

05 JAN 2000

DESCRIPTION

SCREW-IN ELECTRICAL TERMINAL CONNECTOR

5 TECHNICAL FIELD

The present invention relates to a screw-in electrical terminal connector adapted in use to be mounted in an electrical device for connecting an electrical cord to the electrical device.

10 BACKGROUND ART

Japanese Utility Model Unexamined Publication (KOKAI) No. 54-22186 and Japanese Utility Model Examined Publication (KOKOKU) No. 1-41166 disclose conventional screw-in electrical terminal connectors adapted to be mounted in an electrical device.

15 The former publication discloses, as shown in FIG. 18, a terminal ring 210 and a terminal screw 220 extending through an upper wall 211 of the terminal ring to form a cord gap G between the lower end of the screw and a terminal plate supported on a bottom wall of the terminal ring for receiving therein an electrical cord. The electrical cord is squeezed in said cord gap
20 and secured to the terminal plate as the screw is tightened.

The latter publication discloses, as shown in FIG. 19, a terminal ring 310 which is shaped by bending a single metal sheet into a rectangular frame and superimposing the opposite ends of the metal sheet. The opposite ends are secured together with a terminal plate by means of a fixing screw 319. A
25 terminal screw 320 extends through an upper wall 311 of the terminal ring to have its lower end opposed to the upper end of the fixing screw so as to form therebetween a like cord gap G. The electrical cord is inserted in the cord gap and is held thereat as the terminal screw is tightened.

Either of the conventional terminal connector, however, the cord gap has
30 a gap distance which is substantially constant or wider towards opposite ends

of the cord gap with respect to a width direction of the terminal ring.

Therefore, when connecting the electrical cord of a stranded wire, i.e., a conductor having a plurality of filaments to the terminal connector, the individual filaments are likely to spread widely on the terminal plate and even
5 escape beyond the ends of the gap as the terminal screw is tightened, failing to be secured to the terminal plate at a sufficient strength.

DISCLOSURE OF THE INVENTION

The present invention has been achieved in view of the above problem
10 to provide a screw-in electrical terminal connector which is capable of holding the stranded wire securely at a sufficient strength. The terminal connector in accordance with the present invention is adapted to be mounted in an electrical accessory 50 such as a switch box, a receptacle, or the like, and includes a terminal ring 10 having a top wall 11, a bottom wall 14, and a
15 pair of side walls 12, 13 connecting the top and bottom walls. The side walls are spaced in a width direction of the terminal ring to define a lead-in opening 15 at one of longitudinal ends of the terminal ring for leading in an electrical cord 60 into the ring. The top wall has a threaded hole 17. The bottom wall is provided with a terminal plate 30 adapted in use to be
20 electrically connected to the electrical accessory. A terminal screw 20 extends through the threaded hole in the top wall to define a cord gap G between a lower end of the screw and the terminal plate such that the electrical cord inserted through the opening into the cord gap is held against the terminal plate by tightening of the screw. The cord gap includes a
25 principal zone which is defined to have a width center coincident with an upright axis of the screw and extends in opposite directions horizontally along the width direction to have opposite width ends. The characterizing feature of the present invention resides in that the principal zone is configured to have the opposite width ends which have a gap distance which is narrower than at
30 the width center. Thus, when wiring the electrical cord in the form of the

stranded wire composed of a plurality of filaments, the individual filaments can be concentrated around the width center of the principal zone of the cord gap and be therefore prevented from spreading out of the width ends of the zone of reduced gap distance. With this result, the stranded wire can be
5 securely held against the terminal plate at a sufficient strength. When wiring the electrical cord of a type having one or more core wires having a larger diameter than the filaments, the core wire or wires can be guided into the width center of the principal zone as the screw is tightened. Thus, the electrical cord having one or more rigid cores can be secured to the terminal
10 connector reliably and securely as well.

In a preferred embodiment, the principal zone is configured to have the gap distance which is narrower towards the width ends than at the width center. That is, the gap distance is successively narrowed towards the opposite width ends of the zone for effectively retaining the strands of the
15 filaments around the width center of the zone, which is therefore another object of the present invention.

