

Moisture Proof Plug Blade

Background of the Invention

1. Field of the Invention

The present invention relates to a plug blade. In particular, the present
5 invention relates to a moisture proof plug blade for preventing moisture from entering an interior of a plug.

2. Description of the Related Art

A plug is a necessary element to all industries and other fields. The plug
is engaged with a socket to supply electricity to an electric appliance or other
10 electric equipments that may be used in many places including a humid environment. Thus, there is a risk of short circuit, as moisture may enter a gap between an outer periphery of a respective plug blade and a peripheral wall delimiting a respective slot of a socket into which the plug blade is inserted.

Figs. 1 and 2 illustrate a conventional plug blade 1 having a protective
15 sleeve 2 mounted thereon. The protective sleeve 2 includes a through-hole 21 that is rectangular in section and through which the plug blade 1 extends. However, additional cost is incurred for a mold for producing the protective sleeve 2. Further, the protective sleeve 2 and the plug blade 1 are separate members such that entrance of moisture via the gap between the protective sleeve 2 and the plug
20 blade 1 is still possible. Further, the bonding force between the protective sleeve 2 and the plug blade 1 is insufficient such that the protective sleeve 2 may disengage from the plug blade 1 during a subsequent procedure of coupling a wire to the plug blade 1.

Summary of the Invention

An object of the present invention is to provide a moisture proof plug blade for preventing moisture from entering an interior of a plug, avoiding potential short circuit and damage.

5 Another object of the present invention is to provide a moisture proof plug blade including an insulating layer firmly bonded thereto.

A plug blade in accordance with the present invention includes a front section and a rear section. The rear section has a through-hole extending from a first face of the rear section through a second face of the rear section opposite to
10 the first face. An insulating laying is formed on the rear section by injection molding and fills the through-hole of the rear section of the plug blade. The insulating layer includes a flange that abuts against an inner face of an inner frame during a procedure for forming a housing of a plug, thereby preventing moisture from entering an interior of the housing of the plug.

15 Other objects, advantages, and novel features of the invention will become more apparent from the following detailed description when taken in conjunction with the accompanying drawings.

Brief Description of the Drawings

Fig. 1 is an exploded perspective view of a conventional plug blade.

20 Fig. 2 is a sectional view of the conventional plug blade.

Fig. 3 is a perspective view of a row of plug blades in accordance with a first embodiment of the present invention.

Fig. 4 is a perspective view of the row of plug blades in Fig. 3, wherein an insulating layer on the respective plug blade is removed to show structure of the
25 respective plug blade.

Fig. 5 is a perspective view of a row of plug blades in accordance with a second embodiment of the present invention.

Fig. 6 is a perspective view of the row of plug blades in Fig. 5, wherein an insulating layer on the respective plug blade is removed to show structure of the
5 respective plug blade.

Fig. 7 is a perspective view of a row of plug blades in accordance with a third embodiment of the present invention.

Fig. 8 is a perspective view of the row of plug blades in Fig. 7, wherein an insulating layer on the respective plug blade is removed to show structure of the
10 respective plug blade.

Fig. 9 is a side view, partly sectioned, of the plug blades in Fig. 3.

Fig. 9A is an enlarged view of a circled portion in Fig. 9.

Fig. 10 is a sectional view of the plug blades in Fig. 3.

Fig. 11 is a side view, partly sectioned, of the plug blades in Fig. 5.

15 Fig. 12 is a sectional view of the plug blades in Fig. 5.

Fig. 13 is a sectional view of a semi-product of a plug made from the plug blade in Fig. 3.

Fig. 14 is a perspective view of a plug made from the semi-product of the plug in Fig. 13.

20 Fig. 15 is a sectional view of a semi-product of a plug made from the plug blade in Fig. 7.

Fig. 16 is a perspective view of a plug made from the semi-product of the plug in Fig. 15.

Fig. 17 is a sectional view of a semi-product of a plug made from the plug
25 blade in Fig. 5.

Fig. 18 is a perspective view of a plug made from the semi-product of the plug in Fig. 17.

Fig. 19 is an exploded perspective view of a semi-product of another plug made from the plug blade in Fig. 3.

5 Fig. 20 is a sectional view taken along plane A-A in Fig. 19.

Fig. 21 is a sectional view taken along plane C-C in Fig. 19.

Fig. 22 is a perspective view of the semi-product of another plug in Fig. 19.

10 Fig. 23 is a perspective view of a plug made from the semi-product of another plug in Fig. 22.

Fig. 24 is an exploded perspective view of a semi-product of another plug made from the plug blade in Fig. 7.

Fig. 25 is a perspective view of the semi-product of another plug in Fig. 24.

15 Fig. 26 is a perspective view of a plug made from the semi-product of another plug in Fig. 25.

Fig. 27 is an exploded perspective view of a semi-product of another plug made from the plug blade in Fig. 5.

20 Fig. 28 is a perspective view of the semi-product of another plug in Fig. 27.

Fig. 29 is a perspective view of a plug made from the semi-product of another plug in Fig. 28.

