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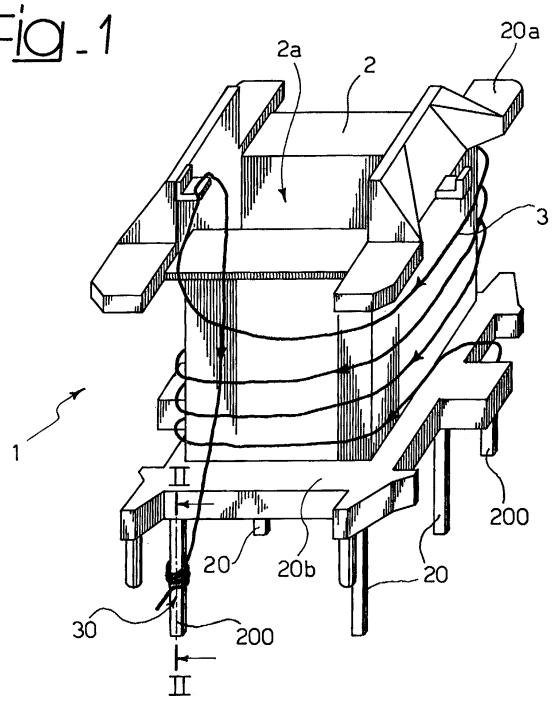
(54) A mounting assembly for inductors and method of producing the same

(57) A mounting assembly of an inductor (1) includes:

- a moulded inductor body (bobbin - 2) of an electrically insulating material having an end face (20b) with one or more integrally moulded pins (200) protruding from the end face (20b),
- a wire winding (3) around the body (2), the wire of the winding having at least one end (30) wound around the a respective one of the integrally moulded pins (200) protruding therefrom, and
- a mass of soldering material (4) securing the end(s) of the wire (3) wound around the respective integrally moulded pin (200), whereby the soldering material (4) provides electrical contact to the end (30) of the wire.

Fig. 1



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Description

Field of the invention

[0001] The present invention relates to mounting assemblies for inductors.

Description of the related art

[0002] Inductors are frequently used as components in a wide variety of electronic/electrical circuits. Exemplary applications of inductors are e.g. so-called "chokes" currently used for interference suppression e.g. in motors of house appliances in order to prevent RF interference on radio, TV equipment and the like or in electronic ballasts of fluorescent lamps.

[0003] Typical inductor mounting assemblies are typically comprised of an inductor body (sheath or bobbin) of an electrically insulating material and a conductive wire winding around the bobbin. A core such as a ferrite core may be inserted in the bobbin to increase the inductance value of the inductor.

[0004] As such, these components are mostly mounted on a printed circuit board (PCB) together with other circuit components. For that purpose, the ends of the inductor winding are connected (soldered) to metal pins.

[0005] A current arrangement provides for the inductor body or bobbin being produced of a plastics material via a moulding process such as injection moulding. After moulding, the metal pins are inserted into the body after moulding at the desired locations, and the ends of the inductor winding are soldered to the metal pins to provide the necessary electrical connection. The pins protrude from the inductor body to permit insertion into receiving holes provided in the PCB onto which the inductor is mounted.

[0006] For insulation reasons, the inductor winding is usually comprised of an electrically conductive (e.g. copper) wire covered by an insulating coating such as e.g. an enamel. In order to provide good electrical connection to the pins, the enamel must be locally removed (e.g. broken), which typically occurs via the application of heat.

[0007] The prior art arrangements just described suffer from a number of disadvantages essentially related to the related process being intrinsically slow. Productions costs of such assemblies are also adversely affected the need of using metal pins and the related insertion step into the inductor body or bobbin.

[0008] From the production of Ing. Norbert Weiner GmbH of Bergneustadt (Germany) so-called potting boxes are known for possible use with PCBs, specifically for use as components adapted for SMD mounting onto a PCB. These are plastic boxes having no metal terminals. When resorting to that arrangement, wires are connected to integrated plastic feet. Depending on the wire thickness, the binding-on points of the wires are fixed in v-shaped slots of the plastic feet for wrapping and provide the eventual connection to the PCB. These soldering points should be brushed blank before positioning onto the PCB. These boxes for PCBs are indicated as suitable for filter chokes or ISDN components.

