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J. C. BRANDON, JR., ET AL

3,018,455

APPARATUS FOR ENCASING MAGNETIC CORES

Filed May 24, 1955

FIG. 1.

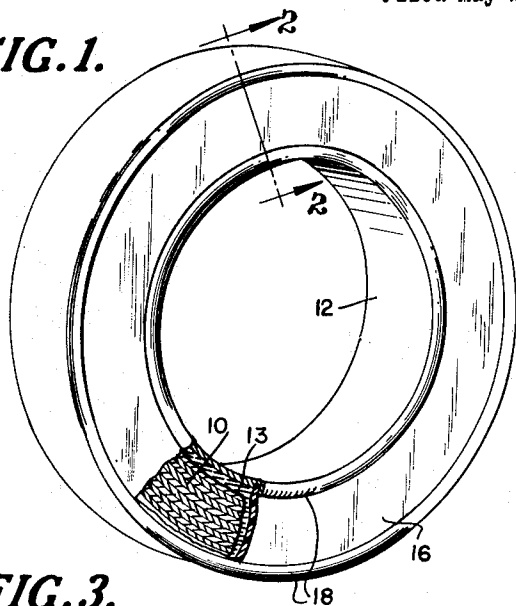


FIG. 2.

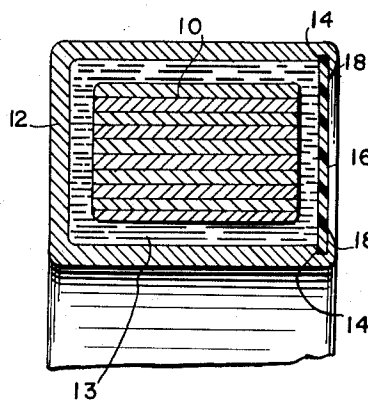


FIG. 3.

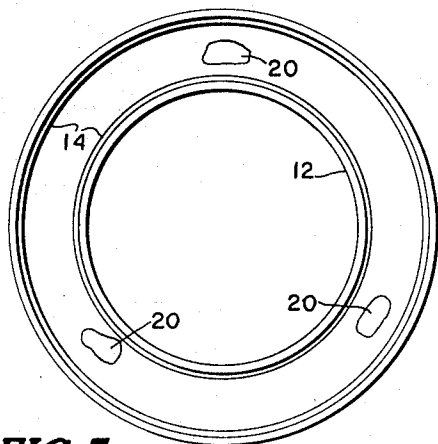


FIG. 4.

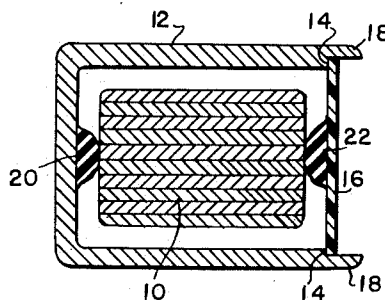


FIG. 5.

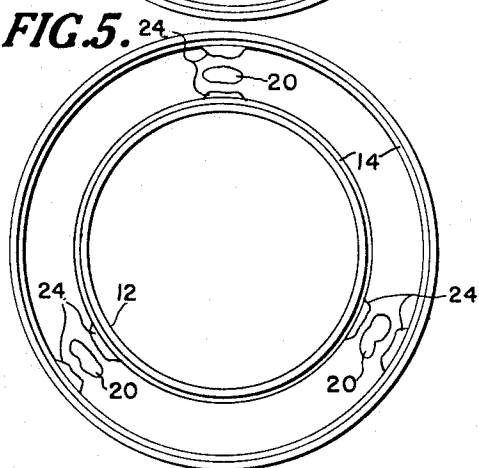
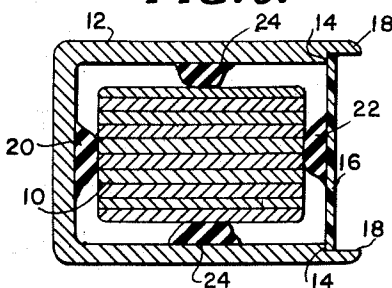


FIG. 6.



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3,018,455

APPARATUS FOR ENCASING MAGNETIC CORES
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8 Claims. (Cl. 335-100)

This invention relates to magnetic core devices and particularly to encasements for magnetic cores and methods for cushioning such a core within an encasement.

