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(12) # EUROPEAN PATENT APPLICATION

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(54) **Apparatus in a ballast or transformer for improving its cooling.**

(57) The invention relates to an apparatus in a ballast or transformer for improving its cooling. The ballast or transformer comprises a core sheet pack (1, 2), a winding (6), whose ends extend beyond the core sheet pack, a shell (4) which surrounds the core sheet pack, and a bottom plate (3), to whose side edges (3a) the shell edges (4a) are fastened. Metal plates (5) leaning against the end of winding (6) are fastened to the gables of a housing made up by shell (4) and bottom plate (3). Between the end of winding (6) and said metal plate (5) is arranged a thin insulating layer.

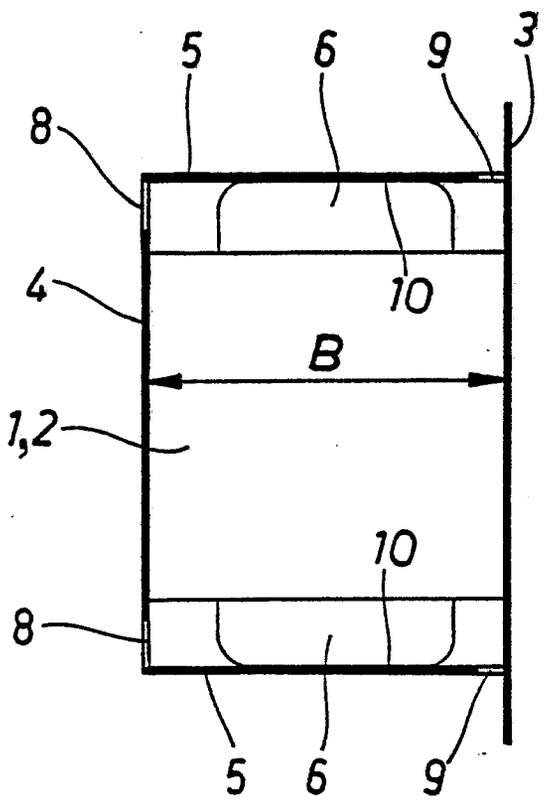

Fig.1

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Apparatus in a ballast or transformer for improving its cooling.

The present invention relates to an apparatus in a ballast or transformer for improving its cooling, said ballast or transformer including a core sheet pack, a winding, whose ends extend beyond the core sheet pack, and metal end plates.

It is well-known that the winding ends of a ballast or transformer must be protected against manual touch so as to eliminate the risk of electric shock. This is generally done by means of guard plates made of plastics or some other insulating material. A drawback with such plates of an insulating material is that they hamper the cooling of the winding ends since, as well-known, insulating materials are very poor heat conductors. In order to avoid overheating, the ballast or transformer must be manufactured in a certain size with respect to its nominal VA-quantity or capacity. On the other hand, the increased size leads to increased material costs and bulkiness that must be taken into consideration, e.g. when dimensioning lighting fixtures.

An object of the invention is to provide an apparatus for improving or intensifying the cooling of a ballast or transformer, so that the physical size of a ballast or transformer relative to its VA-quantity or capacity can be reduced so as to save in material costs and space requirements.

This object is achieved, according to the invention in a manner that metal end plates, leaning against the winding end with a thin insulating layer therebetween, are provided with bent or moulded rib members position ed in a free space between the winding end faces and the end of a core sheet pack, so that, within the area of rib members, cooling air is capable of circulating on either side of the end plate.

The cooling ribs positioned according to the invention do not increase the maximum dimensions of a ballast or transformer.

Thus, according to the invention, it has been realized that, if the size of a ballast or transformer is greater than approximately 100 VA (100 W), it is preferable to install metal plates leaning on the winding ends and insulated from the winding only with a thin insulating material. The extra cost incurred by a metal plate is quite small compared to the saving in winding and magnetic material provided by a considerably increased cooling area. The cooling plate is preferably made of aluminium.

In a preferred embodiment of the invention, the cooling ribs are designed in a manner that the edges of said metal plate are profiled to form grooves which increase its surface area. In the disposition of these grooves, it is possible to utilize the free spaces on either side of the winding end between the shell and the side face of a winding end portion.

For more effective air circulation also along the inner surface of a metal plate, it is preferable to position the lower edge of said metal plate at a little distance clear of the bottom plate, or the lower edge of said metal plate is provided with holes or notches and the upper edge of said metal plate or the shell edge connected therewith is provided with apertures or notches. In this embodiment, it is preferable that, by a proper choice of the dimension "width/height" of a ballast, the rate of air flow can be increased on either side of the winding end (chimney effect). The air flowing inside a cooling plate serves to cool the winding simultaneously and directly. Above all, this arrangement prevents a characteristic drawback of the prior art solution, namely the formation of a hot, still air layer in the space between the winding end and the end insulation.