Object and summary of the invention

[0009] Despite the efforts witnessed by the prior art discussed in the foregoing, the need is still felt for inductor mounting arrangements that:

- may be of simple construction and structure while representing a versatile technical solution, and
- do not involve major changes in the layout of the printed circuit boards and the assembly procedure adopted for mounting an inductor on a PCB.

[0010] The object of the present invention is to provide a choke that satisfies those still outstanding needs.

[0011] According to the present invention, that object is achieved by means of a mounting assembly for inductors having the features set forth in the claims that follow, such claims constituting an integral part of the disclosure of the invention. The invention also relates to a corresponding method of producing such a mounting assembly.

[0012] A presently preferred embodiment of the invention includes:

- a moulded inductor body (or bobbin) of an electrically insulating material (e.g. plastics) having an end face with at least one integrally moulded pin protruding from said end face,
- a wire winding around the said body, the wire of said winding having at least one end wound around said at least one integrally moulded pin protruding from said end face, and
- a mass of soldering material securing said at least one end of said wire wound around said at least one integrally moulded pin, said soldering material providing electrical contact to said at least one end of said wire.

Brief description of the drawings

[0013] The invention will now be described, by way of example only, with reference to the annexed figures of drawing, wherein,

- Figure 1 is schematic perspective view of a mounting assembly for an inductor according to the invention,
- Figure 2 is a cross sectional view along line II-II of Figure 1, and
- Figure 3 is a flow chart of a method of producing the mounting assembly of Figure 1.

Detailed description of a preferred embodiment of the invention

[0014] In Figure 1 of the annexed drawing, reference 1 indicates as a whole an inductor. The inductor in question may be e.g. a so-called choke for use in interference suppression in motors of house appliances in order to prevent RF interference on radio, TV equipment and the like. An alternative exemplary field of use may be electronic ballasts of fluorescent lamps.

[0015] Those of skill in the art will promptly appreciate that these possible field of use are of purely exemplary nature and must in no way be construed in a limiting sense of the scope of the invention, which is altogether general. In fact, the inductor considered herein may be any type of inductor for use in an electrical/electronic circuit and adapted to be mounted on a printed circuit board (PCB) together with other circuit components (not shown).

[0016] The inductor mounting assembly 1 considered herein includes an inductor body (sheath or bobbin) 2 of an electrically insulating material. A case in point for such an insulating material is a plastics material (such as e.g. polybutyleneterephtalate PBTP, or others as polyamide PA, polycarbonate PC, polyethyleneterephtalate PETP, liquid crystal polymer LCP, polyphenylsulfid PPS). Such a material lends itself to producing the body 2 via a moulding process such as injection moulding. Plastics materials such as PBT have generally low softening temperatures in the range of 220 - 240 °C.

[0017] The body 2 generally exhibits a tubular shape with an axial orifice 2a possibly adapted to receive a core such as a ferrite core (not shown) inserted in the body to increase the inductance value of the inductor. The tubular body 2 is provided at its opposite ends 20a and 20b with flange formations whose purpose will be better explained in the following.

[0018] Integrally formed with the body 2 (and thus comprised of the same electrically insulating material e.g. PBT of the body 2) are one or more pins 200.

[0019] The pins 20 protrude from at least one of the end faces (here, the end face 20b) of the moulded inductor body (or bobbin). The pins 200 are thus adapted to be inserted into corresponding receiving holes provided in a PCB (not shown) onto which the inductor 1 is mounted.

[0020] Reference 3 denotes as a whole a winding of electrically conductive (e.g. copper) wire wound around the inductor body 2 in the region between the flange formations provided at the ends 20a and 20b. Such flange formations thus constitute lateral (i.e. axial) containment formations for the wire winding 3.

[0021] For insulation reasons, the electrically conductive wire of the winding 3 is usually covered by an insulating coating e.g. an enamel. In order to expose the winding wire at its ends, the coating must be locally removed (e.g. broken), which typically occurs via the application of heat. A typical enamel used for that purpose is a polyurethane enamel which, in order to be broken, must be brought to a temperature of at least 300 °C. It will be appreciated that such a temperature is in excess of the softening temperature (220 - 240°C) of the plastics material comprising the body 2, including the pins 200 integrally formed therewith.

