

Description

The invention relates to an electrical plug, comprising a base and a plurality of substantially parallel connection pins which project from the front thereof and which are connected to conductors of a connection cable *via* connection points, the base being accommodated in a plastics plug body which leaves free the portions of the connection pins which project from the front of the base.

Such a plug is known from NL—A—80 06 481. The plug body is preferably shaped so that it can be easily held by hand for insertion into or withdrawal from a wall outlet. Some users, however, tend to remove the plug from the wall outlet by pulling the cable. It has been found that sometimes one of the connection pins is then pulled out of the base so that it is left behind in the wall outlet. This occurs notably when the pulling force is directed approximately perpendicularly to the longitudinal direction of the connection pins. The connection pin is then broken out of the base by a twisting movement. It will be evident that a connection pin left behind in the wall outlet is very dangerous to touch.

It is an object of the invention to provide a plug of the kind set forth in which it is impossible to break a connection pin out of the base by pulling the cable. To this end, the plug in accordance with the invention is characterized in that the base and plug body are flexible so that, when the plug is in an appropriate socket, a tensile force in the cable exerted approximately perpendicularly to the pins would distort the plug, the minimum tensile force required for distorting the plug being less than the tensile strength of the cable and in that the tensile strength of the cable is less than the break-out strength of a pin.

It is thus achieved that when the cable is pulled, the connection pin merely assumes a different position with respect to the base and the plug body, without the connection pin being broken out of the base. Consequently, dangerous situations can no longer arise and the plug generally becomes unsuitable for use after such deformation.

Should the connection pin remain jammed in the wall outlet after the described deformation, further pulling could cause a rupture of the cable. Should such a rupture occur outside the plug body, the bare end of the piece of cable still attached to the plug could also be dangerous. Because the weakest portion of the cable (the portion wherefrom the outer jacket has been removed) is situated within the plug body, the risk of a rupture occurring outside the plug body is extremely low. In order to reduce this risk even further, a preferred embodiment of the plug in accordance with the invention is characterized in that the maximum tensile force exertable is limited by the mode of connection of the cable to the pins being such that the tensile force required to separate the conductors from the connection points is less than the tensile strength of the

cable. Thus, the cable will be detached from the connection pin before the cable itself is ruptured, so that no piece of cable can remain attached to one of the connection pins of the plug.

The invention will be described in detail hereinafter with reference to the drawing. Therein:

Figure 1 is a perspective view of a base for an embodiment of a plug in accordance with the invention,

Figure 2 is a longitudinal sectional view of an embodiment of a complete plug, and

Figures 3A to D are side elevations of a plug during a tensile strength test.

Figure 1 shows a base 1 of an insulating material; from the front (the lower side in Figure 1) thereof three connection pins 3 project which are connected to connection points 5 at the rear of the base (see also Figure 2). Each connection point 5 is connected to a conductor 7 of a connection cable 9 when the plug is assembled. For this purpose the end of each conductor 7 is provided with an eyelet 11 which is riveted to the connection point 5. Only one of the three conductors 7 is visible in Figure 2. One of the three connection pins 3 is connected to the associated conductor *via* two clamping contacts 13 which can be electrically interconnected by means of a fuse (not shown). The extreme right connection pin 3 of the base shown is constructed as the ground contact; the other two connection pins 3 are intended to contact the zero and the phase connection of a wall outlet (not shown). For example, the extreme left connection pin 3 in Figure 1 is thus connected to a conductor of the connection cable 9 *via* the clamping contacts 13. The extreme right connection pin is longer than the other two pins. The free end portions of the two connection pins 3 at the left which project from the base 1 are enclosed over a part of their length by a jacket 14 which is made of the same material as that used for the base. This type of plug is suitable for wall outlets which are, for example customarily used in Great Britain.

The plug also comprises an insulating cap 15 which is secured to the rear of the base by means of integral resilient hooks 17 which project through openings 19 in the base 1. As appears from Figure 2, the insulating cap 15 covers the connection points 5 of the two connection pins 3 which do not serve as the ground contact. Should one of the wires of a conductor 7 fail to be attached to the connection point when the conductor is connected to a connection point 5, it will remain within the space bounded by the insulating cap 15 and the base 1 after the mounting of the insulating cap 15.

After the mounting of the insulating cap 15, the rear of the base 1 and the entire insulating cap and its contents are provided with a plastics plug base 21 by injection moulding. The plug body encloses the base 1 on all sides, except the front wherefrom the connection pins 3 project.