The phrase "magnetic cores" as used herein is intended to include not only toroidally shaped endless or annular cores but also cores having hollow square, rectangular or other configurations in plan view with or without an air gap in their circumference. Magnetic cores are well known in the art and are particularly useful with magnetic amplifiers, saturable reactors, saturable transformers, magnetic relays, and the like. In the prior art such cores have been fully encased in a thermosetting plastic material or in nylon boxes. It has been found that the strain produced in the core by winding copper wire windings around the encasement undesirably changes the magnetic characteristics of the magnetic core. This frequently is true even though a cushioning material is disposed between the core and the encasement, because plastic and nylon boxes do not have sufficient structural strength to prevent deflection and distortion of the magnetic core when mechanical stresses are imposed on its encasement.

The present invention obviates the above-mentioned problems by providing a metallic container having a structural strength much greater than the prior art plastic and nylon boxes. A core cannot be entirely surrounded by continuous metallic material, however, since a full metallic encasement would allow eddy currents to be set up within the metallic encasement and thereby reduce the effective inductance of the core.

One phase of the invention provides a full encasement comprising a metallic, non-magnetic container disposed partially around the magnetic core, the remainder of the encasement being closure means made of non-metallic material having strength characteristics approximating the strength characteristics of the metallic container. Therefore, any eddy currents tending to be induced in the metal container will be prevented and the full flux created will be permitted to link the windings placed about the core.

Another phase of this invention provides for non-magnetic, metallic closure means secured against the metallic container but electrically insulated therefrom.

Another phase of this invention in conjunction with either of the preceding phases, is the provision of an encasement which will withstand temperatures up to approximately 500° F. This is an important feature since modern day magnetic core devices are utilized in extremely compact equipment such as that for aircraft.

Still another phase of this invention is the provision of a novel method of cushioning the magnetic core within the encasement. Small discrete quantities of silicone rubber are distributed within the container for the magnetic core to rest against. The core is then inserted and other small discrete quantities of silicone rubber are spaced around the exposed portion of the core. The closure means is then placed upon shoulders provided in the metallic container and the open end portions of the container are folded over the closure means. The core then is fully enclosed and cushioned. The rubber cushion prevents vibration and shock from being transmitted into the magnetic material of the core in such a fashion as to adversely affect magnetic properties.

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Another phase of this invention is the sealing of the encasement to allow subsequent vacuum impregnation. The folding over of the end portions presses the closure means tightly against the shoulders of the container and thereby provides a seal. To insure even a more perfect seal, sealing compounds may be applied before folding over the end portions.

Yet another phase of this invention is to prevent shorting of windings placed about the encasement to the metallic container. In this respect, a silicone varnish is applied at least to a portion of the outside of the metallic container and, preferably but not necessarily, to the exposed portions of the closure means. If silicone rubber is used for cushioning, the rubber and varnish may be cured simultaneously.

In the prior art, the cushioning material frequently utilized is grease or oil packed fully between the core and non-magnetic box. A cushioning material of this type may be utilized with this invention; however, after insertion of such a grease or oil it has frequently been found difficult to remove the seemingly inevitable excess thereof from the shoulders or ledge upon which the closure or lid rests and defective sealing has resulted. The above-mentioned silicone rubber cushioning completely obviates this difficulty.

A primary object of this invention is to provide an encasement for a magnetic core so that windings placed about the encasement cannot deflect or distort the core and thereby change the magnetic characteristics of the core.

Another object, in conjunction with the above object, is the provision of an encasement made partially of non-magnetic metal, the remainder of the encasement being at least partially an insulating material to prevent induced eddy currents.

Another object of the invention in conjunction with the preceding object, is to construct said remainder wholly of non-metallic materials.

Still another object of the invention is to provide for a magnetic core an encasement comprising two parts both of non-magnetic, metallic materials insulated from each other when assembled.

Still another object of the invention is to provide for a magnetic core an encasement which will withstand temperatures up to approximately 500° F.

Another object of the invention is to provide for a magnetic core a partially metallic, sealed encasement which will withstand vacuum impregnation of the windings on the encasement.

A further object of this invention is to provide for a magnetic core a partially metallic encasement having at least a predetermined amount of the metal casing covered with insulation so that the windings placed thereabout may not be damaged during assembly or shorted to the metal casing.

Another object of the invention is to provide material between a magnetic core and encasement for cushioning the core without surrounding it completely.

Another object of the invention in conjunction with the preceding object, is to make the cushioning material of silicone rubber placed in small discrete quantities at least on two sides of the core.

