

[54] **MAGNETIC ANTENNA HAVING A BLOCK OR CIRCUIT COMPONENTS THEREIN**[76] Inventor: **Takashi Tanaka**, 340 Oaza Kisaichi, Katano-cho, Kitakawachi-gun, Osaka-fu, Japan[22] Filed: **Apr. 27, 1971**[21] Appl. No.: **137,998****Related U.S. Application Data**

[63] Continuation-in-part of Ser. No. 679,351, Oct. 31, 1967, abandoned.

[30] **Foreign Priority Application Data**

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Dec. 28, 1966 Japan41/10

[52] U.S. Cl. **343/702, 343/788**[51] Int. Cl. **H01q 7/08, H01q 1/24**[58] Field of Search..... **343/702, 787, 788; 29/600, 601; 325/354**[56] **References Cited****UNITED STATES PATENTS**

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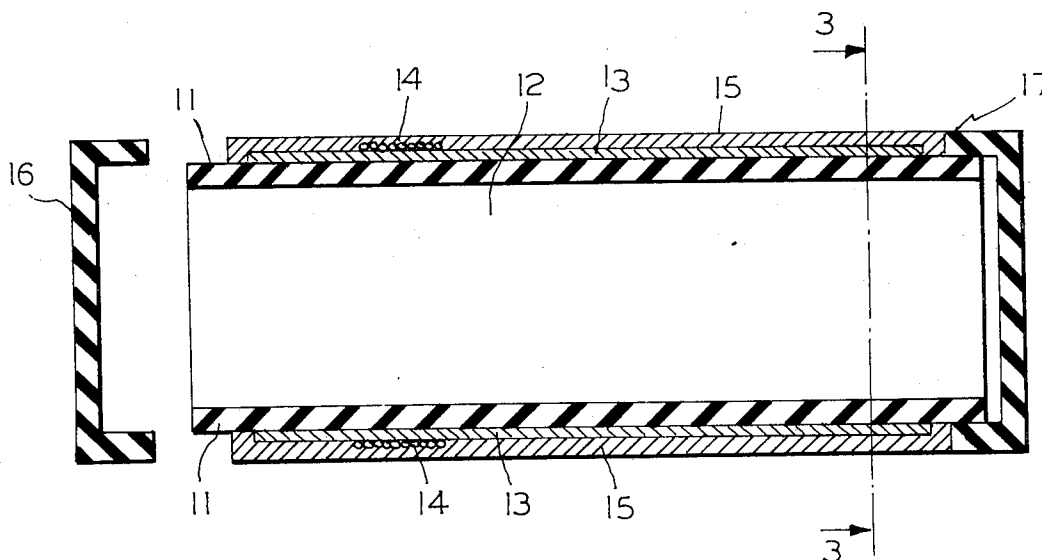
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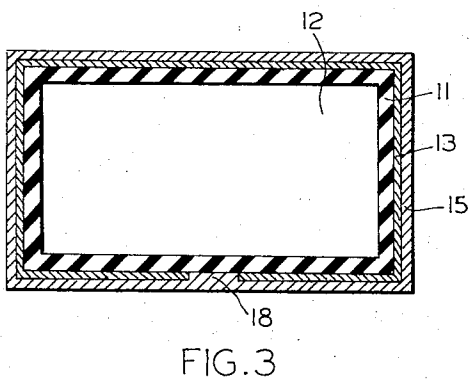
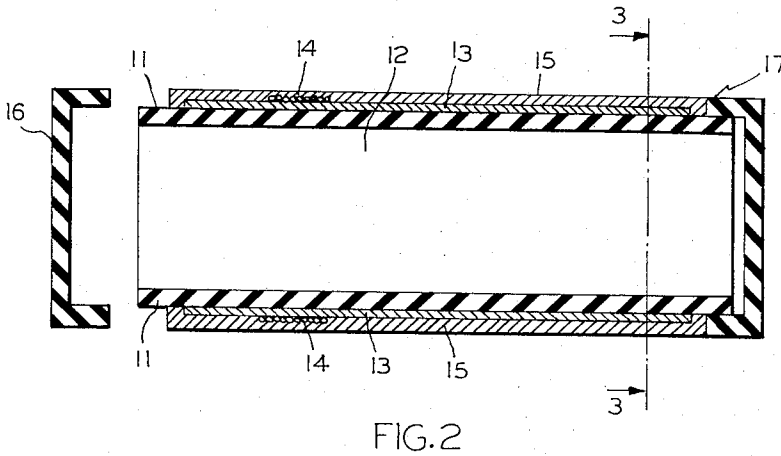
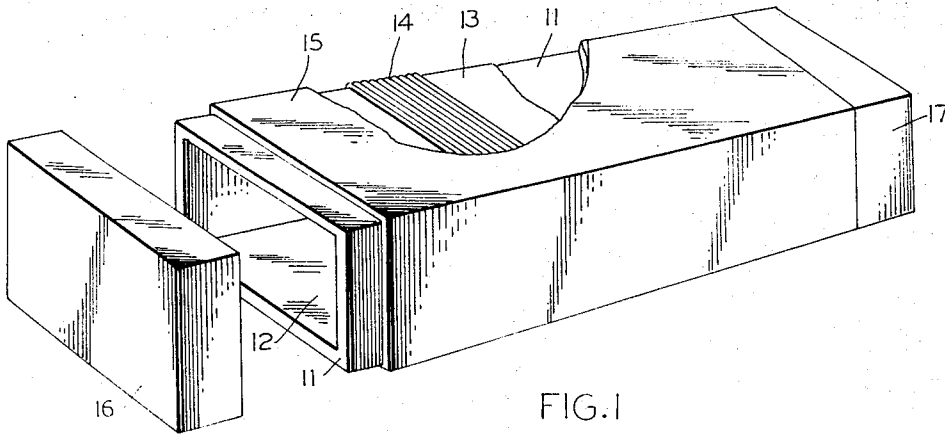
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Primary Examiner—Rudolph V. Rolinac*Assistant Examiner*—Wm. H. Punter*Attorney*—Wenderoth, Lind & Ponack[57] **ABSTRACT**

