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Electrically driven fastener structure and method of use thereof

Abstract

An electrically driven fastener structure includes a body, a fastening unit and a wire. The body has a first assembly portion. The fastening unit has a second assembly portion corresponding to the first assembly portion. The wire is adapted to pass a current and to pass through the first assembly portion or the second portion to form a magnetic switch using the first assembly portion or the second assembly portion, so as to drive the magnetic switch based on on or off or strong or weak of the current, or to drive the magnetic switch based on on or off or strong or weak of a magnetic force.

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Background/Summary

(1) This non-provisional application claims priority under 35 U.S.C. § 119(a) on Patent Application No(s). 110112959 filed in Taiwan, R.O.C. on Apr. 9, 2021, the entire contents of which are hereby incorporated by reference.

BACKGROUND OF THE INVENTION

1. Field of the Invention

(2) The present invention provides a fastener structure and a method of use thereof, and in particular to an electrically driven fastener structure and a method of use thereof.

2. Description of the Related Art

(3) In general, to couple two plates, a screw is usually locked therein to fix the two plates in a form that is not easily separated, thereby ensuring stable coupling between the two plates so that the two are unlikely to be detached from each other.

(4) However, in the conventional connection means above, although the two plates can be coupled

in a form that is not easily separated, the screw cannot be quickly assembled and secured with one of the plates.

BRIEF SUMMARY OF THE INVENTION

(5) With extensive research and development, an electrically driven fastener structure and a method of use thereof are provided in the aim of achieving the object of quick assembly.

(6) An electrically driven fastener structure provided according to a first embodiment of the present invention includes a body, a fastening unit and a wire. The body has a first assembly portion. The fastening unit has a second assembly portion corresponding to the first assembly portion. The wire is adapted to pass a current and to pass through the first assembly portion or the second portion to form a magnetic switch using the first assembly portion or the second assembly portion, so as to drive the magnetic switch based on on or off or strong or weak of the current, or to drive the magnetic switch based on on or off or strong or weak of a magnetic force.

(7) A method of use of an electrically driven fastener structure provided according to a second embodiment of the present invention uses the electrically driven fastener structure above. The method includes passing a current through the first assembly portion or the second portion to form a magnetic switch using the first assembly portion or the second assembly portion, and driving the magnetic switch based on on or off or strong or weak of the current, or driving the magnetic switch based on on or off or strong or weak of a magnetic force.

(8) A method of use of an electrically driven fastener structure provided according to a third embodiment of the present invention uses the electrically driven fastener structure above. The method includes passing a current through the first assembly portion or the second assembly portion to form a magnetic switch using the first assembly portion or the second assembly portion, and driving the magnetic switch based on on or off or strong or weak of the current, or driving the magnetic switch based on on or off or strong or weak of a magnetic force. The body is assembled at the first object, the first object has an insertion portion, and the insertion portion is electrically connected to the wire and is adapted to be hot-pluggable at a second object when electrically connected.

(9) Accordingly, the electrically driven fastener structure and the method of use thereof of the present invention achieve the object of quick assembly.

Description

BRIEF DESCRIPTION OF THE DRAWINGS

(1) FIG. **1** is a first schematic diagram of an electrically driven fastener structure according to a specific embodiment of the present invention.

(2) FIG. **2** is a second schematic diagram of an electrically driven fastener structure according to a specific embodiment of the present invention.

(3) FIG. **3** is a schematic diagram of an electrically driven fastener structure according to a specific embodiment of the present invention, a first object and a second object.

(4) FIG. **4** is a third schematic diagram of an electrically driven fastener structure according to a specific embodiment of the present invention.

(5) FIG. **5** is a fourth schematic diagram of an electrically driven fastener structure according to a specific embodiment of the present invention.

(6) FIG. **6** is a fifth schematic diagram of an electrically driven fastener structure according to a specific embodiment of the present invention.

(7) FIG. **7** is a schematic diagram of a control device applicable to an electrically driven fastener structure according to a specific embodiment of the present invention.

(8) FIG. **8** is a first schematic diagram of a carrying member according to a specific embodiment of the present invention.

