A cord clamp for clamping about an electrical cord where the cord enters an electrical connector or appliance, the cord clamp comprising a body part (herein: body) of an electrical connector or appliance including a cord aperture through which the cord enters the connector or appliance, an annular clamp component comprising an annular proximal end alignable around a cord aperture into the body when the clamp component is in place in relation to the body a passage axially through the clamp component from said proximal end to be a distal end of the clamp component, and a plurality of cord engaging elements radially spaced around said passage through the clamp component, and a locking ring engageable to the body so that a bore through the locking ring axially aligns with the cord aperture and the passage through the clamp component, the interior of the locking ring being arranged to engage with the cord engaging elements of the clamp component when the locking ring is engaged home on the body to cause the cord engaging elements to flex towards one another about said proximal end of the clamp component.
FIELD OF INVENTION

The invention relates to a cord clamp for an electrical connector such as a plug or socket connector, or an electrical appliance.

BACKGROUND OF INVENTION

Electrical connectors such as plug or socket connectors which are sold for installation after sale, to an electrical cord, commonly comprise a cord clamp for clamping the connector to the exterior of the cord. The cord clamp forms a strong physical connection between the body of the connector and the cord, additional to the electrical connections that are made between the wires of the cord and the pins of the plug or socket.

Cord clamps in various forms are known. It is an object of the invention to provide an improved or at least alternative form of cord clamp.

SUMMARY OF INVENTION

In one aspect in broad terms the invention comprises a cord clamp for clamping about an electrical cord where the cord enters an electrical connector or appliance, the cord clamp comprising

a body part (as herein defined, and herein: body) of an electrical connector or appliance including a cord aperture through which the cord enters the connector or appliance,

an annular clamp component comprising an annular proximal end alignable around a cord aperture into the body when the clamp component is in place in relation to the body a passage axially through the clamp component from said proximal end to be a distal end of the clamp component, and a plurality of cord engaging elements radially spaced around said passage through the clamp component, and

a locking ring engagable to the body so that a bore through the locking ring axially aligns with the cord aperture and the passage through the clamp component, the interior of the locking ring being arranged to engage with the cord engaging elements of the clamp component when the locking ring is engaged home on the body to cause the cord engaging elements to flex towards one another about said proximal end of the clamp component.

Preferably the cord clamp comprises an annular seal element for sealing about a cord at a distal end of the clamp component adjacent an entry aperture to the bore through the locking ring. In a preferred form the annular seal element is formed of the same material as flexible
sections between the cord engaging elements and is moulded to the cord engaging elements with the material between the cord engaging elements.

Preferably the cord clamp also includes a seal element at the proximal end of the clamp component for sealing the clamp component to the body. This seal may also be moulded from the same material.

In another aspect in broad terms the invention comprises a cord clamp for clamping about an electrical cord where the cord enters an electrical connector or appliance, the cord clamp comprising

a body part (herein: body) of an electrical connector or appliance including a cord aperture through which the cord enters the connector or appliance,

a one piece annular clamp component including a passage axially through the clamp component which aligns with the cord aperture into the body when the clamp component is in place in relation to the body, a plurality of axially extending, radially spaced, flexibly movable ribs, and an annular seal element for sealing about a cord at a distal end of the clamp component adjacent an entry aperture to the bore through the locking ring, integrally formed as part of the annular clamp component, and

a locking ring engagable to the body so that a bore through the locking ring axially aligns with the cord aperture and the passage through the clamp component, the interior of the locking ring being arranged to engage with the ribs of the clamp component when the locking ring is engaged home on the body to cause the ribs to flex pivotally towards one another to engage the cord and to compress the annular seal element.

In a further aspect in broad terms the invention comprises a cord clamp for clamping about an electrical cord where the cord enters an electrical connector or appliance, the cord clamp comprising

a body part (herein: body) of an electrical connector or appliance including a cord aperture through which the cord enters the connector or appliance,

an annular clamp component including a passage axially through the clamp component which aligns with the cord aperture into the body when the clamp component is in place in relation to the body, the clamp component comprising a plurality of radially spaced cord engaging elements,

a locking ring engagable to the body so that a bore through the locking ring axially aligns with the cord aperture and the passage through the clamp component, the interior of the locking ring being arranged to engage with the ribs of the clamp component when the locking ring is engaged fully home on the body to move the cord engaging elements radially towards one another, and
means retaining the clamp component to the body before the locking ring is engaged on the body.

In this specification the terms "cord" and "flex" are used interchangeably and as indicating one or more wires usually but not necessarily with a surrounding sheath often of a plastics material.

