

ELECTRIC NOISE ABSORBER

The invention relates to a noise absorber for electric noise.

Such a noise absorber for electric noise can be engaged on an
5 electric supply cable of an electronic device so as to prevent
externally generated electric noise from entering the electronic device
via the electric cable.

It is known that using ferrite, as a magnetic substance, to
surround an electric cable can absorb electric noise.

10 For example, Japan Published Unexamined Utility Model Application
No. 63-39997 proposes an electric noise absorber comprising two pieces
of axially divided half-cylindrical ferrite and a pair of plastic cases
to accommodate the two pieces of ferrite. The electric noise absorber,
when installed on an electric cable, attenuates electric noise flowing
15 on the electric cable.

However such an electric noise absorber has a problem in that
since the electric cable is engaged by the electric noise absorber at
apertures in the ends of the cases, the electric cable may be bent in
a sharp curve in the vicinity of the openings when external force is
20 exerted on the electric cable. Thus the electric cable may be damaged
or short-circuited during use.

According to the invention there is provided a noise absorber to
absorb electric noise on a cable comprising:

25 a body of a magnetic substance formed such that it can surround
the cable; and

first and second case members for holding the body around the
cable, the case members being pivotably attached to each other so that
they can rotate between an open position and a closed position in which
the two case members form a case around the body, wherein: two holding
30 members are provided inside each of the first and second case members
with each holding member in the first case member abutting a respective
one of the holding members in the second case member, and each pair of
abutting holding members forming an aperture when the case members are
in a closed position; the cable passes through the two apertures and is
35 gripped by the holding members; two wall members are provided on each
of the first and second case members with each wall member on the first
case member abutting a respective one of the wall members on the second
case member; recesses are provided in the abutting faces of the wall

members, which recesses form openings when the case members are in the closed position; the cable passes through the two openings; the openings have greater diameters than the apertures and the body; the two pairs of abutting holding members and the two pairs of abutting wall members are spaced along the axis of the cable such that the body is located between the two pairs of abutting holding members; and each pair of abutting wall members is located outwardly of a respective pair of the abutting holding members.

Such an electric noise absorber can avoid risk of damage to an electric cable while the electric noise absorber is installed on the electric cable.

When the case is fitted onto the electric cable of the electronic device, the noise absorber attenuates the electric noise on the electric cable. The case members are provided with a pair of holding members, to engage the electric cable, extending from the bottom inside walls of the case members toward the axis of the case. When the case is closed, abutment faces on adjacent holding members make contact, and the apertures are formed in the holding members. At both ends of the case members, the openings are defined through which the electric cable passes. The diameter of the openings is larger than that of the apertures which are defined by the abutment faces of the holding members.

The holding members, when made of elastic material such as plastics, hold the electric cable securely, because the abutment faces can deform to fit the periphery of the electric cable. Thus the tips of the holding members can be inclined in the axial direction of the electric cable and the abutment faces can move in directions orthogonal to the axis, or the abutment faces can widen along the periphery of the electric cable in directions orthogonal to the axis.

Preferably the holding members are made of elastic material to make it easier to attach the magnetic substance such as ferrite to the case or to detach the magnetic substance from the case.

Engaging projections, which are provided on the holding members and extend toward the inside of the case in the axial direction, can engage in notches formed in the magnetic substance without difficulty, so that the magnetic substance is retained in the case members.

The invention is diagrammatically illustrated by way of example in the accompanying drawings in which:-

Figure 1 is a perspective view of an electric noise absorber according to a first embodiment of the invention;

Figure 2 is a plan view of a case of the electric noise absorber;

Figure 3 is a left side view of the case shown in Figure 2;

5 Figure 4 is a front view of the case shown in Figure 2;

Figure 5 is a bottom plan view of the case shown in Figure 2;

Figure 6 is a rear view of the case shown in Figure 2;

Figure 7 is a cross-sectional view taken on line VII-VII in Figure 2;

10 Figure 8 is a cross-sectional view of the electric noise absorber in use;

Figure 9 is a perspective view of the electric noise absorber in use;

Figure 10 is a perspective view of an electric noise absorber according to a second embodiment of the invention; and

Figure 11 is a front view of an electric noise absorber according to a third embodiment of the invention.

Referring to the drawings and firstly to Figures 1 to 9, a case 2 of a noise absorber 1, shown in Figure 1, comprises boat-shaped case members 5 and 6 interconnected by a hinge 3. Two pieces of ferrite 7 are contained in the case members 5 and 6. From the bottom wall of each of the case members 5 and 6 a pair of biasing members 8 made of elastic material project upwardly so as to press the two pieces of ferrite 7 against each other.

