are disclosed in JP-2004/186898 and CA-1 2270726.7.

[0014] SUMMARY OF THE INVENTION

[0015] It is possible to decrease the power compression and increase the output power of the same woofer forcing the convection cooling on the voice coil 9; recycling the air flow produced during the dust cap 13 movement and passing through the hole 6 in the nucleus of the back pole plate.

[0016] The object of the present invention is achieved by a loudspeaker as disclosed in claims 1, 2.

[0017] This results are obtained with a metallic cap 1 in woofer added (also illustrated in FIG. 3 and FIG. 4). The results of the air flow created through the holes by the cap in FIG. 5 and FIG. 6 are visible. Air flow produces an air recycle that flows throughout the voice coil, cooling it and increasing the loudspeaker performances in electric and acoustics power.

[0018]

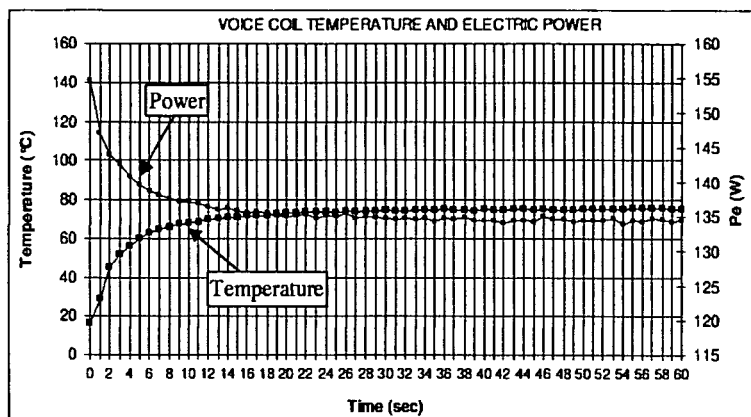


CHART 3 Electric power compression of the woofer with recycle system

TABLE 3

	VARIATION
ΔT [°C]	+ 57
ΔP [W]	-21

[0019] When measures of the same loudspeaker are performed, with the cap placed, a great improvement is obtained (as visible in CHART 3). The temperature of the voice coil in this test varies from 17 °C to 74 °C, thus the electric power as before starts from value of 155 Watts, at the end of 1 minute test is 134 Watts. TABLE 3 shows the results.

[0020] Moreover, the increase of temperature is limited, then there are some advantages in the containment of electric power loss. Important results are showed from electric and acoustic power; in fact the graph of CHART 4 report the loss of acoustic power limited to 1.3 dB.

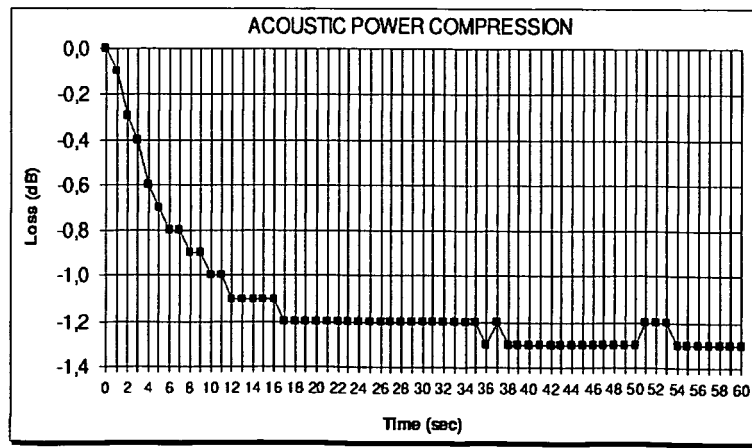


CHART 4 Acoustic power compression of the woofer with recycle system

[0021] TABLE 4 and TABLE 5 shows electric and acoustic power compression of the loudspeaker respectively with and without recycle system (SdR). The analysis show absolute value of the relative difference ($|\Delta Rel|$) of woofer endowed with recycle system, in comparison to the same woofer without recycle system; it illustrates a voice coil temperature attenuation of 40 °C, an increase in electric power of 15 Watts and an increase of acoustic power output of 1.3 dB.

[0022]

TABLE 4

	Without SdR	with SdR	$ \Delta Rel $
ΔT [°C]	+ 97	+ 57	40
ΔP [W]	-36	-21	15

[0023]

TABLE 5

	without SdR	with SdR	$ \Delta Rel $
PC [dB]	-2.6	-1.3	1.3

[0024] FIG. 7 and FIG. 8 reported the case in which, for technical or construction loudspeaker characteristic, a workmanship of the anterior pole plate is not possible or too to perform holes on such plate, the recycle of the air could be used to cool voice coil by a different profile of the cap.

[0025] This woofer doesn't have the lengthened support of voice coil and it is deprived of thickness. The only changes

performed to the standard woofer, therefore, there are the holes in the back **pole** plate and the insertion of new cap.