Preferably, the lower end of the terminal screw is shaped to have a smoothly curved convex, while the terminal plate is profiled to have a lowered surface at a portion corresponding to the width center of the principal
20 zone and a pair of raised surfaces at portions corresponding to the width ends of the zone.

The terminal plate may be formed separately from or integrally with the terminal ring. When the separately formed terminal plate is used, it is advantageous to provide an integral seat on the bottom wall of the terminal
25 ring for stably holding the terminal plate on the bottom wall.

Further, the terminal ring may be formed by bending a single metal sheet into a rectangular shape and engaging opposite ends of the sheet at one of the side wall of the terminal ring. That is, the opposite ends of the sheet define upper and lower parts 40 and 45 of the side wall respectively extending
30 integrally from the top wall and the bottom wall. One of the upper and

lower parts is shaped to have a coupling projection 41, while the other part is shaped to have a coupling recess 42 for intimate engagement with the coupling projection. The coupling projection is of an inverted T-shaped with a vertical root 42 and a horizontal head 43. The root projects from one of
5 the upper and lower parts in parallel with the upright axis of the screw, while the head extends horizontally in a perpendicular relation to the upright axis. Since the T-shaped zigzag engagement of the coupling projection with the coupling recess is made in the side wall, the engagement can well withstand a vertical force which results from the tightening of the screw and would
10 otherwise act to separate the engagement.

The zigzag engagement gives a zigzag mating line Z between the coupling projection and the coupling recess. Preferably, the zigzag mating line includes at least one oblique segment Z1, Z2 which extends in an inclined relation with respect to the horizontal direction of the ring in order to provide
15 a retaining force of retaining portions, i.e., gate members 49 defined at a corresponding one of the upper and lower parts on opposite of the root of the T-shaped coupling projection of the other part. The retaining force acts to retain the gate members against being deformed in a direction of widening the coupling recess when the coupling projection is caused to move away from
20 the coupling recess by a vertical force developed as a consequence of tightening the screw. Therefore, the engagement can be well retained against the vertical force so as to keep the terminal ring intact and therefore assure reliable wiring connection of the electrical cord to the terminal connector. The provision of the oblique segment in the zigzag mating line
25 gives the above advantage independently of the effect resulting from the specific configuration of the cord slot.

These and still other objects and advantageous features of the present invention will become more apparent from the following description of the preferred embodiments when taken in conjunction with the attached drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

- FIG. 1 is an exploded perspective view of a screw-in electrical terminal connector in accordance with a first embodiment of the present invention;
- FIG. 2 is an exploded perspective view of an electrical device equipped with
5 the above terminal connectors;
- FIG. 3 is a partially sectional view of the above connector;
- FIG. 4 is a perspective view of the above connector shown with electrical cords of different types;
- FIG. 5 is a front view of an electrical terminal connector in accordance with a
10 modification of the first embodiment;
- FIG. 6 is a partial perspective view of a terminal ring of the connector of FIG. 5;
- FIG. 7 is an exploded perspective view of an electrical terminal connector in accordance with a second embodiment of the present invention;
- 15 FIG. 8 is a perspective view of an electrical terminal connector in accordance with a third embodiment of the present invention;
- FIG. 9 is a front view of an electrical terminal connector in accordance with a fourth embodiment of the present invention;
- FIG. 10 is a perspective view of a terminal plate employed in the terminal
20 connector of FIG. 9;
- FIG. 11 is a perspective view of a terminal ring employed in the terminal connector of FIG. 9;
- FIGS. 12 to 15 are front views respectively illustrating operations of the terminal connector for wiring connection of electrical cords of different types;
- 25 FIG. 16 is a plan view of a side wall of the above terminal ring;
- FIG. 17 is a perspective view of the above terminal ring shown with particular indentations made to a mating line in the one side wall of the above terminal ring; and
- FIGS. 18 and 19 are views illustrating conventional terminal connectors,
30 respectively.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to FIGS. 1 to 3, there is shown a screw-in terminal connector in accordance with a first embodiment of the present invention.

