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(72) Inventor: **Kuo, Ming-Chang**
Taichung City (TW)

(71) Applicant: **Good Sky Electric Co., Ltd.**
Taichung City, Taiwan (CN)

(74) Representative: **Jenkins, Peter David**
Page White & Farrer
Bedford House
John Street
London WC1N 2BF (GB)

(54) **Electromagnetic Relay and Method for Assembling the Same**

(57) An electromagnetic relay includes a casing (2), and a relay coremember sealed in the casing (2) and including an electromagnetic unit (3) and a terminal unit (4). The electromagnetic unit (3) includes a spool frame set (31) having an engagement portion, a coil unit (32) wound on the spool frame set (31), and a pair of coil winding pins (33). Each of the coil winding pins (33) has a conductive portion (331) exposed from one of opposite first sides (31a) of the spool frame set (31), and a coil winding portion (332) extending along one of opposite second sides (31b) of the spool frame set (31). The terminal unit (4) includes an engaging block (41) having an engagement portion connected to the engagement portion of the spool frame set (31) for preventing separation of the terminal unit (4) from the electromagnetic unit (3), a terminal set (42), and an armature component (43).

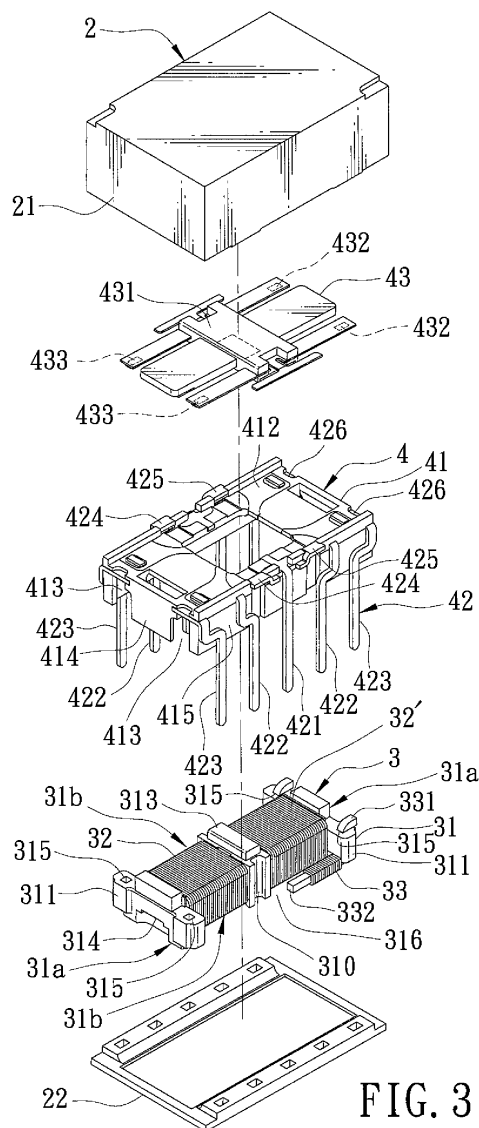


FIG. 3

Description

[0001] The present invention relates to an electromagnetic relay, more particularly to an electromagnetic relay including an armature component supported pivotally at a middle portion thereof.

[0002] Referring to Figures 1 and 2, U.S. Patent No. 4,881,053 discloses an electromagnetic relay 1 including a casing 11, an electromagnet block 12, and a base 13 that are sealed in the casing 11. The electromagnet block 12 includes a spool 121, two pairs of junction terminals 123 having coil winding portions 122 exposed from opposite longitudinal sides of the spool 121, and coils 124 wound on the spool 121. Each of the coils 124 has one end that is to be wound on one of the coil winding portions 122 of the corresponding pair of the junction terminals 123, and the other end that is to be wound on the other one of the coil winding portions 122 of the corresponding pair of the junction terminals 123. The base 13 includes a base body 131 for accommodating the electromagnet block 12, a pair of common terminals 132 and two pairs of fixed contact terminals 133 inserted into the base body 131 and spaced apart from each other, and two pairs of coil terminals 134 connected respectively and electrically to the junction terminals 123. An armature block 135 is connected electrically to the common terminals 132, and is supported pivotally by the electromagnet block 12.

[0003] When the armature block 135 is affected by an electromagnetic field generated by the electromagnet block 12, the armature block 135 is brought into contact with the left fixed contact terminals 133, so as to establish electrical connection between the common terminals 132 and the left fixed contact terminals 133 while breaking electrical connection between the common terminals 132 and the right fixed contact terminals 133. When the electromagnetic field is not generated, the armature block 135 is brought into contact with the right fixed contact terminals 133, so as to establish electrical connection between the common terminals 132 and the right fixed contact terminals 133 while breaking electrical connection between the common terminals 132 and the left fixed contact terminals 133. Therefore, the electromagnetic relay 1 can serve as a switch unit.

[0004] However, because the coil winding portions 122 of each pair of the junction terminals 123 project from the spool 121 away from each other, the size of the base body 131 is relatively large in order to accommodate the entire electromagnet block 12. Moreover, since there is no mechanism for fixing the electromagnet block 12 in the base body 131, it is difficult to connect the junction terminals 123 accurately to the coil terminals 134 during assembly. Further, the common, fixed contact, and coil terminals 132, 133, 134 are manually welded on both sides of the base body 131, so that the electromagnetic relay 1 cannot be fabricated at a high rate.

[0005] Therefore, an object of the present invention is to provide an electromagnetic relay that is easy to assemble and that can be fabricated at a high rate.

[0006] According to an aspect of this invention, an electromagnetic relay comprises a casing, and a relay core member that is sealed in the casing, and that includes an electromagnetic unit and a terminal unit.

[0007] The electromagnetic unit is adapted for generating an electromagnetic field, and includes a spool frame set that includes a pair of opposite first sides and a pair of opposite second sides, a coil unit wound on the spool frame set, and a pair of coil winding pins. Each of the coil winding pins has a conductive portion exposed from one of the first sides, and a coil winding portion extending along one of the second sides. The spool frame set further includes an engagement portion.

[0008] The terminal unit includes an engaging block including an engagement portion connected to the engagement portion of the spool frame set of the electromagnetic unit for preventing separation of the terminal unit from the electromagnetic unit, a terminal set exposed from the casing, and an armature component being affected by the electromagnetic field generated by the electromagnetic unit and serving as a switch mechanism by cooperating with the terminal set.

[0009] According to another aspect of this invention, a method is provided for assembling an electromagnetic relay that includes a casing, an electromagnetic unit, and a terminal unit. The electromagnetic unit includes a spool frame set, a coil unit, and a pair of coil winding pins. The terminal unit includes an engaging block, a terminal set embedded in the engaging block, and an armature component being affected by an electromagnetic field generated by the electromagnetic unit and serving as a switch mechanism by cooperating with the terminal set.

[0010] The method includes the following steps of:

- a) inserting the coil winding pins through the spool frame set at one of a pair of opposite first sides of the spool frame set;
- b) winding one end of the coil unit on one of the coil winding pins;
- c) winding the coil unit on the spool frame set;
- d) winding the other end of the coil unit on the other one of the coil winding pins;
- e) bending each of the coil winding pins upwardly and toward a corresponding one of a pair of opposite second sides of the spool frame set, such that the spool frame set, the coil unit, and the coil winding pins are assembled together to form the electromagnetic unit;
- f) sealing the electromagnetic unit and the terminal unit in the casing to form the electromagnetic relay.

[0011] Other features and advantages of the present invention will become apparent in the following detailed description of the preferred embodiment with reference to the accompanying drawings, of which:

Figure 1 is a partly exploded perspective view illustrating an electromagnetic relay disclosed in U.S.

