

DESCRIPTION

DEVICE FOR ABSORBING ELECTRICAL NOISE

The invention relates to a device for absorbing electrical noise with the aid of elements made from a noise absorbing or preventing material placed around an electrical cable.

It has long been known that with the aid of ferromagnetic material elements it is possible to reduce electrical noise on the line (US patent 34 62 715).

It is also known to make such ferromagnetic material elements in split form, so that they can be subsequently fitted to a cable. The two parts must be in contact so that the action is effective.

This can e.g. be brought about in that (EP-A-452 992) the two half-elements are placed in a casing, whose bases have elastic pretensioning means pressing the two magnetic elements onto one another.

The problem of the invention is to provide a device for absorbing electrical noise, which has a simple construction and in which the insertion of the elements of a noise absorbing or preventing material is easy.

The invention proposes solving this problem by a device having the features given in claim 1. Further developments of the invention form the subject matter of dependent claims.

The device can be so fitted to an electrical cable in which noise is to be reduced that the two casing half-shells with the noise preventing or absorbing material elements located therein are fitted round the cable. This can e.g. take place by folding together or assembling the two casing half-shells.

If the two elements are subsequently inserted in the previously manufactured casing half-shells, fitting takes place in such a way that initially the two elements made from the material are inserted in the two casing half-shells and subsequently secured by in each case one web. The web thereby traverses the in any case present semicylindrical groove of the ferromagnetic material element. Subsequently the two casing half-shells can be assembled round the

electrical cable.

The interconnection of the two casing half-shells can take place by means of snap-on devices or in any other way, e.g. by an adhesive tape, wire or the like placed around the outside of the casing.

In particular, in a further development, for locking the casing on one casing half-shell is provided a tongue having a tooth system and which cooperates with a tooth system on the other half-shell. As a result of the fine tooth system the casing can be locked in finely graduated positions, so that it is possible to compensate tolerances in the manufacture of the ferromagnetic material elements.

It is possible to fit such tongues and tooth systems to both longitudinal sides or both end faces. The tongues can in particular be so positioned that they also bring about a reciprocal alignment of the two casing half-shells.

The tooth systems are so chosen that they have a sawtooth configuration, i.e. prevent unintentional release.

It is also possible to interconnect the two casing half-shells by a film hinge on each longitudinal side thereof, so that they can then be folded from the open into the closed state. Here again a tongue with a tooth system is possible for locking purposes.

For angular alignment of one of the two ferromagnetic material elements, on the bottom of a casing half-shell can be shaped a rigid and in particular rounded projection, which preferably extends over the entire casing length. The outside of the ferrite element then rests on the projection and can tilt within certain limits about its longitudinal axis.

According to a further development of the invention the web, which is used for fixing the ferrite elements, can be in the form of a semicylinder, so that in the assembled casing state the webs in the two half-shells form a closed cylinder, which completely covers the inside of the semicylindrical grooves of the ferrite elements. In the closed state the longitudinal edges

of the two semicylinders engage on one another and consequently hold the webs in position.

For fixing the device to the electrical cable, according to the invention at least one of the webs forming the fixing device can have an inwardly directed projection for fixing the cable. This projection can have an elastic construction. It is also possible for the two webs, particularly the two semicylinders, to have such a projection, which is preferably centrally positioned.

According to a further development of the invention the webs can be laterally insertable into the casing half-shells. It is also possible and is proposed that the web is connected by means of a film hinge to one end of a casing half-shell.

Further features, details and advantages can be gathered from the claims, whose wording is made by reference into content of the description, the following description of a preferred embodiment of the invention and the attached drawings, wherein show:

- Fig. 1 A longitudinal section through a device according to the invention in the assembled state.
- Fig. 2 A cross-section through the arrangement of fig. 1.
- Fig. 3 A longitudinal section through a casing half-shell in the folded up state.
- Fig. 4 A side view of the device corresponding to fig. 1.
- Fig. 5 A plan view of a second embodiment with the elements not yet inserted.
- Fig. 6 A section corresponding to fig. 3 of the embodiment of fig. 5.

- Fig. 7 A cross-section through the arrangement of fig. 5 along line VII-VII therein.
- Fig. 8 A front view of another embodiment.
- Fig. 9 A part section through a half-shell in another embodiment.
- Fig. 10 A plan view of a modified half-shell.
- Fig. 11 A plan view of a web for the half-shell shown in fig. 10.
- Fig. 12 A plan view corresponding to fig. 10 of a half-shell in another embodiment.
- Fig. 13 A simplified representation corresponding to fig. 2 of another embodiment.
- Fig. 14 A larger scale partial section through a locking device between two casing halves.