5 The terminal connector 1 includes a rectangular frame or ring 10, a screw 20, and a terminal plate 30. For instance, the terminal connectors are mounted in an electrical accessory 50 such as a switch box and a receptacle for wiring connection of an electrical cord to the accessory, as shown in FIG. 2. In this accessory which is the receptacle, three terminal connectors 1 are mounted on
10 the back of a receptacle housing 51 with the terminal plates 30 connected to individual sockets in three slots 52. The electric cords are wired to the individual connectors for electrical connection of the receptacle to an ac lines. The illustrated receptacle 50 has a switch handle 53 for selective energization of an electrical device plugged to the receptacle, and a cover plate 54.

15 The ring 10 is formed by bending a metal sheet and engaging opposite ends of the metal sheet into a rectangular shape having a top wall 11, a pair of side walls 12, 13 and a bottom wall 14. The ring 10 has a width (W) along which the side walls are spaced and a length (L) on opposite ends of which the ring is opened. One of the openings at the longitudinal ends of the ring
20 defines a lead-in opening 15 for introducing the electric cord and the other defines an opening through which the terminal plate 30 is assembled on the bottom wall 14. The top wall 11 is formed with a countersink or raised rim 16 with an internal threaded hole 17 extending the full depth of the rim 16 and the top wall 11 for threaded engagement with the screw 20. The screw 20
25 extends vertically through the top wall 11 at the center of the width of the ring 10 to have its lower end opposed to the terminal plate 30 on the bottom wall 14, defining a cord gap G between the lower end 21 of the screw 20 and the terminal plate 30 for entrapping therein the electrical cord or a conductor thereof.

30 As shown in FIG. 3, the lower end 21 of the screw 20 is shaped into a

smoothly curved convex of substantially uniform radius of curvature. The terminal plate 30 is also curved along the width direction of the ring 10 to form a concave upper surface 31 with substantially uniform radius of curvature which is shorter than that of the convex lower end of the screw 20.

5 Thus, the resulting cord gap G has a gap distance which is narrower towards opposite width ends of the terminal plate 30 than at a width center thereof which corresponds to an upright axis of the screw 20. Therefore, when connecting the electrical cord 60 of a stranded wire having a plurality of filaments 61, the filaments 61 are restrained from escaping out of the width

10 ends of the terminal plate 30 and constrained thereon as the screw 20 is tightened. Thus, the filaments 61 can be secured held between the screw 20 and the terminal plate 30 at a sufficient strength. As shown in FIG. 4, when connecting two types of electrical cords 60 one composed of the filaments 61 and the other composed of a core wire 62 having a larger diameter than the

15 filament, the core wire is held at the width center of the terminal plate while the filaments are concentrated adjacent to the core and are prevented from escaping beyond the width ends of the terminal plate 30. It should be noted that, although the illustrated embodiment shows the cord gap which is successively narrower towards the width ends of the gap than at the width

20 center, the present invention is not limited precisely to this feature. That is, the cord gap may be formed to have a gap distance which is narrower at the width ends than at the width center.

Turning back to FIG. 3, the ring 10 is configured to leave a small clearance C between the side walls 12, 13 and the screw 20. The small

25 clearance C is dimensioned to be less than the diameter of the intended filament 61 in order to provide a safeguard for preventing the filaments from accidentally going into the clearance.

As shown in FIG. 1, the side wall 12 of the ring 10 is formed by engaging the opposite ends of the metal sheet. In other words, the side wall

30 12 is composed of an upper part 40 integrally depending from the top wall 11

and a lower part 45 integrally upstanding from the bottom wall 14. The upper part 40 includes an inverted T-shaped coupling projection 41 with a vertical root 42 and a horizontal head 43 extending horizontally along the length of the ring 10 from the lower end of the root 42. The lower part
5 includes an inverted T-shaped coupling recess 46 for intimate engagement with the coupling projection. The coupling recess 46 includes a vertical entrance 47 corresponding to the root 42 and a horizontal cove 48 corresponding to the head 43. These parts are intimately engaged to form a zigzag mating line which provides a resistive force of retaining the
10 engagement against a vertical force applied thereto as a consequence of tightening the screw 20. Conversely, the coupling projection 41 and the coupling recess 46 may be formed on the sides of the lower part and the upper part, respectively.