The connection pins 3 are firmly secured in the base 1 so that the force required for pulling a connection pin out of the base (referred to as

break-out strength) amounts to, for example, 3000 N for the right-hand connection pin and to 2000 N for each of the other two pins. In order to achieve such a high break-out strength use can be made of a known construction, for example a suitable profile, or a suitable surface treatment of the portion of the connection pin which is surrounded by the material of the base.

The tensile strength of the cable 9 is less than the break-out strength of the connection pins, for example, 600 N. The tensile strength of the cable is to be understood to mean herein the tensile strength of the weakest portion of the cable. This is the portion which is situated inside the plug body 21 and wherefrom the outer jacket has been removed. As a result of the presence of the outer jacket, the portion of the cable which is situated outside the plug body 21 has a higher tensile strength.

The material and the shape of the base 1 are chosen so that the base can be bent by exerting a pulling force between the cable 9 and one of the connection pins 3, which pulling force is directed approximately perpendicularly to the longitudinal direction of the connection pins and is less than the break-out strength of the connection pins as well as the tensile strength of the cable, so less than 600 N in the described example. A suitable material for the base is, for example, polyamide. It is also possible to provide each connection pin 3 with a weakened portion so that the connection pin itself will be bent at this area under the influence of the described pulling force. Such a weakened portion should preferably be formed in the portion of the connection pin which is situated inside the plug body 21 or at the transition between this portion and the free end portion.

Figure 3A is a side elevation of a plug having the described construction. When this plug is inserted in a wall socket, the free ends of the connection pins 3 are situated in contact sleeves (not shown). When the cable 9 is pulled in a direction perpendicular to the longitudinal direction of the connection pins 3 as indicated in Figure 3B by an arrow 23, the contact sleeves will exert an equal but oppositely directed force 25 on the connection pins. Because the connection pins 3 at the left are comparatively short, it is not unlikely that these pins will be completely or almost completely pulled out of the wall outlet when the cable is pulled. The longer connection pin 3 at the right, however, will remain in the contact sleeve of the wall outlet in many cases, so that the force 25 will be exerted mainly on this connection pin. Because of the described ratio of the break-out strength of the connection pins 3, the tensile strength of the cable 9 and the force required for changing the position of the free end portion of the connection pin 3 with respect to the base 1, the free end of the right hand connection pin 3 will now be bent to the right as shown in the Figures 3b and 3C, the comparatively elastic plug body 21 being distorted at the same time. Figure 3D illustrates the situation in which the free end of the right-hand connection pin 3 has been bent

through an angle of approximately 90° so that it extends in the same direction as the cable 9. Generally, the right-hand connection pin 3 will be pulled out of the wall outlet at this instant, after which the connection pins will remain approximately in the position shown, so that the plug can no longer be inserted into a wall outlet and becomes unsuitable for further use. Evidently, this is desirable because after the described treatment the plug must be considered to be unsafe. However, should the right-hand connection pin 3 remain in the wall outlet even in the situation shown in Figure 3D, the tensile strength of the cable 9 will be exceeded when pulling is continued. Because, as has already been described, the weakest point of the cable is situated in the bare portion thereof inside the plug body 21, the cable will be ruptured inside the plug body so that no potentially dangerous piece of cable which is still attached to the connection pins will project from the plug body. Even more certainty that any cable rupture will always occur inside the plug body 21 can be obtained by connecting the conductor 7 of the cable to the connection points 5 in such a manner that the adhesion between these conductors and the connection points is less than the tensile strength of the cable.

A type of plug comprising three connection pins as commonly used in Great Britain has been described as an example of a plug in accordance with the invention. It will be apparent that the described steps can also be taken for other types of plugs, possibly comprising a different number of connection pins, for example the types commonly used on the European continent.

Claims

1. An electrical plug, comprising a base (1) and a plurality of substantially parallel connection pins (3) which project from the front thereof and which are connected to conductors (7) of a connection cable (9) via connection points (5), the base being accommodated in a plastics plug body (21) which leaves free the portions of the connection pins which project from the front of the base, characterized in that the base (1) and plug body (21) are flexible so that, when the plug is in an appropriate socket, a tensile force in the cable exerted approximately perpendicularly to the pins would distort the plug, the minimum tensile force required for distorting the plug being less than the tensile strength of the cable and in that the tensile strength of the cable is less than the break-out strength of a pin.

2. A plug as claimed in Claim 1, characterized in that the maximum tensile force exertable is limited by the mode of connection of the cable to the pins being such that the tensile force required to separate the conductors (7) from the connection points (5) is less than the tensile strength of the cable.