In this specification the term "body part" indicates that part of the body of the connector or appliance onto which the locking ring engages. The body part may be the whole of the body, of the plug or connector which will typically be a plastic moulded body, or a part of the body of the plug connector or appliance, such as a smaller part fixed to a larger body of an appliance, which a smaller part defines an aperture through which a cord passes into the appliance and has a threaded exterior onto which the locking ring engages.

The term 'comprising' as used in this specification and claims means 'consisting at least in part of', that is to say when interrupting independent claims including that term, the features prefaced by that term in each claim will need to be present but other features can also be present.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention is further described with reference to the accompanying drawings which show preferred embodiments of cord clamps of the invention by way of example and without intending to be limiting. In the drawings:

Figure 1 is a perspective view of the exterior of a plug connector which comprises a preferred embodiment cord clamp of the invention;

Figure 2 is a longitudinal cross-section of the plug of Figure 1;

Figure 3 is a longitudinal cross-section of the plug of Figures 1 and 2, of the cord clamp of the plug only, at one end of the plug;

Figure 4 is a perspective view of the clamp component of the preferred embodiment cord clamp;

Figure 5 is a view of the cord clamp end of the plug of Figures 1 to 3 (the same end as in Figure 3) showing the locking ring of the preferred embodiment cut away;

Figure 6 is a view similar to Figure 3 also showing the end of a length of an electrical flex passing through the cord clamp, after the locking ring has been initially engaged onto the body of the connector but before the locking ring has been rotated fully home on the connector;

Figure 7 is a view similar to that of Figure 6 but after the locking ring has been rotated fully home on the connector;

Figure 8 is a perspective view of the exterior of a plug connector which comprises an alternative locking ring;
Figure 9 is a longitudinal cross-section of the plug of Figure 8;
Figure 10 is an enlarged longitudinal cross-section of the plug of Figures 8 and 9, of the locking ring and plug at one end of the plug also showing the end of a length of an electrical flex passing through the locking ring and a cord clamp, after the locking ring has been initially engaged onto the body of the connector but before the locking ring has been rotated fully home on the connector;
Figure 11 is a view similar to that of Figure 10 but after the locking ring has been rotated fully home on the connector;
Figure 12 is an exploded view of the locking ring of the plug of Figures 8 to 11;
Figure 13 is a perspective view of the locking ring and the end of the plug body on which the locking ring engages, with the locking ring parts in a relative rotational position that locking tabs of the locking ring do not protrude into the passage through the locking ring to lock the locking ring to the plug body;
Figure 14 is a view of the locking ring and end of the plug body similar to Figure 13 but showing the locking tabs protruding into the passage through the plug body to lock the plug body to the plug end;
Figure 15 is a view into the interior of the locking ring from one end in the direction of arrow C in Figure 13;
Figure 16 is a view similar to that of Figure 15, in the direction of arrow D in Figure 14; and
Figure 17 shows an electrical appliance comprising preferred forms of cord clamp at either end of the appliance.

**DETAILED DESCRIPTION OF PREFERRED FORMS**

Figures 1 to 7 show the first preferred form of the cord clamp, as applied to an electrical plug. The plug comprises a body generally indicated at 1 and electrical (metallic) pins 2. The plug shown is a three phase plug of an industrial grading and optionally comprises a threaded locking ring 3 captive on the body 1 of the plug, which is screwed onto a complementary threaded body of a connector or appliance to which the plug is coupled in use.

In the particular form shown, within the body of the plug is retained a module 4 which comprises the pins 2. The individual wires (not shown) of a length of electrical cord or flex to which the connector is coupled are terminated at the other side of the module 4 within the body 1.

The cord clamp of the invention is provided at the other end of the plug (herein sometimes referred to as the back end), generally indicated at 6. The cord clamp physically clamps the plug to the cord where the cord enters the body of the plug as will be further
Referring particularly to Figures 6 and 7, when the plug is coupled to a cord or flex the cord C passes through an aperture 8 in an entry end of the locking ring 7, through the annular clamp component 6, and through an aperture 9 in the end of the connector body 1 as shown, into the interior of the plug body.

Referring particularly to Figures 3 to 5 the clamp component 6 comprises a plurality of axially extending, radially spaced ribs 11. The ribs 11 are formed of a harder material and may be coupled by sections 12 of a more flexible and/or softer material between the ribs 11. In the preferred form a component comprising the parts 11 is formed for example by injection moulding from a harder plastics material, and then the sections 12 of a softer or flexible compressible plastics material which is preferably also resilient, are moulded (co-moulded) to and between the ribs 11. Alternatively the ribs 11 and sections 12 may be moulded of relatively harder and relatively softer rubber materials, or the ribs 11 may be moulded of a harder plastics material or metal and the sections 12 of a softer rubber material for example. Alternatively again the ribs 11 and sections 12 may be formed of the same material in a single moulding operation, with the sections 12 being formed so as to have a thinner wall dimension than the radial thickness of the ribs 11 so that the sections 12 have the required flexibility.