FIGS. 5 and 6 show a modified terminal connector which is identical to
15 the connector of the first embodiment except for provision of a seat 18 for supporting thereon the terminal plate. The seat 18 is struck from a portion of the bottom wall and shaped to have a concave upper surface in order to stably support the terminal plate thereon.

FIG. 7 shows a terminal connector in accordance with a second
20 embodiment of the present invention which is substantially identical to the first embodiment except that a ring 10A is formed from two halves 100 and 110 of U-shaped configuration. Like parts are designated by like numerals with a suffix letter of 'A'. The upper half 100 includes a top wall 11A and a pair of upper parts 40A, while the lower half includes a bottom wall 14A and
25 a pair of lower parts 45A. The upper parts 40A is formed respectively with a coupling projection 41A and a coupling recess 46A, while the lower parts 45A is formed with a coupling recess 46A and a coupling projections 41A. These projections and recesses are engaged in a manner as in the first embodiment to constitute the side walls with the like zigzag mating line. The bottom wall
30 14A is also provided with a like seat 18A for supporting thereon a like

terminal plate.

FIG. 8 shows a terminal connector in accordance with a third embodiment of the present invention which is similar to the first embodiment except that a terminal plate 30B is integrally formed with a ring 10B and is provided with a socket 70 for receiving a prong of an electrical plug. Like parts are designated by like numerals with a suffix letter of 'B'. The terminal plate 30 has a portion common to the bottom wall 14B of the ring and an extension 36 which extends from the bottom wall to form the socket 70 outside of the ring. The common portion or the bottom wall 14B are shaped to have a concave surface 31B which forms a like cord gap with the lower end of the screw as in the first embodiment.

FIGS. 9 to 16 show a terminal connector in accordance with a fourth embodiment of the present invention which is substantially identical to the first embodiment except that a terminal plate 30C is shaped to have a complex profile. Like parts are designated by like numerals with a suffix letter of 'C'. As best shown in FIG. 10, the terminal plate 30C, which is formed separately from a ring 10C, is of generally V-shape with a complex upper concave surface 31C. The complex surface is composed of a first concave contour 32 at the width center of the plate 30C and a pair of second concave contours 33 at the opposite width ends of the plate 30C. The first concave contour 32 provides a lowered surface, while the second concave contour 33 provides a raised surface at a vertical level higher than the lowered surface 32. The first concave contour 32 has substantially uniform radius of curvature which is smaller than that of the second concave contour 33 and forms ridges 34 at the intersection with the second concave contours 33. The first and second contours are selected to provide a cord gap G with the lower end 21C of a screw 20C. The lower end of the screw 20C has a convex surface of substantially uniform curvature and a beveled edge around the periphery of the lower end 21. The convex surface defines a major zone of the cord gap G with the opposed terminal plate 30C for holding the electrical cord therein.

Within thus defined major zone of the cord gap, a gap distance is narrower towards the width ends of the zone than at the width center.

When connecting the electric cord having a single core wire 62, the core wire 62 is retained on the first concave contour 32 of the terminal plate 30C, as shown in FIG. 9. When connecting the electric cords 60 having the core wire 62 and the filaments 61, the core 62 is held on the first contour 32 and the filaments 61 are held on the second contour 33 adjacent to the core, as shown in FIG. 12. When connecting the electric cord having the filaments 61, the filaments 61 are concentrated at and around the first contour 32 of the terminal plate 30C, as shown in FIG. 13. When connecting the electric cord having a pair of the core wires 62, the two core wires are retained respectively on the second concave contours 33 as shown in FIG. 14A. It is noted in this connection that even if the two core wires 62 are positioned as shown in FIG. 14B before fully tightening the screw 20C, the one core wire 62 is forced to move out of the first concave contour 32 to be held on the second concave contour 33 as the screw 20C is tightened. Once the core wire 62 is moved out of the first concave contour 32, the ridge 34 acts to retain the core wire 62 in place and to effectively prevent it from moving back onto the first concave contour 32. Thus, the two core wires 62 can be stably captured to the terminal plate 30C. When connecting the electric cord having three core wires 61, one of the core wires is retained on the first concave contour 32 and the other two are retained on the second concave contours 33 as shown in FIG. 15. Thus, the three core wires can be connected stably as well. Also in this embodiment, only a small clearance C is given between the screw 20C and the side walls 12C, 13C. The small clearance C is dimensioned to be smaller than the diameter of the filament 61 to prevent the accidental entry of the filaments into the clearance.

