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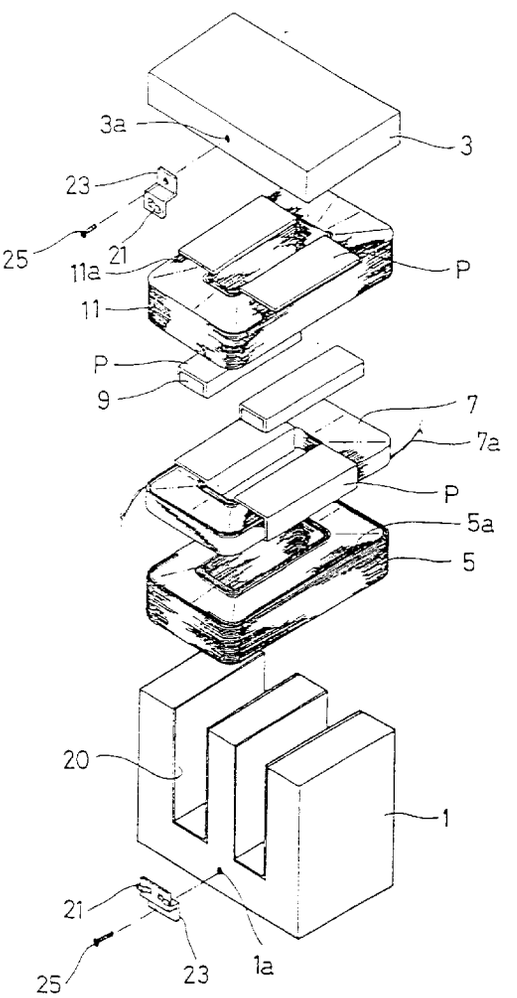
(54) wound component

(57) A wound electrical component comprises a yoke (1, 3) and at least one coil (5, 7, 11) passing through at least one aperture in the yoke. The or each aperture is lined with an insulating liner (20, 30). The use of the liners simplifies manufacture because it reduces the need for a coil to have insulating paper completely wrapped around its turns.

FIG. 3



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Description

The present invention relates to a wound electrical component comprising a yoke having an aperture through which a coil passes.

Microwave ovens usually use a magnetron to generate microwave for cooking food. Magnetrons require high voltages and microwave ovens therefore include high voltage transformers to provide the required high voltages.

Figures 1 and 2 show a typical high voltage transformer for powering the magnetron of a microwave oven. The high voltage transformer has an E-shaped core 1 and an I-shaped core 3 which joined together.

The E-shaped core 1 is formed with two channels. A primary coil 5 is wound from wire 5a, and is inserted to the channels of the E-shaped core 1. A filament coil 7 is wound from wire 7a, and is inserted into the channels of the E-shaped core 1 above the primary coil 5. Pass cores 9 are inserted into the channels of the E-shaped core 1 above the filament coil 7. Finally, a secondary coil 11 is inserted into the channels of the E-shaped core 1 above the pass core 9.

Strips of insulation paper P are wound around the primary coil 5, the filament coil 7, the pass cores 9 and the secondary coil 11, to electrically insulated the coils 5, 7, 9 from the cores 1, 3. A sheet S of insulating material, for example mica, is disposed between the primary coil 5 and the paper wrapped therearound.

A terminal plate 14 provided with a terminal 13 is fixed by adhesive tape T to one end of the primary coil 5. Similarly, a terminal plate 14 provided with a terminal 13 is fixed by adhesive tape T to one end of the secondary coil 11.

The manufacture process of a typical high voltage transformer for a microwave oven will now be described.

The primary coil 5 is wound using wire 5a. A mica sheet S is then wound around the winding of the primary coil 5 and paper P is in turn wound over the mica sheet S. The terminal plate 14 is then fixed to the coil 5 using adhesive tape T. The completed primary coil 5 is then slipped over the middle arm of the E-shaped core 1 and pushed down to sit at the bottom of the channels in the core 1.

The filament coil 7 is wound and then wrapped in insulation paper P. The assembled filament coil 7 is slipped over the middle arm of the E-shaped core 1 and pushed down to rest on top of the primary coil 5. The pass cores 9 are wrapped with insulation paper P and positioned on the filament coil 7.