An antenna for a receiver comprising a magnetic core in the form of a thin layer having a thickness less than 50 microns superposed on a casing of a receiver or on a block of components of the receiver, and a winding wound on said magnetic core and connected electrically to the components in the casing or in the block, the winding serving as the antenna for the receiver. A receiver which comprises said antenna.

10 Claims, 7 Drawing Figures



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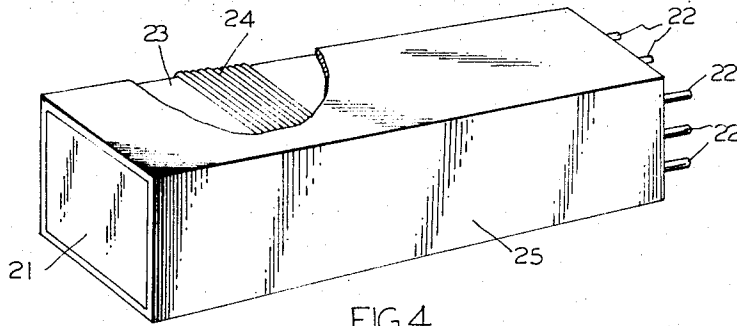


FIG. 4

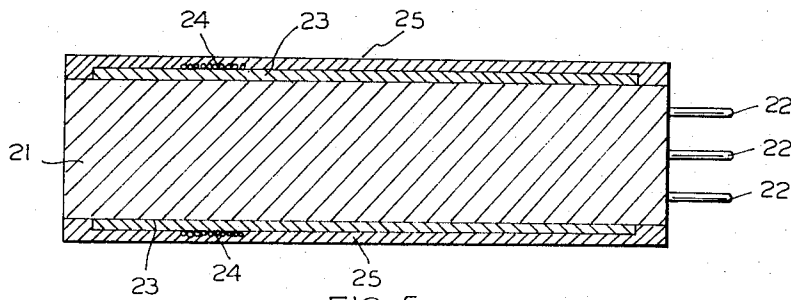


FIG. 5

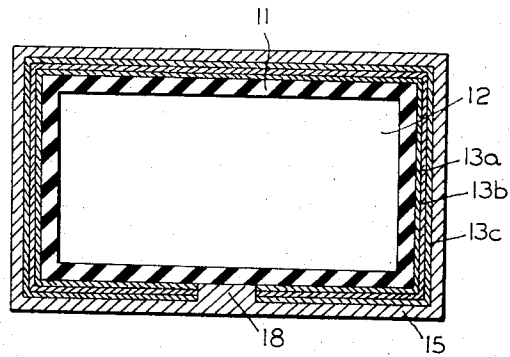


FIG. 6

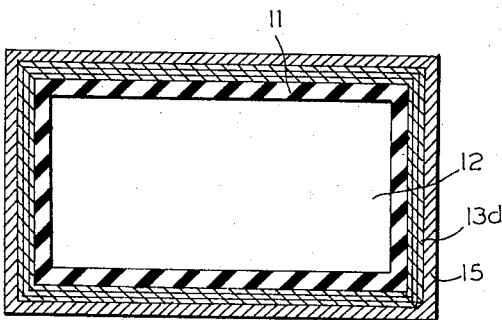


FIG. 7

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MAGNETIC ANTENNA HAVING A BLOCK OR CIRCUIT COMPONENTS THEREIN

This is a continuation-in-part of application Ser. No. 679,351, filed Oct. 31, 1967, now abandoned.