Patent No. 4,881,053;

Figure 2 is a sectional view of the electromagnetic relay disclosed in U.S. Patent No. 4,881,053;

Figure 3 is a partly exploded perspective view illustrating a preferred embodiment of an electromagnetic relay of the present invention;

Figure 4 is a sectional view of the preferred embodiment;

Figure 5 is an exploded perspective view of a semi-product of an electromagnetic unit of the electromagnetic relay of the preferred embodiment, wherein a pair of coil winding pins are inserted through a spool frame set;

Figure 6 is a perspective view of the semi-product of the electromagnetic unit, wherein the coil winding pins have yet to be bent;

Figure 7 is a perspective view of the final product of the electromagnetic unit, wherein the coil winding pins are bent;

Figure 8 is an exploded perspective view of an engaging block and a terminal set of the electromagnetic relay of the preferred embodiment;

Figure 9 is a front perspective view of a relay core member of the electromagnetic relay of the preferred embodiment;

Figure 10 is a rear perspective view of the relay core member of the electromagnetic relay of the preferred embodiment in Figure 9; and

Figure 11 is a flow chart illustrating a preferred embodiment of a method for assembling an electromagnetic relay of the present invention.

[0012] Referring to Figures 3 and 4, an electromagnetic relay of the preferred embodiment of this invention includes a casing 2 and a relay core member including an electromagnetic unit 3 and a terminal unit 4.

[0013] The casing 2 includes an upper casing body 21 and a bottom casing body 22 that are connected to each other by press fitting.

[0014] The electromagnetic unit 3 is adapted for generating an electromagnetic field, and includes a spool frame set 31 having a pair of opposite first sides (31a) and a pair of opposite second sides (31b), a coil unit 32 being wound on the spool frame set 31 and including at least one coil 32', and a pair of coil winding pins 33. The spool frame set 31 includes a spool frame 310 wound with the coil unit 32, a pair of mounting frames 311, an iron core 312 attached fixedly to the spool frame 310, and a permanent magnet 313 inserted into the spool frame 310 and disposed on a middle portion of the iron core 312. Each of the mounting frames 311 is disposed at and extends along a respective one of the first sides (31a) of the spool frame set 31, and has a pair of through holes 315 formed therethrough and spaced apart from each other. Further, each of the mounting frames 311 includes an outer surface formed with a groove 314. Each of the coil winding pins 33 has a conductive portion 331, and a coil winding portion 332 extending along one of

the second sides (31b) of the spool frame set 31. Each of the conductive portions 331 has a horizontal section being exposed from one of the mounting frames 311, and a vertical section extending into a corresponding one of the through holes 315. One end of each of the conductive portions 331 is aligned with an outer surface of the corresponding mounting frame 311, and the coil winding portions 332 of the coil winding pins 33 are disposed in a space 316 defined by the mounting frames 311.

[0015] The terminal unit 4 includes an engaging block 41 configured for accommodating the electromagnetic unit 3, a terminal set 42 inserted into the engaging block 41 and exposed from the bottom casing body 22 of the casing 2, and an armature component 43 being affected by the electromagnetic field generated by the electromagnetic unit 3 and serving as a switch mechanism by cooperating with the terminal set 42. The engaging block 41 includes a pair of opposite sidewalls 414 corresponding respectively to the first sides (31a) of the spool frame set 31, a pair of opposite side surfaces 415 corresponding respectively to the second sides (31b) of the spool frame set 31, a pair of barbs 411 disposed respectively on inner surfaces of the sidewalls 414, and a top surface 412 confronting the armature component 43. Each of the sidewalls 414 of the engaging block 41 is formed with a pair of notches 413, and the horizontal sections of the conductive portions 331 of the coil winding pins 33 are disposed respectively within the notches 413 (see Figure 10). Each of the barbs 411 is configured for engaging a corresponding one of the grooves 314 for preventing separation of the terminal unit 4 from the electromagnetic unit 3. The terminal set 42 includes a pair of common terminals 421, two pairs of fixed contact terminals 422, and two pairs of coil terminals 423. Each of the common, fixed contact and coil terminals 421, 422, 423 is inserted into the top surface 412, and has a portion extending along a corresponding one of the side surfaces 415. The engaging block 41 further includes two pairs of first welding points 424, 425 disposed on the top surface 412 thereof, and a pair of second welding points 426 disposed within the notches 413. The coil terminals 423 are respectively welded to the conductive portions 331 of the coil winding pins 33 at the second welding points 426 for forming electrical connection therebetween. The armature component 43 includes a middle contact portion 431 welded to the common terminals 421 at the welding points 424, 425 and supported pivotally by the spool frame set 31, and two pairs of movable contact portions 432, 433 disposed respectively at two opposite end portions of the armature component 43.

[0016] Referring to Figure 11, a method for assembling the electromagnetic relay of the present invention includes the following steps.

[0017] In step 51, the coil winding pins 33 are inserted through the through holes 315 in one of the mounting frames 311 of the spool frame set 31, and the conductive portions 331 of the coil winding pins 33 are exposed from the through holes 315 as shown in Figure 5.

[0018] Further referring to Figure 6, in step 52, one end of the coil 32' is wound on the coil winding portion 332 of one of the coil winding pins 33, and the coil 32' is wound on the spool frame 310. Thereafter, in step 53 the other end of the coil 32' is wound on the coil winding portion 332 of the other one of the coil winding pins 33. In practice, the ends of the coil 32' can be fixed on the coil winding portions 332 of the coil winding pins 33 by welding with soldering tin.

[0019] In step 54, each of the coil winding portions 332 of the coil winding pins 33 is bent upwardly and toward the corresponding one of the second sides (31b) of the spool frame set 31 as shown in Figure 7. Therefore, the spool frame set 31, the coil unit 32, and the coil winding pins 33 are assembled together to form the electromagnetic unit 3.

[0020] Further referring to Figure 8, the terminal set 42 is formed from a plate. In step 55, the plate is embedded partially in the engaging block 41 such that it has a plurality of plate portions 421', 422', 423' corresponding to the terminals 421, 422, 423 (see Figure 3), and is then bent to form the terminals 421, 422, 423 such that upper ends of the coil terminals 423 are disposed respectively in the notches 413 in the engaging block 41.

[0021] Referring to Figures 8 to 11, in step 56, the electromagnetic unit 3 is inserted into the engaging block 41, and each of the grooves 314 in the mounting frames 311 of the spool frame set 31 engages a corresponding one of the barbs 411 of the engaging block 41. Therefore, the electromagnetic unit 3 and the terminal unit 4 are assembled together to form the relay core member. At this time, the coil terminals 423 of the terminal set 42 are respectively in electrical contact with the conductive portions 331 of the coil winding pins 33. One end of each of the conductive portions 331 of the coil winding pins 33 is aligned with the outer surface of the corresponding one of the mounting frames 311, and is disposed within the corresponding one of the notches 413. The coil winding portions 332 are disposed in the space 316 between the mounting frames 311.

[0022] Subsequently, in step 57, the common terminals 421 are welded to the middle contact portion 431 of the armature component 43, and the coil terminals 423 are welded to the conductive portions 331 of the coil winding pins 33 at the welding points 424, 425, 426, respectively, using laser welding method.

[0023] Referring to Figures 3, 4 and 11, in step 58, the relay core member including the electromagnetic unit 3 and the terminal unit 4 is finally sealed in the casing 2, and the terminal set 42 is exposed from the bottom casing body 22 of the casing 2.

[0024] When a voltage is applied to the coil terminals 423 to pass electric current through the coil 32', the electromagnetic unit 3 generates the electromagnetic field so as to attract the right movable contact portions 432 of the armature component 43. Therefore, each of the right movable contact portions 432 is pivoted to a connection position, where the corresponding right movable contact

portion 432 is electrically connected to a corresponding one of the fixed contact terminals 422. When no voltage is applied to the coil terminals 423, the electromagnetic field is not generated, and therefore each of the right movable contact portions 432 of the armature component 43 is biased to a disconnection position, where the corresponding right movable contact portion 432 is separated from the corresponding one of the fixed contact terminals 422. Thus, the armature component 43 serves as a switch mechanism.