The secondary coil 11 is wound and then wrapped in insulation paper P. The terminal plate 14 is fixed to one end of the secondary coil 11 using adhesive tape T. The assembled secondary coil 11 is then slipped over the middle arm of the E-shaped core 1 and pushed down to rest on top of the pass cores 9.

Once the coils 5, 7, 11 have all been mounted to the E-shaped core 1, the arms of the E-shaped core 1 are bridged with the I-shaped core 3. The I-shaped core 3 is welded to the free ends of the arms of the E-shaped core 1 to form the transformer's yoke.

When the yoke has been completed, the high voltage transformer is inserted into an impregnation tank containing an impregnating material. The impregnating material impregnates the transformer and protects it from rust and reduces the noise produced in use. The transformer then is dried and used.

A problem with the afore-mentioned transformer is that insulation paper P must be manually wound around the coils and the pass core and then fixed with adhesive tape. Furthermore, it is desirable that the step of winding the mica sheet about the primary coil be avoided to simplify manufacture.

It is an aim of the present invention to ameliorate the afore-mentioned problems.

A wound electrical component according to the present invention is characterised in that an insulating liner is provided in the aperture between the coil and the yoke. It will be appreciated that the use of the liner reduces the amount of insulation paper required and that it is a simpler process to insert a liner than wrap a coil with paper as required by the prior art.

Although, the present invention arose in the field of transformers microwave ovens, it will be appreciated that the present invention may be usefully employed in other fields; indeed wherever sheets of insulation material have been wrapped around coils to insulate the coils from the yoke. However, the present invention is particularly useful in respect of components adapted for operation with voltages greater than or equal to 300V, i.e. high voltages and greater.

A wound electrical component consist of one coil, for example a choke or an autotransformer. However. the present invention can be usefully applied to components having a further coil passing through the aperture, for instance a transformer.

Conveniently, the yoke comprises an E-shaped member and an bar-shaped member linking the arms of the E-shaped member, the or each coil being arranged around the central arm of the E-shaped member and an insulating liner being provided in each aperture between a coil and the yoke.

Since, adhesive tape is no longer required for fixing insulating paper to coils. It is desirable that the use of adhesive tape be avoided altogether. Accordingly, a terminal for connecting a coil to a lead may be fixed to the yoke. An alternative is to mount a terminal to a liner.

Embodiments of the present invention will now be described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 shows a prior art high voltage transformer;

Figure 2 is a sectional view of the transformer of Figure 1;

Figure 3 shows a first embodiment of a transformer according to the present invention;

Figure 4 shows a second embodiment of a transformer according to the present invention; and

Figure 5 is a sectional view of the transformer of Figure 4.

Referring to Figure 3, those elements of the high voltage transformer shown that are common to both the present embodiment and the prior art described above have same reference signs and will not be described again. The high voltage transformer comprises an E-shaped core 1 and an I-shaped core 3 which are joined to form a yoke.

First and second liners 20 of insulating material are received within each channel in the E-shaped core 1. A primary coil 5, wound from wire 5a, is inserted into the channels of the E-shaped core 1 such that the liners 20 are between the primary coil 5 and the E-shaped core 1. A filament coil 7 is similarly inserted into the channels and rests on the primary coil 5. Pass cores 9 are inserted into respective channels and rest on the filament coil 7 and are separated from the E-shaped core 1 by the liners 20. A secondary coil 11 is inserted the channels of the E-shaped core 1 and rests on the pass cores 9. The secondary coil 11 is also insulated from the E-shaped core 1 by the liners 20.

Strips of insulation paper P are used to insulated the primary and filament coils 5, 7 from each other, to insulate the pass cores 9 from the secondary and filament coils 11, 7 and to insulate the secondary coil 11 from the I-shaped core 3. Only the filament coil 7 has strips of paper wrapped completely around and through its centre.

Screw holes 1a, 3a are provided in faces of the "upright" of the E-shaped core 1 and the parallel face of the I-shaped core 3 respectively. The screw holes 1a, 3a receive screws 25 to fix terminal plates 23 to respective cores 1, 3.

The terminal plates 23 are formed with steps to bring their terminals 21 away from the cores 1, 3.