The locking ring 7 in the preferred form screw threads onto the body 1 of the plug. At its back end the body 1 is externally threaded as indicated at 13, and the bore of the locking ring comprises an internally threaded portion 14 for threading the locking ring onto the body 1.

Figures 3, 5 and 6 show the locking ring 7 after initial threading onto the body. Figure 7 shows the cord clamp after the locking ring has been screwed fully home onto the back end of the plug. When the locking ring is screwed fully home, the interior of the locking ring engages the ribs 11 and moves the parts 11 towards one another, so that the ribs clamp against the cord C, to form a physical connection between the plug and the cord at the back end of the plug. The parts 11 move by flexing about a proximal end of the clamp component 6.

Referring again to Figures 3 to 5, each of the parts 11 comprises a shoulder 15 which is engaged by the interior of the locking ring when the locking ring is screwed onto the body. As the interior of the locking ring contacts the shoulders 15 of the parts 11 as the locking ring 7 is screwed onto the body, the ribs 11 are moved axially towards one another, to close or compress the clamp component 6 about the cord. In a preferred form the ribs 11 also comprise blunt tooth portions 16 which will bite into the exterior of the cord C as shown in Figure 7.

Optionally a thrust washer 18 may be provided within the locking ring adjacent the entry 8 to the locking ring and the shoulders 15 of the ribs 11. The thrust washer 18 does not rotate as the locking ring is tightened on the clamp component 6, to assist in preventing rotational distortion of the ribs 11, but in another form a thrust washer 18 or equivalent may not be
essential. Preferably the thrust washer 18 is retained within the interior of the locking ring so that it is not lost when the locking ring is removed. The thrust washer in the preferred form has a frusto-conical shape as shown.

As stated the relatively flexible material 12 between the ribs 11 is in a preferred form co-moulded to the ribs 11, after first separately forming the ribs 11 by injection moulding from a harder plastics material or die casting from metal for example. Thus the ribs 11 and sections 12 after co-moulding are a single integral component in which the ribs are held in a position but may flex towards one another. In the preferred form an annular seal element 19 is provided and this may be formed from the same softer material as the sections 12 between the ribs and may also be co-moulded to the ribs 11 at the same time as the sections 12 are co-moulded between the ribs. The same softer material which surrounds the ribs and holds the ribs in position relative to one another then also forms seal 19. In an alternative form however, a component of a softer plastics or rubber material may first be moulded with a series of axially extending radially spaced slots and then each of the ribs 11 inserted into and bonded into such slots.

At the proximal end of the clamp component opposite to the seal 19, the ribs 11 in the preferred form are coupled by a segmented annular part defined by providing each of the ribs 11 with an enlarged end 20a as shown (see particularly Figure 4). Alternatively such an annular part may be non-segmented. For example instead of moulding each of the ribs 11 separately and then co-moulding the material 12 around the ribs, the ribs 11 integrally coupled by continuous (non-segmented) annulus 20 may be injection moulded as a single component, and then the sections 12 and optionally seal 19 co-moulded to and around this first formed component.

It can be seen as shown in Figure 6 that before the locking ring 7 has been screwed home on to the body 1 the clamp component 6 including the ribs 11 and seal 19 are uncompressed. As the locking ring 7 is screwed towards it's fully home position as shown in Figure 7 the ribs 11 are each caused to flex axially inwardly about their ends 20a, to contact the cord C, so that the tooth 16 of each of the ribs 11 engages the exterior of the cord, and also so that the seal 19 is compressed about the exterior of the cord C, to form a moisture tight seal, which will prevent the ingress of moisture and dirt around the cord into the interior of the plug.

In the preferred form there is also provided a seal element 21 at the proximal end of the clamp component 6 for also sealing the clamp component to the body of the coupling as shown (see Figures 6 and 7). This seals against the potential ingress of moisture and dirt through the aperture 8 into the interior of the locking ring 7, and then around the lower annular face of the clamp component 6. In a preferred form the seal 21 is formed of the same material as that of the sections 12 between the ribs 11 and seal 19 at the other end of the clamp component, and is also formed when the clamp component 6 is co-moulded. In an alternative form however, the seal
may be a separate compressible washer or flexible O-ring or similar provided between the clamp component 6 and the body 1 of the coupling around the aperture 9.

The preferred form cord clamp described above is described in relation to a plug but alternatively the cord clamp may be provided at the back end of a socket connector for physically clamping the socket connector to a cord or flex, and alternatively again the cord clamp may be used where a cord enters an electrical appliance. Figure 17 shows in an appliance at either end of which is provided a cord clamp of the invention. The description of the preferred form above in relation to plug is given by way of example only.