By means of a cooling plate arrangement according to the invention, the cooling effect is improved to such a degree that the size of a ballast or transformer can be reduced decisively, up to tens of percent compared to the present practice. The reduction of the size of a ballast also leads to additional savings because of the reduction of the dimensions of a lighting fixture.

One embodiment of the invention will now be described by way of an example and in more detail with reference to the accompanying drawings, in which

Fig. I shows a vertical longitudinal section of a ballast provided with an apparatus according to the invention;

Fig. 2 shows a horizontal section of the same ballast;

Fig. 3 shows a vertical cross-section of the same ballast; and

Fig. 4 shows an alternative embodiment of a ballast according to the invention.

The core sheet pack of a ballast, as shown in the drawing, consists of E-sheets I and I-sheets 2. A winding 6 is fitted between the E-arms and both ends of winding 6 extend beyond the ends of said core sheet pack as the winding must travel around the midmost E-arm. Regardless of what shape of sheets the core sheet pack has been made up, a typical feature in the structure is that the winding ends extend beyond the core sheet pack.

A core sheet pack, together with its winding, has been laid on top of a bottom plate 3. The ends of bottom plate 3 are provided with holes 13 for using screws extending therethrough to fasten the ballast, for example to a lighting fixture.

A shell 4, made of rather thin sheet metal, envelopes the core sheet pack and its winding. The edges of bottom plate 3 are provided with hock-shaped bends 3a to be grabbed by bends 4a at the edges of shell sheet 4.

The ends of winding 6 must be provided with a protective insulation for preventing manual touch. In the invention, however, this protective insulation has been achieved in a rather exceptional manner in connection with metal cooling plates, explained in more detail hereinbelow.

The gables of a housing consisting of a shell 4 and a bottom plate 3 are provided with fixed metal plates 5 leaning against the ends of the winding 6 with just a thin insulating layer therebetween. This insulating layer can be a separate strip of insulant or it can be an insulating coating applied to the inner surface of the metal plates 5.

The edges of the metal plates 5 are provided with profiled grooves 7 for increasing the cooling area of the metal plates 5. The grooves 7 do not increase the size of a ballast as they are positioned in the free spaces on either side of the winding end between the shell 4 and the side face of the end of the winding 6. At the same time, the outer edge of the groove 7 may serve as a fastening means for the attachment to the end edge of shell 4. This attachment can be achieved in various ways, e.g. by bending one edge around the other, by spot welding together the surfaces that are facing each other, or mechanically by shaping the edge surfaces which are facing each other.

The direction of the rib members 7 is perpendicular to the E-arms and the bottom plate 3.

Between the lower edge of the metal plate 5 and the bottom plate 3 is arranged at least one air circulation passage 9 and, correspondingly, between the upper edge of the metal plate 5 and the end edge of the shell 4 is arranged at least one air circulation passage 8. Thus, air flows, as indicated by the arrows, around the winding ends with a chimney effect, which is more effective the greater the height dimension B of a ballast is relative to its width A. Passage 9 can be made by placing the lower edge of the metal plate 5 at a small gap away from the bottom plate 3 or by making holes or notches in the lower edge of the metal plate 5. In a corresponding manner, the upper edge of the metal plate 5, or the edge of the shell 4 connected therewith, is provided with holes or notches 8.

Fig. 4 illustrates alternative cooling rib profiles 7', 7", 7"', .

The end plates are preferably made of aluminium or an aluminium alloy which has better heat conductivity than a shell 4 made of sheet steel.

Ribs 7 are designed as grooves, whose outer edges are bent to extend in the direction of the shell 4 and fastened to the inner surface of the shell 4. The fastening is preferably carried out by pressing the end plate material into the holes of the shell 4 while, at the same time, urging the end plate against the end of winding 6. This secures a good heat conduction contact from the winding 6 to the shell 4 by way of the end plate 5.

Claims

I. An apparatus in a ballast or transformer for improving its cooling, said ballast or transformer comprising a core sheet pack (1, 2), a winding (6), whose ends extend beyond the core sheet pack, a shell (4), which surrounds the core sheet pack, a bottom plate (3), to whose side edges (3a) the shell edges (4a) are fastened, and metal end plates (5), which are fastened to the gables of a housing made up by shell (4) and bottom plate (3) and which lean against the end of winding (6) with a thin insulating layer (10) therebetween, **characterized in** that said end plates are provided with bent or moulded rib members (7), positioned in the free space between the winding end faces and the end of a core sheet pack at a distance from the end of the core sheet pack (I, 2) in a manner that, within the area of said rib members, cooling air is capable of circulating on either side of the end plate, for which purpose the lower edge of end plate (5) is positioned at a small clearance (9) from the bottom plate (3) or the lower edge of the end plate (5) is provided with holes or notches (9) and the upper medge of the end plate (5), or the edge of shell (4) connected therewith, is provided with holes or notches (8) which open into the free spaces between the rib members (7) and the end of core sheet pack (I, 2).

