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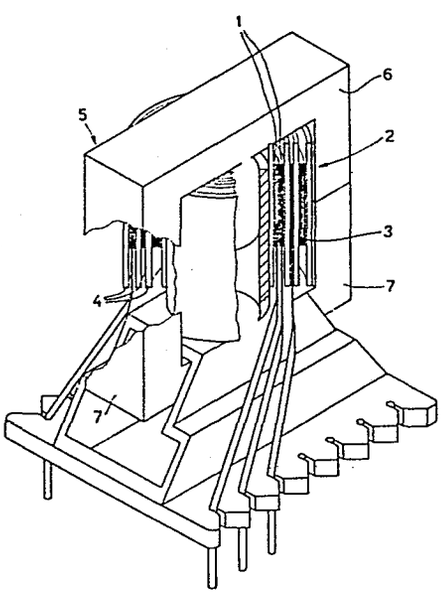
(54) **Switch mode transformer for proportional control of static commutating elements.**

(57) The invention relates to an SMT transformer for proportional control of static commutating elements. The primary (1) and secondary (2) windings of the transformer are formed by winding respective metal strips (3), superimposed on insulating film, around a portion of a ferrite core (5) of the open type.



EP 0 126 365 A1

1 Description

The present invention relates to a transformer of the so-called SMT (switch mode transformer) type, particularly for employ as a basic component for the proportional control of static commutating elements.

Granted that by "proportional control" one normally understands the condition under which the electronic control components associated with the primary winding of the transformer operate at a substantially constant load current/ /control current ratio, it is known that for satisfactory functioning of the entire circuit an SMT transformer has to ensure a reliable separation of the circuits while presenting a minimum parasitic inductance between its primary and secondary windings.

The circuit separation, required for safety reasons, is obtained by maintaining a substantially loose coupling between the windings which are usually formed of insulated copper wire. The loose coupling is at variance, however, with the requirement to minimize the parasitic inductance in the transformer so as to permit a rapid signal transmission between the windings free of spurious components and to thus ensure the correct control of the circuit associated to the transformer.

For minimizing the occurrence of parasitic inductance in spite of the above noted loose coupling (required for safety reasons, as explained above) it is common practice to provide SMT transformers of the type under discussion with a "closed" ferrite core having an internal center core portion and an outer shield substantially enclosing the transformer. In this manner the magnetic flux always circulates within the ferrite core substantially without having to cross air gaps even externally of the transformer.

In practice, the closed core is usually formed of two

components connected to one another in a suitable manner and necessarily formed with windows for the passage of the transformer terminals. These windows are basically undesirable and therefore kept as small as possible.

It is obvious that SMT transformers having a closed core present considerable difficulties as regards the formation of the windings, and in particular as regards the assembly of the various components. These difficulties are such as to render the full automatization of the manufacture and assembly of the transformers impossible with all the resultant consequences with respect to productivity and economy.

It is therefore an object of the present invention to provide an SMT transformer of the type defined in the introduction, which present optimum safety and functional characteristics and permits its manufacture to be substantially simplified and readily automatized.

According to the invention, this object is attained in an SMT transformer for proportional control of static commutating elements, comprising at least two primary windings and at least one secondary winding, by providing that the primary windings and the secondary winding(s) are formed respectively of metal strips wound, with interposition of an insulating film, on at least one portion of a per se known ferrite core of the open type.

The characteristics and advantages of the invention will become more clearly evident from the following description of an exemplary embodiment with reference to the accompanying drawing, the only figure of which shows a partially sectioned perspective view of a preferred embodimetn of a transformer according to the invention.

The SMT transformer shown substantially comprises at least two primary windings 1 and at least one secondary winding 2

formed, in contrast to the windings of a conventional transformer, of a metal strip (3) preferably of aluminum, superimposed on an insulating film. This technique for the formation of windings is per se known for instance from the field of coil-wound capacitors and from the manufacture of certain types of transformers, but has never as yet been employed in the manufacture of SMT transformers of the type under discussion, mainly because of the practical impossibility of forming a metal strip winding in combination with the use of a core of the "closed" type. As explaiend above, the closed core has formerly been thought to be indispensable in an SMT transformer for proportional control in order to minimize parasitic inductance and to thus ensure a satisfactory overall functioning.

According to a fundamental aspect of the invention, the metal strips 3 constituting the primary windings 1 and secondary winding 2 are wound in a concentric arrangement with windings 4 of an insulating film interposed therebetween, on at least one portion (not visible in the drawing) of a ferrite core 5 of the open type.

In the embodiment shown in the drawing, ferrite core 5 comprises two substantially E-shaped portions 6 and 7 connected to one another in a mirror-symmetric arrangement, with the windings 1, 2 supported on the central legs.

The ferrite core may obviously have other shapes, for instance a C-shaped configuration. In each case, the employ of an open core greatly simplifies the assembly of the various components of the transformer permitting such assembly to be readily and completely automatized.

As generally known, the employ of an open ferrite core in an SMT transformer of the type under discussion tends to increase the occurrence of parasitic inductance to a degree unaccceptable for the stated applications. In the transformer according to the invention, this phenomenon is unex-

pectedly compensated by the employ of metal strips for forming the windings.