The liners 20 and the terminal plates 23 are moulded from polyphenylene sulphide or polybutylene terephthalate. The primary coil 5 is installed without first being wound with the insulation paper P thereby reducing the number of steps in the manufacturing process.

Referring to Figures 4 and 5, a second embodiment of a transformer according to the present invention differs from the first embodiment, described above, in the form of the liners 30 and the use of some paper insulation on the primary coil 5.

The liners 30 are generally L-shaped and line the floors and outer walls of the channels in the E-shaped core 1. The liners 30 are provided with flanges 30a to which terminals 32 are fixed with screws 31. This avoids the need to screw terminal plates to the cores 1, 3.

Insulator paper P is used on the primary winding to insulate it from the central arm of the E-shaped core 1 and from the filament winding 7, on the filament winding 7 to insulate it from the central arm of the E-shaped core 1, the primary winding 5 and the pass cores 9, on the pass cores 9 to insulate them from the secondary winding 11, and on the secondary winding to insulate it from the central arm of the E-shaped core 1 and the I-shaped core 3. It should be noted that only the filament coil 7 is completely wrapped with paper.

The liners 30 are moulded from polyphenylene sulphide or polybutylene terephthalate.

A method of assembling the transformer shown in Figure 3 will now be described.

The liners 20 are inserted into the channels of the E-shaped core 1. The primary coil 5 is formed with the wire 5a and is slipped over the central arm of the E-shaped core 1 and pushed to the bottom of the channels, without the primary coil 5 being wound with paper or a mica sheet.

The filament coil 7 is wrapped about with insulation paper P, slipped over the central arm of the E-shaped core 1 and pushed down to rest on the primary coil 5. The assembled pass cores 9 are inserted into the channels of the E-shaped core 1 on top of filament coil 7. The exposed upper parts of the pass cores 9 are covered with insulation paper P. The secondary coil 11 is slipped over the central arm of the E-shaped core 1 and brought to rest on the pass core 9. Strips of insulating paper P are then placed on the secondary coil 11 to insulate it from the I-shaped core 3.

Once all the coils 5, 7, 11 and the pass cores 9 are in position, the I-shaped core 3 is welded to the E-shaped core 1 to complete the yoke. The assembled transformer is soaked in impregnating material in a tank and thereafter dried.

The terminal plates 21 are screwed to the yoke using screws 25 which pass into the screw holes 1a, 3a.

In the above assembly process, insulating paper is not wrapped completely around either the primary or the secondary coils 5, 11 and no mica sheet S is wrapped around the primary coil 5. Consequently, the manufacturing process is simplified. The terminal plates 23 are screwed to the cores 1, 3 avoiding the need for adhesive tape.

A method of assembling the transformer shown in Figure 4 will now be described.

The primary coil 5 is wound from wire 5a. Insulation paper P is then partially wound around the turns of the primary coil 5 (see Figure 5). Insulation paper P is wrapped around the turns of the filament coil 7. A strip of insulating paper P is wrapped around the top of each of the pass cores 9. Insulation paper P is also partially wrapped around the secondary coil 11 (see Figure 5). Thereafter, the primary coil 5, the filament coil 7, the pass cores 9 and the secondary coil 11 are stacked in the liners 30, to which the terminals 32 have previously been screwed. The liners 30 and stack of coils are inserted into the E-shaped core 1 over the central arm thereof. The I-shaped core 3 is then welded to the ends of the arms of the E-shaped core 1.

The assembled transformer is then impregnated

with impregnating material in a tank to prevent rust forming and to reduce noise. The transformer then is dried and used.

The use of the liners 30 means that a mica sheet need not be wound about the primary coil 5. Although insulation paper P is still used, it only partially wraps most of the components thereby simplifying assembly and the cost of the insulation paper P used.

Although the preferred embodiments of the present invention have been disclosed for illustrative purposes, those skilled in the art will appreciate that various modifications, additions and substitutions are possible.

Claims

1. A wound electrical component comprising a yoke (1, 3) having an aperture through which a coil (5) passes, **characterised in that** an insulating liner (20;30) is provided in the aperture between the coil and the yoke.