[0026] The modified cap leaves a part of holes of the back **pole** plate open, in such way the air flow, pushed in (compression phase, illustrated in FIG. 9) from the dust cap through the back **pole** plate nucleus hole, is made to converge by the cap through internal holes in the cap, to after escape from the external holes in the cap.

[0027] In expansion phase the air flow follows the same run, but with opposite verse. The performances results of woofer illustrated in FIG. 8 are 5% lower in comparison the woofer of FIG. 4.

[0028] BRIEF DESCRIPTION OF THE DRAWINGS

[0029] FIG. 1 is a back view of a woofer with cap.

[0030] FIG. 2 is a cross-sectional view of a woofer with cap.

[0031] FIG. 3 is a back view of woofer with cap.

[0032] FIG. 4 is a cross-sectional view of woofer in FIG. 2, with **pole** plates illustrated.

[0033] FIG. 5 is a cross-sectional view of woofer with cap and illustrated air movement during compression stage.

[0034] FIG. 6 is a cross-sectional view of woofer with cap and illustrated air movement during expansion stage.

[0035] FIG. 7 is a back view of a woofer with modified cap.

[0036] FIG. 8 is a cross-sectional view of woofer with modified cap, with **pole** plates illustrated.

[0037] FIG. 9 is a cross-sectional view of woofer with modified cap and illustrated air movement during compression stage.

[0038] FIG. 10 is a cross-sectional view of woofer with modified cap and illustrated air movement during expansion stage.

Claims

1. A dynamic loudspeaker with air recycle system comprising:

a dust cup (13);

a basket (7);

a front pole plate (4);

a back pole plate (2) comprising a center nucleus, wherein said center nucleus is provided with a through hole (6);

a magnet placed on said back pole plate (2), and separated by a air space region from said center nucleus, wherein said back pole plate (2) is provided with through holes (3) in correspondence of said air space region;

a cup (1) applied to the underside of said back pole plate (2) arranged so as to cover from outside said hole (6) in the center nucleus and said holes (3) in the back pole plate (2),

wherein a spacer (5) is provided between the basket and the front pole plate, said spacer being provided with axial apertures, and

said front pole plate (4) is placed on the magnet and provided with through holes (3) in correspondence of the space region, so that the air flow produced during the dust cap movement is recycled passing through the hole (6) in the nucleus, the holes (3) in the back pole plate (2), the holes (3) in the front pole plate (4) and the axial apertures of said spacer.

2. A dynamic loudspeaker with air recycle system comprising:

a dust cup (13);

a back pole plate (2) comprising a center nucleus, wherein said center nucleus is provided with a through hole (6);

a magnet placed on said back pole (2), and separated by a air space region from said center nucleus, wherein said back pole plate (2) is provided with through holes (3) in correspondence of said air space region;

a cup (1) applied to the underside of said back pole plate (2), wherein said cup is arranged so as to cover from outside said hole (6) in the center nucleus and only a part of said holes (3) in the back pole plate (2), in such way that the air flow pushed in compression phase by the dust cup (13) through said hole (6) of the center nucleus is made to converge by said cup (1) through the part of said holes (3) of the back pole (2) which is covered by the cup (1), to after escape through the part of said holes (3) of the back pole (2) which is not covered by the cup (1).

Patentansprüche

1. Dynamischer Lautsprecher mit einem Umluftstromsystem, mit:

einer Staubschutzkalotte (13);
 einem Korb (7);
 einer vorderen Polplatte (4);
 einer hinteren Polplatte (2) mit einem Mittelkern, wobei im Mittelkern ein Durchgangsloch (6) ausgebildet ist;
 einem auf der hinteren Polplatte (2) angeordneten Magnet, der durch einen Luftspaltbereich vom Mittelkern
 getrennt ist, wobei in der hinteren Polplatte (2) Durchgangslöcher (3) in Zuordnung zum Luftspaltbereich aus-
 gebildet sind; und
 einer auf der Unterseite der hinteren Polplatte (2) aufgebrachten Kappe (1), die derart angeordnet ist, dass sie
 das Durchgangsloch (6) im Mittelkern und die Löcher (3) in der hinteren Polplatte (2) von außen abdeckt;

wobei zwischen dem Korb und der vorderen Polplatte ein Abstandselement (5) angeordnet ist, wobei das Abstand-
 selement axiale Öffnungen aufweist, und
 wobei die vordere Polplatte (4) auf dem Magnet angeordnet ist und Durchgangslöcher (3) in Zuordnung zum Luft-
 spaltbereich aufweist, so dass der während der Staubschutzkalottenbewegung erzeugte Luftstrom das Loch (6) im
 Kern, die Löcher (3) in der hinteren Polplatte (2), die Löcher (3) in der vorderen Polplatte (4) und die axialen Öffnungen
 des Abstandselements (5) als Umluftstrom durchströmt.

