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(54) Faraday rotation device.

(57) A Faraday rotation device for use in microwave apparatus includes a ferrite member 1 which is of polygonal transverse section over a substantial part of its length, the transverse section preferably being substantially square or rectangular. The member includes tapered sections 2 and 3 which are pyramidal in shape. This configuration provides good performance and facilitates manufacture.

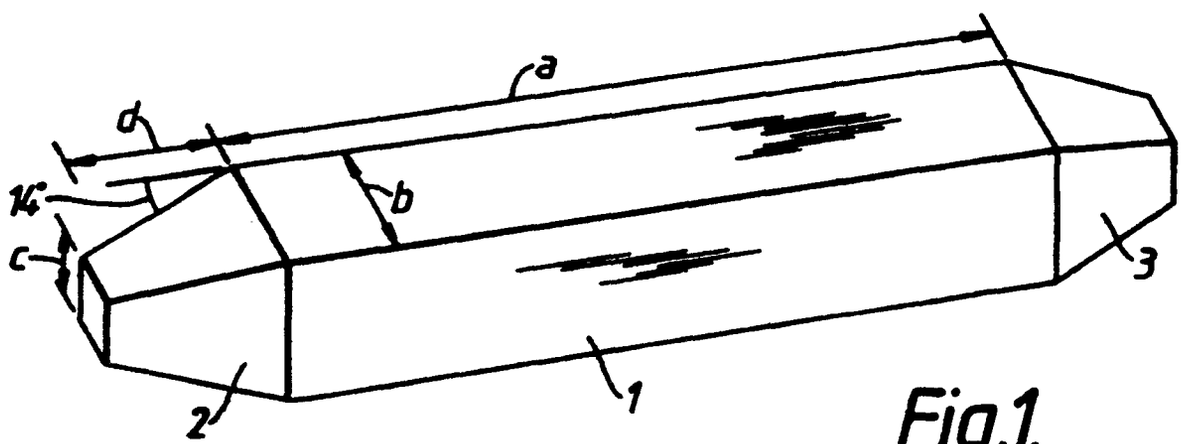

Fig.1.

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FARADAY ROTATION DEVICE

This invention relates to a Faraday rotation device and more particularly to a device which is suitable for use in microwave apparatus.

Faraday rotation is the rotation of the plane of polarization of microwave energy exhibited when the energy is transmitted through ferrite material in the direction of a magnetic field. The present invention is concerned with devices which employ this phenomenon or a Faraday rotation-like effect.

The propagation of received microwave energy along a waveguide may be controlled using the Faraday rotation effect. A ferrite rod is included within the waveguide and is usually surrounded by an electrical coil to provide a magnetic field. By adjusting the plane of polarisation of the microwave radiation, its propagation along the waveguide may be controlled.

The ferrite rods used in Faraday rotation devices are "spear" shaped, having a circular transverse cross-section and tapering points.

The present invention arose in an attempt to provide an improved Faraday rotation device.

According to the invention there is provided a Faraday rotation, or Faraday rotation-like, device for use in microwave apparatus comprising an elongate ferrite member having a polygonal transverse section over a substantial part of its length. It has been found that, surprisingly, although such a ferrite member does not have the same degree of electrical and physical symmetry as the previously known spear-shaped ferrite rod, its performance is still acceptable. A particular advantage of a device in accordance with the invention is that the ferrite member may be manfactured using moulding techniques. Particulate ferrite material is placed in a mould and then subjected to pressure to produce a composite ferrite body having a shape which conforms to the interior configuration of the mould. This manufacturing technique is especially useful where large numbers of ferrite components having similar characteristics are required.

It is preferred that the polygonal transverse section has eight sides or less, as a ferrite member of such configuration may be more easily fabricated than one with more sides. In a particularly advantageous embodiment of the invention, the member has a substantially square or rectangular transverse section over a substantial part of its length.