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to an antenna for a receiver for electromagnetic waves such as a radio receiver, and more particularly to an antenna comprising a magnetic core in the form of a thin layer superposed on the casing of the receiver or on a block of components of the receiver.

2. Prior Art

A conventional antenna for use in a receiver, such as a radio receiver, comprises a magnetic core having a winding thereon. The magnetic core consists of, for example, a ferrite material having a high magnetic permeability and is usually in the form of a rod, a plate, or a tube. It is well-known that the ratio of the length to the cross-sectional area of a magnetic core is one of the factors which affects the sensitivity of an antenna having said magnetic core. A higher ratio results in a higher sensitivity. As a practical matter, it is not easy to obtain a higher ratio because the maximum length of the magnetic core is limited by the size of the casing containing the radio receiver. It is also difficult to reduce the cross-sectional area of the magnetic core of a ferrite because the ferrite has poor mechanical strength. For example, a thin rod or plate which is long is easily broken, if the receiver is dropped carelessly on the ground during handling. A tubular core has a higher mechanical strength than a rod core with the same cross-sectional area and length, but the tubular core has a larger outside dimension than a rod core.

It is desirable that a receiver be small in size. Recent developments in the electronic component industry have succeeded in miniaturizing the electronic components by employing various new elements, for example, transistors instead of electron tubes. Moreover, new techniques such as those for making micromodules and integrated circuits have increased the packing density of the components. On the other hand, it has not been possible to reduce the size of the antenna without decreasing the sensitivity and/or the mechanical strength thereof. Therefore, the conventional antenna occupies quite a large space in a radio receiver in comparison with the other miniaturized components and limits miniaturization of a receiver.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide an antenna having a high sensitivity, a high mechanical strength and/or a small volume.

Another object of the invention is to provide an antenna comprising a magnetic core in the form of a thin layer having a thickness less than 50 microns superposed on the casing of a receiver or on a block of components of a receiver.

A further object of the invention is to provide a receiver, the casing of which has a magnetic core in the form of a thin layer superposed thereon which acts as an antenna.

A further object of the invention is to provide a receiver in which a block of components are combined with a magnetic core in the form of a thin layer superposed thereon.

The antenna according to the invention comprises a magnetic core in the form of a thin layer superposed on a casing of a receiver or on a block of components of a receiver and a winding on said magnetic core.

BRIEF DESCRIPTION OF THE FIGURES

The invention will now be described in connection with the accompanying drawings, in which:

FIG. 1 is a perspective view of one embodiment of an antenna according to the invention, partly broken away;

FIG. 2 is a longitudinal sectional view of the antenna of FIG. 1;

FIG. 3 is a cross-sectional view taken along the line 3—3 of FIG. 2;

FIG. 4 is a perspective view, partly broken away, of another embodiment;

FIG. 5 is a longitudinal sectional view of the antenna of FIG. 4;

FIG. 6 is a cross-sectional view, similar to FIG. 3, showing an embodiment in which a laminated magnetic core is used; and

FIG. 7 is a cross-sectional view similar to FIG. 3 showing an embodiment in which a magnetic core is rolled on the casing.

DESCRIPTION OF PREFERRED EMBODIMENTS

The present invention is an antenna for use in a receiver for electromagnetic waves, which antenna comprises a magnetic core in the form of a thin layer superposed on the cylindrical portion of a casing of the receiver or on a block of components of the receiver, said layer having a thickness less than 50 microns. The provision of a magnetic core in the form of a layer superposed on a casing or on a block of components makes the cross-sectional area of the magnetic material of the core smaller and increases the ratio of this length to the cross-sectional area. The magnetic core according to this invention is very thin, but the overall assembly has a higher mechanical strength than conventional antenna cores, because the casing or a block of components themselves strengthens said magnetic core. A magnetic core in the form of a thin layer superposed on the casing or the block of components requires no special space for the antenna and miniaturizes the receiver in accordance with this invention. Referring to FIGS. 1, 2 and 3, reference character 11 designates the right cylindrical portion of a casing of a receiver. The portion 11 has a hollow interior 12. All the components of the receiver, for example, resistors, transformers, transistors and speakers (not shown in the FIGS.) are combined together into a receiver network and are positioned in the hollow interior 12 of the casing portion 11.

