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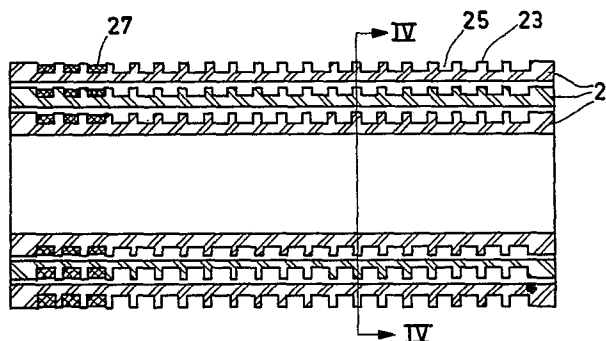
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⑤④ **High-voltage transformer.**

⑤⑦ A high-voltage transformer, comprising a ferromagnetic core on which at least one primary winding (3) and one secondary winding (5) are provided, said secondary winding (5) consisting of a series of wire-wound cylindrical coils (7), each of which coaxially surrounds the preceding coil and is separated therefrom by a cylindrical insulating body (21), every two successive coils (7) being electrically connected by a diode (9), all of said diodes (9) being connected in the same rectifying sense and each coil (7) consisting of a number of series-connected subcoils (27). Each coil is wound on a dimensionally stable cylindrical coil former (21) which also forms the insulating body and on the surface of which at least ten winding chambers (25) are defined by means of circumferential ridges (23), the depth of said chambers preferably being at the most equal to their width.



High-voltage transformer.

The invention relates to a high-voltage transformer, comprising a ferromagnetic core on which at least one primary winding and one secondary winding are provided, said secondary winding consisting of a plurality of wire-wound cylindrical coils, each successive coil co-axially surrounding the preceding coil and being separated therefrom by a cylindrical insulating member, each pair of successive coils being electrically interconnected by a diode, all of said diodes being poled in the same rectifying sense and each coil consisting of a number of series-connected sub-coils.

A high-voltage transformer of this kind is known from Netherlands Patent Application 7713118 (PHN 8970) laid open to public inspection. The division of the coils into sub-coils serves to compose each coil from more than one winding layer, so that either the number of coils constituting the secondary winding (and hence also the number of diodes required) may be smaller or each coil may be shorter, so that the dimensions of the ferromagnetic coil may be smaller. The cost of the transformer is reduced in both cases.

It is a drawback of the known transformer construction that the manufacturing process is comparatively complex, because a special winding method has to be used and also because an insulating foil must be provided after the winding of each coil in order to insulate the coil from the next coil.

It is an object of the invention to provide a construction which enables a simpler and hence cheaper and more reliable manufacturing process, while the advantages of the known construction are maintained.

To this end, the high-voltage transformer in

accordance with the invention is characterized in that each coil is wound on a dimensionally stable cylindrical coil former which between successive coils also forms the insulating member, circumferential ridges on the surface of each former defining at least ten winding chambers, in each of which a separate sub-coil is wound. Preferably, the depth of the winding chambers at the most equals the width.

This construction enables each coil to be separately wound on a coil former of its own without special steps being required during the winding of each sub-coil, after which the coil formers are simply slid into one another. The ridges prevent damaging the windings during this sliding movement. If desirable, the entire secondary winding can be impregnated with a synthetic material after assembly, possibly in combination with the primary winding. In order to ensure that the synthetic material can readily penetrate between the turns of the secondary coils, a preferred embodiment of the transformer in accordance with the invention is characterized in that each of the circumferential ridges has an interruption in at least two locations.

The invention will be described in detail hereinafter by way of example with reference to the accompanying drawing.

Therein:

Figure 1 is a diagrammatic view of the construction of an embodiment of a high-voltage transformer in accordance with the invention,

Figure 2 shows an electrical diagram of the high-voltage transformer shown in Figure 1,

Figure 3 is a longitudinal sectional view on an increased scale of the secondary winding of the high-voltage transformer shown in Figure 1, and

Figure 4 is a cross-sectional view of the winding shown in Figure 3.

The high-voltage transformer shown in the

Figures 1 and 2 (for example, a line output transformer for a television receiver) comprises a ferromagnetic core 1 which consists of two U-shaped portions and which supports a primary winding 3 and a secondary winding 5.

5 The secondary winding 5 of the embodiment shown in Figure 1 is coaxially arranged about the primary winding 3, but the primary winding may alternatively be provided on another limb of the core; underneath the secondary winding a coupling winding may be provided, if desirable.

10 The secondary winding 5 is composed (see also Figure 2) of a series of wire-wound cylindrical coils 7 (in this case three coils), each of which coaxially surrounds the preceding coil. A cylindrical insulating member (not shown in the Figures 1 and 2) is provided between adjacent coils 7. Successive pairs of coils are
15 electrically connected by a diode 9, all of said diodes being poled in the same rectifying sense as appears from Figure 2. The last coil 7 is connected to an output connection 13 via a diode 11 which is connected in the
20 same rectifying sense. The diode 9 and 11 are mounted on a diode holder 15 which is arranged on the secondary winding 5 and are conductively connected to the coils via wires 17. The complete assembly formed by the secondary winding and the diodes is preferably moulden in a
25 synthetic resin (not shown). Because the coils 7 are coaxially arranged over one another, they have a given capacitance with respect to each other; this is symbolized by the capacitors 19 (denoted by broken lines) in Figure 2.