2. A wound electrical component according to claim 1, adapted for operation with voltages greater than or equal to 300V.

3. A wound electrical component according to claim 1 or 2, wherein at least one further coil (7, 11) passes through the aperture.

4. A wound electrical component according to claim 1, 2 or 3, wherein the yoke comprises an E-shaped member (1) and an bar-shaped member (3) linking the arms of the E-shaped member, the or each coil (5, 7, 11) being arranged around the central arm of the E-shaped member and an insulating liner being provided in each aperture between a coil and the yoke .

5. A wound electrical component according to any preceding claim, wherein a terminal (21;32) is fixed to the yoke for connecting a coil to a lead.

6. A wound electrical component according to any one of claims 1 to 5, wherein a terminal (32) is mounted to a liner.

7. A high voltage transformer for a microwave oven comprising an E-shaped core provided with a channel for piling up a primary coil, a filament coil, a pass core and a secondary coil sequentially, and an I-shaped core connected to the E-shaped core, characterised in that bobbins of insulation materials being mounted at each inner wall of the channels of he E-shaped core, terminal plates being connected at each outside of the E-shaped core and I-shaped core, terminals being connected to each terminal plate.

8. A high voltage transformer for a microwave oven comprising an E-shaped core provided with a channel for piling up a primary coil, a filament coil, a pass core and a second coil sequentially, and an I-shaped core counted to the E-shaped core, characterised in that the bobbins of insulation materials being mounted at each inner wall of the channels of the E-shaped core, said bobbins being formed with a terminal fixing part therein, terminals being connected to the terminal fixing part.