A further object of the invention in conjunction with the preceding object, is to make the cushioning material of silicone rubber placed in small discrete quantities at least on two sides of the core.

A further object of the invention in conjunction with the preceding object, is to place the silicone rubber in predetermined places on all four sides of the core.

Further objects and the entire scope of the invention will become further apparent from the following detailed

description of the exemplary embodiments of the various phases of the invention.

The exemplary embodiments according to the invention may be best understood with reference to the accompanying drawing wherein:

FIGURE 1 is a perspective view of a magnetic tape wound core encased in accordance with this invention. Parts are broken away to illustrate details;

FIGURE 2 is a cross-sectional view taken approximately along the line 2—2 of FIGURE 1;

FIGURES 3 and 4 illustrate one embodiment for cushioning a magnetic core within an encasement; FIGURE 4 being a cross-sectional view of the container of FIGURE 3 with parts added; and

FIGURES 5 and 6 illustrate another embodiment for cushioning of a magnetic core with an encasement; FIGURE 6 being a cross-sectional view of the container of FIGURE 5 with parts added.

In reference now to the drawings, there is shown in FIGURES 1 and 2 a magnetic core device having a magnetic core 10 surrounded by an inert cushioning material 13, such as silicone grease or oil, all of which is partially enclosed in a non-magnetic, toroidal metallic container 12 which is U-shaped in radial section. At the open end of the container 12 the inner and outer walls thereof are formed with interior circumferential ledges or shoulders 14 against which is set a non-metallic closure means such as the annular lid 16. The end portions 18 of the inner and outer walls extending beyond the lid 16 have been folded over the latter (for example, by crimping or spinning) to hold it in place. It is apparent, then, that the container 12 and lid 16 provide a full encasement for the core 10 and its cushioning material 13. The folding over of ends 18 may effectively seal the encasement; however, a sealing material (not shown) may be used in conjunction with the lid 16 and the folded ends 18 to provide a more perfect seal if desired. Therefore, it is evident that any windings placed about the encasement may be vacuum impregnated without any deleterious effect upon the magnetic core 10.

The magnetic core 10 is preferably a tape wound core of an alloy made in accordance with the patent to E. A. Gaugler, 2,569,468, issued October 2, 1951. The invention, however, is not limited by the type core within the container 12, the principles of this invention being applicable as well to stacked washer cores, bobbin cores, powdered iron cores, and the like.

Preferably, container 12 is constructed of aluminum to reduce manufacturing costs and provide lightness in weight. However, other non-magnetic, comparatively strong, metallic materials—metals or alloys—may be utilized in constructing the container 12. For example, magnesium, brass, copper, and the like, are suitable materials for container 12.

Continuing to refer to FIGURES 1 and 2, the lid 16, which, as hereinbefore mentioned, prevents eddy current from being induced in, and from circulating around, the container 12 since the electrical current path is broken thereby, may be made of any electrical insulating material which has the desirable strength and temperature characteristic for a given situation. For temperatures near 500° F., silicone resin impregnated glass or a polymer of tetrafluoroethylene as manufactured under the trademark Teflon or other suitable materials may be used. Alternatively, the lid 16 may be made of a non-magnetic metal such as aluminum and insulated (for example, with a polymer of trifluorochloroethylene as manufactured under the trademark Kel-F) at least along one of its marginal edges where contact would otherwise be made with the container 12. For lower temperatures, thermosetting plastics such as phenolic resins (e.g., phenol formaldehyde and phenol furfuraldehyde resins) or a melamine formaldehyde resin may be employed as the material for the lid. Any other electrical insulating materials

which will provide sufficient strength at a desired operating temperature are within the purview of this invention.

As previously mentioned, the silicone grease or oil 13 illustrated in FIGURES 1 and 2, provides a cushion for the magnetic core 10. However, such cushioning material will be absorbed to some extent by lid 16 and, particularly, by lids made of the above-mentioned thermosetting plastics. FIGURE 3 illustrates a method of obviating the use of grease as a cushioning material. Around the bottom or integrally closed end of the container 12 are placed discrete quantities 20 of silicone rubber. The specific illustration shows three such quantities 20; however, more or less may be used if desired. It will be apparent, however, that if the enclosure is completely filled with silicone rubber, the subsequent curing of the rubber will tend to cause a pressure within the container which may distort the magnetic characteristic of the core. After insertion of the core 10, as shown in FIGURE 4, another set of discrete quantities 22 of silicone rubber may be annularly spaced around the then exposed end of the core. Therefore, after the insertion of lid 16, the folding over of end portions 18, and the application of a silicone varnish on the outside of the encasement, both the silicone rubber and the silicone varnish may be cured simultaneously at a temperature which will not adversely affect the magnetic characteristics of the core 10. The magnetic core is consequently prevented from movement, particularly in the sidewise direction.