[0025] It should be noted that the electromagnetic unit 3 can also include two pairs of the coil winding pins 33 (not shown), so that the electromagnetic relay of this invention serves as a double-pole-double-throw (DPDT) relay to transmit two control signals. Techniques for transmitting two control signals and the DPDT relay are existing techniques, and descriptions thereof will be omitted herein for the sake of brevity.

[0026] In sum, the electromagnetic relay of the present invention and the method for assembling the same have the following advantages. First, because one end of each of the conductive portions 331 of the coil winding pins 33 is aligned with the outer surface of the corresponding one of the mounting frames 311, and the coil winding portions 332 are disposed in the space 316 between the mounting frames 311, it is possible to reduce the size of the electromagnetic unit 3. Second, the welding points 424, 425, 426 can be formed using laser welding method, such that the manufacturing process of the electromagnetic relay is relatively simple. Third, each of the barbs 411 engages a corresponding one of the grooves 314 for preventing separation of the terminal unit 4 from the electromagnetic unit 3, so that the coil terminals 423 can be connected accurately to the coil winding pins 33 during assembly of the electromagnetic relay. Therefore, an automated manufacturing process can be utilized for the electromagnetic relay of the present invention.

Claims

1. An electromagnetic relay including:

a casing (2); and
a relay core member sealed in said casing (2),
said relay core member including

an electromagnetic unit (3) adapted for generating an electromagnetic field, said electromagnetic unit (3) including a spool frame set (31) that includes a pair of opposite first sides (31a) and a pair of opposite second sides (31b), a coil unit (32) wound on said spool frame set (31), and a pair of coil winding pins (33), said spool frame set (31) further including an engagement portion, and a terminal unit (4) that includes an engaging block (41) including an engagement portion

connected to said engagement portion of said spool frame set (31) of said electromagnetic unit (3) for preventing separation of said terminal unit (4) from said electromagnetic unit (3), a terminal set (42) exposed from said casing (2), and an armature component (43) being affected by the electromagnetic field generated by said electromagnetic unit (3) and serving as a switch mechanism by cooperating with said terminal set (42);

characterized by each of said coil winding pins (33) having a conductive portion (331) exposed from one of said first sides (31a) and a coil winding portion (332) extending along one of said second sides (31b).

2. The electromagnetic relay as claimed in claim 1, **characterized in that:**

said spool frame set (31) includes a pair of mounting frames (311), each of said mounting frames (311) being disposed at and extending along a respective one of said first sides (31a) of said spool frame set (31), and being formed with a pair of through holes (315) formed through a corresponding one of said mounting frames (311) and spaced apart from each other; and each of said conductive portions (331) includes a horizontal section being exposed from one of said mounting frames (311), and a vertical section extending into a corresponding one of said through holes (315).

3. The electromagnetic relay as claimed in claim 2, further **characterized in that:**

said engaging block (41) is configured for accommodating said electromagnetic unit (3), and further includes a pair of opposite sidewalls (414) corresponding respectively to said first sides (31a) of said spool frame set (31) and a pair of barbs (411) disposed respectively on said sidewalls (414) and constituting cooperatively said engagement portion of said terminal unit (4); said terminal set (42) is embedded partially in said engaging block (41); and each of said mounting frames (311) includes an outer surface formed with a groove (314) configured for engaging with a corresponding one of said barbs (411), said grooves (314) in said mounting frames (311) constituting cooperatively said engagement portion of said spool frame set (31).

4. The electromagnetic relay as claimed in claim 3, further **characterized in that** said engaging block (41)

includes a pair of notches (413), and said horizontal sections of said conductive portions (331) of said coil winding pins (33) are disposed respectively within said notches (413), said coil winding portions (332) of said coil winding pins (33) being disposed in a space defined by said mounting frames (311).

5. The electromagnetic relay as claimed in any one of claims 1 to 4, **characterized in that** said engaging block (41) includes a pair of opposite side surfaces (415), and said terminal set (42) of said terminal unit (4) includes a pair of common terminals (421), two pairs of fixed contact terminals (422), and two pairs of coil terminals (423), each of said common, fixed contact and coil terminals (421, 422, 423) having a portion that extends along a corresponding one of said side surfaces (415), said coil terminals (423) being respectively and electrically connected to said conductive portions (331) of said coil winding pins (33).

6. The electromagnetic relay as claimed in claim 5, further **characterized in that** said armature component (43) includes a middle contact portion (431) electrically connected to said common terminals (421) and supported pivotally by said spool frame set (31), and a pair of movable contact portions (432, 433) that are disposed respectively at two opposite end portions of said armature component (43), each of said movable contact portions (432, 433) being pivotable between a connection position, where a corresponding one of said movable contact portions (432, 433) is connected electrically to a corresponding one of said fixed contact terminals (422), and a disconnection position, where the corresponding one of said movable contact portions (432, 433) is separated from the corresponding one of said fixed contact terminals (422).

7. The electromagnetic relay as claimed in claim 6, further **characterized in that** said engaging block (41) of said terminal unit (4) includes a top surface (412) having a plurality of welding points (424, 425, 426), said common terminals (421) being welded to said middle contact portion (431) of said armature component (43) and said coil terminals (423) being welded to said conductive portions (331) of said coil winding pins (33) at said welding points (424, 425, 426), respectively.

8. The electromagnetic relay as claimed in claim 7, further **characterized in that** said welding points (424, 425, 426) are formed using laser welding method.

9. The electromagnetic relay as claimed in any one of claims 1 to 8, **characterized in that** said casing (2) includes an upper casing body (21) and a bottom casing body (22) that are connected to each other

by press fitting, and said bottom casing body (22) is further configured to permit said terminal set (42) to be exposed therefrom.

10. A method for assembling an electromagnetic unit (3) of an electromagnetic relay, the electromagnetic unit (3) including a spool frame set (31), a coil unit (32), and a pair of coil winding pins (33), said method being **characterized by**:
- i) inserting the coil winding pins (33) through the spool frame set (31) at one of a pair of opposite first sides (31a) of the spool frame set (31);
 - ii) winding one end of the coil unit (32) on one of the coil winding pins (33);
 - iii) winding the coil unit (32) on the spool frame set (31);
 - iv) winding the other end of the coil unit (32) on the other one of the coil winding pins (33); and
 - v) bending each of the coil winding pins (33) upwardly and toward a corresponding one of a pair of opposite second sides (31b) of the spool frame set (31), such that the spool frame set (31), the coil unit (32), and the coil winding pins (33) are assembled together to form the electromagnetic unit (3).
11. A method for assembling an electromagnetic relay that includes a casing (2), an electromagnetic unit (3), and a terminal unit (4), the electromagnetic unit (3) including a spool frame set (31), a coil unit (32), and a pair of coil winding pins (33), the terminal unit (4) including an engaging block (41), a terminal set (42) embedded in the engaging block (41), and an armature component (43) being affected by an electromagnetic field generated by the electromagnetic unit (3) and serving as a switch mechanism by cooperating with the terminal set (42), said method being **characterized by**:
- a) inserting the coil winding pins (33) through the spool frame set (31) at one of a pair of opposite first sides (31a) of the spool frame set (31);
 - b) winding one end of the coil unit (32) on one of the coil winding pins (33);
 - c) winding the coil unit (32) on the spool frame set (31);
 - d) winding the other end of the coil unit (32) on the other one of the coil winding pins (33);
 - e) bending each of the coil winding pins (33) upwardly and toward a corresponding one of a pair of opposite second sides (31b) of the spool frame set (31), such that the spool frame set (31), the coil unit (32), and the coil winding pins (33) are assembled together to form the electromagnetic unit (3); and
 - f) sealing the electromagnetic unit (3) and the

terminal unit (4) in the casing (2) to form the electromagnetic relay.