FIG. 1

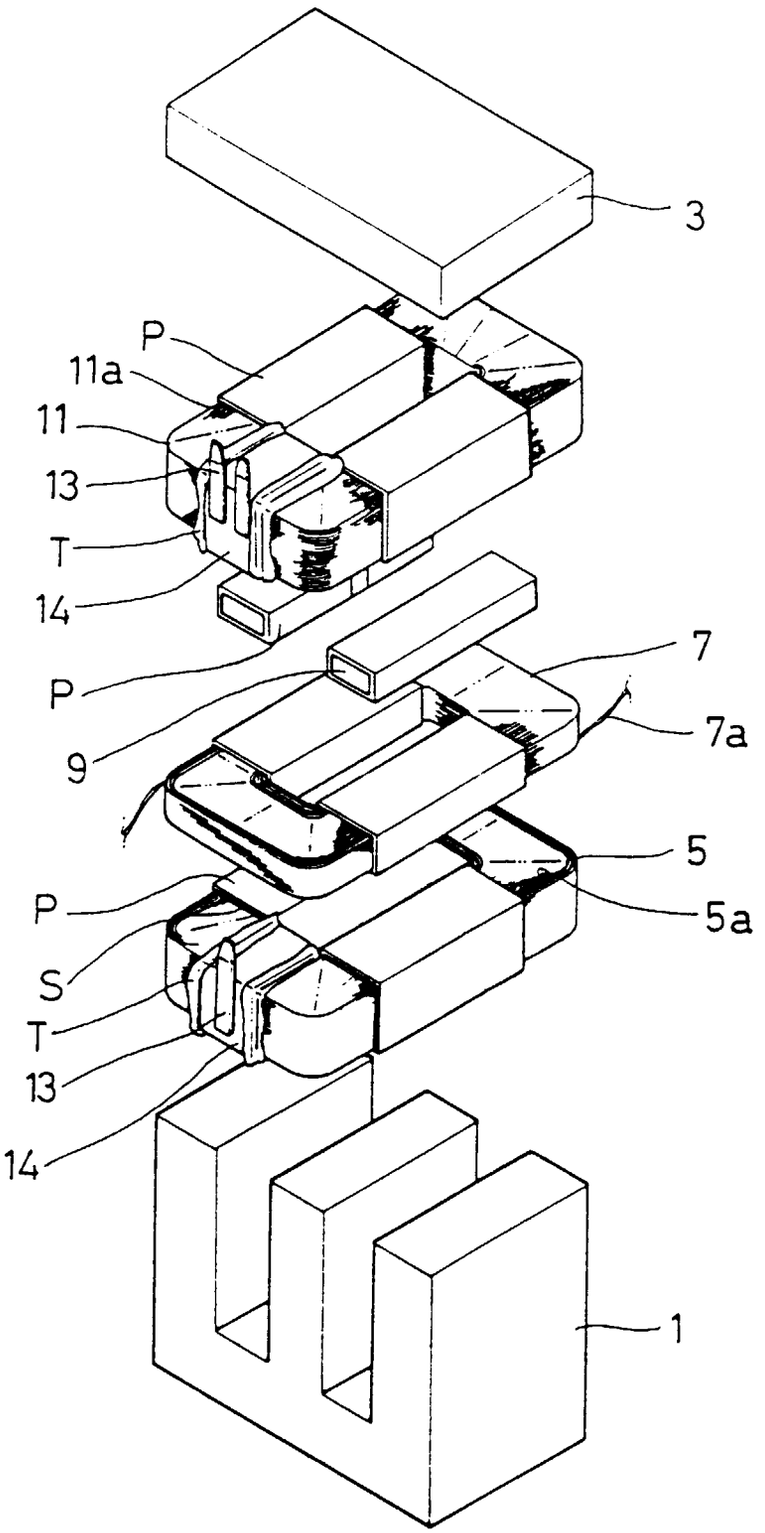


FIG. 2

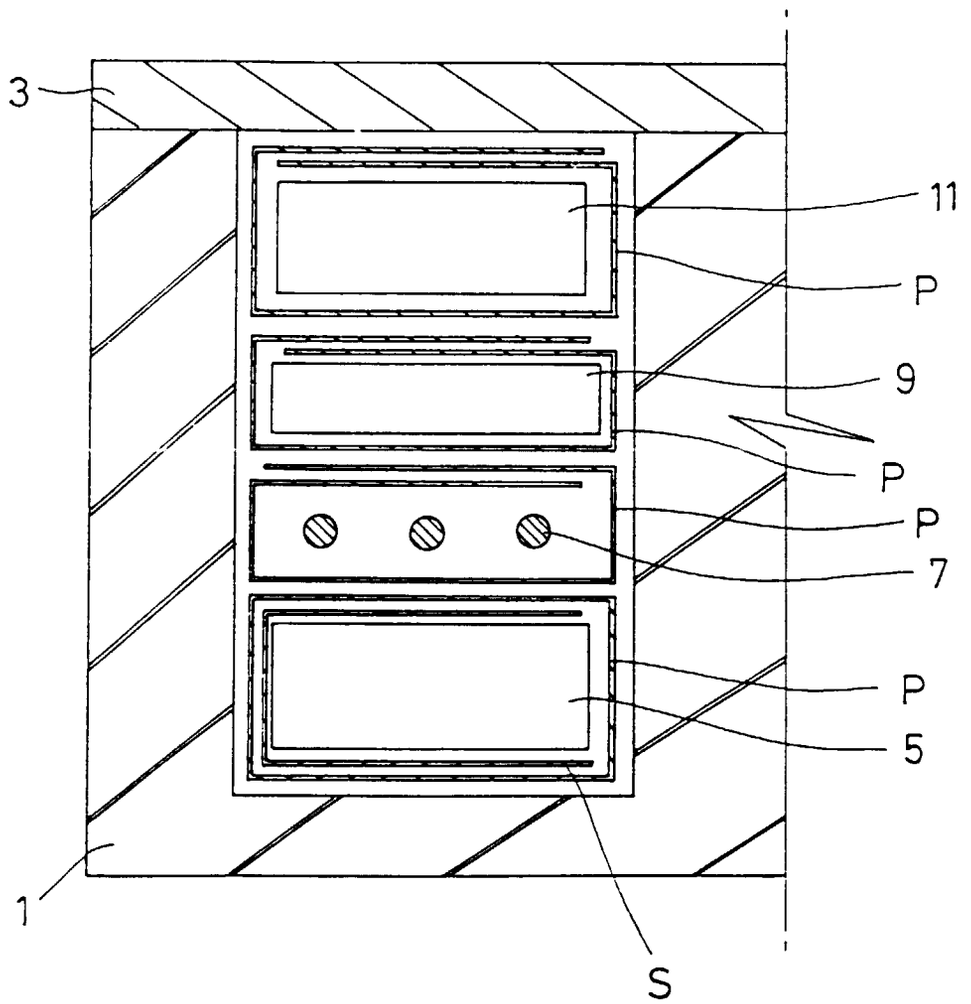