In the preferred form shown the locking ring 7 threadedly engages onto the body 1 of the plug and in particular onto the back end of the plug. In an alternative form however the locking ring may engage onto the back end of the plug (or alternatively a connector or appliance) via a twist lock-type connection, which requires that the locking ring be pushed hard axially onto the back end of the coupling by the installer and rotated to guide the locking ring fully home and lock the locking ring onto the coupling, in a position in which the locking ring compresses the clamp component 6 as described and generally as shown in Figure 7. In a further alternative form, the locking ring may snap lock onto the body by simply being pushed hard (without rotation necessarily being required) onto the body.

In the preferred form shown a screw 22 through a side wall of the locking ring is provided as means for locking the locking ring fully home on the body of the plug to prevent the locking ring from loosening unintentionally. After the locking ring has been rotated fully home to compress the clamp component, the screw 22 is screwed inwardly against the body at the back end of the plug to lock the locking ring into position (Figure 6 shows the screw 22 before and Figure 7 the screw 22 after). If for any reason it is subsequently desired to remove the plug or connector from the cord or separate the cord and an appliance, the screw 22 is loosened and then the locking ring 7 unscrewed to release the clamp component 6, and the cord may then be removed (after undoing the electrical terminations of the cord wires to the module 4 or equivalent).

In a preferred form the cord clamp includes means for retaining the clamp component 6 to the body 1 of the coupling, before initial installation of the plug and which will retain the clamp component 6 to the back end of the plug if the locking ring 7 is subsequently removed to enable the cord and plug to be separated. In the preferred form the clamp component 6 is externally waisted or shaped whereby a circlip 23 conveniently formed of a plastics material may retain the clamp component 6 of the body of the plug or connector or appliance. Teeth of the circlip 23 engage into annular slots 24 in an annular wall part 25 of the back end of the body 1 as shown. In an alternative form means for retaining the clamp component to the body may be manually
releaseable to enable the clamp component to be attached to and detached from the body. For example an annular rib may be provided on the interior surface of the annular wall 25 so that the clamp component 6 can removably snap fit into place. Alternatively one or more flexible plastic latches may be incorporated in the annular wall 25 which engage the clamp component 6 and can be manually released optionally with a screw driver for example, to enable the clamp component to be detached.

In the preferred form described above the ribs 11 comprise cord engaging elements which flex pivotally towards and clamp the cord when the locking ring is tightened. The ribs are longer in the axial direction of the clamp, than they are wide. In an alternative embodiment however cord engaging elements may be in an alternative form and may comprise round or square for example pressure points which are radially spaced around the cord clamp axis and have a ring of softer plastics material co-moulded around them to maintain them in position relative to one another, but which enables the harder pressure point components to flex towards one another to clamp the cord when the locking ring is tightened.

Figures 8 to 16 show a form of plug comprising a cord clamp of the invention which is the same as that described above with reference to Figures 5 to 7 except that the cord clamp comprises an alternative means for locking the locking ring fully home on the body of die plug.

Figures 8 and 9 show the plug, which also comprises a body generally indicated at 1 and electrical pins 2. The plug shown is a three phase plug of an industrial grading and optionally comprises a threaded locking ring 3 captive on the body 1 of the plug, which is screwed onto a complementary threaded body of a connector or appliance to which the plug is coupled in use. As before, within the body of the plug is retained a module 4 which comprises the pins 2. The individual wires (not shown) of a length of electrical cord or flex to which the connector is coupled are terminated at the other side of the module 4 within the body 1. A cord clamp 6 is provided at the back other end of the plug. When the plug is coupled to a cord or flex the cord C passes through an aperture 8 in an entry end of locking ring 7, through an annular clamp component 6 which is as described previously, and through an aperture 9 in the end of the connector body 1 as shown, into the interior of the plug body.

The locking ring 7 in this preferred form also screw threads onto the body 1 of the plug. At the back end of the plug the body 1 is externally threaded as indicated at 13, and the locking ring comprises an internally threaded portion 14. Figure 10 shows the locking ring 7 after initial threading onto the body. Figure 11 shows the locking ring 7 after it has been screwed fully home onto the plug body, with the interior of the locking ring compressing the cord clamp component 6 tightly around the cord, to clamp and form a physical connection between the plug and the cord at the back end of the plug. As before a thrust washer 18 is provided within the
locking ring adjacent the entry 8 to the locking ring and between the nut 7 and clamp component 6. There is also provided a seal element 21 at the proximal end of the clamp component 6 for also sealing the clamp component to the body of the coupling.