12. The method as claimed in claim 11, further **characterized by** a step e1) of inserting the electromagnetic unit (3) into the engaging block (41) of the terminal unit (4) to assemble the electromagnetic unit (3) and the engaging block (41) together after the step e).
13. The method as claimed in claim 12, further **characterized by** a step e2) of welding the terminal set (42) to the armature component (43) and the coil winding pins (33) at a plurality of welding points (424, 425, 426) on a top surface (412) of the engaging block (41) after the step e1).
14. The method as claimed in claim 13, further **characterized in that**, in the step e2), the terminal set (42) is welded using laser welding method.

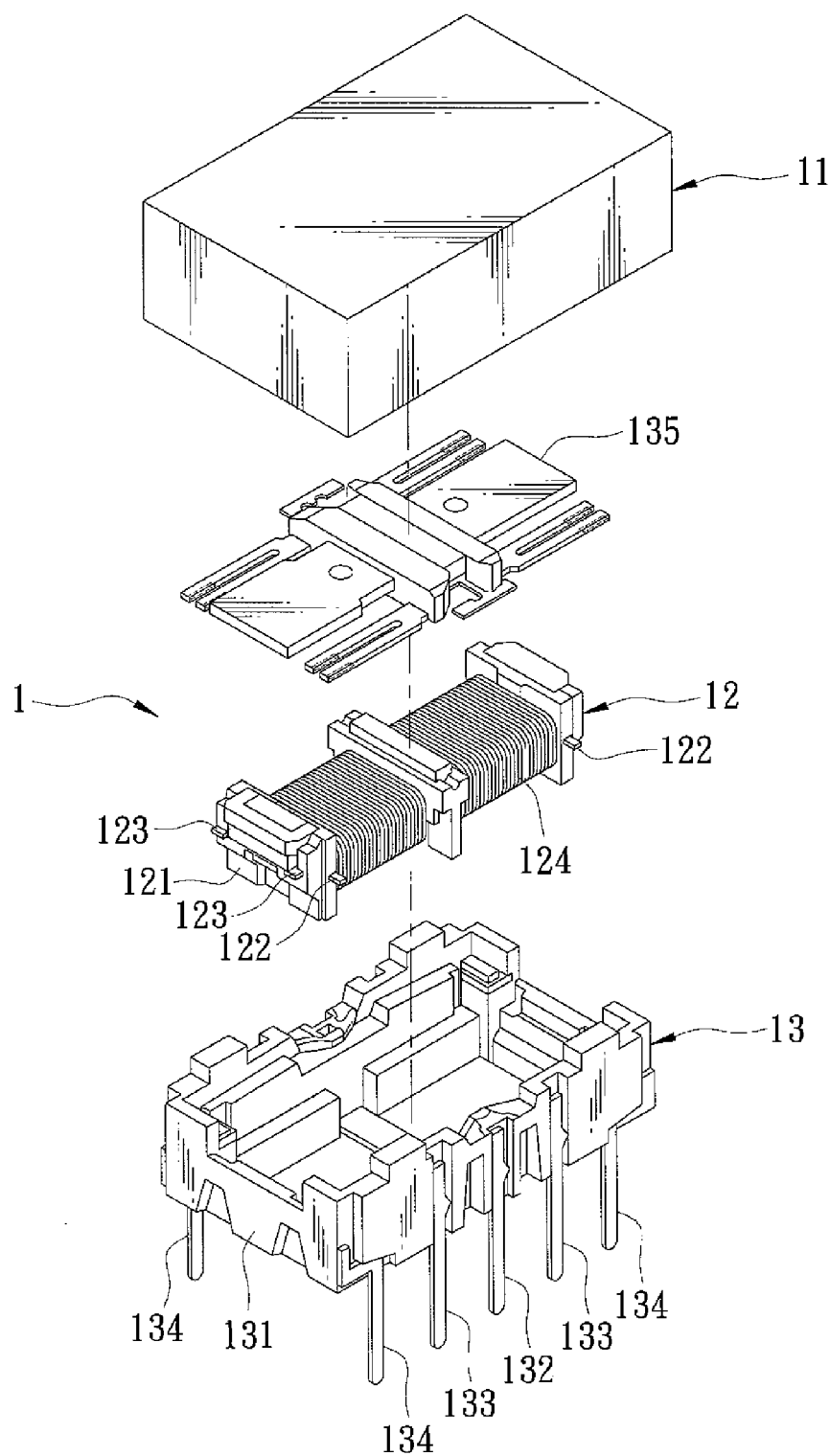