FIG. 3

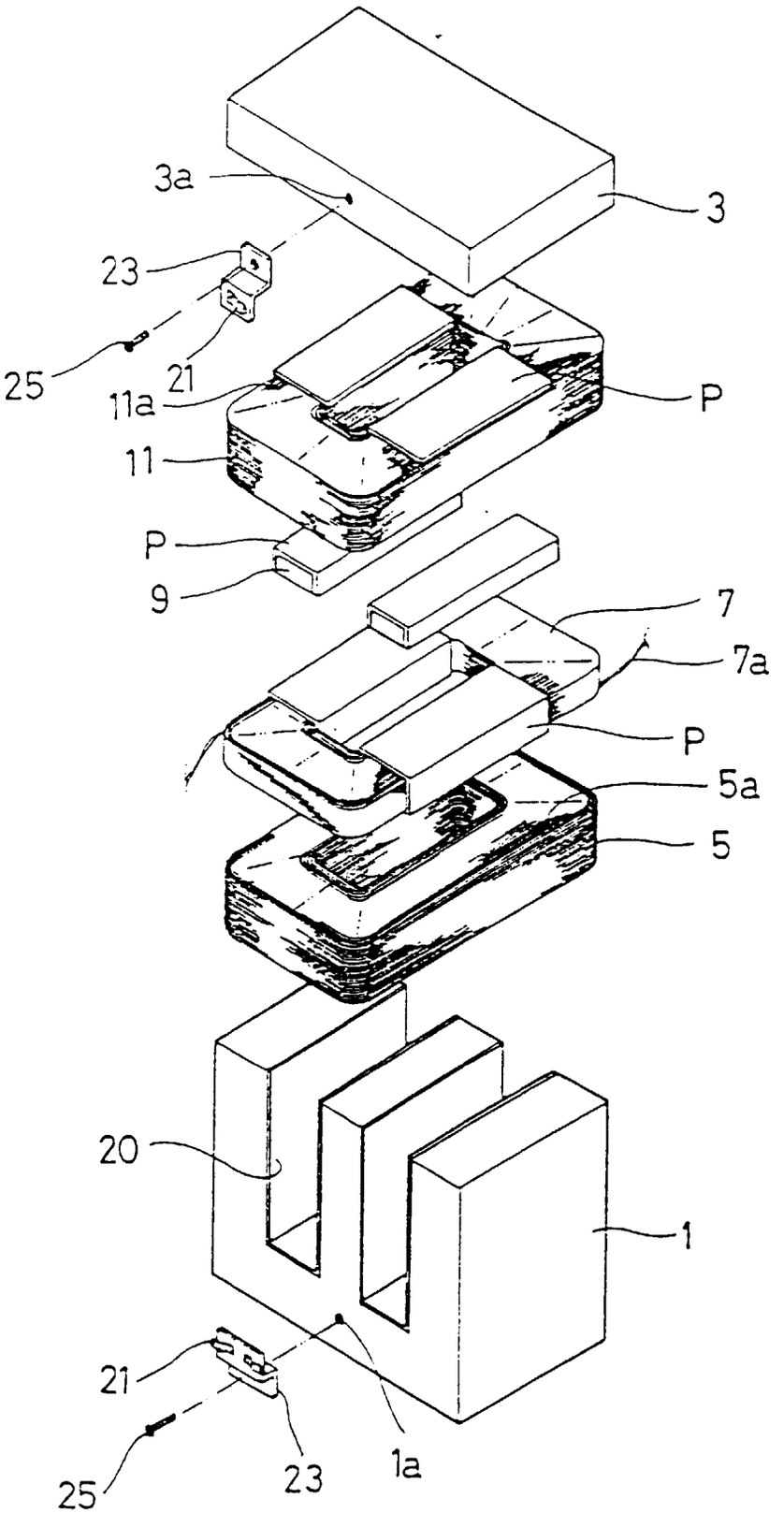


FIG.4