(9) FIG. **9** is a second schematic diagram of a carrying member according to a specific embodiment of the present invention.
(10) FIG. **10** is a fifth schematic diagram of an electrically driven fastener structure being operated according to a specific embodiment of the present invention.
(11) FIG. **11** is a sixth schematic diagram of an electrically driven fastener structure being operated according to a specific embodiment of the present invention.
(12) FIG. **12** is a seventh schematic diagram of an electrically driven fastener structure being operated according to a specific embodiment of the present invention.
(13) FIG. **13** is an eighth schematic diagram of an electrically driven fastener structure being operated according to a specific embodiment of the present invention.
(14) FIG. **14** is a ninth schematic diagram of an electrically driven fastener structure being operated according to a specific embodiment of the present invention.
(15) FIG. **15**A is a first schematic diagram of an electrically driven fastener structure according to a specific embodiment of the present invention installed to a first object.
(16) FIG. **15**B is a second schematic diagram of an electrically driven fastener structure according to a specific embodiment of the present invention installed to a first object.
(17) FIG. **16**A is a third schematic diagram of an electrically driven fastener structure according to a specific embodiment of the present invention installed to a first object.
(18) FIG. **16**B is a fourth schematic diagram of an electrically driven fastener structure according to a specific embodiment of the present invention installed to a first object.
(19) FIG. **17** is a top schematic diagram of an electrically driven fastener structure according to a specific embodiment of the present invention installed to a first object.
(20) FIG. **18** is a fifth schematic diagram of an electrically driven fastener structure according to a specific embodiment of the present invention installed to a first object.
(21) FIG. **19** is a tenth schematic diagram of an electrically driven fastener structure being operated according to a specific embodiment of the present invention.
(22) FIG. **20** is an eleventh schematic diagram of an electrically driven fastener structure being operated according to a specific embodiment of the present invention.
(23) FIG. **21** is a twelfth schematic diagram of an electrically driven fastener structure being operated according to a specific embodiment of the present invention.
(24) FIG. **22** is a thirteenth schematic diagram of an electrically driven fastener structure being operated according to a specific embodiment of the present invention.
(25) FIG. **23** is a sixth schematic diagram of an electrically driven fastener structure according to a specific embodiment of the present invention.
(26) FIG. **24** is a fourteenth schematic diagram of an electrically driven fastener structure being operated according to a specific embodiment of the present invention.
(27) FIG. **25** is a section view corresponding to FIG. **23**.
(28) FIG. **26** is a fifteenth schematic diagram of an electrically driven fastener structure being operated according to a specific embodiment of the present invention.
(29) FIG. **27** is a sixteenth schematic diagram of an electrically driven fastener structure being operated according to a specific embodiment of the present invention.
(30) FIG. **28** is a top view corresponding to FIG. **26**.
(31) FIG. **29** is a top view corresponding to FIG. **27**.
(32) FIG. **30** is a seventh schematic diagram of an electrically driven fastener structure according to a specific embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

(33) To facilitate understanding of the object, characteristics and effects of this present disclosure, embodiments together with the attached drawings for the detailed description of the present disclosure are provided.
(34) Referring to FIG. **1** to FIG. **5**, an electrically driven fastener structure **1** provided according to

a first embodiment of the present invention includes a body **11**, a fastening unit **12** and a wire **13**. The body **11** has a first assembly portion **110**. The fastening unit **12** has a second assembly portion **120** corresponding to the first assembly portion **110**. The wire **13** is adapted to pass a current, and to pass through the first assembly portion **110** (as shown in FIG. **1**) or the second portion **120** (as shown in FIG. **2**) to form a magnetic switch **19** using the first assembly portion **110** or the second assembly portion **120**, so as to drive the magnetic switch **19** based on on or off or strong or weak of the current, or to drive the magnetic switch **19** based on on or off or strong or weak of a magnetic force.

(35) Referring to FIG. **1** to FIG. **5** and FIG. **30**, in one embodiment, the wire **13** first passes through a first object **2**, and then passes through the first assembly portion **110** or the second assembly portion **120**.