2. Dynamischer Lautsprecher mit einem Umluftstromsystem, mit:

einer Staubschutzkalotte (13);
 einer hinteren Polplatte (2) mit einem Mittelkern, wobei im Mittelkern ein Durchgangsloch (6) ausgebildet ist;
 einem auf der hinteren Polplatte (2) angeordneten Magnet, der durch einen Luftspaltbereich vom Mittelkern
 getrennt ist, wobei in der hinteren Polplatte (2) Durchgangslöcher (3) in Zuordnung zum Luftspaltbereich aus-
 gebildet sind; und
 einer auf der Unterseite der hinteren Polplatte (2) aufgebrachten Kappe (1), wobei die Kappe derart angeordnet
 ist, dass sie das Durchgangsloch (6) im Mittelkern und nur einen Teil der Löcher (3) in der hinteren Polplatte
 (2) von außen abdeckt, so dass veranlasst wird, dass der in der Verdichtungsphase durch die Staubschutzkalotte
 (13) durch das Durchgangsloch (6) des Mittelkerns gedrückte Luftstrom mittels der Kappe (1) über den Teil der
 Löcher (3) der hinteren Polplatte (2) konvergent ausgerichtet wird, der durch die Kappe (1) abgedeckt ist, um
 anschließend über den Teil der Löcher (3) der hinteren Polplatte (2) zu entweichen, der nicht durch die Kappe
 (1) abgedeckt ist.

Revendications

1. Haut-parleur dynamique muni d'un système de recyclage d'air, comprenant :

une coupelle protectrice (13);
 un panier (7) ;
 une plaque polaire avant (4) ;
 une plaque polaire arrière (2) comprenant un noyau central, ledit noyau central étant pourvu d'un trou traversant
 (6) ;
 un aimant placé sur ladite plaque polaire arrière (2), et séparé du noyau central par une région d'espace d'air,
 dans lequel ladite plaque polaire arrière (2) est pourvue de trous traversants (3) en correspondance avec ladite
 région d'espace d'air ;
 une coupelle (1) appliquée sur la face inférieure de ladite plaque polaire arrière (2), adaptée pour couvrir de
 l'extérieur ledit trou (6) pratiqué dans le noyau central et lesdits trous (3) pratiqués dans la plaque polaire arrière
 (2),

dans lequel une entretoise (5) est placée entre le panier et la plaque polaire avant, ladite entretoise étant pourvue
 d'ouvertures axiales, et ladite plaque polaire avant (4) est placée sur l'aimant et pourvue de trous traversants (3)
 en correspondant avec la région d'espace, de sorte que le flux d'air produit pendant le mouvement de la coupelle
 protectrice est recyclé en passant par le trou (6) du noyau, les trous (3) de la plaque polaire arrière (2), les trous
 (3) de la plaque polaire arrière (4) et les ouvertures axiales de ladite entretoise.

2. Haut-parleur dynamique muni d'un système de recyclage d'air, comprenant :

une coupelle protectrice (13);

EP 1 836 873 B1

une plaque polaire arrière (2) comprenant un noyau central, ledit noyau central étant pourvu d'un trou traversant (6) ;

un aimant placé sur ladite plaque polaire arrière (2), et séparé du noyau central par une région d'espace d'air, dans lequel ladite plaque polaire arrière (2) est pourvue de trous traversants (3) en correspondance avec ladite région d'espace d'air ;

une coupelle (1) appliquée sur la face inférieure de ladite plaque polaire arrière (2), ladite coupelle étant adaptée pour couvrir de l'extérieur ledit trou (6) pratiqué dans le noyau central et seulement une partie desdits trous (3) pratiqués dans la plaque polaire arrière (2), de telle manière que le flux d'air poussé en phase de compression par la coupelle protectrice (13) dans le trou (6) du noyau central converge grâce à ladite coupelle (1) dans la partie desdits trous (3) de la plaque polaire arrière (2) qui est couverte par la coupelle (1), pour s'échapper ensuite par la partie des trous (3) de la plaque polaire arrière (2) qui n'est pas couverte par la coupelle (1).

