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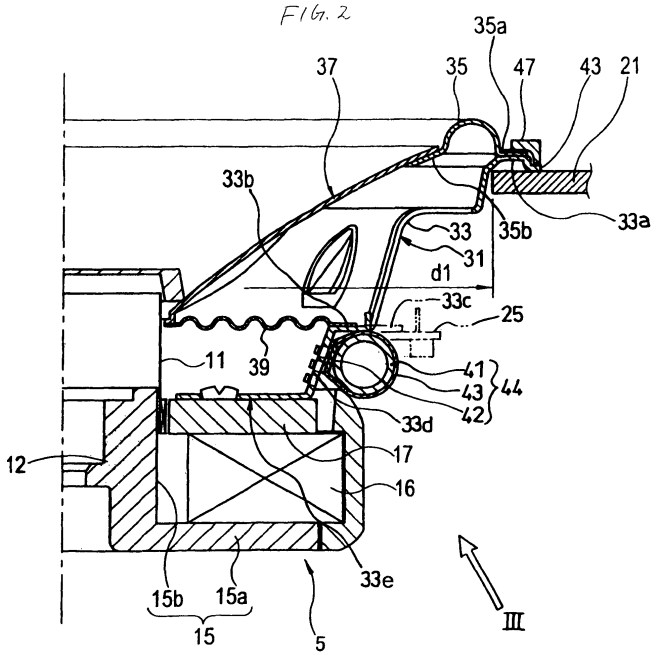
(54) Vehicle-mounted speaker apparatus

(57) An assembly in which a tying band (42) is fixed to a network coil (41) is formed by placing the tying band (42) adjacent to the outer circumferential surface of the network coil (41) parallel with the longitudinal direction of the network coil (41) and heat-shrinking a heat-shrinkable tube (43) in which the tying band (42) and the network coil (41) are inserted, and the tying band (42) of the assembly is tied to a proper portion the speaker frame (33). The network coil (including both its ends) can be fixed to the speaker frame firmly. The heat-shrinkable tube (43) which surrounds the network coil prevents the network coil (41) from waterdrop.

FIG. 2



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Description

BACKGROUND OF THE INVENTION

1. FIELD OF THE INVENTION

[0001] The present invention relates to a vehicle-mounted speaker apparatus in which a network coil is fixed to a speaker frame by a tying band.

2. DESCRIPTION OF THE RELATED ART

[0002] In vehicle-mounted audio systems etc., because of a restriction of a vehicle body side mounting space and other factors, various kinds of vehicle-mounted speaker apparatuses having a multiway speaker system have been developed in which a resin terminal plate is attached to a speaker frame (which movably supports a vibration plate) of a speaker unit and network elements are attached to the resin terminal plate.

[0003] Fig. 1 shows a resin terminal plate 1 that is attached to a speaker frame and network elements 3 and 4 that are mounted on the resin terminal plate 1 in such a vehicle-mounted speaker apparatus.

[0004] In addition to the network elements 3 and 4, input terminals 7a and 7b for connection of output lines led from an external amplifier or the like and other things are mounted on the resin terminal plate 1. A known structure for fixing such a resin terminal plate 1 to a speaker frame is such that the speaker frame is formed with female threads and the resin terminal plate 1 is screwed to the speaker frame (e.g., JP-A-2004-187233).

[0005] The large network element 3 on the resin plate 1 is a network coil (choke coil) and the small network element 4 is a capacitor or a resistor. Each of the network elements 3 and 4 is fixed to the resin terminal plate 1 in an exposed state (e.g., JP-A-2001-251694).

[0006] The small and light network element 4 is fixed to the resin terminal plate 1 by soldering lead wires to metal terminal parts that are fixed to the resin terminal plate 1. However, for the larger and heavy network coil 3, merely soldering lead wires cannot provide fixing strength that is sufficiently high to sustain vibration of a vehicle body. As shown in Fig. 1, one conventional measure is such that the network coil 3 is tied and fixed to the resin terminal plate 1 by means of a tying band 9 that is wound around the network coil 3.