25 Semicircular recesses 11 are provided in end walls 9 at both ends of the case members 5 and 6. Inwardly of the recesses 11 of each of the case members 5 and 6, a pair of holding members 12 extending toward the axis of the case 2 is provided, which holding members 12 may be deformed in the longitudinal direction of the noise absorber. Three teeth 14 are positioned on each of abutment faces 13 of each of the holding members 12, as shown in Figure 3. At each end of each case member 5 and 6 an engaging projection 15 is attached to the middle tooth of the three teeth 14 with the projections 15 at the opposite ends positioned opposite each other. The engaging projections 15 engage with engaging notches 22 formed at the ends of each piece of ferrite 7.

A pair of hooks 17 is provided on an outer surface 16 of the case member 6 and a pair of protrusions 18 is provided on the outer surface

of the case member 5. The pair of hooks 17 and the pair of protrusions 18 co-engage when the noise absorber 1 is closed. A plate 20 defines on another outer surface 19 opposite the outer surface 16 reinforces the engagement of the case members 5 and 6. A lenticular part 21
 5 formed in the hinge 3 disperses external force. The case 2 is integrally moulded from synthetic material. The biasing members 8, the protrusions 18 and the hooks 17 are bestowed with suitable elasticity.

The two pieces of ferrite 7 can together form an axially divided octagonal cylinder of ferrite. When the two pieces of ferrite 7 are
 10 pushed between the pair of the holding members 12 in the direction indicated by arrow A in Figure 1, the engaging projections 15 and the engaging notches 22 engage and the two pieces of ferrite 7 are securely held in the respective case members 5 and 6.

As shown in Figures 8 and 9, the noise absorber 1 is placed
 15 around an electric cable 10 of an electronic device with the case members 5 and 6 containing the two pieces of ferrite 7.

When the case members 5 and 6 are closed together, the six teeth 14 on the abutment faces 13 of the case members 5 and 6 at each end of the case 2 are disposed in a circle, forming an aperture 23 through
 20 which the electric cable 10 passes, as shown in Figure 8. The two semicircle recesses 11 however together form an opening larger than the aperture 23. Therefore, the electric cable 10 is retained securely at the apertures 23 by the teeth 14 and is held loosely at the recesses 11 at the same time. In addition, since the protrusions 18 engage with
 25 the hooks 17 and the biasing members 8 press the two pieces of ferrite 7 against each other, the pieces of ferrite 7 placed at their appropriate positions effectively absorb the electric noise.

The noise absorber 1 with the structure described above produces the effects explained below.

30 An adequate number of the noise absorbers 1 each containing the two pieces of ferrite 7, which are placed around the electric cable 10, attenuate the electric noise entering into the electronic device via the electric cable 10.

The electric cable 10 is secured by the elastic holding members
 35 12 and is also held loosely at the recesses 11. Consequently, the electric cable 10 can be bent slightly between the aperture 23 and the recesses 11 and also in the outside of the recesses 11 by external force. In brief, the noise absorber 1 prevents the electric cable 10

from being damaged by curving sharply in the neighbourhood of the recesses 11 in the case members 5 and 6.

When external force is exerted on the electric cable 10 in the axial direction, the force is absorbed by the elastic holding members 12 without a bad influence on the noise absorber 1; that is to say, the noise absorber 1 is not broken nor are the pieces of ferrite 7 moved.

Although ferrite does not withstand external force well and chips easily, it is difficult for the two pieces of ferrite 7 of this embodiment accommodated in the case members 5 and 6 to be broken.

The hinge 3 is also durable because the lenticular part 21 in the hinge 3 disperses the external force produced when the noise absorber 1 is opened or closed.

Moreover, the noise absorber 1 may be installed on electric cables of various diameters. Specifically, when the diameter of the electric cable 10 is wider than that of the apertures 23, the tips of the holding members 12 are axially inclined and the abutment faces 13 are deformed to fit the periphery of the electric cable 10 so as to grip the electric cable 10.

The noise absorber 1 can be assembled and taken apart by simple operations; the two pieces of ferrite 7 are attached to the case members 5 and 6 simply by being inserted between the holding members 12, and detached from the case members 5 and 6 by spreading the elastic holding members 12 apart.

In order to change the position of the noise absorber 1 or detach it from the electric cable 10, the hooks 17 of the case members 6 are simply pulled to disengage them from the protrusions 18.