FIG. 1
PRIOR ART

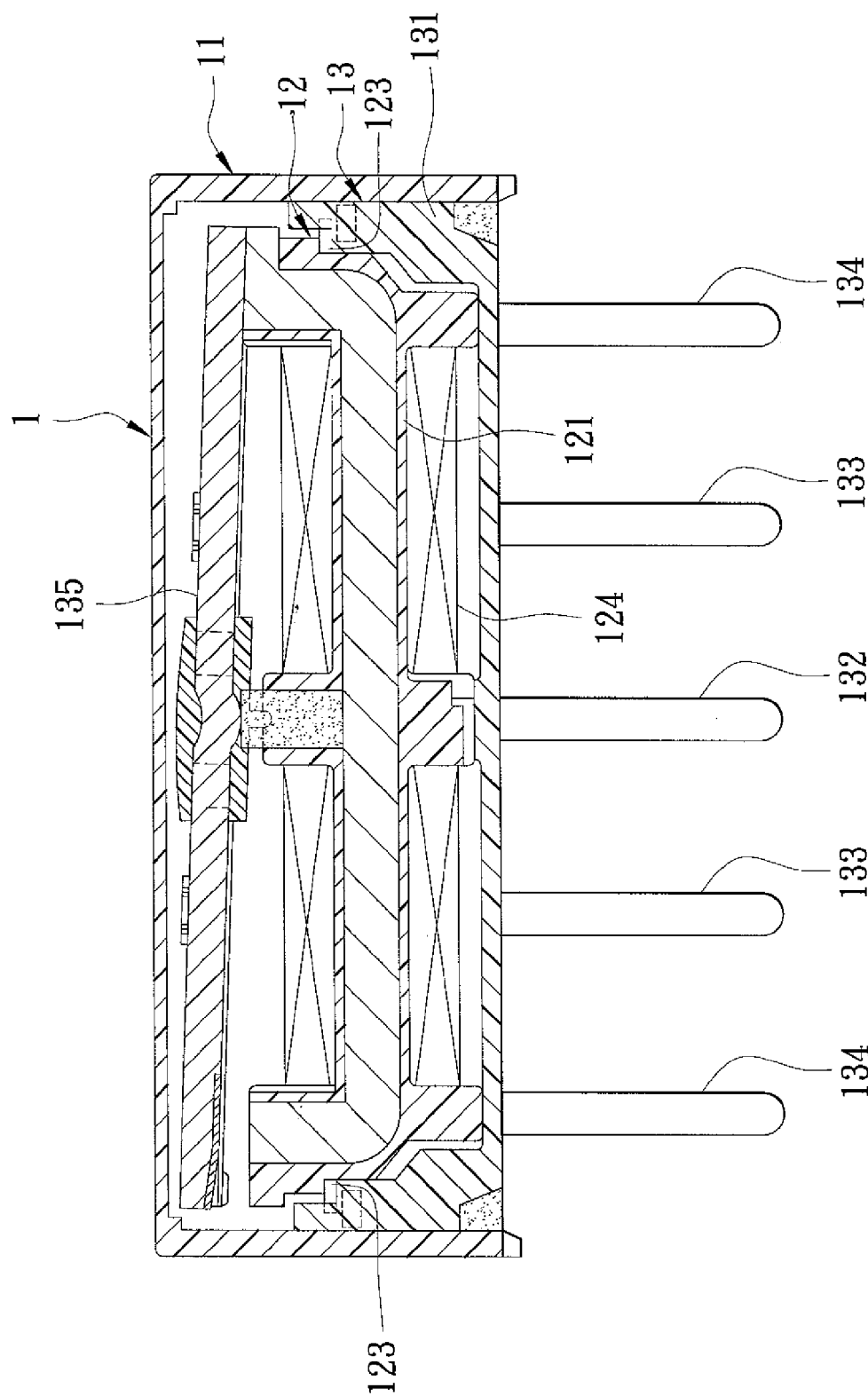


FIG. 2
PRIOR ART

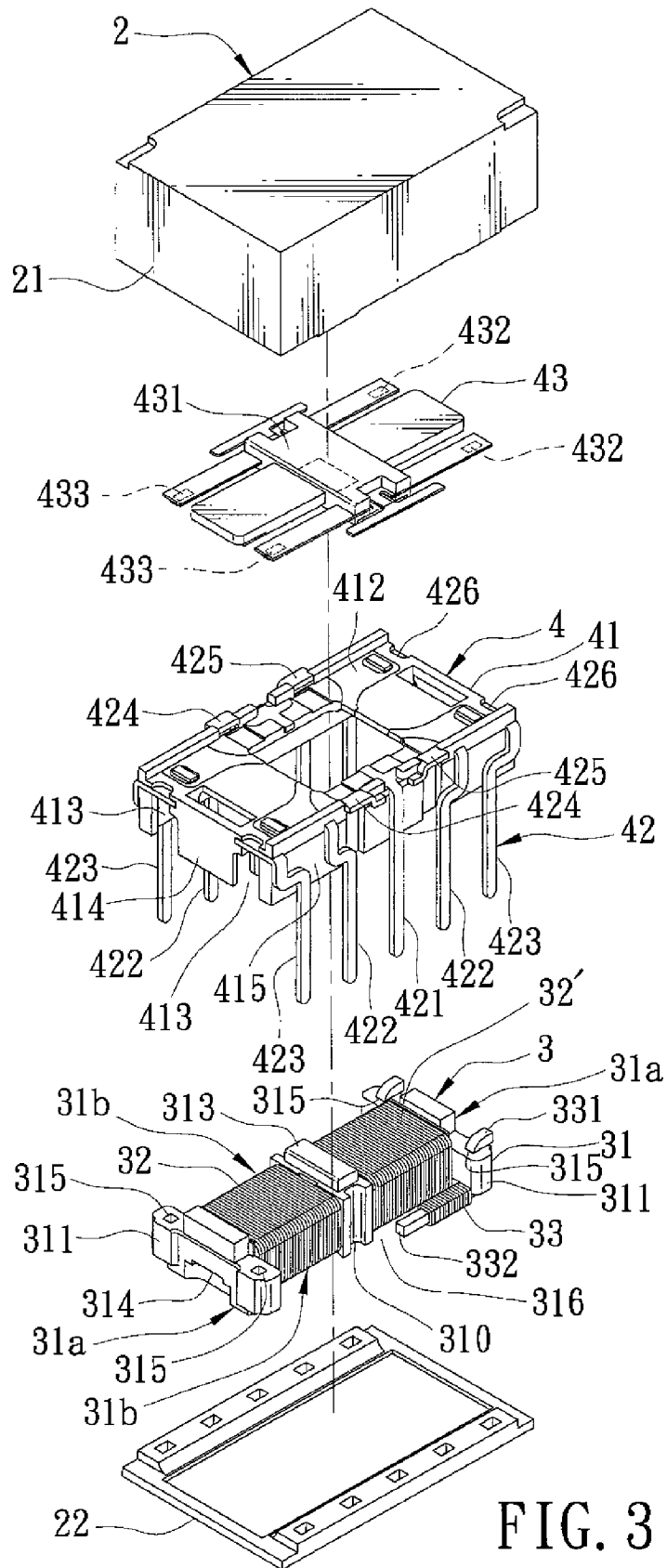


FIG. 3

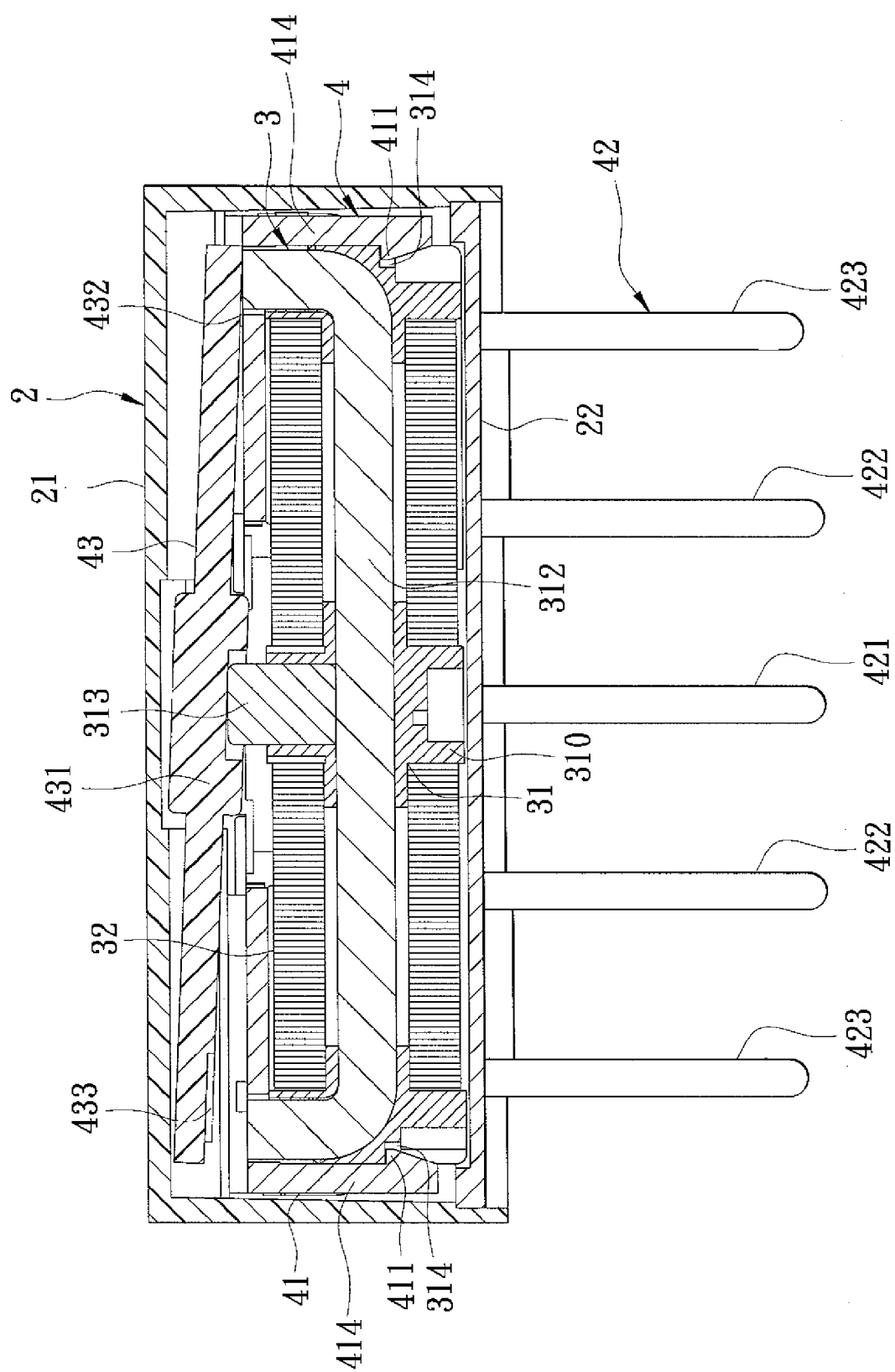


FIG. 4

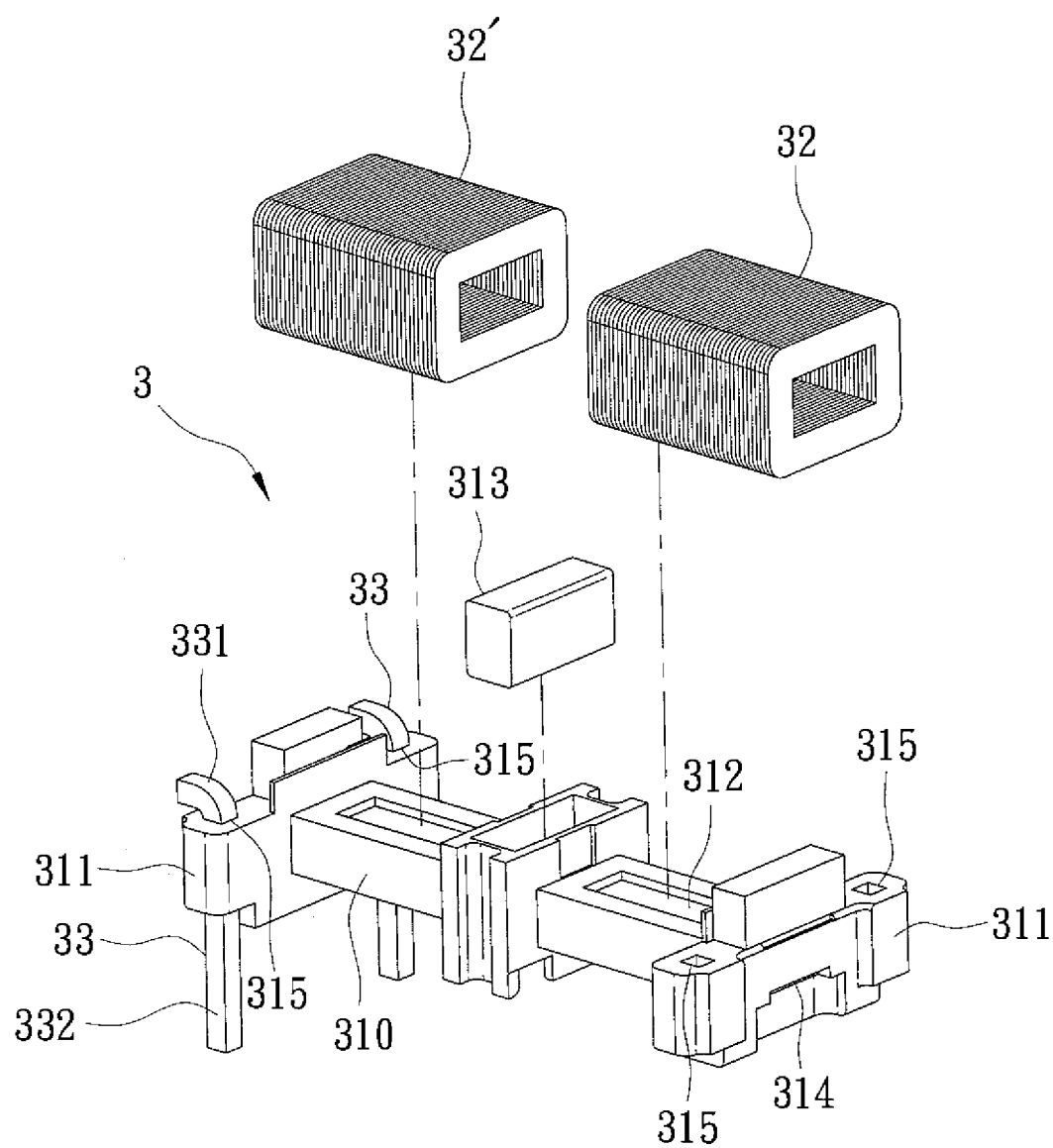


FIG. 5

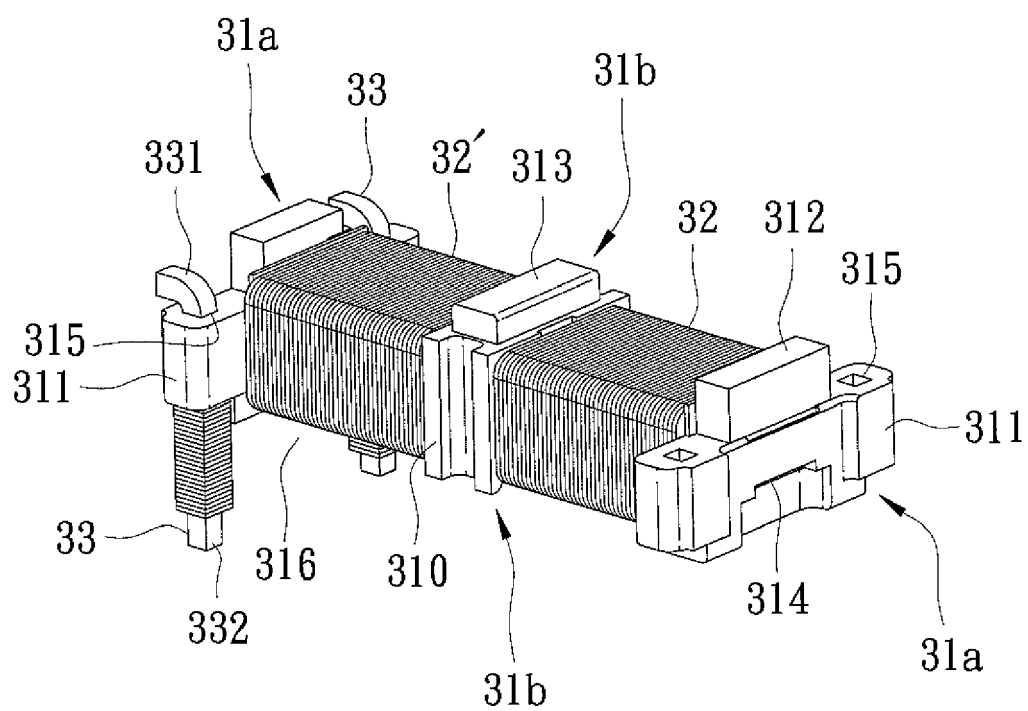


FIG. 6

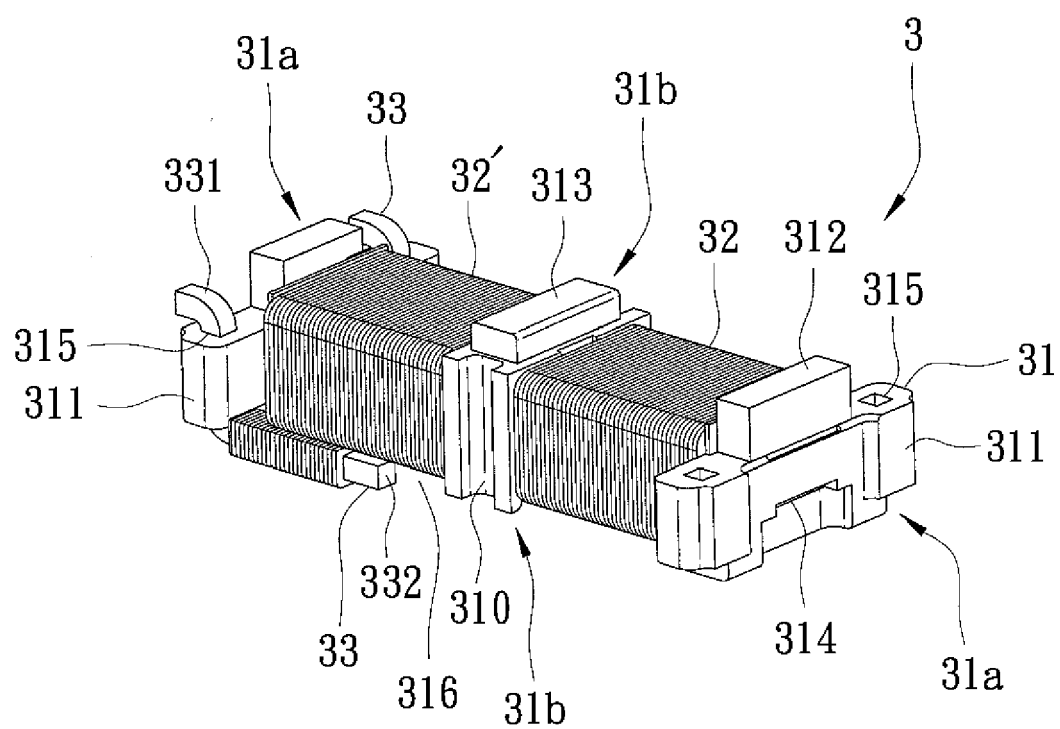


FIG. 7

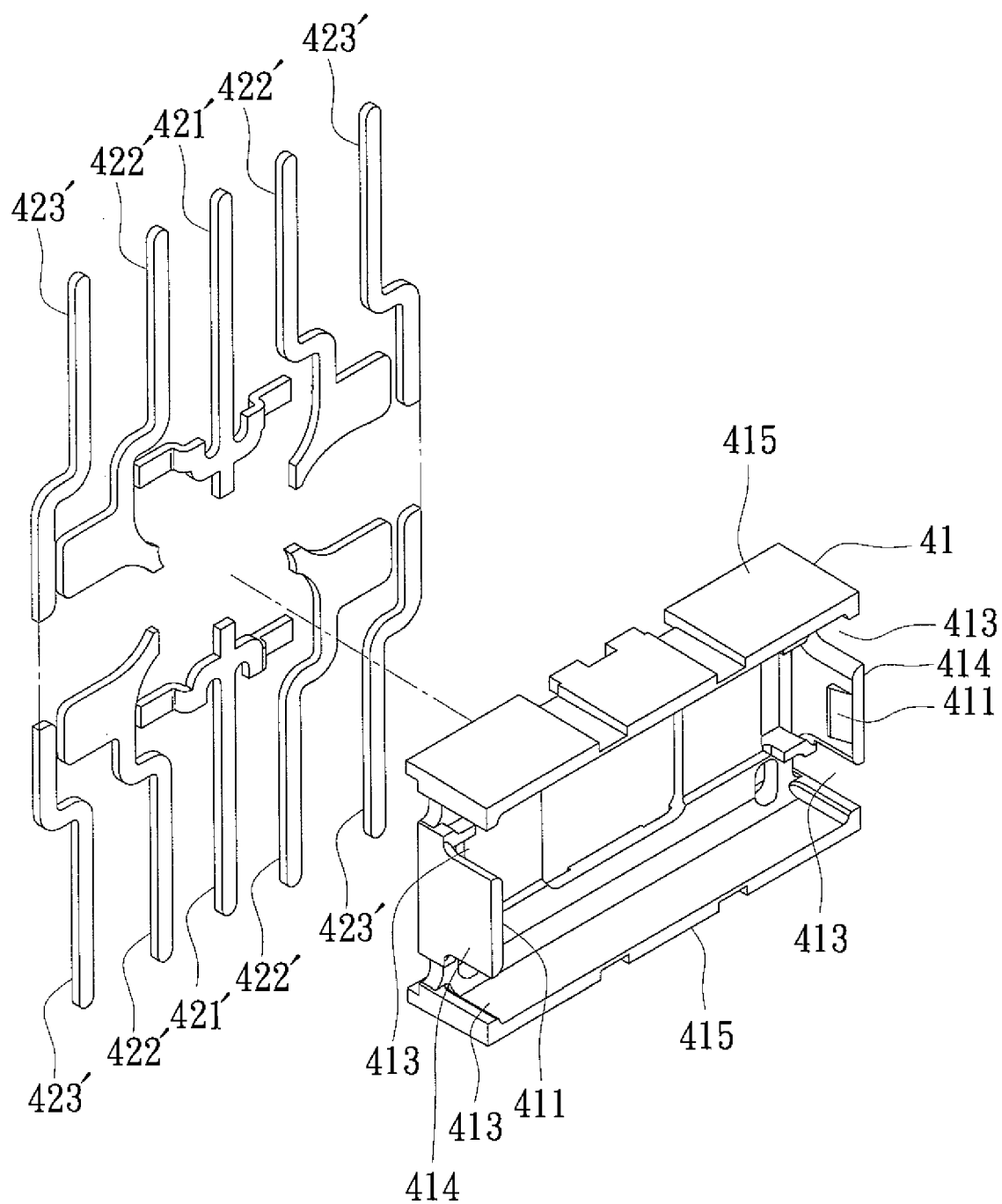