As shown in FIGS. 11 and 16, the ring 10C is formed from a single metal sheet into a rectangular shape in a manner as described with reference to the first embodiment. Thus, one of the side wall 12C is composed of an

upper part 40C integrally depending from a top wall 11C and a lower part 45C integrally upstanding from a bottom wall 14C. The upper part 40C includes a coupling projection 41C of a generally T-shaped configuration with a vertical root 42C and a horizontal head 43C. The lower part 45C is
5 formed with a coupling recess 46C which is shaped in exact registration with the coupling projection to have a vertical entrance 47C and a cove 48C. The entrance 47C is defined between opposed guide members 49 of the lower part 45C. The coupling projection 41C is intimately engaged with the coupling recess 46C to give a zigzag mating line Z. In this embodiment, the mating
10 line Z further includes first oblique segments Z1 and second oblique segments Z2, and third vertical segments Z3, as shown in FIG. 16. The first oblique segment Z1 is defined at the interface between the head 43C and the guide member 49 to extend in an inclined relation with respect the horizontal, i.e., the length of the ring 10C in order to develop a retaining force of retaining the
15 guide member 49 against being deformed in a direction of widening the entrance when the coupling projection 41C is subject to a vertical force which results from the tightening of the screw 20 and acts to pull the coupling projection 41C from the coupling recess 46C. The second segment Z2 is defined between the guide member 49 and the upper part 40C to extend in an
20 inclined relation with respect to the horizontal for developing a like resistive force of retaining the guide member 49 against being deformed in the direction of widening of the entrance 43 under the effect of the vertical force. The third vertical segment Z3 extends from the inner end of the second segment to horizontal segment Z4 defined between the guide member 49 and
25 the upper part 40C for developing the like resistive force. With the inclusion of the first, second, and third segments, the guide members 49 are made reluctant to spread when the coupling projection is subject to the vertical force resulting from the tightening the screw, thereby securely holding the engagement of the coupling projection with the coupling recess and therefore
30 protecting the ring 10C from being torn apart at the side wall. As a matter of

course, at least one of the first, second, and third segments is effective for assuring rigid engagement between the upper part 40C and the lower part 45C.

In order to further enhance the engagement, indentations 19 are made at several portion along the mating line Z as shown in FIG. 11 in order to deform
5 or collapse the corresponding portions of the material forming the side wall. As shown in FIG. 17, relatively wide indentations are alternatively made to zones 19A including the first, second, and the third segments, partially or entirely.



Claims:

1. A screw-in electrical terminal connector for an electrical accessory, said terminal connector (1) comprising:

5 a terminal ring (10) having a top wall (11), a bottom wall (14), and a pair of side walls (12, 13) which are spaced in a width direction of said terminal ring to connect said top and said bottom walls, said side walls forming therebetween a lead-in opening (15) through which an electrical cord (60) is led into said ring, said top wall having a threaded hole (17), said bottom wall being provided with
10 a terminal plate (30) adapted in use to be connected to said electrical accessory; and

 a terminal screw (20) extending through said threaded hole to define a cord gap (G) between a lower end (21) of said screw and said terminal plate such that said electrical cord inserted through said opening into said cord gap is
15 held against said terminal plate by tightening of said screw, said cord gap including a principal zone which has a width center coincident with an upright axis of said screw and extends in opposite directions horizontally along said width direction to have opposite width ends;

 characterized in that said principal zone is configured to have said
20 opposite width ends which has a gap distance which is narrower than at said width center.

2. The terminal connector as set forth in claim 1, wherein
25 said principal zone is configured to have a gap distance which is narrower towards said width ends than at said width center.

3. The terminal connector as set forth in claim 1 or 2, wherein
30 the lower end of said terminal screw is shaped into a smoothly curved convex



(21), and said terminal plate is configured to have a lowered surface (32) at a portion corresponding to said width center of said principal zone and a pair of raised surfaces (33) at portions corresponding to the width ends of said principal zone.