Fig. 30 is a sectional view of a row of plug blades in accordance with a fourth embodiment of the present invention.

25 Fig. 31 is a sectional view of the respective plug blade in Fig. 30.

Fig. 31A is an enlarged view of a circled portion in Fig. 31.

Fig. 32 is an exploded perspective view similar to Fig. 19, illustrating a modified embodiment of the insulating layer.

Fig. 33 is a sectional view taken along plane B-B in Fig. 32.

Fig. 34 is a sectional view taken along plane D-D in Fig. 32.

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Detailed Description of the Preferred Embodiments

Referring to Figs. 3, 4, 9, and 10, a plug blade 3 in accordance with the present invention is cut from a row of plug blades 3 in Fig. 3 and includes an enclosed rear section 31 enclosed by an insulating layer 4 and an exposed front section 32. The enclosed rear section 31 includes a through-hole 33 extending
10 from a first face of the rear section 31 through a second face of the rear section 31 opposite to the first face. The plug blade 3 is made of metal for conducting electricity.

The insulating layer 4 is made of plastics and formed on the rear section 31 by injection molding, as shown in Fig. 3. The insulating layer 4 may include a
15 flange 41 on a rear end thereof. Molten plastic material is poured into a mold (not shown) in which the respective plug blade 3 is placed. The molten plastic material also fills the through-hole 33 of the respective plug blade 3. Thus, after hardening of the molten plastic material, the insulating layer 4 is firmly bonded with the rear section 31 of the respective plug blade 3, best shown in Figs. 9 and 10. The flange
20 41 of the insulating layer 4 abuts against an inner face of an inner frame 5 (Fig. 13) during subsequent integral formation of a housing 6 (Fig. 14) that provides a final product of the plug. Thus, entrance of moisture into an interior of the housing 6 of the plug is prevented.

Referring to Figs. 13 and 14, an insulating layer 4 is firstly formed on the
25 respective plug blade 3. After coupling an end of a wire (not shown) to the respective plug blade 3, the respective plug blade 3 is mounted on and thus

positioned by an inner frame 5 for subsequent formation of a housing 6 by means of injection molding. Thus, a plug with two plug blades 3 is provided.

As illustrated in Figs. 9 and 9A, the insulating layer 4 may include an inclined end face 46 on an end thereof that is adjacent to the exposed front section 32 of the respective plug blade 3. The inclined end face 46 allows the plug blade 3 to be smoothly inserted into a slot (not shown) of a socket (not shown) with less friction.

Fig. 19 is an exploded perspective view of a semi-product of another plug made from the plug blade in Fig. 3. Fig. 20 is a sectional view taken along plane A-A in Fig. 19. Fig. 21 is a sectional view taken along plane C-C in Fig. 19. Fig. 22 is a perspective view of the semi-product of another plug in Fig. 19. Fig. 23 is a perspective view of a plug made from the semi-product of another plug in Fig. 22. An insulating layer 4 is firstly formed on the respective plug blade 3. After coupling an end of a wire (not shown) to the respective plug blade 3, the respective plug blade 3 is mounted on and thus positioned by an inner frame 5C for subsequent formation of a housing 6C by means of injection molding. Thus, a plug with three plug blades 3 is provided. As illustrated in Fig. 21, the flange 41 of the insulating layer 4 may include chamfered corners 42. As illustrated in Fig. 20, the remaining portion of the insulating layer 4 may include chamfered corners 43.

Figs. 5 and 6 illustrate a row of plug blades 3A of another type. Fig. 11 is a side view, partly sectioned, of the plug blades in Fig. 5. Fig. 12 is a sectional view of the plug blades in Fig. 5. In this embodiment, the plug blade 3A includes a front section 32 and a rear section 31 having a through-hole 33 extending from a first face of the rear section 31 through a second face of the rear section 31 opposite to the first face. An insulating layer 4A having a flange 41 encloses the

rear section 31 and fills the through-hole 33, as mentioned above. Four faces 34A of the rear section 31 are lower than those of the front section 32. After formation, four faces of the insulating layer 4A (except the flange 41) are respectively flush with those of the front section 32.

5 Referring to Figs. 17 and 18, an insulating layer 4A is firstly formed on the respective plug blade 3A. After coupling an end of a wire (not shown) to the respective plug blade 3A, the respective plug blade 3A is mounted on and thus positioned by an inner frame 5A for subsequent formation of a housing 6A by means of injection molding. Thus, a plug with two plug blades 3A is provided.

10 Fig. 27 is an exploded perspective view of a semi-product of another plug made from the plug blade in Fig. 5. Fig. 28 is a perspective view of the semi-product of another plug in Fig. 27. Fig. 29 is a perspective view of a plug made from the semi-product of another plug in Fig. 28. An insulating layer 4A is firstly formed on the respective plug blade 3A. After coupling an end of a wire
15 (not shown) to the respective plug blade 3A, the respective plug blade 3A is mounted on and thus positioned by an inner frame 5E for subsequent formation of a housing 6E by means of injection molding. Thus, a plug with three plug blades 3A is provided.