FIG. 8

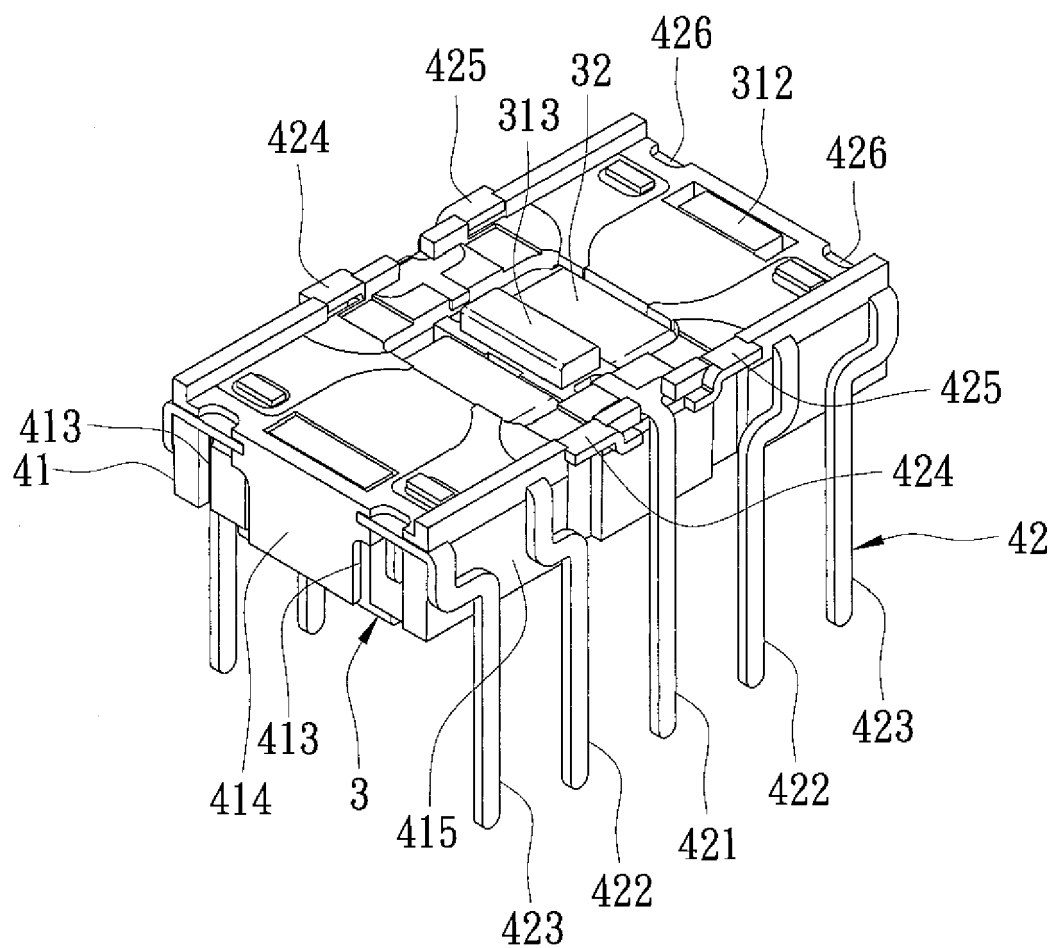


FIG. 9

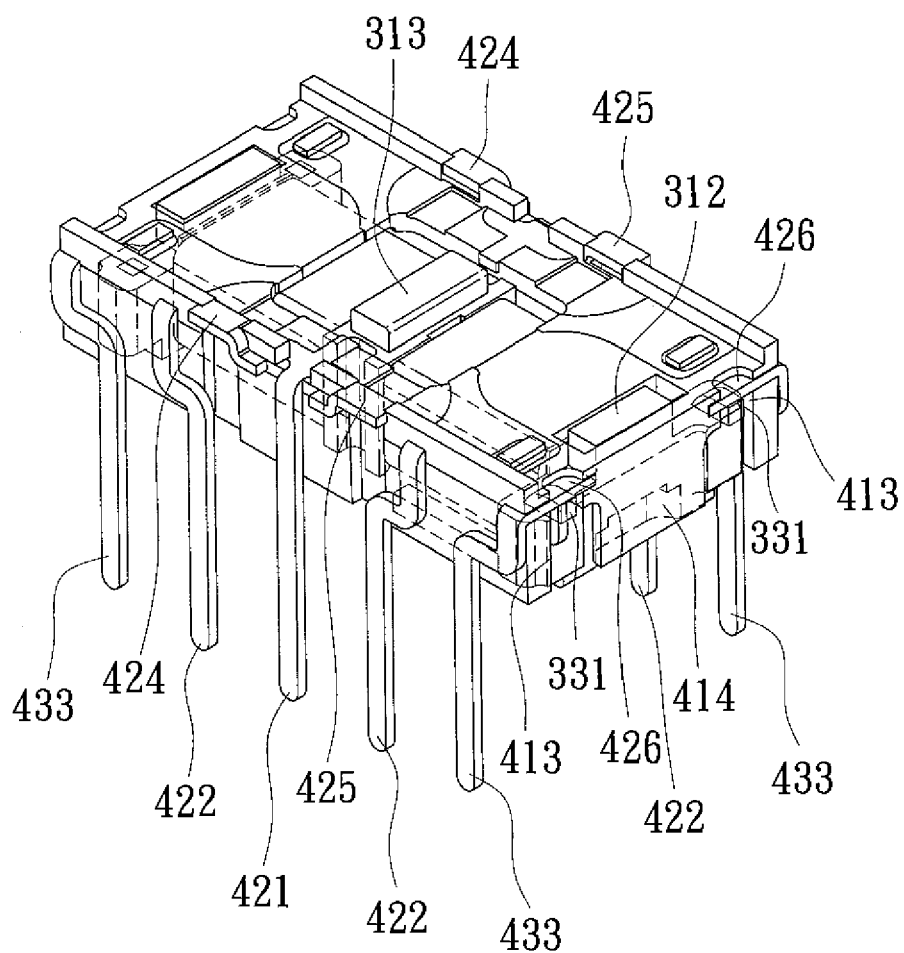


FIG. 10

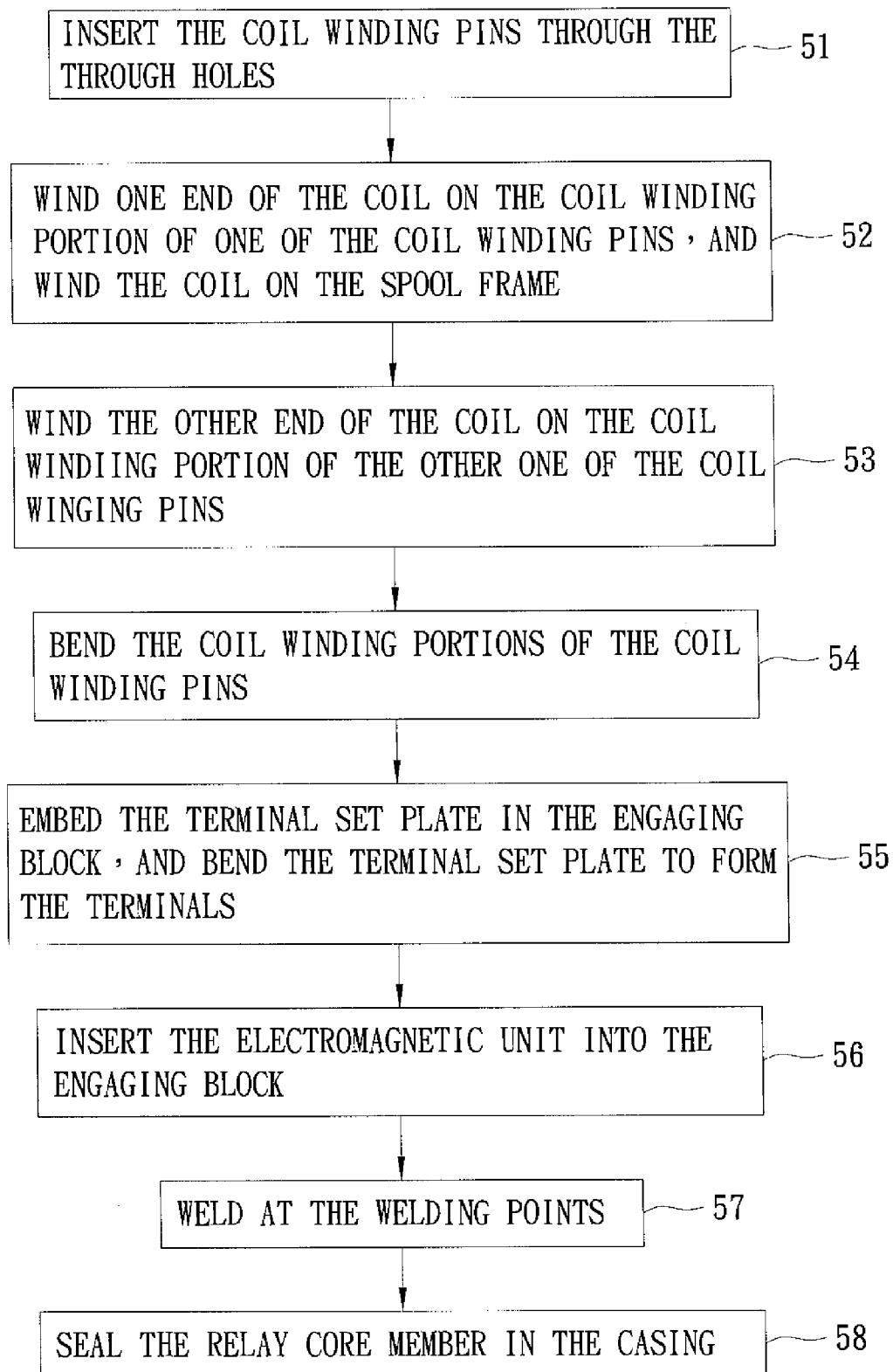


FIG. 11



EUROPEAN SEARCH REPORT

Application Number
EP 09 16 0229

DOCUMENTS CONSIDERED TO BE RELEVANT			
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The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
The Hague		25 September 2009	Overdijk, Jaco
CATEGORY OF CITED DOCUMENTS		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	
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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 09 16 0229

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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