(36) Referring to FIG. **1** to FIG. **5** and FIG. **3**, in one embodiment, the wire **13** is adapted to pass a current, and to pass through the first object **2** and then pass through the first assembly portion **110** or the second assembly portion **120**. The first object **2** has a first insertion portion **29**, which is electrically connected to the wire **13** and is adapted to be hot-pluggable at an insertion portion **80** of a second object **8** when electrically connected. The second object **8** may be a power supply device, and the insertion portion **80** may be provided with a copper sheet. Moreover, the first object **2** or a pluggable second object **8** may be a motherboard, a PCB, a circuit board, a casing, a frame, a server, a hard drive, a memory or a computer, or a correspondingly engaged third object (not shown) may be a casing, a frame, a server, a motherboard, a PCB, a circuit board, a hard drive, a memory or a computer. In FIG. **30**, the wire **13** is connectable to a connector **24** of the first object **2**, so as to energize and drive the magnetic switch **19**.

(37) Referring to FIG. **1** to FIG. **5**, a method of use of an electrically driven fastener structure according to a second embodiment of the present invention uses the electrically driven fastener structure **1** above. The method includes passing a current through the first assembly portion **110** or the second portion **120** to form a magnetic switch **19** using the first assembly portion **110** or the second assembly portion **120**, and driving the magnetic switch **19** based on on or off or strong or weak of the current, or driving the magnetic switch **19** based on on or off or strong or weak of a magnetic force.

(38) Referring to FIG. **1** to FIG. **5**, a method of use of an electrically driven fastener structure provided according to a third embodiment of the present invention uses the electrically driven fastener structure **1** above, passes a current through the first assembly portion **110** or the second assembly portion **120** to form a magnetic switch **19** using the first assembly portion **110** or the second assembly portion **120**, and drives the magnetic switch **19** based on on or off or strong or weak of the current, or drives the magnetic switch **19** based on on or off or strong or weak of a magnetic force. The body **11** is assembled at the first object **2**, and the first object **2** has the insertion portion **29**.

(39) Accordingly, the electrically driven fastener structure **1** and the method of use thereof of the present invention achieve the object of quick assembly.

(40) As shown in FIG. **1** and FIG. **2**, in one embodiment, an elastic element **14** may be further included. Two ends of the elastic element **14** may be pressed against the first assembly portion **110** and the second assembly portion **120**, respectively, so as to position the magnetic switch **19** at an on or off position when the magnetic force is absent. The elastic element **14** may be, for example but not limited to, a spring. In FIG. **1**, the fastening unit **12** is adapted to be inserted into a fastened unit **740** of a fastened object **74**, and in FIG. **2**, the fastening unit **12** in a form of a stud is screw connected in the fastened unit **740** in a form of a screw hole, so that the fastening unit **12** is engaged at the fastened object **74**. It should be noted that the present invention is not limited to the examples above.

(41) As shown in FIG. **4**, in one embodiment, the fastening unit **12** is accommodated in the body **11**, and the elastic element **14** is provided between the inside of the body **11** and the fastening unit

12. The body **11** has a stopping portion **111**, and the fastening unit **12** has a corresponding stopping portion **121** adapted to stop at the stopping portion **111** when the magnetic force is on. It should be noted that the present invention is not limited to the examples above. The first assembly portion **110** or the second assembly portion **120** may be a magnetic portion so as to generate a magnet force when the current is on. For example, the first assembly portion **110** or the second assembly portion **120** as the magnetic portion may be made of a metal material, or the first assembly portion **110** or the second assembly portion **120** may be a magnetism generating portion. The wire **13** may have positive and negative power so as to generate a magnetic force, and the second assembly portion **120** or the first assembly portion **110** may be made of a metal material so as to be attracted by the magnetic force generated by the wire. The fastening unit **12** may be magnetically driven to perform an action of rotational engagement, vertical engagement, horizontal engagement, screw locking rotation, leverage lifting or pulling.