In this embodiment the locking ring 7 comprises two parts 40 and 41 which are connected but rotatable relative to one another about the passage through the nut. In the preferred form shown one of the parts 40 is relatively larger than the other part 41, so that the part 41 forms a ring rotatable about the larger part 40. Also the two locking ring parts 40 and 41 have a similar diameter, but alternatively the locking ring part 41 could have larger or smaller diameter than the part 40. Figure 12 shows the locking ring 7 in exploded form, and the assembled locking ring is shown in Figure 13 and 14 in its relative rotational positions. To rotatably connect the locking ring parts 40 and 41, in the preferred form connection tabs 42 on the part 40 snap-fit into grooves inside the part 11, when the two locking ring parts 40 and 41 which may be manufactured from a plastics material by injection moulding for example, are assembled together. The connection of the parts 40 and 41 to form the locking ring 7 allows the two parts 40 and 41 to be rotatably moved relative to one another through at least a limited angle such as approximately 10 to 30 degrees of rotational movement for example.

In the preferred form an arcuate element 45, which in the preferred form comprises a metal strip, carries movable locking tabs 14 one at each end as shown, and in the assembled locking ring extends around a waisted portion 47 of the nut part 40 above the annular ridge 50. The arcuate element 45 includes cut outs 49 to accommodate die connection tabs 42 on the nut part 40. The element 45 is associated with to move with the locking ring part 40. Locking tabs 46 are formed as cut outs from the arcuate metal strip 45, which may be formed of spring steel for example, so that the locking tabs 46 move by flexing relative to the main part of the arcuate element strip 45. Alternatively the locking tabs 46 may be otherwise hingably connected to the metal strip 45, or may alternatively for example be small plastic tabs which are formed as part of the waisted portion 47 of the locking ring part 40 rather than on a separate element strip 15.

Cam parts 52 are provided on the interior of the other locking ring part 41, and are positioned so that in one relative rotational position of the locking ring parts 40 and 41 the cams 52 will contact the flexible locking tabs 46 and cause them to move or protrude into the passage through the locking ring. This is shown in Figures 4 and 7. The arcuate metal strip 45 carrying the locking tabs 46 is associated with and moves with the locking ring part 40, so that parts 40 and 41 can be rotated relative to one another to move the cams 52 relative to the flexible locking tabs 46. When the locking ring parts are in the relative position shown in Figures 10 and 13 the cams 52 on the locking ring part 41 do not align with the flexible locking tabs 46 which therefore are not caused to protrude into the passage through the locking ring, to engage the plug body. When
the locking ring parts are moved to their relative position shown in Figures 11 and 14, the cam parts 52 on their locking ring part 41 move against the flexible locking tabs 46, causing them to engage with the plug body to lock the locking ring against further rotation on the plug body. Referring to Figure 13 to move die locking ring parts from the relative position shown in this 5 Figure to that shown in Figure 14 it is necessary to rotate the locking ring parts 40 and 41 relative to one another in the direction(s) of arrow A in Figure 13. Referring to Figure 14 to move the locking ring from the relative position shown in Figure 14 to that of Figure 13 it is necessary to move the locking ring part(s) in the direction of arrow(s) B in Figure 14. Figures 11 and 14 show the locking ring with it's two parts 40 and 41 in another relative rotational position, in which the cams 52 contact the flexible locking tabs 46 causing them to protrude into the passage through the locking ring. A series of ridges 53 are provided around the end of the plug body below the threaded portion 13 on the plug body, which are engaged by the protruding locking tabs 46. As stated, the arrangement is such that one relative rotational position of the locking ring 7 allows rotational movement of the locking ring on the plug body, enabling the locking ring to be threaded onto the plug body, and screwed home fully which in the preferred form also compresses the cord clamp component 6 as referred to previously, while the other relative rotational position of the locking ring causes the locking tabs 46 to engage the ribs 53 on the plug body.

In the preferred form the locking tabs 46 are flexibly biased radially outwardly of the passage through the nut, so that when they are not contacted by the cams 52 the locking tabs 46 will return to a non-locking position.

In the preferred form shown the ribs 53 are provided on the connector body below the threaded portion 13 thereof but alternatively the relative positions of the ribs 53 and threaded portion 13 on the body 1 may be reversed.

As referred to previously the locking tabs 46 may be flexible or one or more tabs may be provided which will move otherwise by pivoting or hinging for example, relative to one of the nut parts. In the preferred form two locking tabs 46 are carried one each at or near the opposite ends of an arcuate spring steel element 45 but other arrangements are possible as referred to previously.