Fig. 1 shows the device proposed by the invention in the ready-to-operate state, it being necessary to imagine the electrical cable in which the electrical noise is to be suppressed. The device contains a casing 1 formed from two casing half-shells 2, 3. The two casing half-shells 2, 3 are so joined together that their open sides rest on one another. As a result the assembled casing has in its two end faces a through opening 7, which are aligned. In one casing half-shell 2 is inserted a ferromagnetic material element 5, which has roughly the same length as the interior of the casing half-shell 2. The ferromagnetic material element 5, hereinafter referred to as ferrite element, has on its one side a semicylindrical groove 6 extending over the length of the ferrite element 5. In the assembled state according to figs. 1 and 2, the two ferrite elements 5 face one another in such a way that the two semicylindrical grooves 6 together form a cylindrical passage. The two adjacent separating faces 7 rest on one another. As a result a closed ferrite body is formed round the passage and through it passes the electrical cable.

Onto the two half-shells 2, 3, cf. now fig. 3, is shaped on the end face 8 a web 9 with the aid of a film hinge 10. The web 9 is in the form of a circular semicylinder or expressed otherwise a half-tube 11. Roughly in the centre of the longitudinal extension is formed in the web 9 a resilient projection 12, which projects into the channel formed by the half-tube 11 and is provided with two individual, small prongs 13.

The second casing half-shell 2, which in fig. 3 is to be considered behind the visible casing half-shell 3, is also articulated with the aid of a film hinge 14 onto the casing half-shell 3 and also this second casing half-shell 2 has a web 9 articulated by means of a film hinge 10.

In the two open half-shells 2, 3 in the position shown in fig. 3 are inserted the ferrite elements 5, namely one ferrite element 6 in each half-shell, the grooves 6 being located at the top, i.e. towards the open side of the half-shells 2, 3. The base of one of the two half-shells 2 contains a rounded projection 15 running in the longitudinal direction of the casing, cf. above in fig. 2, on which rests the corresponding ferrite element 5. Through a certain amount of rolling on the crest of the projection 15 it can also tilt somewhat. The two locking webs 9 are now folded round until they are located in and lock in the groove 6 of the ferrite elements 5. The casing is then closed by folding together the two half-shells round the film hinge 14. On the longitudinal side of the casing opposite to the film hinge 4, the half shell 3 has a tongue 16, which has on its inside a single tooth or a row of teeth. The tongue 16 is so dimensioned that its inside is roughly flush with the outside of the facing half-shell. This second half-shell, namely the top half-shell in fig. 2, contains at this point a row of teeth 17, cf. also fig. 4. The teeth have a sawtooth configuration, so that it is impossible to detach the tongue 16 without using a tool. On folding together the casing half-shells 2, 3 they are pressed onto one another to such an extent that the two ferrite elements 5 engage on one another at their separating faces 7. In this position the tongue 16 remains locked with respect to the tooth system 17. The tongue 16 has three webs 16a, b, c, with which it is shaped onto the casing half-shell 3, its free end then being connected in one piece by a crossbolt 18. The shaping or articulation of the tongue 16 is immediately alongside the edge 19 of the casing half-shell 3 facing the other

casing half-shell 2. This prevents any resilience of the locking system.

If the device proposed by the invention is folded round a electrical cable, then the projections 12 engage on the outside of the cable, so that the overall device is non-positively fixed to the cable.

When the casing is locked the longitudinal edges 20 of the separating plane of the webs 9 engage flat on one another.

In the represented embodiment the two half-shells are articulated together with the aid of a film hinge 14. It would also be possible to construct the two casing half-shells as separate parts and then e.g. bring about fixing in such a way that the casing half-shell 3 has a tongue 16 on each of its two longitudinal sides and the other casing half-shell has a corresponding tooth system 17 on both sides. This would also lead to a locking of the casing in the closed state.

The embodiment shown in figs. 5 to 7 differs slightly from the preceding embodiment and consequently only the differences will be explained.