(42) As shown in FIG. **1** to FIG. **3**, in one embodiment, the first object **2** is a printed circuit board, and the first object **2** has a wiring layer **28** so as to be electrically connected to the wire **13**. The body **11** is adapted to be arranged at the first object **2**, and the fastening unit **12** is for engaging with a fastened object **74**. The insertion portion **29** of the first object **2** is adapted to be first inserted in the second object **8** and then engaged at the fastened object **74** via the fastening unit **12** to achieve assembly. Alternatively, the fastening unit **12** is adapted to be disengaged from the fastened object **74** and the insertion portion **29** of the first object **2** is then pulled out from the second object **8** to achieve separation. When the insertion portion **29** of the first object **2** is inserted into or pulled out from the second object **8**, the second object **8** may be kept in an electrically connected state.

(43) As shown in FIG. **2**, the body **11** is arranged on the first object **2**, the body **11** and the first object **2** have weldable surfaces **17**, one between the weldable surfaces **17** of the body **11** and the first object **2** may be a copper layer and the other between the two may be a solder layer or a combination of a copper and a solder layer. It should be noted that the present invention is not limited to the examples above. The fastener structure may be welding connected, engagingly connected, rivet connected, expansion connected, lockingly connected, fittingly connected or adhesion connected to the first object **2**.

(44) As shown in FIG. **5**, in one embodiment, a bottom portion of the fastening unit **12** may be in a form of a lopsided H-shape so as to form a holding portion **122**. The holding portion **122** is adapted to pass through the fastened unit **740** of the fastened object **74** and the fastening unit **12** is rotated to hold a bottom surface and a top surface of the fastened object **74**.

(45) As shown in FIG. **6**, in one embodiment, the fastening unit **12** has an engagement channel **123**, and the fastening unit **12** is adapted to be rotated downward to have the engagement channel **123** be engaged at the fastened unit **740** of the fastened object **74**. The body **11** may be locked on the first object **2** by, for example but not limited to, a plurality of bolts **117**. In other embodiments, the fastening unit **12** may be a threaded portion, a column, an elastic unit, an outer fastener, an inner fastener, a recessed fastener, a rotation fastener, a protruding fastener, a handle, a latch, an auxiliary thruster or a pressing unit.

(46) As shown in FIG. **1** and FIG. **7**, in one embodiment, a control device **9** signally connected to the wire **13** may be used to control on and off of the magnetic switch, wherein the control device **9** is a control instrument, a cellphone, a mobile communication device, a computer, a wired electronic device or a wireless electronic device. Moreover, the control device **9** may also be signally connected to the fastening unit **12**.

(47) As shown in FIG. **8** to FIG. **10**, in one embodiment, the fastener structure **1** is adapted to be placed in a carrier **4**, wherein the carrier **4** includes a carrying member **40** in which the fastener structure **1** is placed. A tool **3** is adapted to take out the fastener structure **1** and remove the fastener structure **1** out of the carrier **4**, and the fastener structure **1** is moved onto the first object **2** and be assembled at the first object **2**. The tool **3** may be a vacuum suction device, a clamp, a fixture or a magnetic suction device. In FIG. **8**, the carrying member **40** may also be strip-shaped so as to be

adapted to be rolled, or be a roll, a tape of a tray. Alternatively, in FIG. **9**, the carrying member **40** may also be a plate.

(48) As shown in FIG. **10**, the fastener structure **1** may be first moved onto a calculation device **5** (or an image recognition device) before being assembled at the first object **2**. The calculation device **5** is adapted to calculate relative positions of the fastener structure **1** and the first object **2**, so as to install the fastener structure **1** to an opening **21** at a predetermined position **20** of the first object **2**. The tool **3** takes out the fastener structure **1** from the body **11** in FIG. **13**, and takes out the fastener structure **1** from the fastening unit **12** in FIG. **14**. Means of the taking out may be selected according to different installation requirements. In one embodiment, the inside and the periphery of the opening **21** at the predetermined position **20** of the first object **2** are provided with a solder layer **22**, and a solder layer **22** corresponding to the body **11** is provided on the solder layer **22**. The fastener structure **1** is adapted to be moved by the tool **3** to above the predetermined position **20** and be released so as to enter the opening **21** by a joining portion **16** of the body **11**, and the solder layer **22** and the solder layer **22** are then heated to weld the fastener structure **1** at the first object **2**.