Figs. 7 and 8 illustrate a row of plug blades 3B of another type. In this
20 embodiment, the plug blade 3B includes a front section 32 and a rear section 31 having a through-hole 33 extending from a first face of the rear section 31 through a second face of the rear section 31 opposite to the first face. An insulating layer 4B having a flange 41 encloses the rear section 31 and fills the through-hole 33, as mentioned above. Two lateral faces 34B of the rear section 31
25 are lower than those of the front section 32. After formation, two lateral faces of

the insulating layer 4A (except the flange 41) are respectively flush with those of the front section 32.

Referring to Figs. 15 and 16, an insulating layer 4B is firstly formed on the respective plug blade 3B. After coupling an end of a wire (not shown) to the
5 respective plug blade 3B, the respective plug blade 3B is mounted on and thus positioned by an inner frame 5B for subsequent formation of a housing 6B by means of injection molding. Thus, a plug with two plug blades 3B is provided.

Fig. 24 is an exploded perspective view of a semi-product of another plug made from the plug blade in Fig. 7. Fig. 25 is a perspective view of the
10 semi-product of another plug in Fig. 24. Fig. 26 is a perspective view of a plug made from the semi-product of another plug in Fig. 25. An insulating layer 4B is firstly formed on the respective plug blade 3B. After coupling an end of a wire (not shown) to the respective plug blade 3B, the respective plug blade 3B is mounted on and thus positioned by an inner frame 5D for subsequent formation of
15 a housing 6D by means of injection molding. Thus, a plug with three plug blades 3B is provided.

Fig. 30 is a sectional view of a row of plug blades in accordance with a fourth embodiment of the present invention. Fig. 31 is a sectional view of the respective plug blade in Fig. 30. Fig. 31A is an enlarged view of a circled portion
20 in Fig. 31. An embossed section 35 is preferably formed on at least one of the two faces of the rear section 31 of the respective plug blade (now designated by 3C). The embossed section 35 improves the bonding strength between the respective face of the respective plug blade 3C and the insulating layer (now designated by 4C) on the respective plug blade 3C, further avoiding entrance of moisture into an
25 interior of the housing of the final plug.

Fig. 32 is an exploded perspective view similar to Fig. 19, illustrating a modified embodiment of the insulating layer. Fig. 33 is a sectional view taken along plane B-B in Fig. 32. Fig. 34 is a sectional view taken along plane D-D in Fig. 32. As illustrated in Fig. 34, the flange 41 of the insulating layer 4 may include rounded corners 44. As illustrated in Fig. 33, the remaining portion of the insulating layer 4 may include rounded corners 45.

According to the above description, it is appreciated that the insulating layer 4, 4A, 4B, 4C is firmly bonded with the plug blade 3, 3A, 3B, 3C as the insulating layer 4, 4A, 4B, 4C fills the through-hole 33 of the plug 3, 3A, 3B, 3C. The insulating layer 4, 4A, 4B, 4C made of plastic material provides a strong bonding effect with the through-hole 33 of the plug 3, 3A, 3B, 3C. The flange 41, 41A, 41B that abuts against the inner face of the inner frame 5, 5A, 5B, 5C, 5D, 5E avoids entrance of moisture into an interior of the housing 6, 6A, 6B, 6C, 6D, 6E. The insulating layer 4, 4A, 4B, 4C on the rear section 31 of the plug blade 3, 3A, 3B, 3C reduces the risk of shock resulting from inadvertent touch of the rear section 31 of the plug blade 3, 3A, 3B, 3C by the user.

Although the invention has been explained in relation to its preferred embodiment, it is to be understood that many other possible modifications and variations can be made without departing from the scope of the invention as hereinafter claimed.

The embodiments of the invention in which an exclusive property or privilege are:

1. A plug blade comprising a front section and a rear section, the rear section having a through-hole extending from a first face of the rear section through a second face of the rear section opposite to the first face, an insulating laying being formed on the rear section by injection molding and filling the through-hole of the rear section of the plug blade, the insulating layer including a flange adapted to abut against an inner face of an inner frame during a procedure for forming a housing of a plug, thereby preventing moisture from entering an interior of the housing of the plug.
2. The plug blade as claimed in claim 1, wherein the rear section of the plug blade includes an embossed section on at least one of four faces thereof for increasing a bonding strength between the insulating layer and the rear section of the plug blade.
3. The plug blade as claimed in claim 2, wherein the embossed section is formed on each of the first face and the second face of the rear section of the plug.
4. The plug blade as claimed in claim 1, wherein the flange of the insulating layer includes four rounded corners.
5. The plug blade as claimed in claim 4, wherein a remaining portion of the insulating layer includes four rounded corners.
6. The plug blade as claimed in claim 1, wherein the flange of the insulating layer includes four chamfered corners.
7. The plug blade as claimed in claim 6, wherein a remaining portion of the insulating layer includes four chamfered corners.

8. The plug blade as claimed in claim 1, wherein the insulating layer includes an inclined end face on an end thereof that is adjacent to the exposed front section of the respective plug blade, allowing smooth insertion of the plug blade into a slot of a socket.