

SHIELDING DEVICE FOR A SWITCHING POWER SUPPLY TRANSFORMER

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BACKGROUND OF THE INVENTION

This invention concerns an electromagnetic shielding device for a switching power supply transformer.

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DESCRIPTION OF THE PRIOR ART

Switching power supplies are currently used on most television sets and computer monitors. Each of these power supplies is fitted with a transformer mounted on a chassis, which itself is placed beneath the cathode ray tube (CRT) of the television or monitor.

These power supplies operate by chopping or switching the current. This switching has the undesirable effect of inducing parasitic electromagnetic radiation at the transformer which affects electromagnetic receivers, in particular CRT deflecting coils. This creates varying degrees of image disturbance whose visibility depending on the switching frequency, the physical position of the transformer and the sensitivity of the deflecting coils.

In the case of a synchronized switching frequency of fixed value, these electromagnetic disturbances actually exist but fortunately they are not visible on the screen since they appear during the return phase of the scanning spot.

However, some switching power supplies operate at a frequency that varies significantly according to the electrical power demand by the television set or monitor, the power supply voltage and the demand on the transformer. This switching frequency then varies continuously, resulting in a beat phenomenon between this frequency and fixed scanning frequency of the spot on the television set or monitor. This frequency beating causes image pollution on the screen which appears visually as a horizontal "pattern" that may be more or less dark, in

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other words a grayish strip that scrolls on the CRT screen and which is obviously unacceptable in the vast majority of cases. Since it is usually impossible to physically move the switching transformer sufficiently far away (it would have to be completely removed from the chassis of the television or monitor), another solution must be found to avoid this image pollution phenomenon.

First, it would be possible to invert the parasitic electromagnetic field transmitted by the switching transformer by inverting its windings to shift this field. This solution is unfortunately insufficient to efficiently prevent the image pollution mentioned above, and therefore a shielding device has to be provided for this transformer.

One shielding device that is currently used on these transformers consists of a metal cover which completely encloses the transformer, which obviously gives an excellent result from the point of view of protection against the image pollution mentioned above. However, this cover is physically large and is expensive to manufacture (if only due to the price of the raw material). Furthermore, this completely enclosing cover reduces safety distances between the primary and secondary circuits of the transformer since it necessarily passes close to certain cable or wiring outlets; it is usually necessary to insulate the inside of this metal cover by depositing a coat of insulating material in order to respect compulsory galvanic insulation standards. It is also usually necessary to insulate the outer surface in the same way, since the distance between the cover and electronic components located on the television board is usually too short to respect safety standards. This increases the cost price of this shielding part, which is already high.

Another shielding solution is to provide a magnetic loop consisting of an annular copper strip which encloses the middle part of the transformer parallel to the plate on which its output pins are soldered.

In a transformer made in "layers", this shielding ring is installed directly by tight winding followed by soldering of this ring around the transformer's "belly" (the part containing its windings). This solution provides satisfactory electromagnetic protection, but not as good as the total shielding provided by the cover described

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above. Moreover, it is also expensive, since it is an add-on part that must be placed precisely around the transformer, enclosing it closely to prevent any risk of movement (this risk would be contrary to safety standards), and on which a soldering operation has to be carried out to guarantee that it is short circuited.

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Furthermore, these layered transformers are increasingly tending to be replaced by "flat coil" transformers for obvious reasons related to easier automation during manufacture. This type of transformer is shown in figure 1 under the general reference 1.

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In this figure, we see the transformer's ferrite core 2, the "flat coils" 3, the wires 4 that they guide and support, and the transformer's input/output pins 5.

For this type of transformer, it is obviously impossible to provide a short circuited metal strip enclosing the belly, since the flat coils 3 are fitted with projecting parts of complicated shape. The solution then adopted consists in providing a plastic cover 6 which completely encloses the transformer 1 as shown on the drawing, around which a metal shielding loop 7 is fitted of about the same height and thickness as those used on layer-type transformers. This part 6, 7 is click-fitted onto the transformer 1. This part, like the solutions mentioned previously, is expensive to manufacture and is difficult to mount automatically on a switching transformer assembly line. Furthermore, as in the case of the magnetic loop described above, the electromagnetic protection provided is not absolutely perfect.