SUMMARY OF THE INVENTION

[0007] However, in the network coil fixing structure shown in Fig. 1 using the tying band 9, the binding ability of the tying band 9 is effective only in a limited region in the axial direction where it is wound around the network coil 3. For example, both ends 3a and 3b of the network coil 3 cannot be fixed firmly.

[0008] As a result, vibration or the like occurring while a vehicle is running may cause both ends 3a and 3b to shake in the direction perpendicular to the center axis of the coil 3 as indicated by arrows A and B, possibly resulting in deterioration in the acoustic characteristics or damage (e.g., fatigue) of an electric connecting portion or the like.

[0009] Further, since the network coil 3 is mounted in an exposed state, it may be stained in such a manner that water condensation occurs on, for example, the inner surface of a vehicle body panel on which the speaker apparatus is mounted and resulting water droplets fall onto and cover the network coil 3.

[0010] Still further, where the tying band 9 is fixed to the resin terminal plate 1, an installation space large enough to mount the network coil 3 on the resin terminal plate 1 needs to be secured. This is a factor of causing increase of the size of the resin terminal plate 1, which in turn is a factor of preventing realization of a compact vehicle-mounted speaker apparatus or causing a cost increase.

[0011] It is an object of the present invention to provide a vehicle-mounted speaker apparatus in which deterioration in the acoustic characteristics and fatigue of an electric connecting portion or the like due to vibration of a large network coil can be prevented by fixing the network coil (including both its ends) firmly and the network coil can be prevented from being covered with droplets-turned water and thereby stained. Another object of the invention is to provide a vehicle-mounted speaker apparatus which can be made more compact and reduced in cost.

[0012] According to an aspect of the invention, there is provided with a vehicle-mounted speaker apparatus including: an assembly including: a network coil having an outer circumferential surface; and a tying band being attachable to the outer circumferential surface of the network coil along a longitudinal direction of the network coil; and a heat-shrinkable tube into which the network coil and the tying band can be at least partially inserted, wherein the network coil is fixed to the speaker frame by tying the tying band to the speaker frame.

BRIEF DESCRIPTION OF THE DRAWING

[0013]

Fig. 1 is an explanatory diagram showing a resin terminal plate that is attached to a speaker frame of a conventional vehicle-mounted speaker apparatus and mounting structures for mounting of network elements on the resin terminal plate.

Fig. 2 is a vertical sectional view of the vehicle-mounted speaker apparatus according to the embodiment of the invention.

Fig. 3 is a perspective view of a mounting portion for a network coil as viewed from a direction indicated by arrow III in Fig. 2.

Fig. 4 is a schematic diagram showing a state that the network coil and a tying band shown in Fig. 2 are

inserted in a heat-shrinkable tube.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0014] A vehicle-mounted speaker apparatus according to a preferred embodiment of the present invention will be hereinafter described in detail with reference to the drawings.

[0015] Figs. 2-4 show the vehicle-mounted speaker apparatus according to the embodiment of the invention. Fig. 2 is a vertical sectionalview ofthevehicle-mountedspeaker apparatus according to the embodiment of the invention. Fig. 3 is a perspective view of a mounting portion for a network coil as viewed from a direction indicated by arrow III in Fig. 2. Fig. 4 is a schematic view showing a state that the network coil and a tying band shown in Fig. 2 are inserted in a heat-shrinkable tube.

[0016] The vehicle-mounted speaker apparatus 31 according to this embodiment is equipped with a magnetic circuit 5, a speaker frame 33 to whose rear portion the magnetic circuit 5 is attached, a cone-shaped vibration plate 37 to whose outer circumferential portion an edge 35 having a generally semicircular cross section is connected, a cylindrical voice coil bobbin 11 which is attached to an inner circumferential flange of the vibration plate 37, a voice coil 12 which is wound around the voice coil bobbin 11, a resin terminal plate 25 on which network elements are mounted, and a network coil 41 as a network element.