Another modification is shown in FIGURES 5 and 6 wherein not only the discrete quantities 20 and 22 are utilized, but also additional discrete quantities 24 of silicone rubber are disposed along the inner sides of container 12 at desirable spacings. The core 10 is then cushioned permanently to prevent movement thereof against any part of the container 12 or the lid 16.

Modifications of this invention not described herein will become apparent to those skilled in the art. Therefore, it is intended that the matter contained in the foregoing description and the accompanying drawings be interpreted as illustrative and not limitative, the scope of the invention being defined in the appended claims.

What is claimed is:

1. An enclosed magnetic core device comprising an encasement, a magnetic core within the encasement, and cushioning means disposed within the encasement separating all surfaces of the magnetic core from the encasement; the encasement including a non-magnetic metallic container partially enclosing the core, non-magnetic closure means joined to the container to complete enclosing the core, and sealing means between the container and the closure means.
2. An enclosed magnetic core device comprising an encasement, a magnetic core within the encasement, and cushioning means disposed within the encasement completely surrounding the magnetic core and separating the magnetic core from the encasement; the encasement including a non-magnetic metallic container partially enclosing the core and non-magnetic closure means joined to the container to complete enclosing the core.
3. An enclosed magnetic core device comprising an encasement, a magnetic core within the encasement, and cushioning means separating the core from the encasement; the encasement including a non-magnetic metallic container partially enclosing the core and non-magnetic closure means joined to the container to complete enclosing the core, the cushioning means being disposed in the encasement to separate the magnetic core from adjacent surfaces of the container and the closure means.
4. An enclosed magnetic core device comprising an encasement, a magnetic tape-wound core, and cushioning material disposed within the encasement separating each boundary surface of the core from a respective adjacent surface of the encasement; the encasement including a non-magnetic metallic toroidal container having an open

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end and non-magnetic closure means for the open end electrically insulated from the metallic container.

5. An enclosed magnetic core device comprising an encasement, a magnetic tape-wound core, and cushioning material disposed within the encasement separating the magnetic tape-wound core from the encasement so as to prevent shock and vibration from being transmitted directly to the tape-wound core; the encasement including a non-magnetic metallic toroidal container having an open end, a circumferential ledge on the container at its open end, and non-magnetic closure means for the open end of the toroidal container supported by the circumferential ledge.

6. An enclosed magnetic core device comprising an encasement, a magnetic core within the encasement, and cushioning means disposed within the encasement to prevent contact between the core and the encasement; the encasement including a trough-like toroidal container of non-magnetic metallic material partially enclosing the magnetic core, the container having an open end defined by end portion, a circumferential ledge formed on the open end of the container, and a non-magnetic closure means supported by the circumferential ledge with end portions of the container folded over to seal the closure means to the container and complete enclosure of the magnetic core.

7. An enclosed magnetic core device comprising an encasement, a magnetic core within the encasement, and cushioning means disposed within the encasement separating all surfaces of the magnetic core from the encasement; the encasement including a non-magnetic metallic container partially enclosing the core, non-magnetic metallic closure means joined to the container to complete enclosing the core, and electrical insulating means between the container and the closure means.

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8. A magnetic core device as in claim 1 wherein the cushioning means comprises a plurality of discrete quantities of rubber-like material disposed in predetermined positions between the encasement and the magnetic core.

References Cited in the file of this patent

UNITED STATES PATENTS

2,180,759	Kneisley	Nov. 21, 1939
2,435,242	Somes	Feb. 3, 1948
2,467,101	Walters	Apr. 12, 1949
2,469,808	Aske	May 10, 1949
2,561,456	Zwelling	July 24, 1951
2,569,468	Gaugler	Oct. 2, 1951
2,592,721	Mott	Apr. 15, 1952

FOREIGN PATENTS

673,267	Great Britain	June 4, 1952
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OTHER REFERENCES

"Special Magnetic Alloys and Applications," pp. 1-3 reprinted from the Sept. 1948 issue of Electrical Engineering.