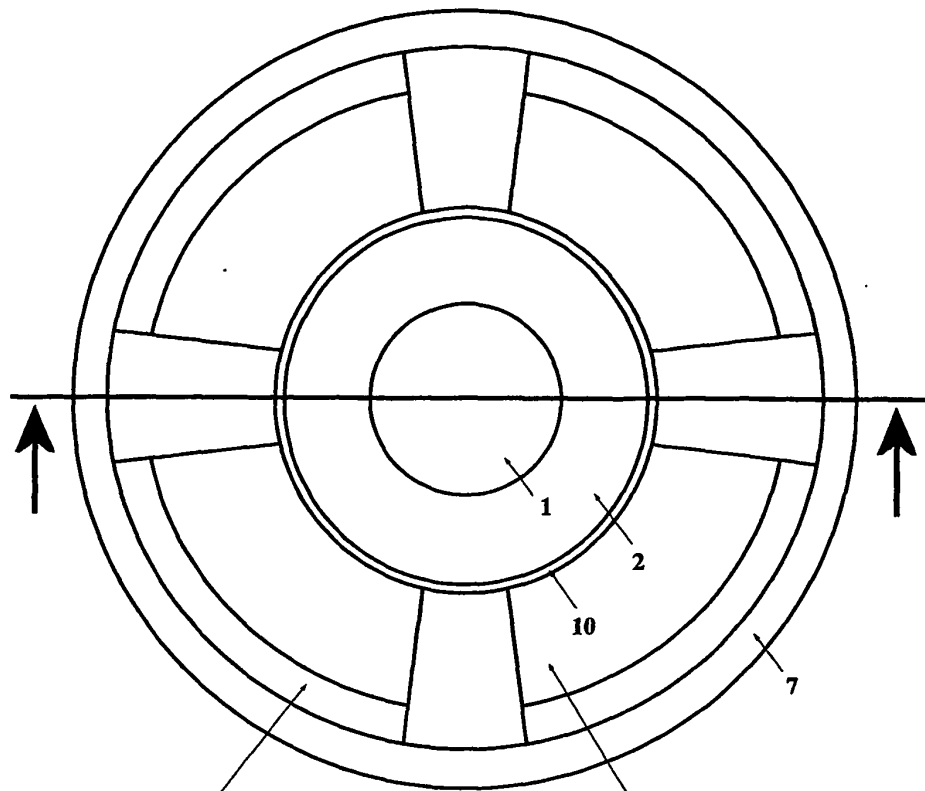


FIG. 1

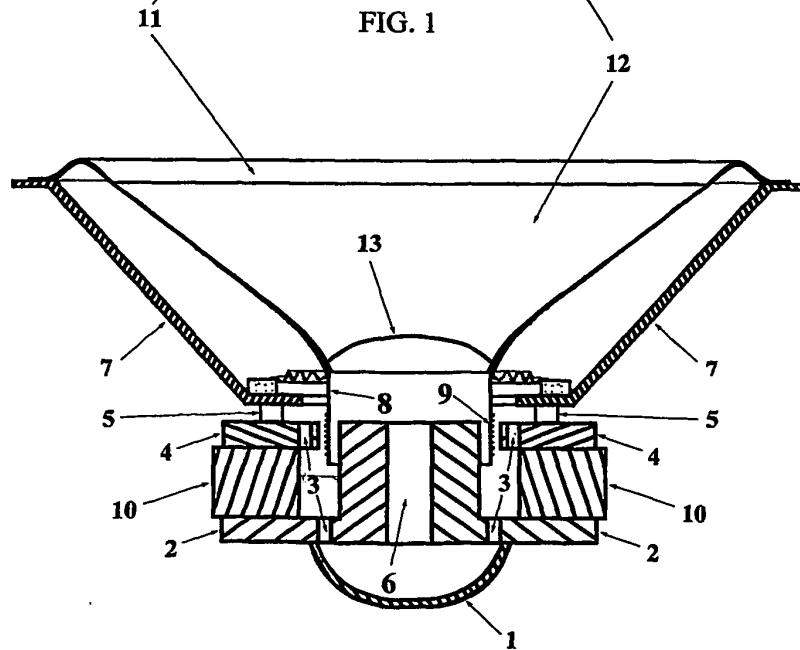


FIG. 2

- 1 CAP
- 2 BACK POLAR PLATE
- 3 POLAR PLATES HOLES
- 4 FRONT POLAR PLATE
- 5 THICKNESS
- 6 BACK POLAR PLATE NUCLEUS HOLE
- 7 BASKET