[0017] The magnetic circuit 5 is composed of a yoke 15 having a structure that a cylindrical center pole 15b projects from a disc-shaped plate 15a at the center, a ring-shaped magnet 16 which loosely fitted with the center pole 15b, and a ring-shaped top plate 17 which is loosely fitted with a front portion of the center pole 15b in such a manner that the magnet 16 is sandwiched between the top plate 17 itself and the plate 15a. The top plate 17 is fixed to the rear end of the speaker frame 33.

[0018] In the magnetic circuit 5, the gap between the inner circumferential surface of the top plate 17 and the center pole 15b is a magnetic gap in which the voice coil 12 is disposed.

[0019] The voice coil bobbin 11 which is fixed to the inner circumferential flange of the vibration plate 37 is connected to the speaker frame 33 via a corrugation damper 39 in which peaks and bottoms are arranged alternately and concentrically in the radial direction, whereby the voice coil bobbin 11 is suspended so as to be movable in the axial direction of the center pole 15b.

[0020] The edge 35 is fixed to the outer circumferential portion 33a in such a manner that an attachment flange 35a as an outer circumferential portion of the edge 35 which is located outside the vibration plate 37 is adhered to an outer circumferential portion 33a (located outside a speaker mounting opening (diameter: d1) of a speaker mounting plate 21) of the speaker frame 33 and is held between the outer circumferential portion 33a and a packing 47 which is fixed to the outer circumferential portion 33a.

[0021] A flange 35b as an inner circumferential portion of the edge 35 is bonded to the back surface of the vibration plate 37 and thereby rendered integral with the vibration plate 37.

[0022] In the speaker frame 33 which is produced by press-forming a metal sheet, a flat portion 33b to which the corrugation damper 39 is attached is located in front of a rear plate 33e as a mounting portion for the magnetic circuit 5. An attachment flange 33c to which the resin plate 25 is attached is integral (continuous) with the flat portion 33b.

[0023] The attachment flange 33c is a flat plate extending outward in the radial direction from the outer periphery of the flat portion 33b, and is formed by cutting and erecting a portion of a plate material in a region where the opening of the speaker frame 33 is formed.

[0024] The resin terminal plate 25 is a resin plate that is fixed to the attachment flange 33c of the speaker frame 33 by screwing or engagement using an engagement projection etc. The resin terminal plate 25 serves as a mounting portion for terminal metal parts and small parts (e.g., resistors and capacitors) excluding the network coil 41 among various parts that are necessary for forming a network circuit of the vehicle-mounted speaker apparatus 31.

[0025] In this embodiment, the network coil 41 which is necessary for forming the network circuit is fixed singly to the speaker frame 33 by a resin tying band 42 rather than fixed to the resin terminal plate 25.

[0026] The structure for mounting the network coil 41 on the speaker frame 33 in the embodiment will be described below in detail.

[0027] As shown in Fig. 4, an assembly 44 in which the resin tying band 42 is fixed to the network coil 41 is formed in advance by placing the tying band 42 adj acent to the outer circumferential surface of the network coil 41 parallel with the longitudinal direction of the network coil 41 and heat-shrinking a heat-shrinkable tube 43 in which the tying band 42 and the network coil 41 are inserted. A state that the network coil 41 is fixed to the speaker frame 33 at a position close to the resin terminal plate 25 is established by winding and tying the tying band 42 of the assembly 44 around and to a cylindrical outer circumferential portion 33d of the speaker frame 33. The outer circumferential portion 33d is located between the rear plate 33e and the flat portion 33b at a position close to the rear end of the speaker frame 33.

[0028] As described above in detail, in the vehicle-mounted speaker apparatus 31 according to the embodiment of the invention in which the network coil 41 is fixed to the speaker frame 33 by the tying band 42, the assembly 44 in which the tying band 42 is fixed to the network coil 41 is formed by placing the tying band 42 adjacent to the outer circumferential surface of the network coil 41 parallel with the longitudinal direction of the network coil 41 and heat-shrinking the heat-shrinkable tube 43 in

which the tying band 42 and the network coil 41 are inserted and the network coil 41 is fixed to the speaker frame 33 by tying the tying band 42 of the assembly 44 to a proper portion the speaker frame 33.