5

4. The terminal connector as set forth in claim 3, wherein said lowered surface has a first concave contour (32), and each of said raised surface has a second concave contour (33), and opposite width ends of said first concave contour define ridges (34) at the intersection respectively with said second concave contours.

10

5. The terminal connector as set forth in any one of claims 1 to 4, wherein said terminal plate (30) is formed separately from said terminal ring (10), said bottom wall (14) having a seat (18) which is struck out from a portion of said bottom wall to have a concave surface on which said terminal plate is placed.

15

6. The terminal connector as set forth in any one of claims 1 to 4, wherein said terminal plate (30) is formed as an integral part of said terminal ring (10) which is struck out from a portion of said bottom wall.

20

7. The terminal connector as set forth in any one of the preceding claims, wherein

25

at least one of said side walls (12, 13) comprises an upper part (40) integrally extending from said top end wall (11) and a lower part (45) integrally extending from said bottom wall,

one of said upper and lower parts having a coupling projection (41) and

30



the other part having a coupling recess (46) for intimate engagement with said coupling projection,

said coupling projection being configured into an inverted T-shape with a root (42) and a head (43), said root projecting from one of said parts in parallel with said upright axis of the screw, and said head (43) extending horizontally in a perpendicular relation to said upright axis of the screw from a free end of said root.

8. The terminal connector as set forth in claim 7, wherein said coupling recess (46C) is in the form of an inverted T-shape with an entrance (47C) and a cove (48C), said entrance being shaped for exact registration with said root and being defined between opposite gate members (49) which extend horizontally towards each other from one of said parts, said coupling projection (41C) engaging with said coupling recess (46C) to define a zigzag mating line (Z) therebetween, said zigzag mating line including at least one oblique segment (Z1, Z2) which extends in an inclined relation with respect to the horizontal direction of said ring in order to develop a retaining force of retaining said gate members against being deformed in a direction of widening said entrance when said coupling projection is caused to move away from said coupling recess by a vertical force developed as a consequence of tightening said screw.

9. A screw-in electrical terminal connector for an electrical accessory, said terminal connector comprising:

a terminal ring (10C) having a top wall (11C), a bottom wall (14C), and a pair of side walls (12C, 13C) which are spaced in a width direction of said terminal ring to connect said top and said bottom walls, said side walls forming



therebetween a lead-in opening (15C) through which an electrical cord (60) is led into said ring, said top wall having a threaded hole (17C), said bottom wall being provided with a terminal plate (30C) adapted in use to be connected to said electrical accessory; and

5 a terminal screw (20C) extending through said threaded hole to define a cord gap (G) between a lower end (21C) of said screw and said terminal plate such that said electrical cord inserted through said opening into said cord gap is held against said terminal plate by tightening of said screw, said cord gap including a principal zone which has a width center coincident with an upright
10 axis of said screw and extends in opposite directions horizontally along said width direction to have opposite width ends;

 at least one of said side walls comprising an upper part (40C) integrally extending from said top end wall (11C) and a lower part integrally extending from said bottom wall,

15 one of said upper and lower parts having a coupling projection (41C) and the other part having a coupling recess (46C) for intimate engagement with said coupling projection,

 said coupling projection being configured into an inverted T-shape with a root (42C) and a head (43C), said root projecting from one of said parts in
20 parallel with said upright axis of the screw, and said head extending horizontally in a perpendicular relation to said upright axis of the screw from a free end of said root,

 said coupling recess being in the form of an inverted T-shape with an entrance (47C) and a cove (48C), said entrance being shaped for exact
25 registration with said root and being defined between opposite gate members (49) which extend horizontally towards each other from one of said parts,

 said coupling projection engaging with said coupling recess to define a zigzag mating line (Z) therebetween,
characterized in that:

30 aid zigzag mating line includes at least one oblique segment (Z1, Z2) which



extends in an inclined relation with respect to the horizontal direction of said ring in order to develop a retaining force of retaining said gate members (49) against being deformed in a direction of widening said entrance when said coupling projection is caused to move away from said coupling recess by a
5 vertical force developed as a consequence of tightening said screw.

10. A screw-in electrical terminal connector substantially as hereinbefore described with the accompany drawings.