- 8 SUPPORT
- 9 VOICE COIL
- 10 MAGNET
- 11 SURROUND
- 12 CONE
- 13 DUST CAP

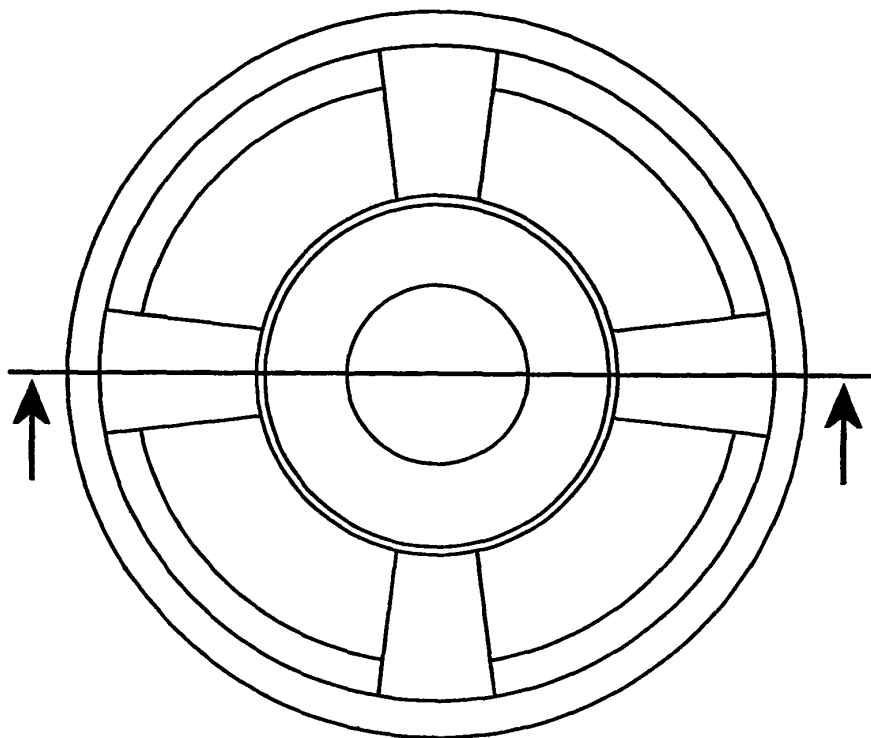


FIG. 3

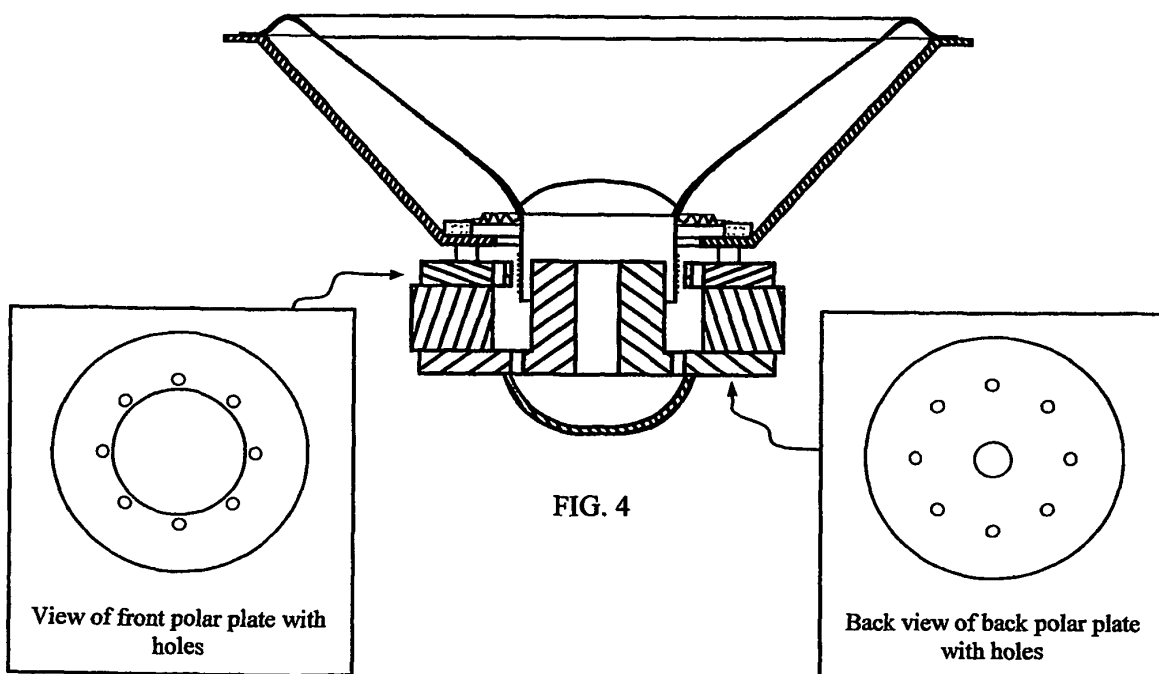