Break-out strength) amounts to, for example, 3000 N for the right-hand connection pin and to 2000 N for each of the other two pins. In order to achieve such a high break-out strength use can be made of a known construction, for example a suitable profile, or a suitable surface treatment of the portion of the connection pin which is surrounded by the material of the base.

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The material and the shape of the base 1 are chosen so that the base can be bent by exerting a pulling force between the cable 9 and one of the connection pins 3, which pulling force is directed approximately perpendicularly to the longitudinal direction of the connection pins and is less than the break-out strength of the connection pins as well as the tensile strength of the cable, so less than 600 N in the described example. A suitable material for the base is, for example, polyamide. It is also possible to provide each connection pin 3 with a weakened portion so that the connection pin itself will be bent at this area under the influence of the described pulling force. Such a weakened portion should preferably be formed in the portion of the connection pin which is situated inside the plug body 21 or at the transition between this portion and the free end portion.

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through an angle of approximately 90° so that it extends in the same direction as the cable 9. Generally, the right-hand connection pin 3 will be pulled out of the wall outlet at this instant, after which the connection pins will remain approximately in the position shown, so that the plug can no longer be inserted into a wall outlet and becomes unsuitable for further use. Evidently, this is desirable because after the described treatment the plug must be considered to be unsafe. However, should the right-hand connection pin 3 remain in the wall outlet even in the situation shown in Figure 3D, the tensile strength of the cable 9 will be exceeded when pulling is continued. Because, as has already been described, the weakest point of the cable is situated in the bare portion thereof inside the plug body 21, the cable will be ruptured inside the plug body so that no potentially dangerous piece of cable which is still attached to the connection pins will project from the plug body. Even more certainty that any cable rupture will always occur inside the plug body 21 can be obtained by connecting the conductor 7 of the cable to the connection points 5 in such a manner that the adhesion between these conductors and the connection points is less than the tensile strength of the cable.

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2. A plug as claimed in Claim 1, characterized in that the maximum tensile force exertable is limited by the mode of connection of the cable to the pins being such that the tensile force required to separate the conductors (7) from the connection points (5) is less than the tensile strength of the cable.



Patentansprüche

1. Elektrischer Stecker mit einer Basis (1) und einer Anzahl im wesentlichen paralleler Anschlußstifte (3), die aus der Vorderseite der Basis herausragen und mit Leitern (7) eines Verbindungskabels (9) über Verbindungspunkte (5) verbunden sind, wobei die Basis in einen Kunststoff-Steckerkörper (21) aufgenommen ist, der die aus der Vorderseite der Basis herausragenden Teil der Verbindungsstifte freiläßt, dadurch gekennzeichnet, daß die Basis (1) und der Steckerkörper (21) biegsam sind, so daß, wenn der Stecker in eine geeignete Steckdose eingesteckt ist, eine ungefähr senkrecht auf die Stifte ausgeübte Zugkraft im Kabel den Stecker verformen würde, wobei die erforderliche Mindest-Zugkraft zum Verformen des Steckers weniger beträgt als die Zugfestigkeit des Kabels, und daß die Zugfestigkeit des Kabels geringer ist als die Ausbruchfestigkeit eines Stiftes.

2. Stecker nach Anspruch 1, dadurch gekennzeichnet, daß die ausübbare Höchstzugkraft dadurch begrenzt wird, dass das Kabels derart mit den Stiften verbunden ist, dass die erforderliche Zugkraft zum Trennen der Leiter (7) von den Verbindungspunkten (5) geringer ist als die Zugfestigkeit des Kabels.

Revendications

1. Connecteur électrique comprenant un socle (1) et un certain nombre de broches de contact (3) essentiellement parallèles qui dépassent de la face avant de celui-ci et qui sont connectées à des conducteurs (7) d'un câble de raccordement (9) à travers des points de raccordement (5), le socle étant placé dans un corps de connecteur (21) en matière plastique qui laisse libres les parties des broches de contact qui dépassent de la face avant du socle, caractérisé en ce que le socle (1) et le corps de connecteur (21) sont flexibles de façon que, lorsque le connecteur se trouve dans une prise adéquate, une force de traction dans le câble, exercée à peu près perpendiculairement aux broches déforme le connecteur, la force de traction minimale nécessaire pour déformer le connecteur étant inférieure à la résistance à la traction du câble et en ce que la résistance à la traction du câble est inférieure à la résistance à l'arrachement d'une broche.

2. Connecteur selon la revendication 1, caractérisé en ce que la force de traction maximale pouvant être exercée est limitée par le fait que le mode de raccordement du câble aux broches est tel que la force de traction nécessaire pour séparer les conducteurs (7) des points de raccordement (5) est inférieure à la résistance à la traction du câble.



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