Onto the base 21 of the two casing half-shells 22, 23, a short distance behind the end walls 24, are in each case shaped two transversely directed webs 25. The two pairs of webs 25 serve to compensate tolerances during the manufacture of the elements to be inserted in the casing half-shells. In this embodiment they replace the centring projection 15 provided in the embodiment of figs. 1 to 4 on the base of one or both half-shells.

Once again on the unilateral end walls 24 of the two half-shells 22, 23 is attached by means of a film hinge 26 in each case one cross-sectionally roughly U-shaped channel 27. This channel is used for fixing the elements and for this purpose is placed around the film hinge 26, the terminal edge 28 facing the film hinge 26 being locked in the casing, no details being shown.

The base of the channel 27 has two shaped projections 29, which project into the interior of the channel 27 and secure the electrical cable there.

On the longitudinal side remote from the film hinges 30 linking the two casing half-shells 22, 23, one of the half-shells 22 has a tongue 31, which has on its inside a rib or tooth system. Correspondingly the facing side wall of the other casing half-shell 23 has a rib system 32 in sawtooth form, which cooperates with the rib system on the inside of the tongue 31.

The tooth system 33 on the inside of the tongue 31 can in particular be gathered from fig. 6, which shows the tongue 31 in side view. The tooth system 33 can also be seen in fig. 7.

Fig. 8 shows another embodiment, which has a casing comprising two casing half-shells 34, 35. The casing comprising the two half-shells 34, 35 is injection moulded round the noise absorbing material elements placed in a mounting support. As a result of the shrinkage occurring with this manufacturing mode the casing contracts somewhat, so that it adheres in non-positive manner to the outside of the elements 5. The tolerances which may arise during the manufacture of the ferrite material elements are compensated when the casing half-shells are made in this way, so that a simple snap hinge closure 36 is sufficient for fixing purposes. Also in the embodiment according to fig. 8 the inside of the semicylindrical groove 6 of the elements 5 can be covered by a plastic layer, which is manufactured during injection moulding. However, this is not necessary.

In the case of the half-shell for housing one element made from the electrical noise preventing or absorbing material shown in fig. 9 a somewhat resilient hook 42 is shaped onto a side wall 41 and forms in the area of its free end a barb 43. With this hook 42 the casing 40 can e.g. be fixed to a printed circuit board or some other component in that the hook 42 is introduced through an opening or breakthrough. On the opposite side wall, not shown in fig. 9, is provided a correspondingly shaped, symmetrically arranged hook 42, so that fixing can take place by merely snapping in. The distance between the underside of the base of the half-shell 40 and the barb 43 can be matched to the conventional circuit board thickness.

Figs. 10 and 11 show details of another embodiment, in which the locking teeth 45 provided for locking the two half-shells 44 are located within a

recess 49 of the longitudinal side wall of one half-shell 44. The tongue on the other half-shell can be so shaped that it can engage in the recess 46. The edges of this tongue slide in the laterally constructed grooves 47 of the recess 46. This not only ensures a reliable guidance of the tongue on enclosing the casing, but also prevents an engaging behind of the tongue when the casing is closed.

Once again in the end walls 49 of the half-shell 44 are formed semicircular openings 50 for the passage of the cable, to which the half-shells are to be fixed.

The base 48 of the half-shell has two ribs 51 running transversely to the connecting line of the openings 50 and which serve to compensate tolerances of the ferrite cores.

In the semicircular openings 50 of the end walls 49 are provided several projections 52, 53. The central projection 53 can have a type of tongue.

With the projections 52, 53 cooperate the front end of the transverse web 9 according to fig. 11. Fig. 11 shows such a transverse web 9, which has a similar construction to the web 9 of the embodiment of fig. 3, i.e. in the form of a channel or half-tube. In the area of its front ends it has a breakthrough 54, whose shape and dimensions correspond to the tongue-like projection 53 in the semicircular openings 50 of the half-shell 44.

On both longitudinal edges 55 of the component are made notches 56, which cooperate for locking purposes with the projections 52. The notches 56 need not extend to the planar separating line of the channel-shaped component.

After inserting a ferrite element in the half-shell 44, the web 9 shown in fig. 11 is inserted in the semicircular openings 50 and guided and fixed there with the aid of the cooperation of the projections 52, 53 and the breakthroughs 54, notches 56 respectively.