30 Figure 3 is a longitudinal sectional view of the secondary winding 5 which shows that each of the coils 7 is wound on a cylindrical coil former 21 which is made of a suitable synthetic material, for example, by injection moulding. Consequently, the coil formers are dimensionally stable and each coil former can be separately
35 provided with a coil 7 in a winding machine, after which they are arranged coaxially over one another. The insulating body between adjacent coils is then formed by the

coil former of the outer one of these two coils.

Each coil former 21 comprises a large number of circumferential ridges 23 which define winding chambers 25 on the surface of the coil former. A sub-coil 27 is wound in each winding chamber 25. All sub-coils 27 on a coil former 21 are connected in series and together they form one coil 7. For the sake of simplicity, Figure 3 shows only three sub-coils 27 per coil former 21. No special requirements are imposed as regards the winding of the sub-coils 27, and the series connection of the sub-coils is very simply realized by feeding the winding wire, after deposition of the required number of turns in a chamber, via a narrow slit or gap (not shown) in the intermediate circumferential ridge, to the next chamber where winding is continued.

The capacitance 19 between two successive coils 7 depends mainly on the wall thickness and the material of the coil formers 21 and on the height of the ridges 23. In order to realize a sufficiently high capacitance, the depth of the winding chambers 25 preferably should not exceed their width. In order to reduce the number of turns to be accommodated in a winding chamber, the number of winding chambers should exceed ten. An excessive number of turns in a winding chamber imposes the risk that the voltage difference between neighbouring turns can no longer be withstood by the insulation of the winding wire.

In a practical embodiment, each coil former 21 comprises twenty winding chambers 25 with a depth of 0.5 mm and a width of 1 mm. The thickness of the ridges 23 is 0.5 mm and each winding chamber accommodates 45 turns of wire having a thickness of 0.09 mm (in five layers).

Figure 4 is a cross-sectional view of the secondary winding which shows that the circumferential ridges 23 are interrupted in four locations by interruption 29. These interruptions facilitate the penetration of

an impregnating medium (for example, epoxy resin) with which the secondary winding is impregnated, if desired. The number of interruptions 29 depends inter alia on the dimensions of the secondary winding 5 and on the number of coil formers 21. For thorough penetration of the impregnating medium, this number of interruptions should at least be two.

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1. A high-voltage transformer, comprising a ferro-magnetic core on which at least one primary winding (3) and one secondary winding (5) are provided, said secondary winding (5) consisting of a plurality of wire-wound cylindrical coils (7), each successive coil coaxially surrounding the preceding coil and being separated therefrom by a cylindrical insulating member (21), each pair of successive coils (7) being electrically inter-connected by a diode (9), all of said diodes (9) being poled in the same rectifying sense and each coil (7) consisting of a number of series-connected sub-coils (27), characterized in that each coil (7) is wound on a dimensionally stable cylindrical coil former (21) which, between successive coils, also forms the insulating member, circumferential ridges (23) on the surface of each former defining at least ten winding chambers (25), in each of which a separate sub-coil (27) is wound.

2. A high-voltage transformer as claimed in Claim 1, characterized in that the depth of each of the winding chambers (25) at the most equals its width.

3. A high-voltage transformer as claimed in Claim 1 or 2, characterized in that each of the circumferential ridges (23) has an interruption (29) in at least two locations.

