FLYBACK TRANSFORMER

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a flyback transformer, and more particularly to a connection between cores of a flyback transformer.

2. Description of Related Art

A flyback transformer has been conventionally known as a lateral deflection output transformer which supplies a direct high voltage to an anode of a cathode-ray tube of a television or the like. Figs. 5 and 6 show such a conventional flyback transformer. The flyback transformer comprises two U-shaped cores abutting on each other's legs, a primary low-voltage coil section 2, legs 1b of the cores 1 being inserted in the low-voltage coil section 2, while the other legs 1a thereof being out of the coil section 2, a secondary high-voltage coil section 3 which is fitted around the low-voltage coil section 2, and a case 4 enclosing the high-voltage coil section 3 with an insulating resin (not shown) filled therein. In the case 4, further, other necessary elements such as high-voltage rectifying diodes, capacitors, resistors, etc. are provided, though they are not shown in Figs 5 and 6. Numeral 5 in Fig. 5 denotes a focus potentiometer fitted to the flyback transformer.

The cores 1 are joined together by connecting their legs 1a and 1b by an insulating (for example, silicone, acrylic, epoxy or the like) adhesive 7 with an insulating cap 6 in-between. In order to secure the integration, the legs 1a which are out of the case 4 are held by a U-shaped metal spring 8. The joined cores 1 form a path of a magnetic flux, and the insulating cap 6 is to prevent saturation of magnetism of the cores 1. The insulating cap 6 may be provided in one of the connecting portions between the legs 1a and between the legs 1b or may be provided in both of the connecting portions. The metal spring 8 also functions to electrically connect the grounded lower core 1 to the upper core 1.

The low-voltage coil section 2 is composed of a cylindrical insulating bobbin 9 and a wire 10, for example, an enamel copper wire, section-wound around the bobbin 9. The cylindrical bobbin 9 has partitions on the circumference and a flange 9a at the lower end. The wire 10, after being wound in each section between two adjacent partitions, is once led down to the flange 9a and connected to one of terminal pins 11 which are protruded from the flange 9a. The high-voltage coil section 3 is composed of an insulating cylindrical bobbin 12 and a wire 13, for example, an enamel copper wire, wound around the bobbin 13. In the cylindrical bobbin 12, the low-voltage coil section 2 is inserted.

In the above-described conventional flyback transformer, the metal spring 8 is provided to the joined cores 1

in order to electrically connect the cores 1. For the purpose, other arrangements have been also adopted conventionally. For example, as shown in Fig. 7, instead of providing the metal spring 8, the legs 1a of the cores 1 are coated with a conductive adhesive 14. In this case, the conductive adhesive 14 electrically connects the lower core 1 to the upper core 1.

In joining the cores 1 of the flyback transformer shown in Figs. 5 and 6, the metal spring 8 must be prepared as a separate part from the U-shaped cores 1 and must be fixed to the cores 1. Thus, the metal spring 8 increases the cost and the number of processes. In joining the cores shown in Fig. 7, after connecting two U-shaped cores by the insulating adhesive 7, the conductive adhesive 14 must be coated on the legs 1a in a separate process, and this also increases the cost and the number of processes.

SUMMARY OF THE INVENTION

An object of the present invention is to provide a flyback transformer which requires less cost and fewer processes for assembly thereof.

A flyback transformer according to the present invention has a U-shaped cores abutting on each other's legs, and butted legs of the cores at least on one side are connected by a conductive material containing adhesive, which is pre-

pared by adding a conductive material to an insulating adhesive at a percentage within a range from about 1wt% to 15wt%.

In the structure, since the butted legs of the cores at least on one side are connected by a conductive material containing adhesive, the cores are electrically connected to each other.

BRIEF DESCRIPTION OF THE DRAWINGS

This and other objects and features of the present invention will be apparent from the description with reference to the accompanying drawings, in which:

Fig. 1 is a sectional view of a flyback transformer according to the present invention, showing the general structure;

Fig. 2 is a side view of cores which have a first modified connection therebetween;

Fig. 3 is a side view of cores which have a second modified connection therebetween;

Fig. 4 is a graph showing the relationship between the adhesive strength and the percentage of a conductive material contained in an adhesive;

Fig. 5 is a perspective view of a conventional flyback transformer;

Fig. 6 is a sectional view of the conventional flyback transformer, showing the general structure; and

Fig. 7 is a side view of cores of another conventional flyback transformer.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Preferred embodiments of the present invention are described with reference to the accompanying drawings.

Fig. 1 is a sectional view of a flyback transformer according to the present invention, showing the general structure. Fig. 2 is a side view of a first modified core of the flyback transformer, and Fig. 3 is a side view of a second modified core of the flyback transformer. The fundamental structure and the elements of the flyback transformer of the embodiment are basically the same as those of the conventional flyback transformers. In Figs. 1 through 3, the same or corresponding parts and members as those shown in Figs. 5 through 7 are provided with the same reference symbols, and the detailed description of these members is omitted.