(49) As shown in FIG. **11**, in one embodiment, the tool **3** is provided with a sensing element **31**, and the tool **3** is notified to release the fastener structure **1** when the fastener structure **1** is moved to the predetermined position **20** and contacts the first object **2**. The sensing element **31** may be provided with elasticity, so that a suction tip **33** of the tool **3** can be notified to release the fastener structure **1** when the tool **3** moves the fastener structure **1** to the predetermined position **20** that the contacts the first object **2**.

(50) As shown in FIG. **12**, in one embodiment, the tool **3** has a vacuum cavity **33** and the suction tip **33** assembled at the vacuum cavity **32**, and the vacuum cavity **32** is provided with an elastic element **34** therein, wherein the elastic element **34** presses between the suction tip **33** and an inner wall of the vacuum cavity **33**. When the elastic element **34** is compressed, the vacuum degree in the vacuum cavity **32** rises to cause the suction tip **33** to suck up the fastener structure **1**; when the elastic element **34** is released, the vacuum degree in the vacuum cavity **32** drops to cause the suction tip **33** to release the fastener structure **1** to the predetermined position **20**. The elastic element **34** may be, for example but not limited to, a spring.

(51) As shown in FIG. **13**, in one embodiment, the body **11** is recessed to form a coupling recess **118**, the part of the body **11** having the coupling recess **118** is placed into the opening **21** of the first object **2**, and the body **11** is adapted to be fitted by a body part larger than the opening **21** into the opening **21**, so that the opening **21** or the material around the opening **21** is squeezed into the coupling recess **118** of the body **11** to arrange the body **11** at the first object **2**.

(52) As shown in FIG. **14**, in one embodiment, the body **11** is provided with bendable pressing portions **119**, and the pressing portions **119** are adapted to be placed into the opening **21** of the first object **2** to arrange the body **11** at the first object **2**. For example, a bending tool **58** may be used to bend the pressing portions **119**.

(53) As shown in FIG. **15**A and FIG. **15**B, in one embodiment, the bottom portion of the body **11** has an elastic hook **112** that passes through the opening **21** of the first object **21** and becomes hooked at a bottom surface of the first object **2**. In FIG. **20**B, a tightening member **1121** is further provided between the bottom surface of the first object **2** and the elastic hook **113** to increase the tightness of coupling. The tightening member **112** may be an annular object.

(54) As shown in FIG. **16**A and FIG. **16**B, in one embodiment, the bottom portion of the body **11** has a stud **114** that locks at the opening **21** in a form of a screw hole structure of the first object **2**. In FIG. **21**B, the stud **114** may pass through the bottom surface of the first object **2** so as to be further locked by a locking member **1101** to increase the tightness of coupling. The locking member **1101** may be a nut.

(55) As shown in FIG. **17**, in one embodiment, the body **11** has an anti-rotation portion, and a corresponding anti-rotation portion is provided at the predetermined position **20** to mutually achieve anti-rotation. The solder layer **22** may be provided along the periphery of the