[0022] As shown in Figure 1 and better detailed in the cross sectional view of Figure 2 - the wire winding 3 around the body 2 has at least one end 30 (and preferably both ends) wound around a respective one of the integrally moulded pins 200 protruding from the end face 20b of the body 2.

[0023] A mass of soldering material 4 secures the end 30 of the winding 3 around the respective pin 200 integrally moulded with the body. The soldering material (typically a Sn-Pb soldering mass having a melting temperature of about 180°C or the new lead free alloys which melting temperature may vary depending on the elements included but generally below 250°C) provides electrical contact to the end 30 of the wire.

[0024] This arrangement gives rise to a pin structure including a "core" integrally formed of the same insulating (plastics) material of the body 2. This structure also includes outer, electrically conductive "cladding" comprised of the end 30 of the wire 3 wound around the pin 200 and the mass of soldering material 4 that secures the end 30 around the pin 200.

[0025] The manufacturing process schematically represented by the flow chart of Figure 3 includes as a first step 100 the moulding of the body 2 - and the pin(s) 200 integrally formed therewith. This typically occurs via conventional technologies such as injection moulding, so that the said body 2 and each pin 200 integrally moulded therewith comprise a (single) injection-moulded piece.

[0026] In a step 102, the wire 3 is wound around the body 2. This again occurs by resorting to automated winding techniques that are conventional in the art of inductor manufacture. Such automated techniques usually provide for the body 2 to be rotated around a main axis, while the wire is metered out of dispensing head that moves relatively axially of the body 2. Such a winding technique can be easily extended in a step 103, to winding the wire end(s) 30 around the respective pin or pins 200 as shown in Figure 2.

[0027] At this point, in a step 104, the wire end 30 wound around the pin 200 is subject to heating (typically in excess of 300°C, such as e.g. heating at 400°C for 1/10 of a second) in order to "break" the insulating enamel and thus locally remove the insulating coating to expose the conductive core of the wire end.

[0028] Despite the short time of application, heat applied to break the insulating enamel may in fact marginally soften the plastics material of the pin 200, which has a lower softening temperature. Any undesired deformation of the pin is however avoided by the wire end 30 forming a sort of containment cage around the plastics core of the pin 200.

[0029] Finally, in step 105, the soldering mass 4 is ap-

plied around the pin 200 and the wire end 30 wound thereon to complete the arrangement shown in Figure 2.

[0030] Of course, without prejudice to the underlying principles of the invention, the details and the embodiments may vary, also significantly, with respect to what has been described, by way of example only, without departing from the scope of the invention as defined by the annexed claims.

Claims

1. A mounting assembly of an inductor (1), including:

   - a moulded inductor body (bobbin - 2) of an electrically insulating material having at least one end face (20b) with at least one integrally moulded pin (200) protruding from said end face (20b),
   - a wire winding (3) around said body (2), the wire of said winding having at least one end (30) wound around said at least one integrally moulded pin (200) protruding from said end face (20b), and
   - a mass of soldering material (4) securing said at least one end (30) of said wire (3) wound around said at least one integrally moulded pin (200), said soldering material (4) providing electrical contact to said at least one end of said wire.

2. The assembly of claim 1, **characterized in that** said electrically insulating material is a plastics material.

3. The assembly of claim 2, **characterized in that** said electrically insulating material is polybutyleneterephtalate (PBTP).

4. The assembly of claim 2, **characterized in that** said electrically insulating material is polyamide (PA)

5. The assembly of claim 2, **characterized in that** said electrically insulating material is polycarbonate (PC).

6. The assembly of claim 2, **characterized in that** said electrically insulating material is polyethyleneterephtalate (PETP).

7. The assembly of claim 2, **characterized in that** said electrically insulating material is, liquid crystal polymer (LCP).

8. The assembly of claim 2, **characterized in that** said electrically insulating material is polyphenylsulfid (PPS)

9. The assembly of any of claims 1 to 8, **characterized in that** said body (2) and said at least one integrally moulded pin (200) comprise an injection moulded piece.

10. The assembly of any of claims 1 to 9, **characterized in that** the wire of said winding (3) is covered by an insulating coating, said coating being locally removed said at least one end (30).