As in fact found in practical experiments, the metal strips permit the formation of a more compact winding as compared to a conventional winding of copper wire, with a reduced dispersion of the magnetic flux, so as to compensate in optimum manner the hypothtical functional disadvantages deriving from the employ of an open core.

The transformer according to the invention may of course be modified in any suitable manner within the scope of the basic characteristics of the present invention.

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TITLE MODIFIED
see front page

SMT Transformer for Proportional Control of Static Commutating Elements

Patent Claim:

An SMT transformer for proportional control of static commutating elements, comprising at least two primary windings and at least one secondary winding, characterized in that said primary windings (1) and said secondary winding(s) (2) are formed respectively of metal strips (3) wound, with the interposition of an insulating film, on at least one portion of a per se known ferrite core (5) of the open type.

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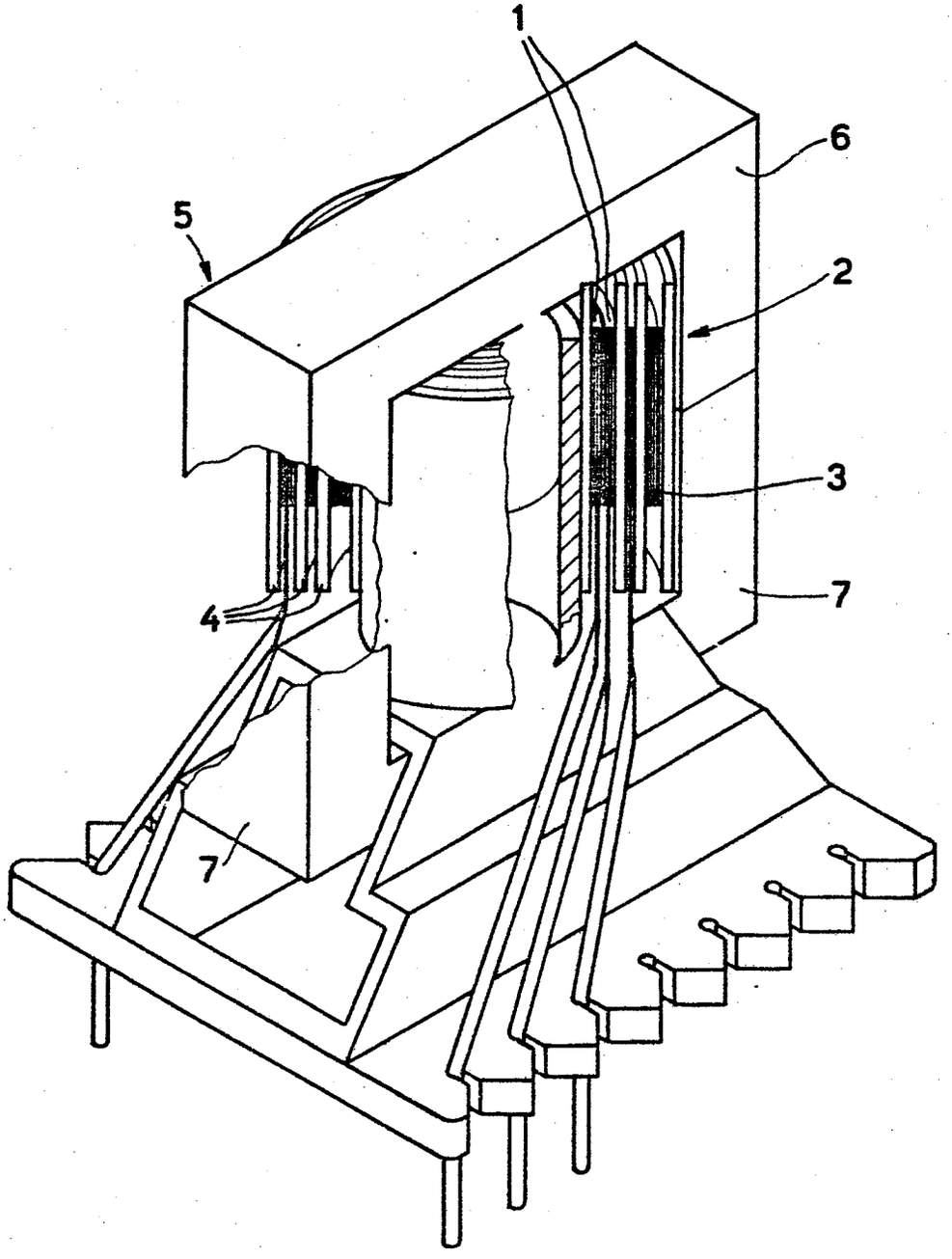

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EUROPEAN SEARCH REPORT

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Application number

EP 84 10 5148

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. ³)
X	US-A-3 617 854 (COLE) * Column 3, line 60 - column 4, line 1; column 4, lines 30-39; figure 4 *	1	H 01 F 19/08
A	US-A-3 611 233 (HALDEMANN) * Column 1, lines 53-70; figure 4 *	1	
A	US-A-3 742 332 (SIEMENS)		

TECHNICAL FIELDS SEARCHED (Int. Cl. ³)

H 01 F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	15-08-1984	BIJN E.A.

CATEGORY OF CITED DOCUMENTS

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E : earlier patent document, but published on, or after the filing date
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