FIG. 4

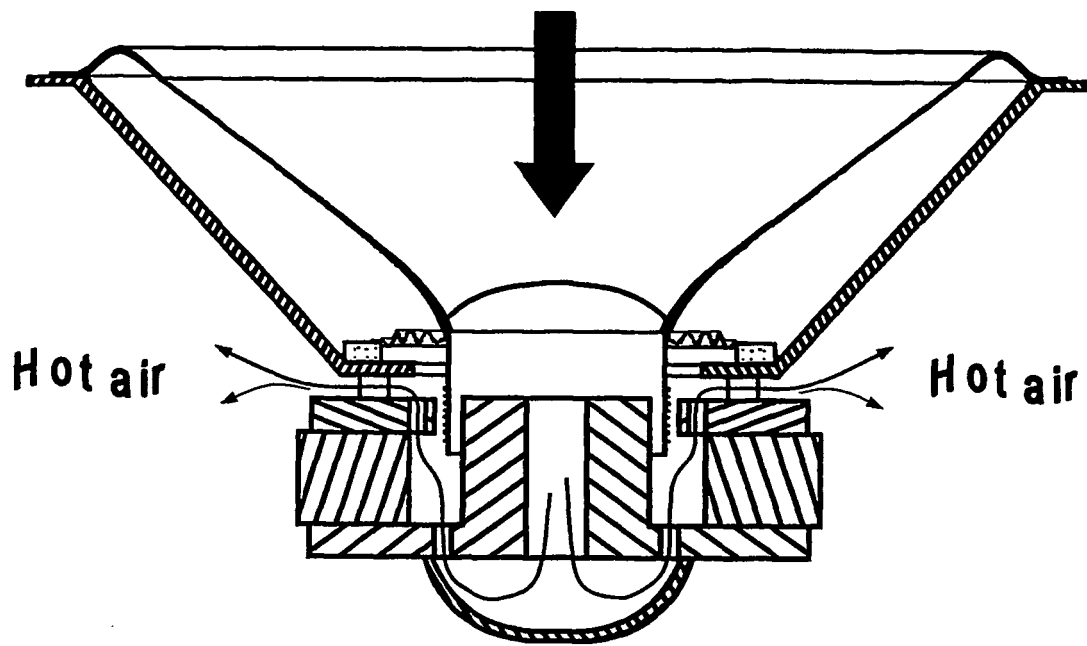


FIG. 5

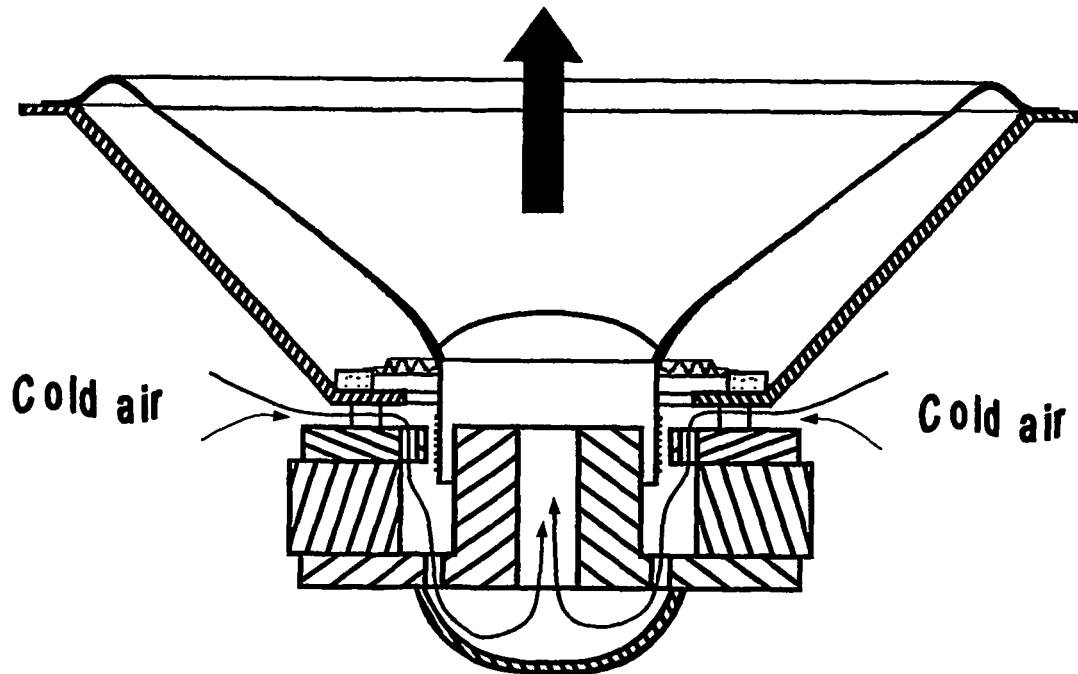


FIG. 6

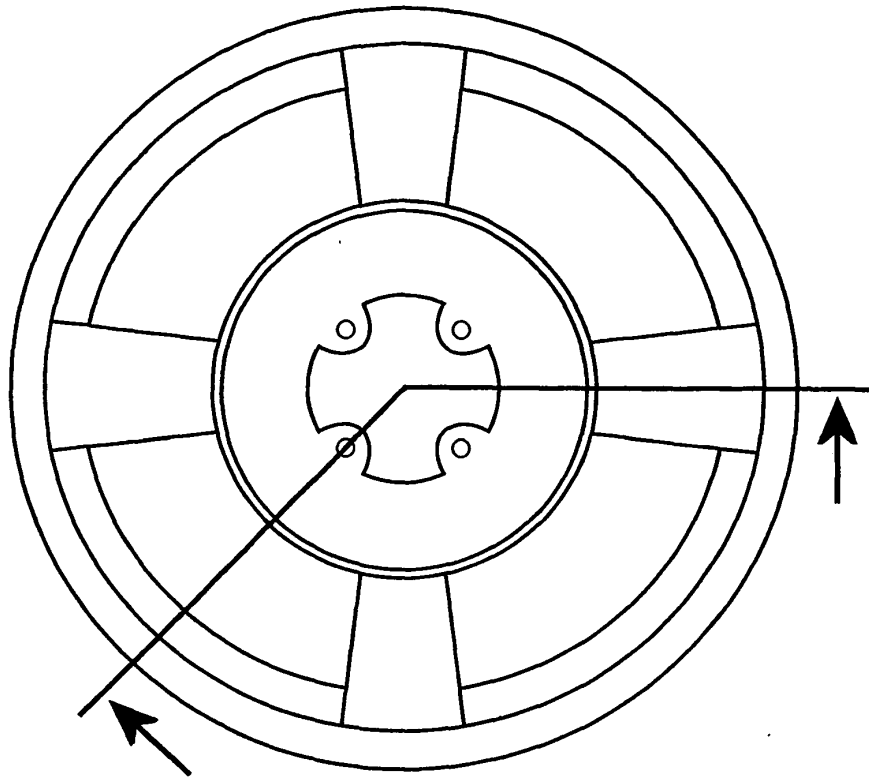