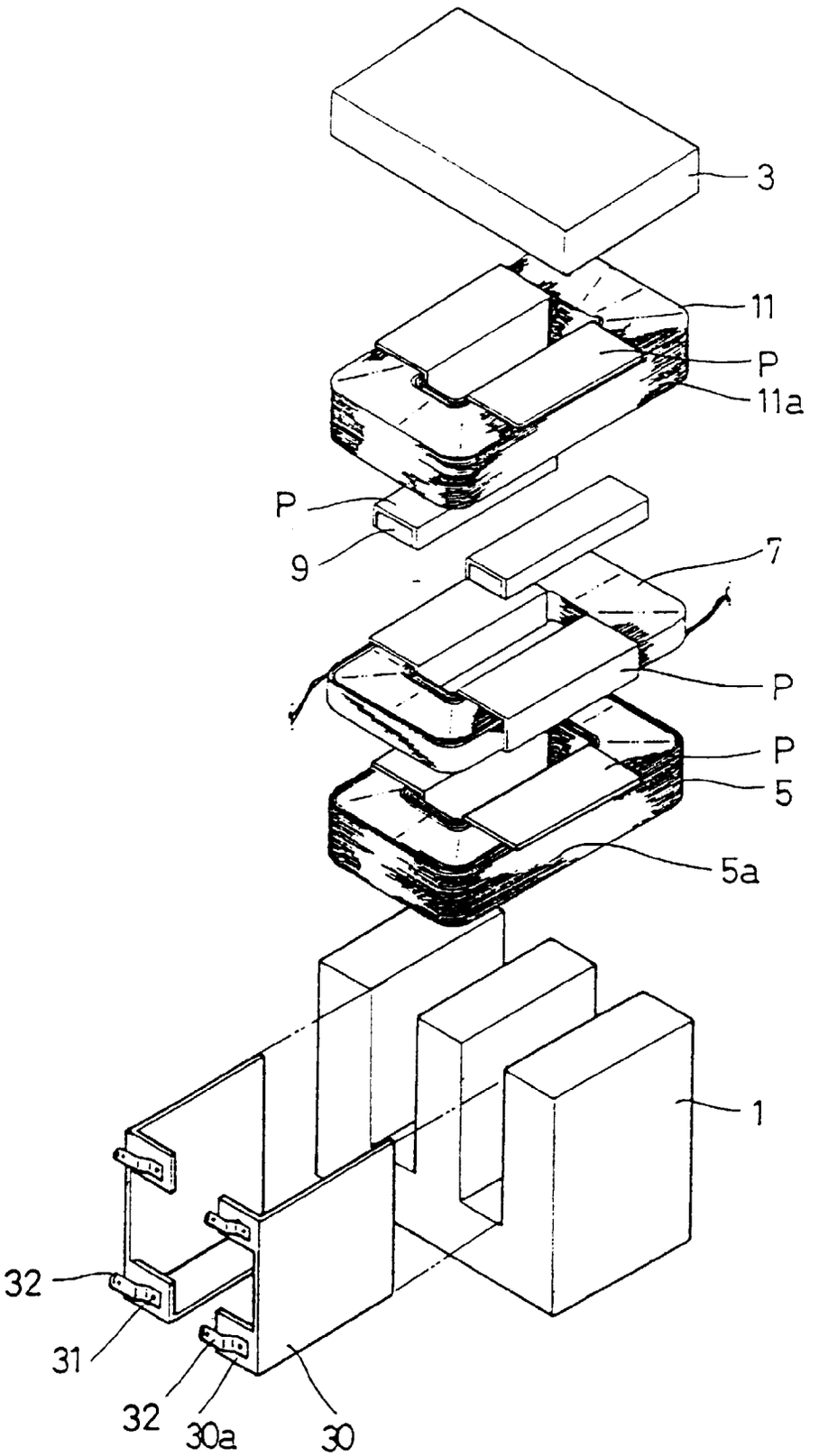
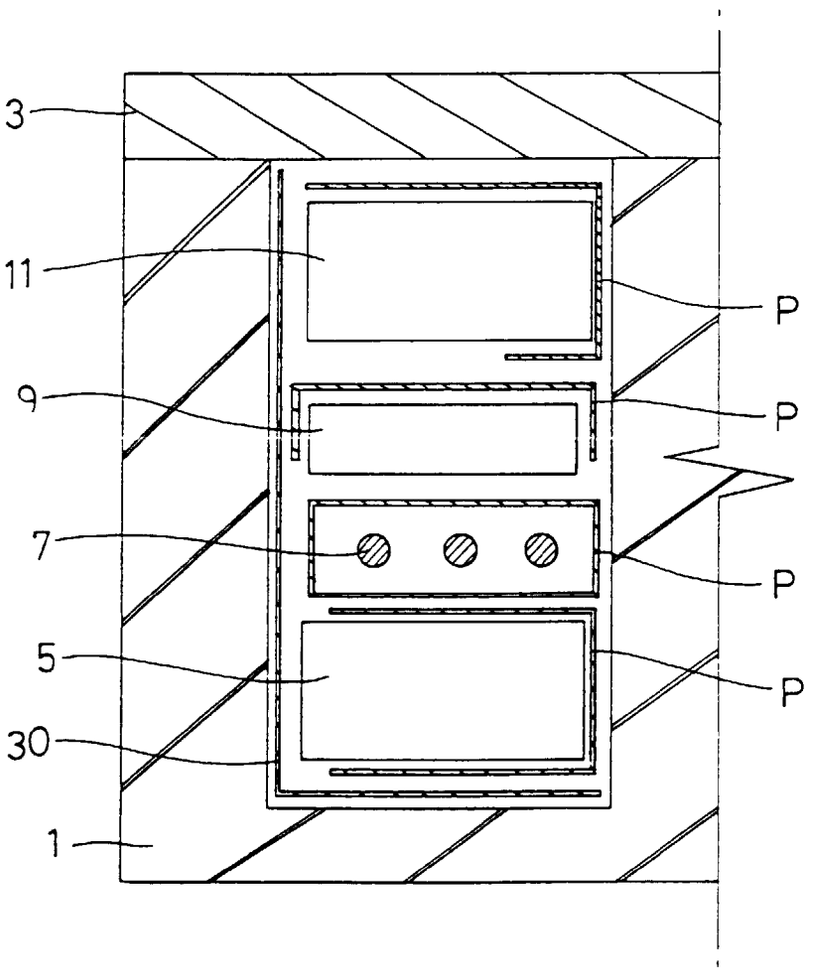