Fig. 12 shows another half-shell 57, which corresponds to the half-shell 44 of the embodiment of figs. 10 and 11, but in which the base 58 of the half-

shell has a longitudinally directed rib 59, which takes the place of the two ribs 51. The rib 59 has a cross-sectional shape roughly corresponding to the cross-sectional shape of the rib 25 in fig. 6. Thus, the cross-sectional shape is roughly triangular, optionally with a rounded upper edge.

In all the represented embodiments the two half-shells with the inserted noise absorbing material cores are folded round the line and closed. The tongue engages to a greater or lesser extent into the tooth system of the other part, as a function of the actual size of the inserted elements. For tolerance reasons they can have somewhat differing dimensions. Thus, in this case the casing could be slightly opened compared with the representation of figs. 1, 2 and 4, but it is always ensured that the separating faces 7 of both elements are in tight engagement.

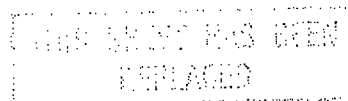
In the embodiment shown in simplified form in fig. 13, the two longitudinal sides of the ferrite core 5, i.e. both sides of the half-cylinder inner opening, are in a slightly bulging form, particularly on the side where the casing is open. The casing has on this open side an undercut. In this way the ferrite core 5 can be more easily secured in the casing, which is of particular interest during the storage and handling of the absorber prior to assembly.

Fig. 14 shows in a larger scale partial section a locking device, which has a similar construction to the locking device of the embodiment of figs. 11 and 12. The locking teeth 45 in the recess 46 are in this case located on the outside of a slightly resilient tongue 60. If the web 31 with the tooth system 33 is inserted in the recess 46, the tongue 60 springs back somewhat and is locked particularly securely with the web 31.

For opening purposes a screwdriver or other tool can be pressed onto the outside of the web 31 and consequently the tongue 60 is somewhat inwardly deformed.



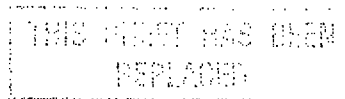
CLAIMS



1. Device for absorbing electrical noise having
 - 1.1 a casing (1), which
 - 1.1.1 has two casing half-shells (2, 3) for receiving in each case one noise preventing material element (5) and
 - 1.1.2 in the assembled state in its two end faces in each case one passage opening (4) for an electrical cable,
 - 1.2 two elements (5) from said material, which
 - 1.2.1 are placed in the casing half-shells (2, 3) and
 - 1.2.2 in each case have a semicylindrical groove (6), which
 - 1.2.3 in the assembled state of the casing (1) form a closed, cylindrical passage for the electrical cable, as well as with
 - 1.3 a fixing device for fixing the elements (5) made from said material in the particular half-shell (2, 3).
2. Device according to claim 1, wherein the fixing device for each half-shell (2, 3) has a web (9) extending from one end face to the other of the casing (1) and passing through the semicylindrical grooves (6) of the two elements made from the material.
3. Device according to claim 1 or 2, wherein for locking the casing in the closed state at least on one half-shell is provided, particularly shaped, a tongue (16) provided with a tooth system, which cooperates with a tooth system (17) on the other casing half-shell (2).
4. Device according to one of the preceding claims, wherein the two casing half-shells (2, 3) are interconnected on one longitudinal side thereof by a film hinge (14).
5. Device according to one of the preceding claims, wherein for the alignment of an element (5) made from the material on the base of one casing half-shell (2) is shaped a rounded, rigid projection (15), which preferably extends over the entire length of the casing (1).

This Sheet Has Been Replaced





6. Device according to one of the preceding claims, wherein the web (9) is in the form of a semicylinder (11).
7. Device according to one of the preceding claims, wherein the web (9), preferably in the centre of its longitudinal extension, has an inwardly directed projection (12) for fixing the casing (1) to the electrical cable.
8. Device according to one of the preceding claims, wherein the web (9) is connected with the aid of a film hinge (10) to one end face (8) of a casing half-shell (2, 3).
9. Device according to one of the claims 1 to 7, wherein the web (9) is in particular laterally insertable into the casing half-shell (2, 3).
10. Device according to one of the preceding claims, wherein the two casing half-shells (34, 35) are injection moulded around the noise absorbing material elements (5).
11. Device according to one of the preceding claims, wherein the fixing of the elements (5) in the casing half-shells (34, 35) takes place by a non-positive engagement of the casing half-shells (34, 35) on the elements (5), which is in particular brought about by a shrinkage of the casing material.

This Sheet Has Been Replaced