predetermined position **20**, the solder layer **22** is heated and cooled after the body **11** is placed at the predetermined position **20** so as to weld the body **11** at the first object **2**, with the heated and cooled solder layer **22** present between the body **11** and the first object **2**.
(56) As shown in FIG. **18**, in one embodiment, the body **11** has an engaging portion having the stud **114** for mutually engaging with an engaging member **7** after heating and cooling are performed and the body **11** is welded at the first object **2**.
(57) As shown in FIG. **19** to FIG. **22**, in one embodiment, the body **11** may be movably assembled at the first object **2** by a movable assembly portion **87**. In this embodiment, the movable assembly portion **87** acts, for example but not limited to, as a pivotal axis for the body **11** to be pivoted at the first object **2**. The fastening unit **12** also rotates with the rotation of the body **11**, and the fastening unit **12** at this point is for pushing the fastened unit **74**. The fastening unit **12** may appear as a grip, and pushes the fastened unit **74** by means of leverage during rotation. In this embodiment, the body **11** and the fastening unit **12** assembled with each other appear as, for example but not limited to, an integral form, or may appear as a movable assembly or a fixed assembly. In FIG. **24**, the body **11** may have a force application portion **1105**, which is for applying a force in a manual operation. For example, the force application portion **1105** is a handle. The elastic element **88** may be a spring.
(58) As shown in FIG. **23** to FIG. **28**, in one embodiment, the body **11** has an activity space S, which provides the fastening unit **12** in motion with inner and outer movement spaces. A magnetic portion **88** and the movable assembly portion **87** may be arranged on two different positions of the first object **2**. The magnetic portion **88** is located in the activity space S, and an elastic element **89** is connected between the body **11** and the magnetic portion **88**. The magnetic portion **88** may also generate a magnetic force from a current provided by the wire **13** so as to connect to or disconnect from the body **11**.
(59) As shown in FIG. **26** to FIG. **29**, in one embodiment, the activity space S is strip-shaped, and two ends of the elastic element **89** are respectively connected to the magnetic portion **88** and the fastening portion **12**, allowing the fastener structure **1** to perform linear movement and hence the fastening unit **12** to perform linear movement. The current of the wire **13** is received via the magnetic portion **88** so as to control activities of the fastener structure **1**, so that the fastening unit **12** is engaged with or disengaged from the fastened object **74**. The movable assembly portion **87** may be used to press against two ends of the activity space S so as to limit a movement range of the fastener structure **1**.
(60) While the present disclosure has been described by means of specific embodiments, numerous modifications and variations could be made thereto by those skilled in the art without departing from the scope and spirit of the present disclosure set forth in the claims.

Claims

1. An electrically driven fastener structure, comprising: a body having a first assembly portion; a fastening unit having a second assembly portion corresponding to the first assembly portion; a wire adapted to pass a current and to pass through the first assembly portion or the second assembly portion to form a magnetic switch using the first assembly portion or the second assembly portion, so as to drive the magnetic switch based on on or off or strong or weak of the current, or to drive the magnetic switch based on on or off or strong or weak of a magnetic force; and an elastic element, wherein two ends of the elastic element are pressed against the first assembly portion and the second assembly portion, respectively, so as to position the magnetic switch at an on or off position when the magnetic force is absent.
2. The electrically driven fastener structure of claim 1, wherein the wire is adapted to pass a current and to pass through a first object and then pass through the first assembly portion or the second assembly portion.
3. The electrically driven fastener structure of claim 1, further comprising: a control device signally

connected to the wire to control on and off of the magnetic switch, the control device being a control instrument, a cellphone, a mobile communication device, or a computer.

4. The electrically driven fastener structure of claim 1, wherein the first assembly portion or the second assembly portion is a magnetic portion, or the first assembly portion or the second assembly portion is a magnetism generating portion so as to generate a magnetic force when the current is conducted.

5. The electrically driven fastener structure of claim 1, wherein the wire has positive and negative power so as to generate a magnetic force, and the second assembly portion or the first assembly portion is made of a metal material so as to be attracted by the magnetic force generated by the wire.

6. The electrically driven fastener structure of claim 1, wherein the fastening unit is signally connected to a control device, the control device being a cellphone, a mobile communication device, a computer, a wired electronic device or a wireless electronic device.

7. A method of use of an electrically driven fastener structure, using the electrically driven fastener structure of claim 1, the method comprising: passing a current through the first assembly portion or the second portion to form a magnetic switch using the first assembly portion or the second assembly portion; and driving the magnetic switch based on on or off or strong or weak of the current, or driving the magnetic switch based on on or off or strong or weak of a magnetic force.

8. The electrically driven fastener structure of claim 1, wherein the fastening unit is magnetically driven to perform an action of rotational engagement, vertical engagement, horizontal engagement, screw locking rotation, leverage lifting or pulling.

9. The electrically driven fastener structure of claim 1, wherein the fastener structure is welding connected, engagingly connected, rivet connected, expansion connected, lockingly connected, fittingly connected or adhesion connected to a first object.