11. The assembly of any of claims 1 to 10, **characterized in that** said mass of soldering material (4) includes a Sn-Pb soldering mass.

12. The assembly of any of claims 1 to 10, **characterized in that** said mass of soldering material (4) includes a new lead free alloys soldering mass.

13. The assembly of any of claims 1 to 12, **characterized in that** said at least one end (30) of said a wire winding (3) forms a containment cage around the respective pin (200).

14. A method of producing a mounting assembly of an inductor (1), including the steps of:

   - moulding (100) an inductor body (bobbin - 2) of an electrically insulating material having at least one end face (20b), said moulded body (2) having at least one integrally moulded pin (200) protruding from said end face (20b),
   - winding (102) a wire (3) around said body (2), said winding including winding (103) at least one end (30) of said wire (3) around said at least one integrally moulded pin (200) protruding from said end face (20b), and
   - applying (105) a mass of soldering material (4) to secure said at least one end (30) of said wire (3) wound around said at least one integrally moulded pin (200) while providing electrical contact to said at least one end of said wire.

15. The method of claim 14, **characterized in that** said moulding (100) is performed as injection moulding.

16. The method of either of claims 14 or 15, **characterized in that** said winding (102, 103) is performed by rotating said body (2) around a main axis, while said wire (3) is metered out of dispensing head that moves relatively axially of said body (2).

17. The method of any of claims 14 to 16, **characterized in that** it includes the steps of:

   - providing said wire (3) with a heat removable insulating coating, and
   - subjecting (104) said at least one pin (200) having said at least one end (30) of the wire wound thereon to heating in order to locally remove said insulating coating.