2. An apparatus as set forth in claim I, **characterized in** that the cooling ribs are in the form of grooves (7) profiled in the edges of the end plate (5) for increasing its surface area, said grooves being positioned in the free spaces on either side of the end of the winding (6) between the shell (4) and the side face of the end section of the winding (6) and the outer edges of said grooves (7) being bent to extend in the direction of the shell (4) and fastened to the inner surface of said shell.

3. An apparatus as claimed in claim I or 2, **characterized in** that the end plate is made of aluminium or an aluminium alloy, whose heat conductivity is better than that of the shell (4).

4. An apparatus as claimed in claim I, 2 or 3, wherein the core sheet pack consists of E-and I-sheets,
characterized in that the direction of the rib members (7) is perpendicular to the E-arms and the bottom plate (3).

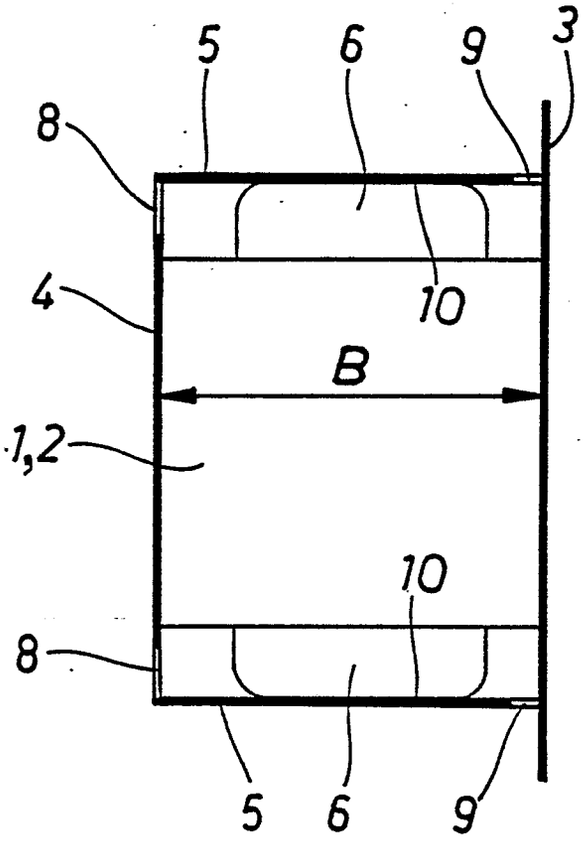

Fig.1

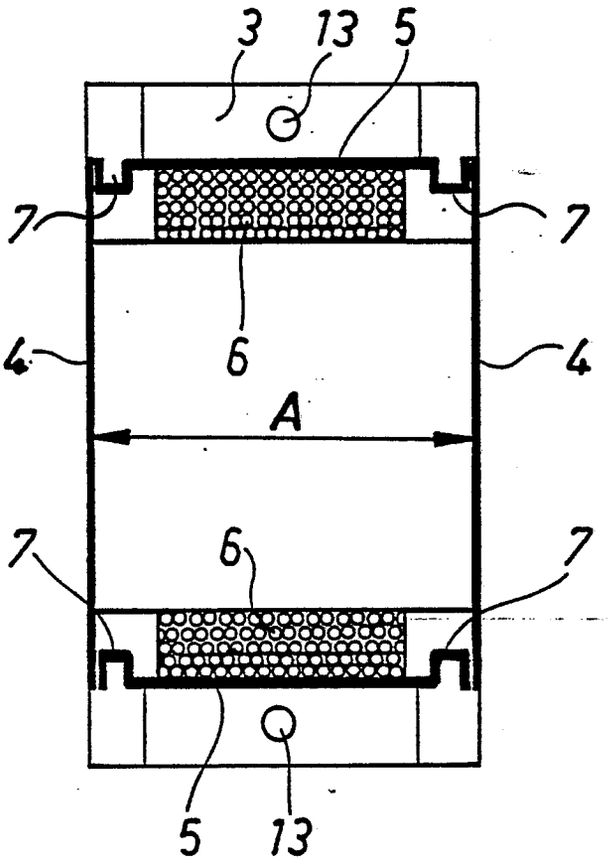

Fig.2