[0029] Since the tying band 42 that is placed adjacent to the network coil 41 parallel with the longitudinal direction of the network coil 41 is fixed to the outer surface of the network coil 41 so as to be in close contact with the latter by means of the heat-shrinkable tube 43, the network coil 41 (including both its ends) can be fixed to the speaker frame 33 firmly when the tying band 42 is wound around and tied to the proper portion of the speaker frame 33.

[0030] Since the large network coil 41 (including both its ends) is fixed to the speaker frame 33 firmly, the network coil 41 can be prevented from shaking even if vibration occurs while a vehicle is running is propagated to the network coil 41. This prevents deterioration in the acoustic characteristics and fatigue of an electric connecting portion or the like due to coil vibration.

[0031] Since the network coil 41 is not mounted in an exposed state but surrounded by the heat-shrinkable tube 43, even if water condensation occurs on, for example, the inner surface of a vehicle body panel on which the vehicle-mounted speaker apparatus 31 is mounted and resulting water droplets fall onto the heat-shrinkable tube 41, the water droplets do not come into direct contact with the network coil 41 and hence the network coil 41 can be prevented from being covered with water and thereby stained.

[0032] In the vehicle-mounted speaker apparatus 31 according to the embodiment, the network coil 41 is directly fixed to the speaker frame 33 by winding and tying the tying band 42 directly around and to the cylindrical outer circumferential portion 33d of the speaker frame 33.

[0033] Therefore, it is not necessary to secure an installation space for the network coil 41 which is a large part on the resin terminal plate 25 which is provided on the speaker frame 33 for mounting of the parts constituting the network circuit. The size of the resin terminal plate 25 can be made smaller accordingly, which can in turn make the vehicle-mounted speaker apparatus 31 more compact and reduce its cost.

[0034] In the above embodiment, as shown in Fig. 2, the cylindrical outer circumferential portion 33d which serves as the mounting portion for the network coil 41 recedes from the outer circumferential surface of the magnetic circuit 5 and defines a groove-like space. And this space is effectively utilized as amounting space for the network coil 41 . This reduces the outward projection length of the fixed network coil 41 and thereby enables miniaturization of the vehicle-mounted speaker apparatus 31 efficiently.

[0035] The mounting position of the assembly 44 is not limited to the cylindrical outer circumferential portion 33d (above embodiment), and may be another portion of the speaker frame 33 as long as an installation surface is secured that is sufficiently wide for mounting of the network coil 41. However, to make the wiring between the network coil 41 and the other network elements as short as possible, it is desirable that the mounting position of the assembly 44 be set near the position of the resin terminal plate 25.

[0036] The cylindrical outer circumferential portion 33d is the best in this respect.

Claims

1. A vehicle-mounted speaker apparatus comprising:

   an assembly including:

   a network coil having an outer circumferential surface; and
   a tying band being attachable to the outer circumferential surface of the network coil along a longitudinal direction of the network coil; and
   a heat-shrinkable tube into which the network coil and the tying band can be at least partially inserted, wherein the network coil is fixed to the speaker frame by tying the tying band to the speaker frame.

2. The vehicle-mounted speaker apparatus according to claim 1, wherein the tying band is wound around and tied to a cylindrical outer circumferential portion of the speaker frame which is located close to a rear end of the speaker frame.