This preferred form electrical connector also comprises second locking means for locking the two locking ring parts in one relative position, which is releasable to enable the locking ring to be returned to it's original relative position to enable in turn the locking ring 7 to be unscrewed from the body of the plug. In particular the arcuate element 45 associated with the locking ring part 40 is bent intermediate of its length to define an outwardly facing detent 55, which interengages with a part (in particular shoulder 56b referred to subsequently) on the interior
of the other locking ring part 41. The arrangement is such that when the locking ring part 41 is moved relative to the other part 40, from the one position in which the cams 52 do not engage the locking tabs 46, to the other relative position in which the cams 52 engage the flexible locking tabs 46, the detent 55 drops outwardly from recess 56a into recess 56b on the interior of the part 41. This prevents the locking ring part 41 from being returned to the first relative position until the detent 55 is first manually released from the recess 56b. In the preferred form shown an aperture 57 radially through the locking ring part 41 aligns with the detent 55 when the locking ring is in this second relative position, which enables a tool such as the end of a small screwdriver for example, to be inserted through the aperture 57 to depress the detent 55 while parts 40 and 41 are then rotated back to their original position to withdraw the locking tabs 46, enabling the nut to be unscrewed from the plug body. This movement also returns the detent 55 to recess 56a, in the part 41.

Alternatively at the position of the aperture 57 a small button component may be provided in the locking ring part 41, which may be depressed manually to release the detent 55 while the locking ring 41 is rotated, or a larger aperture 57 may be provided through which the detent 55 may be directly pushed by a finger.

In use the locking ring 7 may be screwed onto the body of the connector and then the locking ring part 41 rotated to through a small angle cause the detent 55 to drop into the recess 56 to lock the locking ring onto the plug body. Alternatively the orientation of the flexible locking tabs 46 is such that the locking ring part 41 may be rotated to cause the detent 55 to engage the recess 56 before the locking ring is engaged and rotated fully home on the plug body, with the locking tabs 46 riding over the ribs 53 on the plug body as the nut is screwed onto the plug body, with the locking tabs 46 engaging with the ribs 53 to prevent rotation of the locking ring in the opposite direction to unscrew the locking ring 7 from the body (until the detent 55 has been released as described above).

Again this preferred form lock nut system described above is described in relation to a plug but alternatively may be provided at the back end of a socket connector and alternatively again may be used where a cord enters an electrical appliance.

The foregoing describes the invention including preferred forms thereof. Alterations and modifications as will be obvious to those skilled in the art are intended to be incorporated in the scope hereof as described in the accompanying claims.
CLAIMS:

1. A cord clamp for clamping about an electrical cord where the cord enters an electrical connector or appliance, the cord clamp comprising

   a body part (herein: body) of an electrical connector or appliance including a cord aperture through which the cord enters the connector or appliance,

   an annular clamp component comprising an annular proximal end alignable around a cord aperture into die body when the clamp component is in place in relation to the body a passage axially through the clamp component from said proximal end to be a distal end of the clamp component, and a plurality of cord engaging elements radially spaced around said passage through the clamp component, and

   a locking ring engagable to the body so that a bore through the locking ring axially aligns with the cord aperture and the passage through the clamp component, the interior of the locking ring being arranged to engage with the cord engaging elements of the clamp component when the locking ring is engaged home on the body to cause the cord engaging elements to flex towards one another about said proximal end of the clamp component.

2. A cord clamp according to claim 1 comprising an annular seal element for sealing about a cord at the distal end of the clamp component.

3. A cord clamp according to either one of claims 1 and 2 wherein the cord engaging elements to comprise axially extending ribs.

4. A cord clamp according to claim 3 wherein said annular seal element at the distal end of the clamp component is engagable to distal ends of the axially extending ribs or is bonded to distal ends of the axially extending ribs.

5. A cord clamp according to claim 4 wherein the annular seal element is moulded to the distal ends of the axially extending ribs.

6. A cord clamp according to any one of claims 1 to 5 comprising flexible sections between the cord engaging elements.

7. A cord clamp according to claim 6 wherein the flexible sections between the cord engaging elements are moulded between and to the cord engaging elements.

8. A cord clamp according any one of claims 1 to 7 including a seal element at the proximal end of the clamp component for sealing the clamp component to the body.

9. A cord clamp according to claim 3 wherein an annular seal element at the distal end of the clamp component is moulded to the distal end of the axially extending ribs and of a soft compressible material, a seal element is moulded at a proximal end of the clamp component and
of the same material, and flexible sections are moulded between the axially extending ribs, of the same material.

10. A cord clamp according to any one of claims 1 and 9 wherein the cord engaging elements are moulded from a hard plastics material.

11. A cord clamp according to any one of claims 1 to 10 wherein the cord engaging elements each comprise of a shoulder facing away from the passage through the clamp component and which is engaged by the interior of the locking ring when the locking ring is engaged home on the body to cause the cord engaging elements to flex towards one another.

12. A cord clamp according to any one of claims 1 and 11 including a thrust washer between the interior of the bore of the locking ring adjacent the entry to the locking ring and the cord engaging elements of the clamp component.