Preferably, at least one end of the member is tapered such that the transverse sectional area at the end is smaller than that at the centre of the member. This configuration enables the operation of the device to be optimised but still lends itself to moulding techniques. It is preferred that the tapered end is pyramidal in shape, such that a substantially square or rectangular transverse section is retained throughout the tapered section. The end of the member is preferably flat rather than pointed as this facilitates manufacture.

Where an end of the polarizer is tapered, it is preferred that the taper has a half angle in the range 5° to 20°. Advantageously, the member is of substantially uniform transverse sectional area for approximately two thirds of its total length.

According to a feature of the invention, microwave apparatus comprises a waveguide along which received microwave radiation is arranged to be propagated and a Faraday rotation device in accordance with the invention for controlling the propagation of the radiation along the waveguide.

One way in which the invention may be performed is now described by way of example with reference to the accompanying drawings, in which:

Figure 1 is a schematic perspective view of a ferrite member included in a device in accordance with the invention;

Figure 2 is a transverse section through the member shown in Figure 1 at its centre; and

Figure 3 schematically illustrates in section part of a microwave apparatus which includes the ferrite member shown in Figure 1.

With reference to Figures 1 and 2, a ferrite member 1 used in a Faraday rotation device for controlling the propagation of microwave energy along a waveguide has a square transverse section along its length. It is of uniform transverse sectional area for approximately two-thirds of its total length along the distance a, which in this particular embodiment is approximately 40mm long. Its width b at the part of the member 1 of uniform section is approximately 4 mm.

The ferrite member 1 has tapered sections 2 and 3 at each end. Each taper is pyramidal in shape, retaining the square transverse section as it reduces in transverse sectional area. The ends of the tapers are square flats having sides c of approximately 1 mm length. The length d over which the taper occurs is approximately 8.5 mm, giving a half-angle of approximately 14°.

With reference to Figure 3, microwave apparatus includes a waveguide 4 along which recieved microwave energy is transmitted in the direction indicated by the arrow. The ferrite member 1 is located within the waveguide 4 and is surrounded by an electrical coil 5, which is spaced from the member 1 by dielectric material 6. By controlling the magnetic field at the ferrite member 1 using the coil 5, the propagation of energy along the waveguide may be controlled.

In an alternative embodiment to that shown in Figure 3, the ferrite member is located in a waveguide, and an electrical coil is positioned around the outside of the waveguide and co-axially with the ferrite member.

Claims

1. A Faraday rotation, or Faraday rotation-like, device,for use in microwave apparatus comprising an elongate ferrite member having a polygonal transverse section over a substantial part of its length.

2. A device as claimed in claim 1 wherein the polygonal transverse section has eight sides or less.

3. A device as claimed in claim 2 wherein the member has a substantially square or rectangular transverse section over a substantial part of its length.

4. A device as claimed in claim 1, 2 or 3 wherein at least one end of the member is tapered such that the transverse sectional area at the end is smaller than that at the centre of the member.

5. A device as claimed in claim 4 wherein, where the transverse section is substantially square or rectangular, the tapered end is pyramidal in shape.

6. A device as claimed in claim 4 or 5 wherein the end of the member is flat.

7. A device as claimed in claim 4, 5 or 6 wherein the taper has a half angle in the range of 5° to 20°.

8. A device as claimed in claim 4, 5, 6 or 7 wherein the member is of substantially uniform transverse sectional area for approximately two-thirds of its total length.

9. A device as claimed in any preceding claim and including a coil for conducting electrical current which is located coaxially around the member.

10. Microwave apparatus comprising a waveguide along which received microwave radiation is arranged to be propagated and a device as claimed in any preceding claim for controlling the propagation of the radiation along the waveguide.