FIG. 1

PRIOR ART

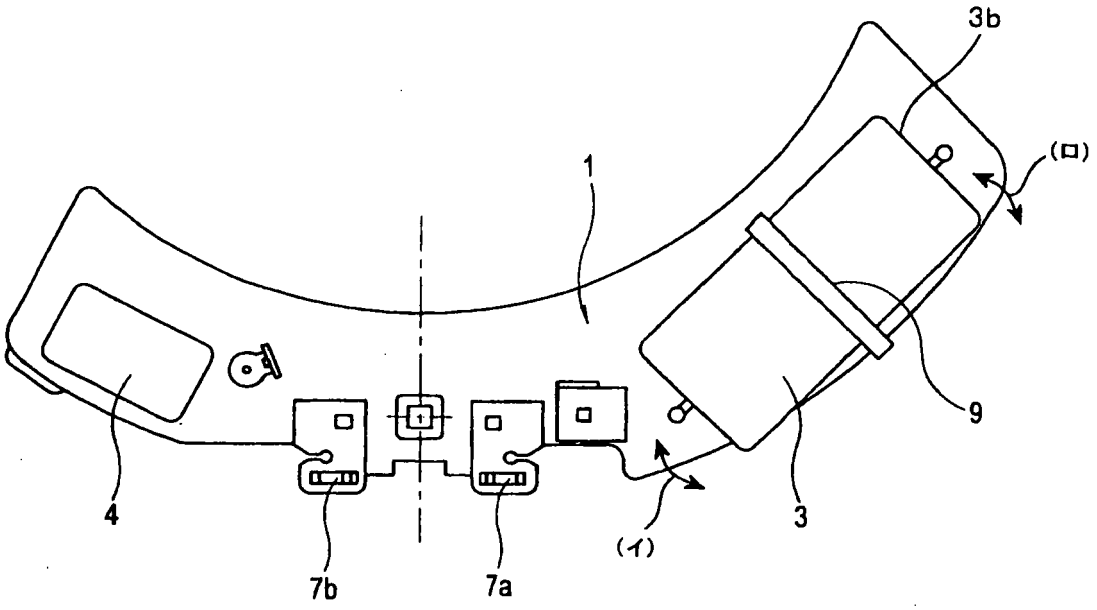
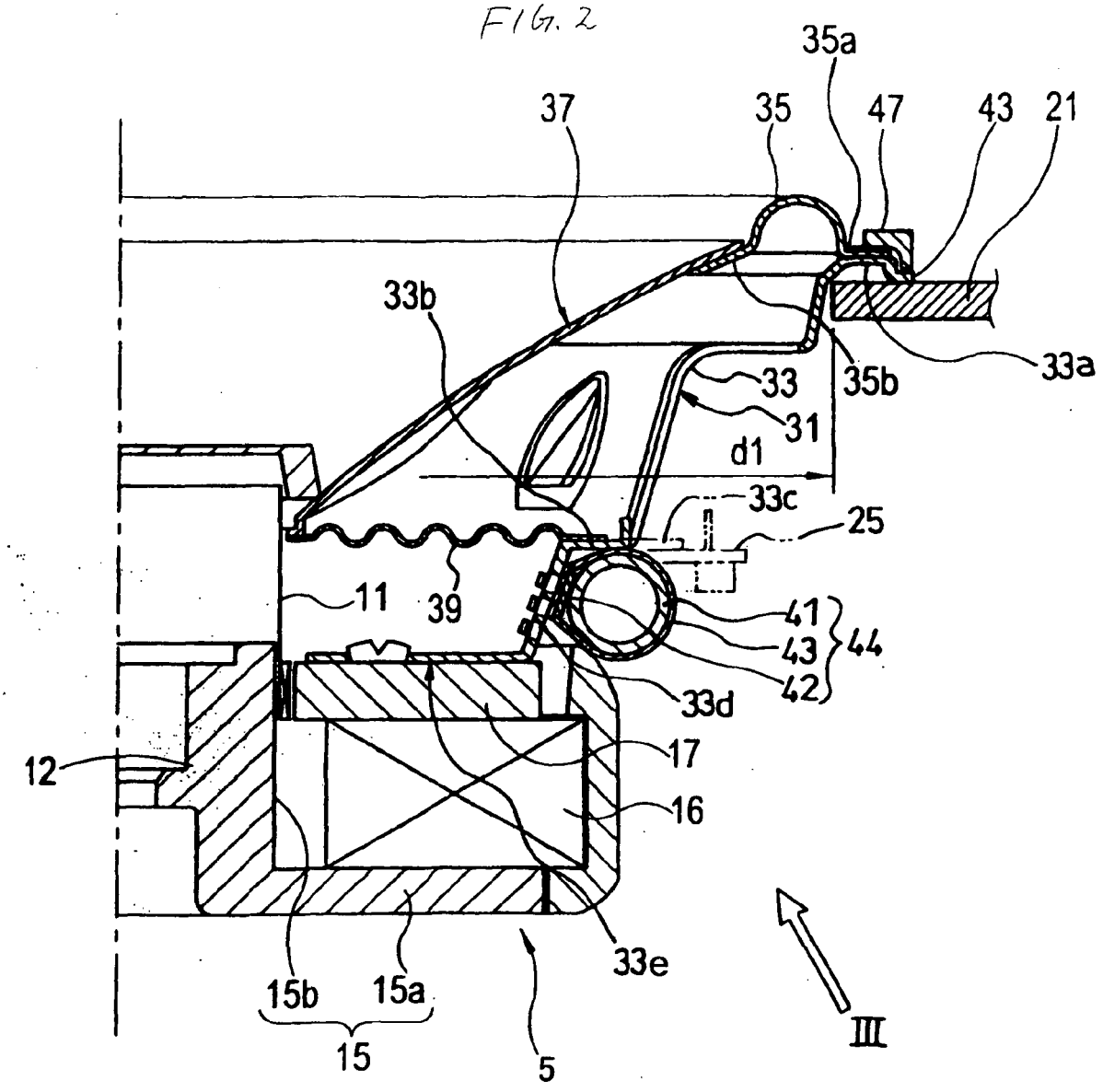