13. A cord clamp according to any one of claims 1 to 12 wherein said annular proximal end of the clamp component is a segmented or non-segmented annular part integrally formed with the cord engaging elements.

14. A cord clamp according to any one of claims 1 to 13 wherein the locking ring is rotatably engageable on the body of the electrical connector or appliance.

15. A cord clamp according to claim 14 wherein a part of the body of the electrical connector or appliance is externally threaded and the bore of the locking ring comprises an internally threaded portion for threading of the locking ring onto the body to engage the locking ring on the body of the electrical connector or appliance.

16. A cord clamp according to any one of claims 1 to 15 including means for retaining the cord clamp component to the body.

17. A cord clamp according to claim 16 including manually releasable means for releasably retaining the cord clamp to the body.

18. A cord clamp according to claim 16 wherein the clamp component is externally waisted whereby a circlip may retain the clamp component to the body of the connector or appliance.

19. A cord clamp according to any one of claims 1 to 17 including means for locking the locking ring fully home on the body of the connector or appliance.

20. A cord clamp according to claim 19 wherein the means for locking the locking ring comprises a locking screw through a side wall of the locking ring.

21. A cord clamp according to claim 19 wherein the means for locking the locking ring comprises two connected parts rotatable relative to one another and about the passage through the locking ring, and locking means which in one relative rotational position of the locking ring parts allows rotational movement of the locking ring on the body and in another relative
rotational position of the locking ring parts engages the body to inhibit rotation of the locking ring on the body.

22. A cord clamp according to claim 21 wherein said locking means includes one or more locking parts which in said another relative rotational position of the locking ring is caused to protrude from the interior of the locking ring to engage the body to inhibit rotation of the locking ring on the body.

23. A cord clamp according to either one of claims 21 and 22 wherein the locking ring comprises second locking means which locks the two locking ring parts relative to one another after movement of the locking ring parts from said one relative rotational position to said another relative rotational position, against return of the locking ring parts to said one relative position.

24. A cord clamp according to claim 23 comprising an aperture radially through one of the locking ring parts enabling insertion of a tool through said aperture to release said second locking means to enable return of the two locking ring parts relative to one another from said another relative rotational position to said one relative position.

25. A cord clamp according to any one of claims 22 or 23 and 24 when dependent on claim 22 wherein said one or more locking parts which in said another relative rotational position of the locking ring parts is caused to protrude from the interior of the locking ring to engage the body to inhibit rotation of the locking ring on the body comprises one or more movable locking tabs associated with one of the locking ring parts, and wherein the other locking ring part comprises one or more cams which on movement of the two locking ring parts from said one relative rotational position to said another relative rotational position engage said one or more locking tabs to move said locking tabs to protrude from the interior of the locking ring.

26. A cord clamp according to claim 21 wherein said locking means includes an arcuate element around said passage through the locking ring and which is carried by one of the locking ring parts or is captive between the two locking ring parts and which carries said one or more movable locking tabs.

27. A cord clamp according to either one of claims 25 and 26 wherein said one or more movable locking tabs are flexible locking tabs.

28. A cord clamp according to either one of claims 26 and 27 comprising at least two of said movable locking tabs, one each at or towards opposite ends of said arcuate element.

29. A cord clamp according to either one of claims 27 or claim 28 when dependent on claim 27 wherein said arcuate element comprises a metal strip which integrally comprises said flexible locking tabs.
30. A cord clamp according to any one of claims 26 to 29 when dependent directly or indirectly on claim 23 wherein said arcuate element is carried by an inner part of one of the locking ring parts and comprises intermediate of its length a detent which is caused after movement of the locking ring parts from said one relative rotational position to said another relative rotational position to engage an outer part of the other locking ring part to lock against return of the locking ring parts to said one relative rotational position.

31. A cord clamp according to claim 30 wherein release means associated with said outer part of one of the locking ring parts enables manual release of said detent to enable movement of the locking ring parts back to said one relative rotational position.

32. A cord clamp according to claim 31 wherein said release means includes an aperture radially through said outer part of one of the locking ring parts enabling manual release of said detent through said aperture.

33. A cord clamp according to any one of claims 21 to 32 wherein one of the locking ring parts is relatively larger and the other is relatively smaller and comprises a locking ring rotatable about said larger locking ring part.