A magnetic core 13 in the form of a thin layer having a thickness less than 50 microns is superposed on the casing portion 11. The magnetic core according to the invention can be prepared from any available magnetic material having a high magnetic permeability.

A winding 14 is wound on the magnetic core 13 by a per-se well known method for making an antenna for a receiver and the winding 14 is coupled to the receiver components positioned in the hollow interior 12. It is preferable that the core 13 and the winding 14 be covered by a plastic film 15, such as vinyl or epoxy, in order to provide the antenna with a high resistance to moisture.

The casing has a front cover 16 and a back cover 17. These covers 16 and 17 protect the components in the hollow interior 12. The controlling components, such as tuning or switching components, are positioned nearest to the covers 16 and 17 for easy handling.

Referring to FIGS. 4 and 5, a block 21 of components is made of various components combined together into an electrical circuit and is cast or molded into a simple cylindrical form, such as a circular cylinder, a plate or a parallelepiped by using suitable plastics such as epoxy resin or polyester resin. The necessary lead wires 22 of the block 21 extend to the casting or molding material and are connected with other components so as to form a receiver network.

The block 21 has a magnetic core 23 in the form of a thin layer having a thickness less than 50 microns superposed thereon, a winding 24 wound on the core 23, and a protection film 25 which covers the core 23 and the winding 24, as described in connection with the embodiment of FIGS. 1-3.

Materials which can be used for said magnetic cores are iron, iron nickel alloys, various ferrites and powder cores. The magnetic core in the form of a thin layer can be superposed on the casing 11 or on the block 21 by using per-se well known techniques, such as adhesion of magnetic sheets or magnetic particles, electroless plating, vacuum deposition or applying a magnetic paste containing magnetic powder, such as iron powder, iron alloy powder, or ferrite powder and suitable and available binding material, such as epoxy, polyester and vinyl.

Metals have very low electrical resistivities. Therefore, when a magnetic sheet made of a metal such as iron or nickel alloys is superposed on the casing 11 (or on the block 21), care should be taken that the magnetic core 13 has at least one gap 18 to prevent an electrically short circuited winding of the core 13, as shown in FIG. 3. In addition, it is desirable for preventing eddy currents that a laminated magnetic core composed of very thin individual layers 13a, 13b, and 13c, as shown in FIG. 6, and together having a thickness of 50 microns be employed instead of a magnetic core in one body, such as the layer 13 of FIG. 3 or 23 of FIG. 5. It is preferable to use a magnetic core in the form of a single thin layer 13d wrapped a plurality of times around the casing 11, as shown in FIG. 7. The same wrapping can be placed on block 21 shown in FIG. 5. The magnetic core 13d has the same effect when it is in the form of the laminated core in FIG. 7 for the prevention of the eddy current and needs no gap, such as the gap 18

shown in FIG. 3.

What is claimed is:

1. An antenna consisting essentially of a casing for a receiver having at least a portion thereof in the shape of a cylinder, a magnetic core in the form of a thin layer consisting of high magnetic permeability material superposed on the cylindrical portion of the casing, said layer having a thickness less than 50 microns and having substantially no intrinsic strength and a winding wound on said magnetic core, the casing supplying the strength for supporting the winding and the core.

2. An antenna as claimed in claim 1 wherein said magnetic core is of a magnetic metal and has at least one gap therein extending the length of said core parallel to the longitudinal axis thereof.

3. An antenna as claimed in claim 1 wherein said thin layer is a thin sheet of magnetic metal wrapped around said casing a plurality of times the total thickness of the layer being less than 50 microns.

4. The combination as claimed in claim 1 in which said thin layer is a single layer of magnetic material.

5. The combination as claimed in claim 1 in which said thin layer is a plurality of thicknesses of magnetic material having a total thickness of less than 50 microns.

6. In combination, a block of components for a receiver having at least a portion thereof in the shape of a cylinder and an antenna consisting essentially of a magnetic core in the form of a thin layer consisting of high magnetic permeability material superposed on the cylindrical portion of said block of components, said layer having a thickness less than 50 microns and having substantially no intrinsic strength, and a winding on said magnetic core.

7. The combination as claimed in claim 6 wherein said magnetic core is of a magnetic metal and has at least one gap therein extending the length of said core parallel to the longitudinal axis thereof.

8. The combination as claimed in claim 6 wherein said thin layer is a thin sheet of magnetic metal wrapped around said block of components a plurality of times, the total thickness of the layer being less than 50 microns.

9. The combination as claimed in claim 6 in which said thin layer is a single layer of magnetic material.

10. The combination as claimed in claim 6 in which said thin layer is a plurality of thicknesses of magnetic material having a total thickness of less than 50 microns.

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