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SUMMARY OF THE INVENTION

The present invention is designed to overcome these disadvantages.

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It consists of an electromagnetic shielding device for a switching power supply transformer, composed of a single metal cap having a flat bottom and downward-facing edges that fits on top of said transformer and provides electromagnetic protection for this transformer.

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The width of the edges of said cap is small enough so that it does not affect the galvanic insulation provided by the transformer, but nevertheless wide enough to facilitate its placing (for example by a robot) on top of the transformer, and to provide the required electromagnetic protection.

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The cap is preferably made by stamping. Its design enables it to be easily placed and fixed, for example by gluing, on the ferrite core of said transformer. It is placed on the ferrite core after applying glue to this core (drops of glue at one or two points, for example), this glue preferably being the same as that used to assemble the parts of the ferrite core. These gluing and fitting operations are easily performed using an automated assembly system.

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BRIEF DESCRIPTION OF THE DRAWINGS

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The invention will be better understood and other advantages will become clear on reading the following description of an embodiment, taken as a non-limitative example, making reference to the appended figures, of which:

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- Figure 1, already described, is a front view of a system of shielding of a power supply transformer, according to the prior art;

- Figure 2 is a full-scale perspective view of a shielding device for a switching power supply transformer, according to the invention, showing its method of fitting on the transformer.

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Referring to figure 2, the switching power supply transformer 1 in figure 1 is shown in perspective, with its ferrite core 2, its flat coils 3, its connection wires 4, and its input/output pins 5.

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The electromagnetic shielding device consists of a cap 7 in the form of a dish or tray that is made by stamping. The flat bottom 8 of this cap is rectangular and has the same outside dimensions as the upper rectangular face 9 of the ferrite core 2. The cap 7 may be made of copper, aluminum or brass, for example.

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The edges 10 of the cap 7 are inclined at an angle α with respect to the line perpendicular to the bottom plane 8. This angle, which may be of the order of 15° to 20°, for example, is optimized to facilitate automatic placement of the cap 7 on the top of transformer 1 (as shown by the dashed line on the drawing) with edges 10 facing downwards, and to provide the required electromagnetic protection.

The width L of these edges 10 is chosen to be small (for example of the order of a few millimeters); it must be wide enough so that placement of cap 7 on the top face 9 of core 2 is as easy as possible, but not too wide. In this way the galvanic protection standards for the transformer can be respected, while providing the required electromagnetic isolation.

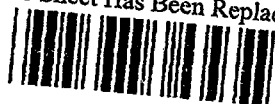
The simple shape of the shielding cap 7, with no cutouts or sharp points that could catch on other parts, and its compact size facilitate its manipulation on an automated assembly line with a vibrating hopper feeder. No costly change of the production line should be necessary.

Two droplets of glue 11, 12 are placed on the top face 9 of the ferrite core 2 before a robot places the cap 7 (in the direction of arrow F and with edges 10 facing downwards) on the top 9 of transformer 1, this glue preferably being the same as is used to assemble the two halves of the ferrite core 2 at 13 (which provides a cost advantage from the point of view of glue provisioning).

With this shielding device, electromagnetic protection performances of television set and monitor deflecting coils are almost perfect.

Obviously, the invention is not limited to the embodiment described above, and can be made in other equivalent forms.

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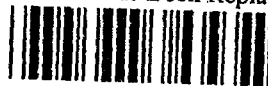
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WHAT IS CLAIMED IS

- 5 1. Electromagnetic shielding device for a switching power supply transformer, composed of a single metal cap having a flat bottom and downward-facing edges that fits on top of said transformer and provides electromagnetic protection for this transformer.
- 10 2. Electromagnetic shielding device according to claim 1, wherein said metal cap is made by stamping.
3. Electromagnetic shielding for a switching power supply transformer according to claim 1, that can be fixed by gluing to the top surface of the
15 ferrite core of said transformer, using the same glue as that used to assemble the components of this ferrite core.
4. Television power supply transformer that includes an electromagnetic shielding device according to claim 1.
- 20 5. Transformer according to claim 4, composed of a ferrite core and flat coils that guide wires connected to the connection pins.
- 25 6. Television fitted with a switching power supply transformer, wherein this transformer includes an electromagnetic shielding device according to claim 1.



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