In the second embodiment of the invention shown in Figure 10 a noise absorber 101 comprises an openable case 102 whose case members 105 and 106 have a half-cylindrical shape in the longitudinal direction. Inwardly of recesses 111 formed at both ends of the case members 105 and 106, holding members 112 are provided so as to position an electric cable (not shown). Abutment faces 113 on the holding members 112 are shaped in a semicircle to fit the periphery of the electric cable. Two teeth 114 are positioned on each of the abutment faces 113. A cylindrical piece of ferrite 107 is accommodated between the two pairs of holding members 112 of the case members 105 and 106. A pair of half-cylindrical pieces of ferrite may be utilized instead of the cylindrical piece of ferrite 107 if desired.

A pair of hooks 117 provided on the case member 105 engage with a pair of protrusions 118 provided on the case member 106 so that the case 102 may be held closed.

5 The noise absorber 101 is bestowed with durability along with other characteristics similar to those of the electric noise absorber 1 of the first embodiment. Specifically, since being rotatably connected, the electric noise absorber 101 is prevented from being damaged by opening and closing operations.

10 In the third embodiment of the invention illustrated in Figure 11, a slit 224 is formed between abutment faces 213 and 213' of each of holding members 212 so that the abutment faces 213 and 213' may be deformed in directions orthogonal to the axis of the case 2, namely, in the horizontal direction in Figure 11. The slit 224 can be cut out in U-shape as shown or in V-shape, Y-shape, or other suitable shape.

15 Although specific embodiments of the invention have been shown and described for the purpose of illustration, it should be understood that the invention is not limited to the embodiments illustrated and described, many modifications being possible within the scope of the appended claims.

20 Hard ferrite, soft ferrite, plastics magnet moulded from plastics and particles of magnetic substance including ferrite, or rubber magnet moulded from synthetic resin and particles of magnetic substance can be utilized as the piece or pieces of ferrite. Furthermore, a variety of magnetic substances including permalloy and thermalloy may be used.
25 Conductive material such as silicon steel can also be utilized as magnetic substance because the case members 5, 6, 105 and 106 function as insulating material.

CLAIMS

1. A noise absorber to absorb electric noise on a cable comprising:
a body of a magnetic substance formed such that it can surround
5 the cable; and
first and second case members for holding the body around the
cable, the case members being pivotably attached to each other so that
they can rotate between an open position and a closed position in which
the two case members form a case around the body, wherein two holding
10 members are provided inside each of the first and second case members
with each holding member in the first case member abutting a respective
one of the holding members in the second case member and each pair of
abutting holding members forming an aperture when the case members are
in a closed position; the cable passes through the two apertures and is
15 gripped by the holding members; two wall members are provided on each
of the first and second case members with each wall member on the first
case member abutting a respective one of the wall members on the second
case member; recesses are provided in the abutting faces of the wall
members, which recesses form openings when the case members are in the
20 closed position; the cable passes through the two openings; the
openings have greater diameters than the apertures and the body; the
two pairs of abutting holding members and the two pairs of abutting
wall members are spaced along the axis of the cable such that the body
is located between the two pairs of abutting holding members; and each
25 pair of abutting wall members is located outwardly of a respective pair
of the abutting holding members.
2. A noise absorber according to claim 1, wherein the diameter of
the apertures is slightly larger than the diameter of the cable, and a
30 plurality of teeth located on the holding members protrude into the
apertures and contact the cable.
3. A noise absorber according to claim 2, wherein the holding
members are resiliently provided within the case members such that the
35 holding members can deflect along the axis of the cable.
4. A noise absorber according to claim 3, wherein:
the magnetic body is divided into two magnetic pieces, with



grooves cut in each magnetic piece; and

each magnetic piece is securely held in a respective one of the case members such that the cable can be inserted into either of the grooves when the case members are in the open position and the cable is surrounded by the two magnetic pieces when the case members are in the closed position.

5. A noise absorber according to claim 4, wherein the two case members are pivotably attached to each other by a resilient plastics hinge having a lenticular member formed thereon.

6. A noise absorber according to claim 5, wherein:
at least one protrusion is located on the first case member and at least one hooking means is located on the second case member, the hooking means and the protrusion can lock the two case members together when the case members are in the closed position; and

biasing means are formed on the inside of the case members for forcing the two magnetic pieces together when the case members are in the closed position.

7. A noise absorber according to claim 3, wherein a semi-circular opening is defined in each holding member and abutment surfaces are located on the holding members on both sides of the semi-circular opening, where the abutment surfaces of each holding member in the first case member contact the abutment surfaces of one of the holding members in the second case member such that the semi-circular openings in each pair of abutting holding members form the apertures.

8. A noise absorber according to claim 6, wherein a slit is formed in each holding member between the abutment surfaces such that the holding members may deflect in directions orthogonal to the axis of the cable.

9. A noise absorber for absorbing electric noise on a cable substantially as hereinbefore described and illustrated with reference to the accompanying drawings.