34. An electrical connector comprising a cord clamp according to any one of claims 1 to 33.

35. An electrical connector according to claim 34 wherein the electrical connector is a plug.

36. An electrical connector according to claim 34 wherein the electrical connector is a socket.

37. An electrical appliance comprising a cord clamp according to any one of claims 1 to 33.

38. A cord clamp for clamping about an electrical cord where the cord enters an electrical connector or appliance, the cord clamp comprising
   a body part (herein: body) of an electrical connector or appliance including a cord aperture through which the cord enters the connector or appliance,
   a one piece annular clamp component including a passage axially through the clamp component which aligns with the cord aperture into the body when the clamp component is in place in relation to the body, a plurality of axially extending, radially spaced, flexibly movable ribs, and an annular seal element for sealing about a cord at a distal end of the clamp component adjacent an entry aperture to the bore through the locking ring, integrally formed as part of the annular clamp component, and
   a locking ring engagable to the body so that a bore through the locking ring axially aligns with the cord aperture and the passage through the clamp component, the interior of the locking ring being arranged to engage with the ribs of the clamp component when the locking ring is engaged home on the body to cause die ribs to flex pivotally towards one another to engage the cord and to compress the annular seal element.
39. A cord clamp according to claim 38 wherein the ribs are formed from a hard plastics material.
40. A cord clamp according to either one of claims 38 and 39 wherein the annular seal element is formed of a soft, compressible material.

41. A cord clamp according to any one of claims 38 to 40 wherein the annular seal element is moulded to the ribs.
42. A cord clamp according to any one of claims 38 to 41 including a second seal element at a proximal end of the clamp component for sealing the clamp component to the body.
43. A cord clamp according to claim 42 wherein said second seal element is moulded to the ribs.

44. A cord clamp according to any one of claims 38 to 43 wherein a part of the interior of the locking ring proximal to an entry aperture to the bore through locking ring is shaped to engage the ribs to cause the ribs to flex inwardly towards one another and to compress the seal(s) when the locking ring is engaged fully home on the body.

45. A cord clamp according to any one of claims 38 to 44 comprising a segmented or non-segmented annular part of the clamp component integrally formed with the ribs at a proximal end of the ribs.

46. A cord clamp according to any one of claims 38 to 45 wherein the locking ring is rotatably engageable on the body of the electrical connector or appliance.

47. A cord clamp according to claim 44 wherein a part of the body of the electrical connector or appliance is externally threaded and the bore of the locking ring comprises an internally threaded portion for threading of the locking ring onto the body part to engage the locking ring on the body of the electrical connector or appliance.

48. An electrical connector comprising a cord clamp according to any one of claims 38 to 47.

49. An electrical connector according to claim 48 wherein the electrical connector is a plug.

50. An electrical connector according to claim 48 wherein the electrical connector is a socket.

51. An electrical appliance comprising a cord clamp according to any one of claims 38 to 47.

52. A cord clamp for clamping about an electrical cord where the cord enters an electrical connector or appliance, the cord clamp comprising

a body part (herein: body) of an electrical connector or appliance including a cord aperture through which the cord enters the connector or appliance,

an annular clamp component including a passage axially through the clamp component which aligns with the cord aperture into the body when the clamp component is in place in relation to the body, the clamp component comprising a plurality of radially spaced cord engaging elements,
a locking ring engagable to the body so that a bore through the locking ring axially aligns
with the cord aperture and the passage through the clamp component, the interior of the locking
ring being arranged to engage with the cord engaging elements of the clamp component when the
locking ring is engaged fully home on the body to move the cord engaging elements radially
towards one another, and
means retaining the clamp component to the body before the locking ring is engaged on
the body.
53. A cord clamp according to claim 52 wherein said means retaining the clamp component
to the body is manually releasable enabling the clamp component to be attended to and detached
from the body.
54. A cord clamp according to claim 52 wherein the clamp component is externally waisted
whereby a circlip comprising said means retaining the clamp component retains the clamp
component to the body.
55. A cord clamp according to any one of claims 52 to 54 wherein the body comprises an
annular wall surrounding said cord aperture and the means for retaining the clamp component
engages said annular wall.
56. An electrical connector comprising a cord clamp according to any one of claims 52 to 55.
57. An electrical connector according to claim 56 wherein the electrical connector is a plug.
58. An electrical connector according to claim 56 wherein the electrical connector is a socket.
59. An electrical appliance comprising a cord clamp according to any one of claims 52 to 55.
A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl.

HOIR 13/58 (2006.01)    HOIR 13/585 (2006.01)

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

USPTO, ESP@CENET, IEEE and the Internet using similar keywords as above.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
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<td>US 4,208,085 A (LAWRENCE et al.) 17 June 1980</td>
<td>1, 3, 10, 14 - 16, 52, 52</td>
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<td>See abstract, figures 1 - 4, 11 column 3 line 22 - column 4 line 9, column 4 lines 40 - 52, column 5 lines 42 - 43, and claim 1</td>
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<td>Y</td>
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Date of the actual completion of the international search
12 June 2008

Date of mailing of the international search report
18 JUM 2003

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Authorized officer

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## DOCUMENTS CONSIDERED TO BE RELEVANT

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END OF ANNEX