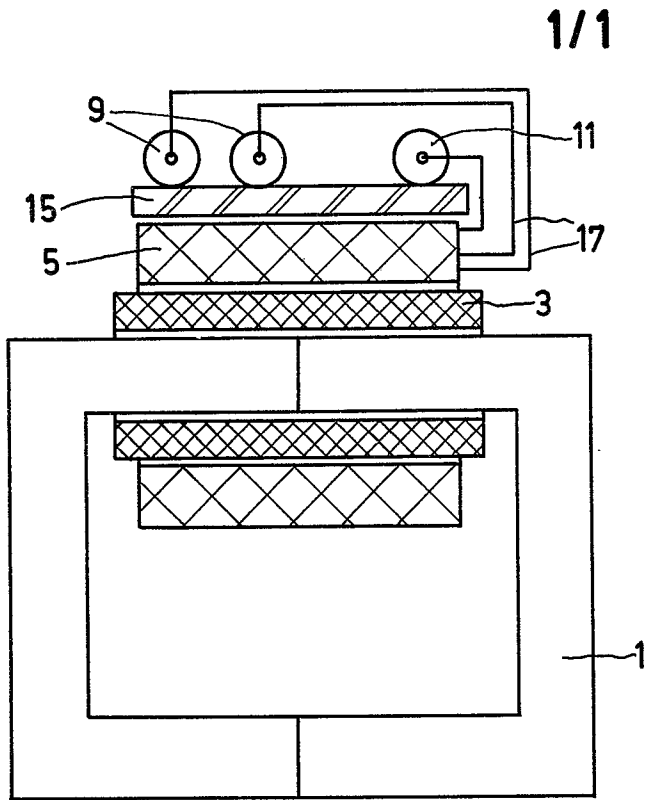


FIG. 1

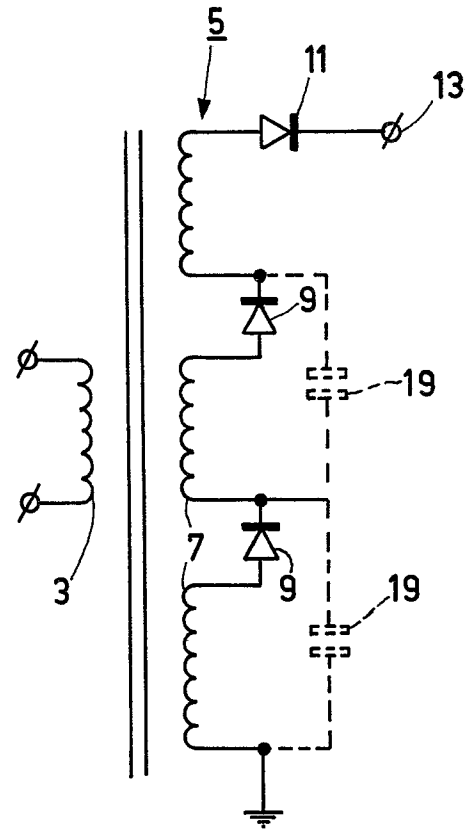


FIG. 2

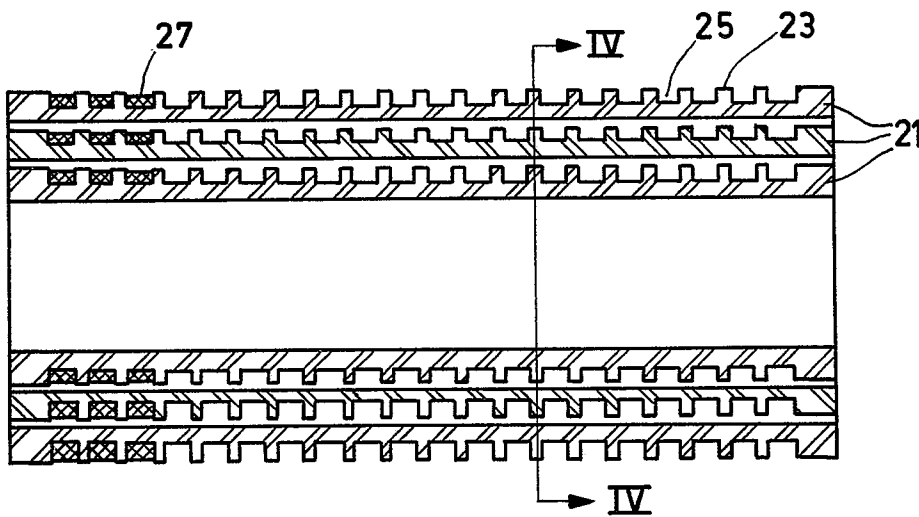


FIG. 3

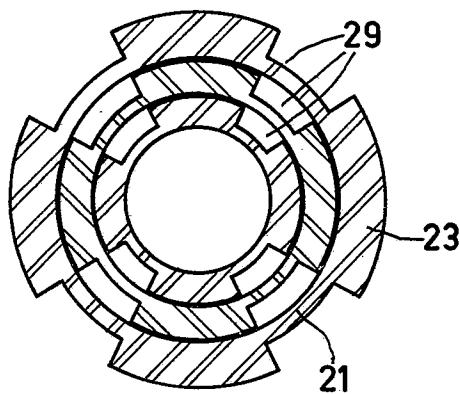


FIG. 4



DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int. Cl. ³)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
	<u>US - A - 4 204 263</u> (DENKI-ONKYO) * Column 3, lines 14-26; column 4, lines 60-61 *	1-3	H 01 F 27/30 19/00 31/08
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	<u>GB - A - 2 007 030</u> (MURATA MANUFACTURING) * Figures 1-30 *	1,2	
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A	<u>US - A - 3 843 903</u> (MATSUSHITA)		
A	<u>US - A - 3 904 928</u> (HITACHI)		
A	<u>CA - A - 1 073 978</u> (A.E.S. APPLICAZIONI ELETTRONICHE S.P.A.)		

			TECHNICAL FIELDS SEARCHED (Int. Cl. ³)
			H 01 F 27/30 19/00 31/08 5/02 27/32
			CATEGORY OF CITED DOCUMENTS
			X: particularly relevant A: technological background O: non-written disclosure P: intermediate document T: theory or principle underlying the invention E: conflicting application D: document cited in the application L: citation for other reasons
			&: member of the same patent family, corresponding document
☒ The present search report has been drawn up for all claims			
Place of search	Date of completion of the search	Examiner	
The Hague	22-09-1981	VANHULLE	