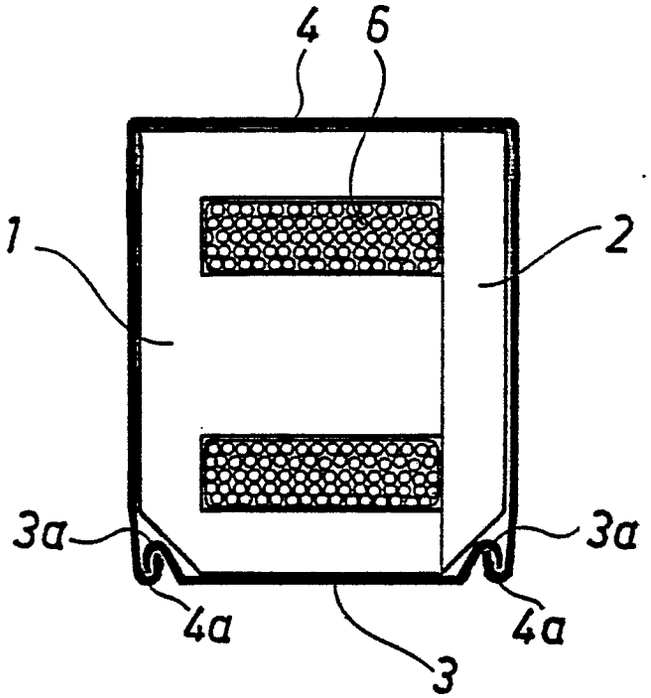

Fig. 3

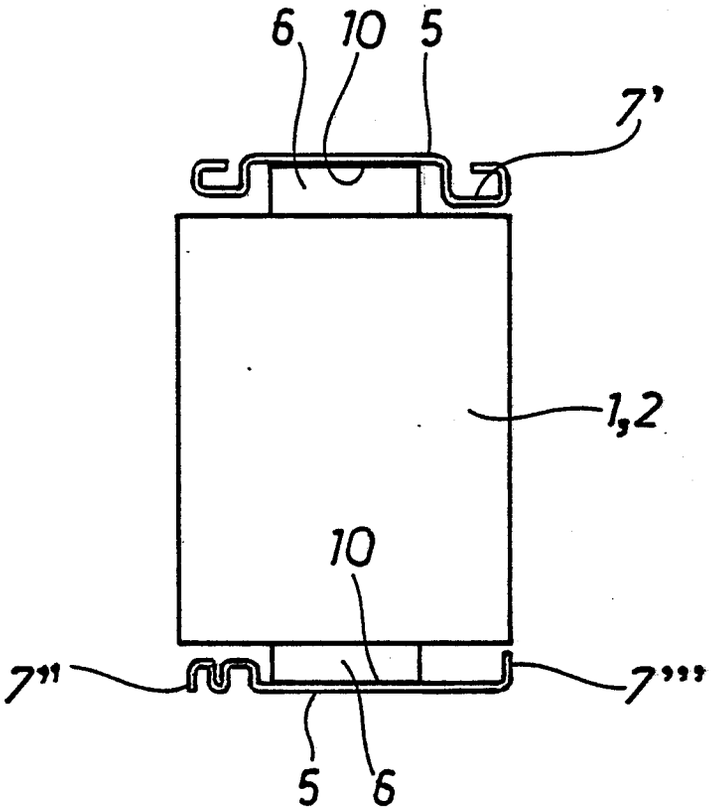

Fig. 4

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EUROPEAN SEARCH REPORT

Application number

EP 87 10 9829

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.4)
A	AU-A- 488 513 (FERGUSON TRANSFORMERS) * Page 7, last paragraph; page 8, paragraph 1 *	1-3	H 01 F 27/02
A	PATENT ABSTRACTS OF JAPAN, vol. 9, no. 270 (E-353)[1993], 26th October 1985; & JP-A-60 115 212 (TOKYO DENKI K.K.) 21-06-1985 * Abstract *	1-3	
A	DE-B-1 272 444 (MAY & CHRISTE)		
A	PATENT ABSTRACTS OF JAPAN, vol. 9, no. 197 (E-335)[1920], 14th August 1985; & JP-A-60 64 418 (HTACHI SHIYOUMEI K.K.) 13-04-1985		TECHNICAL FIELDS SEARCHED (Int. Cl.4) H 01 F 27/00 H 01 F 31/00
A	PATENT ABSTRACTS OF JAPAN, vol. 7, no. 178 (E-191)[1323], 6th August 1983; & JP-A-58 82 511 (TOKYO DENKI K.K.) 18-05-1983		

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	21-10-1987	VANHULLE R.

CATEGORY OF CITED DOCUMENTS

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