The flyback transformer according to the present invention, like the above-described conventional ones, comprises two U-shaped cores 1 abutting on each other's legs, a low-voltage coil section 2 in which legs 1b of the cores 1 are inserted, a high-voltage coil section 3 fitted around the low-voltage coil section 2, and a case 4 enclosing the high-voltage coil section 3 with an insulating resin (not shown)

filled therein. The other legs 1a of the cores 1 are out of the case 4. Insulating caps 6 are provided in the connecting portions between the legs 1a and between the legs 1b of the cores 1. The legs 1b inserted in the cylindrical bobbin 9 of the low-voltage coil section 2 are connected by an insulating (for example, silicone, acrylic, epoxy or the like) adhesive 7.

The legs 1a which are out of the case 4 are connected by a conductive material containing adhesive 15. The conductive material containing adhesive 15 is made by adding a conductive material to an insulating adhesive, such as a silicone, an acrylic or an epoxy adhesive, at a percentage within a range from about 1wt% to 15wt%. The conductive material is practically carbon powder, for example, furnace black, carbon black, acrylic black, etc., or metal powder, for example, powder of nickel, silver, molybdenum, aluminum, etc. The conductive material and the insulating adhesive are stirred sufficiently. The percentage of the conductive material is changed depending on the diameter of particles of the conductive material.

Fig. 4 shows the relationship between the adhesive strength of the cores 1 to each other and the percentage by weight of the conductive material contained in the adhesive 15. Fig. 4 is a result of a tensile strength test. The conductive material containing adhesive 15 was prepared by adding furnace black, which is a conductive material, to a

liquid silicone thermosetting adhesive, which is an insulating adhesive, and the adhesive 15 was coated on the ends of the legs 1a of the cores 1 at a thickness of 50 μm. Then, the joined cores 1 were subjected to the test. As is apparent from Fig. 4, as the percentage of the furnace black is increasing until 5wt%, the adhesive strength is increasing because of the consolidating action of the carbon. However, as the percentage of the furnace black is increasing over 5wt%, the adhesive strength is decreasing.

Considering that an adhesive strength not less than 15kgf/cm^2 is required for the connection between the cores 1, although the required adhesive strength depends on the kind and the use of the flyback transformer, the conductive material should be added at not more than 15wt%. The reason why a conductive adhesive 14 on the market is not used is that any ordinary conductive adhesive on the market contains a conductive material at a percentage within a range from 20wt% to 80wt% and has poor strength and poor moisture resistance.

In this embodiment, although the legs 1b of the cores 1 are connected by the insulating adhesive 7, the cores 1 are electrically connected because the other legs 1a of the cores 1 are connected by the conductive material containing adhesive 15. According to experiments conducted by the inventors, an adhesive prepared by adding carbon powder to a silicone insulating adhesive at 4wt% could electrically connect the cores 1 when the distance between the legs 1a was

0.5mm. In this embodiment, the legs 1a of the cores 1 are connected by the conductive material containing adhesive 15. However, it is possible to use the conductive material containing adhesive 15 for the connection between the legs 1b, not for the connection between the legs 1a or to use the conductive material containing adhesive 15 for both the connections between the legs 1a and between the legs 1b.

In the flyback transformer shown in Fig. 1, an insulating cap 6 is provided between the legs 1a of the cores 1. However, as shown in Fig. 2, it is possible to connect the legs 1a by the conductive material containing adhesive 15 without providing the insulating cap 6. Further, as shown in Fig. 3, instead of the insulating cap 6, a conductive cap 16 can be provided between the legs 1a which are connected by the conductive material containing adhesive 15.

Although the present invention has been described in connection with the preferred embodiments above, it is to be noted that various changes and modifications are possible to those who are skilled in the art. Such changes and modifications are to be understood as being within the scope of the present invention.

CLAIMS

1. A flyback transformer comprising:

a couple of U-shaped cores abutting on each other's legs;

a conductive material containing adhesive for connecting butted legs of the cores at least on one side, the conductive material containing adhesive being prepared by adding a conductive material to an insulating adhesive at a percentage within a range from about 1wt% to 15wt%;

a low-voltage coil wound around the cores; and

a high-voltage coil wound around the low-voltage coil.

2. A flyback transformer as claimed in claim 1, wherein the insulating adhesive contains one of silicone resin, acrylic resin and epoxy resin.

3. A flyback transformer as claimed in claim 1, wherein the conductive material contains metal powder of one selected from groups of nickel, silver, molybdenum and aluminum, or carbon powder.

4. A flyback transformer as claimed in claim 1, wherein a conductive member is provided between the butted legs of the cores which are connected by the conductive material

containing adhesive.

5. A flyback transformer as claimed in claim 1, wherein:

butted legs of the cores in a first connecting portion are connected to each other by an insulating adhesive; and

butted legs of the cores in a second connecting portion are connected to each other by the conductive material containing adhesive.

6. A flyback transformer as claimed in claim 5, wherein an insulating member is provided in the first connecting portion and/or the second connecting portion.