FIG. 2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III

FIG. 3

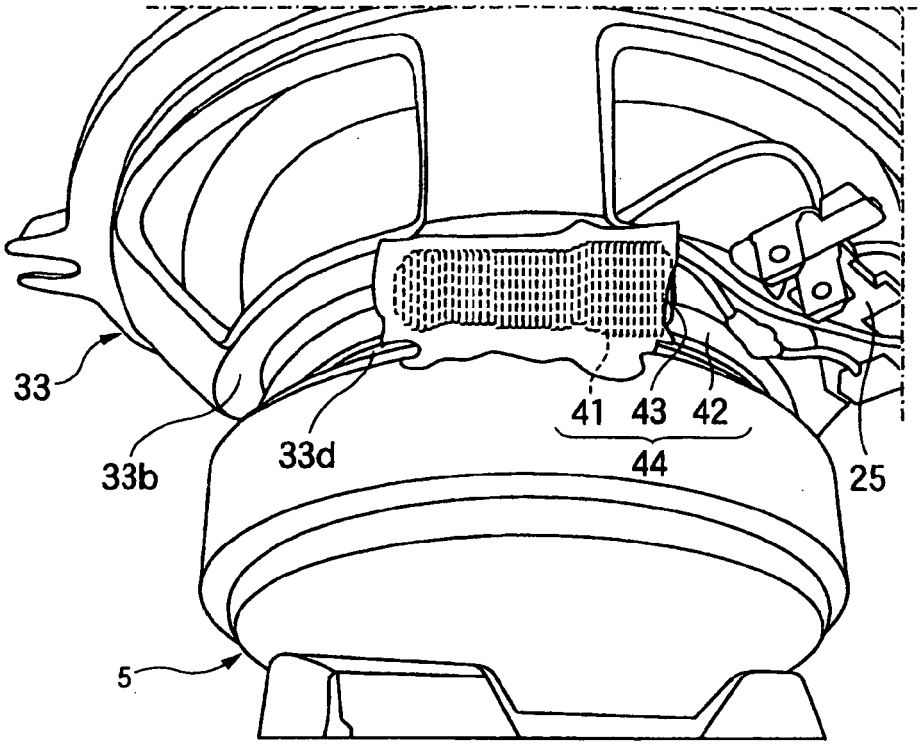

FIG. 4