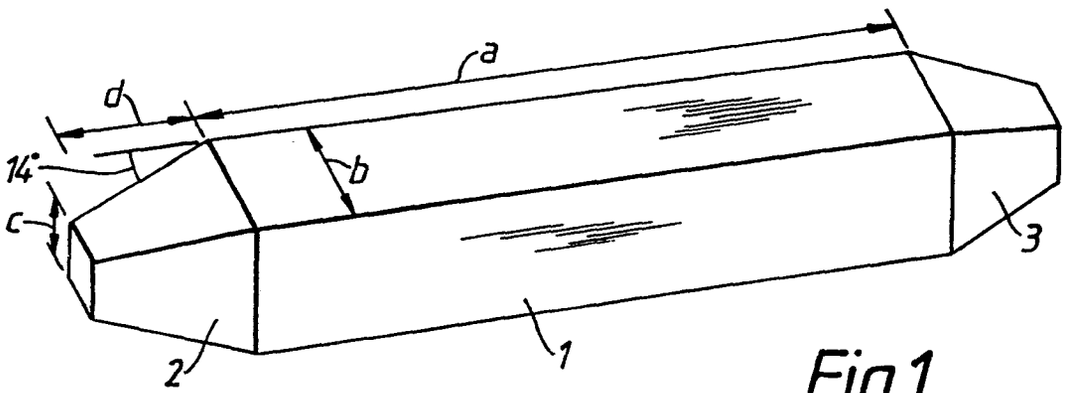

Fig.1.

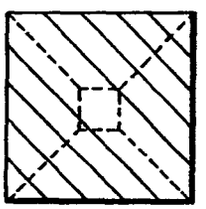

Fig.2.

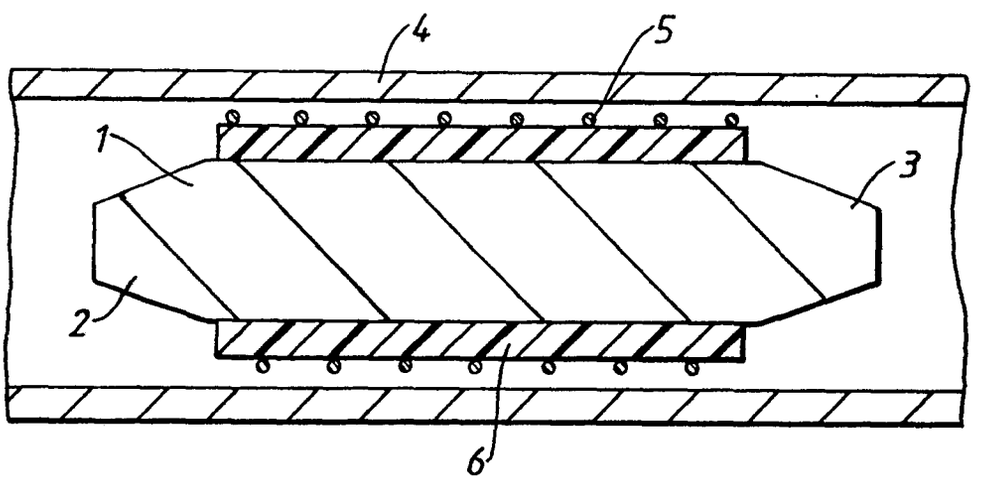

Fig.3.

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EUROPEAN SEARCH REPORT

Application Number

EP 90 30 1474

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X	US-A-3 177 449 (CHO et al.) * Column 4, line 65 - column 6, line 39; column 7, lines 63-66; figures 5-7 * ---	1,9,10	H 01 P 1/175
Y	---	2-8	
Y	PATENT ABSTRACTS OF JAPAN, vol. 2, no. 106, 31st August 1978, page 5659 E 78; & JP-A-53 72 439 (TOKYO SHIBAURA DENKI K.K.) 27-06-1978 * Complete * ---	2-6	
Y	IRE TRANSACTIONS ON MICROWAVE THEORY AND TECHNIQUES, vol. MTT-3, no. 4, April 1955, pages 27-31; C. STEWART: "Some applications and characteristics of ferrite at wavelengths of 0.87 Cm and 1.9 Cms" * Page 27, left-hand column, lines 1-25; page 29, right-hand column, line 21; figure 1 * ---	7	TECHNICAL FIELDS SEARCHED (Int. Cl.5)
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	07-06-1990	DEN OTTER A.M.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

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Application Number

EP 90 30 1474

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	07-06-1990	DEN OTTER A.M.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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