FIG. 7

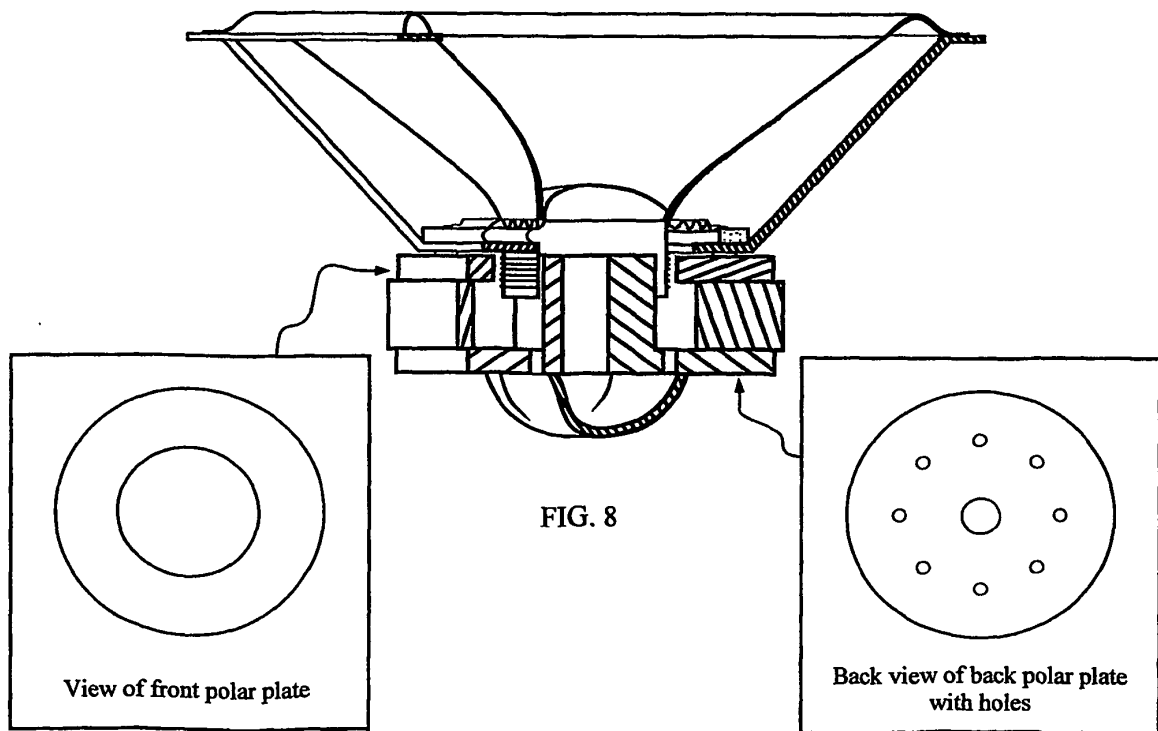


FIG. 8

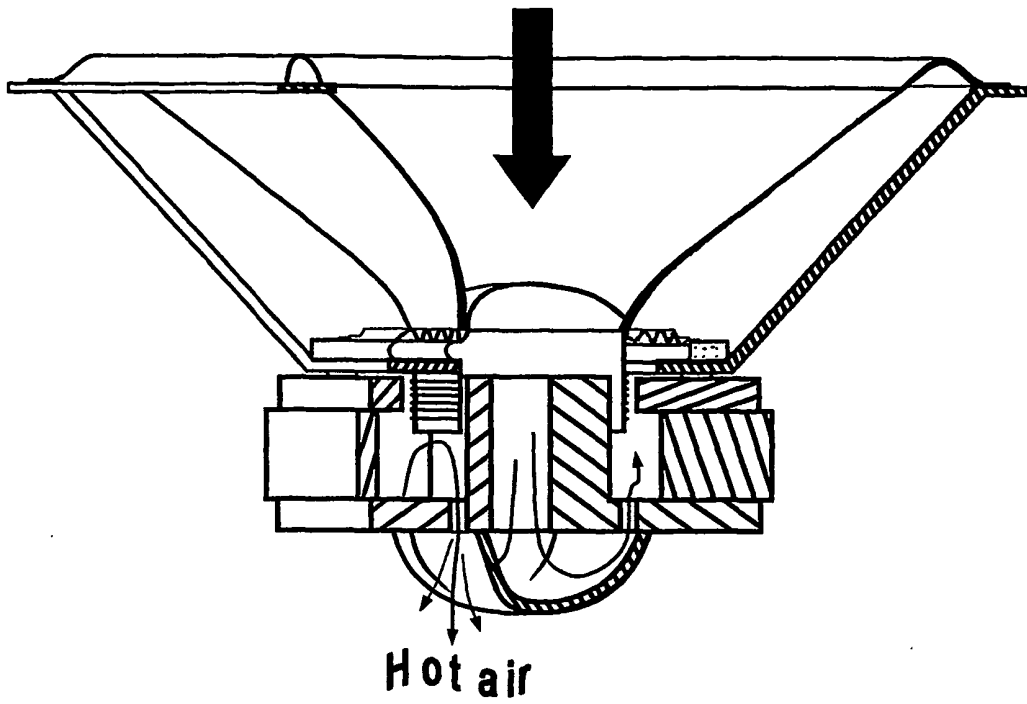


FIG. 9

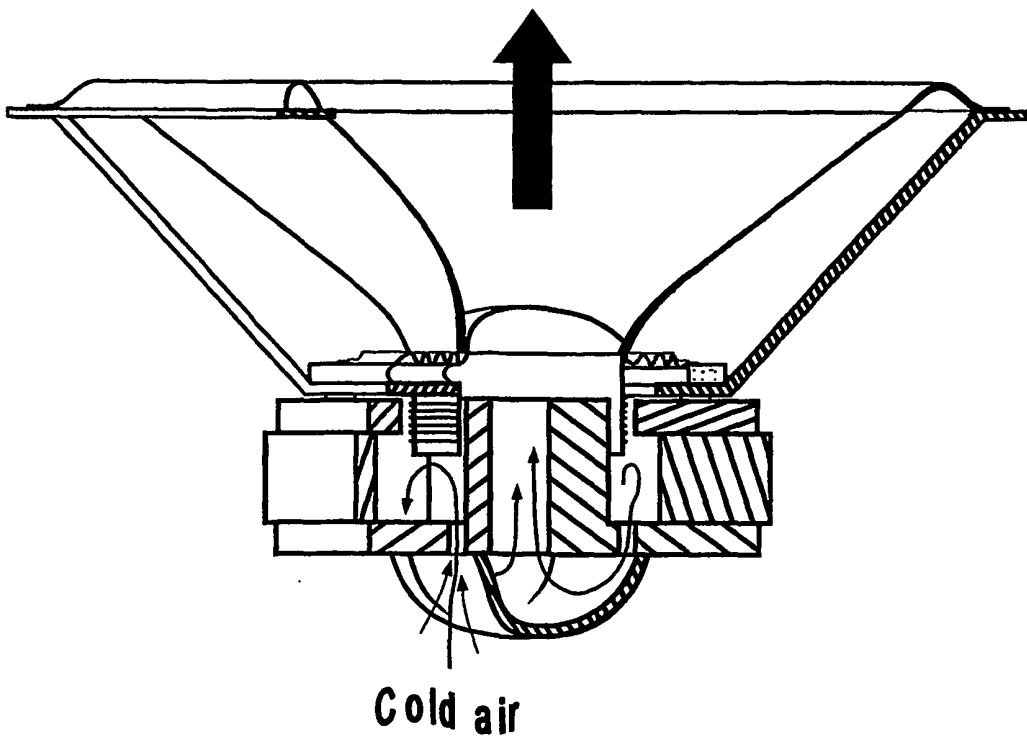


FIG. 10

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- IT FO20050001 U [0002]
- JP 2004186898 A [0013]
- CA 12270726 [0013]