FIG.5



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EUROPEAN SEARCH REPORT

Application Number
EP 97 30 3220

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.6)
X	PATENT ABSTRACTS OF JAPAN vol. 012, no. 038 (E-580), 4 February 1988 & JP 62 190826 A (TABUCHI DENKI KK), 21 August 1987, * abstract *	1-4	H01F38/08 H01F27/32
Y	---	7,8	
Y	US 3 728 656 A (NEUBER R) 17 April 1973 * column 2, line 21 - column 3, line 20 *	7	
A	---	5	
Y	US 4 347 490 A (PETERSON DAVID A) 31 August 1982 * column 2, line 19 - line 37 *	8	
A	---	6	
A	PATENT ABSTRACTS OF JAPAN vol. 011, no. 390 (E-567), 19 December 1987 & JP 62 154709 A (TOKYO ELECTRIC CO LTD), 9 July 1987, * abstract *		TECHNICAL FIELDS SEARCHED (Int.Cl.6) H01F
A	--- PATENT ABSTRACTS OF JAPAN vol. 005, no. 121 (E-068), 5 August 1981 & JP 56 058215 A (MATSUSHITA ELECTRIC IND CO LTD), 21 May 1981, * abstract *		
A	--- US 5 440 286 A (PIKUL HENRY ET AL) 8 August 1995		
A	--- US 3 387 245 A (CZERNOBIL EUGENE) 4 June 1968		
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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	19 August 1997	Vanhulle, R

CATEGORY OF CITED DOCUMENTS

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Application Number
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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.6)
A	PATENT ABSTRACTS OF JAPAN vol. 014, no. 070 (E-0886), 8 February 1990 & JP 01 289105 A (FUJITSU LTD), 21 November 1989, * abstract * -----		
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)

The present search report has been drawn up for all claims

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