Fig_1

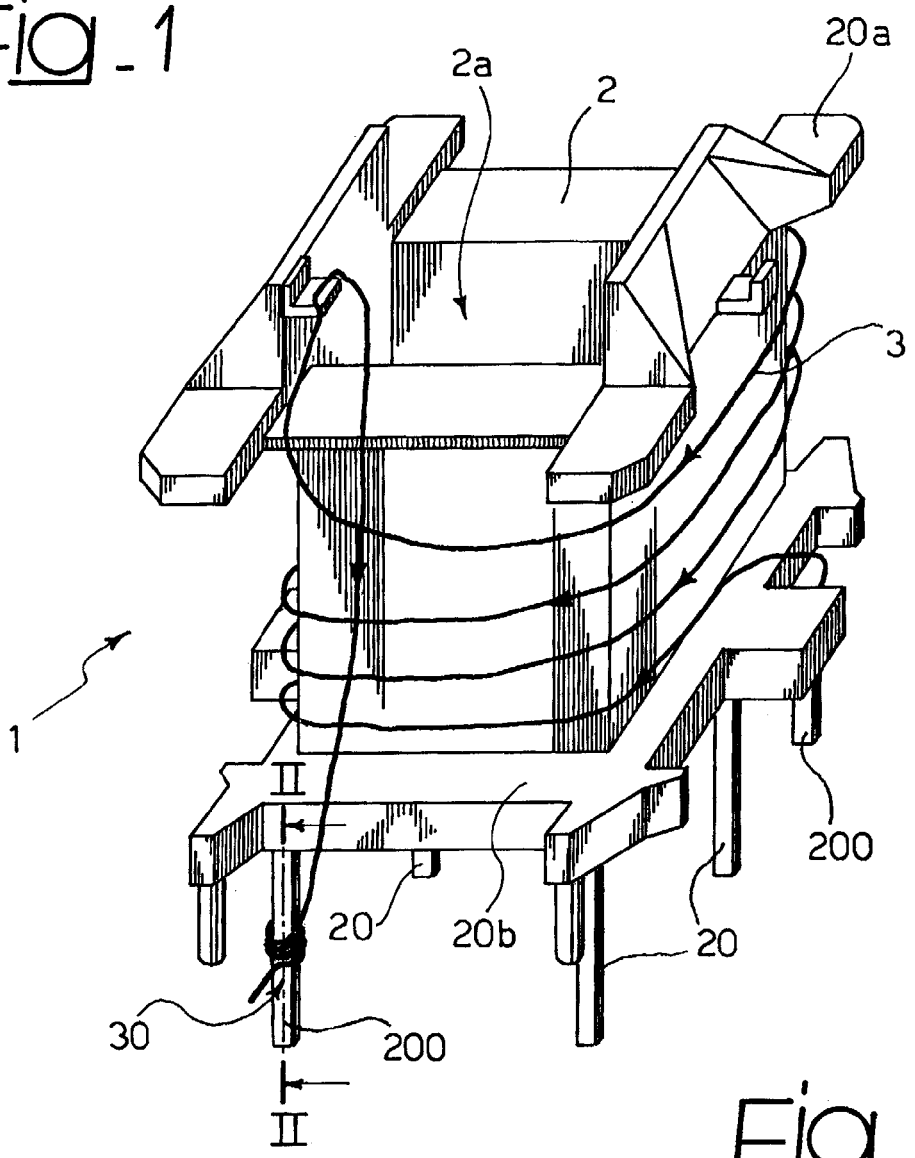


Fig_2

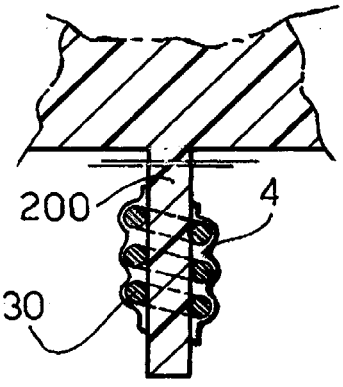
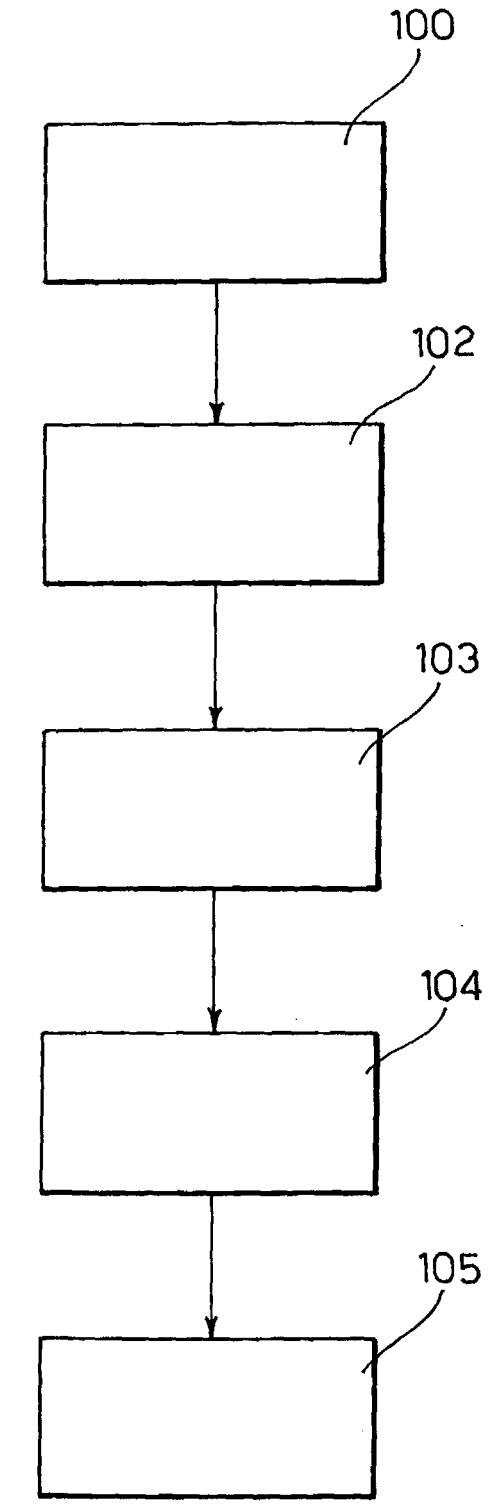


Fig. 3



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EUROPEAN SEARCH REPORT

Application Number
EP 04 42 5772

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TECHNICAL FIELDS SEARCHED (Int.Cl.7)

H01F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	14 March 2005	Stichauer, L

CATEGORY OF CITED DOCUMENTS

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 04 42 5772

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