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(54) ELECTRICAL CONNECTOR WITH INSULATING SEPARATOR

(71) We, HEGO ELECTRIC G.m.b.H., a Swiss Company, of Spielhof 16, 8750 Glarus, Switzerland, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to insulating separators used with electrical connectors of the kind having a generally slab-shaped insulating housing containing electrical terminals, the housing being capable of being mounted side by side with similar connectors to form a row of connectors in which the major surfaces of adjacent connectors abut, the terminals being accessible through the narrower surfaces of the connector housing, and a recess being provided in the housing which recess intersects both of the said major surfaces and an intervening narrower surface of the housing and serves to accommodate cross-connection means for interconnecting the terminals of adjacent connectors.

Such connectors are in widespread use, especially in the form of the well known clip-on connector or terminal block which is clipped on to a metal supporting rail side by side with similar connectors. To enable two or more adjoining connectors to be interconnected electrically, individual connectors have the said recesses in their housings, through which a metal member connected to the terminals of the connector is accessible. Usually, a metal screw or pillar is fitted to this metal member, and a metal cross-connecting strip is attached to the screws or pillars of the adjoining connectors which are to be interconnected.

Clearly, the cross-connecting elements must be electrically insulated from adjacent connectors which are at different voltages, especially if one or more adjacent connectors is also provided with a cross-connection; since the connectors and cross-connections are of standard construction, the cross-connecting strips of adjacent connectors will inevitably be in line with one another and

in practice are separated only a relatively narrow gap. It is therefore necessary to provide means for preventing arcing or tracking between cross-connectors of adjacent electrical connectors.

It is possible to insert an insulating plate between two adjacent connectors provided with respective cross-connection strips at different voltages. This has the disadvantage that it disturbs the otherwise regular placing of the connectors in a row, and in particular it increases the space required for the row of connectors. Furthermore it can be difficult to insert the plate or plates after a row of connectors has been set up. In the case of connectors which are open on one major surface (for insertion of the terminals into the housing) an insulating separator can be fitted into the open side face of the housing, so that the overall length of a row of connectors is not increased, but in this case it is clearly extremely difficult or impossible to add such a separator after the row of connectors has been set up, except by removing the connector in question.

The present invention resides in an electrical connector of the kind referred to, provided with a separator which comprises a body of resilient electrically insulating material, of substantially rectangular channel-section, having along the edges of the flanges of said channel laterally outwardly directed projections for engaging the recess provided in the connector housing and retaining the separator therein by virtue of the resilience of the separator, the web of said channel serving to separate a cross-connection means in the connector from such means in an adjacent connector.

Preferably, to accommodate such a separator, the connector housing has, extending into the said recess from the said intervening surface, opposed grooves for slidably receiving respective projections of the separator.

These grooves accordingly remain accessible when a plurality of connectors are mounted side by side. The separator can

[Price 25p]

therefore be fitted into the housing before or after mounting of the latter in a row, before or after connection of the terminals to the associated conductors, and before or after fitting of the cross-connections. Preferably, the separator lies wholly within the thickness of the housing, when inserted, and the said flanges preferably extend throughout substantially the entire thickness of the housing, in order to provide the maximum protection for the associated cross-connection and in particular so as to provide the longest possible tracking path between the cross-connection and an adjacent connector. The separator can be slid into or out of the recess in the connector housing, without the assistance of special tools, being retained by its elasticity alone.

The separator may incorporate an integral means for receiving and retaining a marking strip or tag, for example for identifying the associated cross-connection. The separator may for example be provided with a rib or a pair of opposed ribs, for receiving a marking plate or tag inserted in the longitudinal or transverse direction relative to the row of connectors, in use.

Five embodiments of the invention are shown in the accompanying drawings, in which:

FIGURE 1 shows in perspective, and partly cut away, a row of electrical connectors of the kind referred to, and an insulating separator;

FIGURES 2 and 3 show a second form of separator;

FIGURES 4 and 5 show a third form of separator;

FIGURES 6 and 7 show a fourth form of separator; and

FIGURES 8 and 9 show a fifth form of separator.

Figure 1 shows a row of six electrical terminal blocks each having a generally slab-shaped flat-sided insulating housing 14 provided with a notched foot 15 in which is a retaining spring; by means of the notched foot and spring the housing can be clipped onto a flanged metal supporting rail. One of the major surfaces of the housing is open, to permit insertion into the housing of a pair of electrical terminals 17 and an interconnecting metal bar 18. The other major surface of the housing is closed by a side wall 22, so as to insulate the terminals from those of an adjacent terminal block. Each terminal consists of a metal sleeve and a clamping screw. The interior of the sleeve, and the head of the screw, are accessible through the narrower surfaces of the connector housing, these being the surfaces which are exposed when the connectors are mounted in a row as shown.

Each connector housing has a recess 7 between the holes for the clamping screws.

This recess extends to the bar 18, in the middle of which is a screw hole. This screw hole receives a screw 19, between whose head and a spacer sleeve 20 is secured a cross-connector strip 5. In this way, the terminals of two or more adjacent terminal blocks can be interconnected, as shown in Figure 1. To accommodate the connector strip 5, the side wall of the housing is recessed.

As shown in Figure 1, two adjacent groups of terminal blocks may be provided with respective cross-connector strips 5, and in this case there is only a relatively narrow gap between the ends of the adjacent strips. This gap may well be insufficient to prevent tracking or arcing if there is a substantial voltage difference between the two cross-connector strips. To separate adjacent strips 5, and in particular to increase the tracking distance between such strips, we provide an insulating separator 1 made of resilient thermoplastic or other material. This separator is of rectangular channel-section and has, along the free edges of its flanges 2, outwardly directed projections 3.

The terminal block housing has a pair of opposed grooves 4 extending into the recess 7 along respective corners of the latter, where the recess meets the open side face 6 of the housing. The separator can be slid into the recess, with its projections 3 engaging the grooves 4, so that it fits around the end of the cross-connector bar 5. The width of the separator, excluding the projections 3, is substantially equal to the width of the recess 7 (transverse to the length of the row of terminal blocks), and the dimensions of the separator perpendicular to its web are substantially equal to the thickness of the housing, so that the separator is substantially coextensive with the recess 7 but does not project beyond the side surfaces of the housing. The separator, when inserted, extends throughout substantially the entire depth of the recess and, in the case of the separator shown in Figure 1, projects slightly above the recess to facilitate removal if necessary.

It will be seen that the separator provides a very substantial tracking distance between the adjacent cross-connector bars 5.

In the unstressed condition, that is to say before insertion in the recess, the distance between the flanges increases from the web of the channel towards the free edges of the flanges; the flanges are therefore slightly deformed when the separator is inserted and the resulting stress retains the separator in the recess.

The separator shown in Figures 2 and 3 is basically similar to that of Figure 1, but is provided with ribs 8 on the inwardly facing surfaces of the flanges, these ribs being perpendicular to the web. By means

of these ribs, a marking tag 10 can be retained in the separator.

The separator shown in Figures 4 and 5 also has retaining ribs 8, but in this case the portions of the flanges on which the ribs are provided stand proud of the terminal block housing as shown in Figure 5, so as to receive and retain a marking strip 11 which extends over several terminal blocks.

The separator shown in Figures 6 and 7 differs from those of Figures 1 to 5 in that, in the unstressed state, the distance between the flanges increases from one end of the channel towards the other end, and in particular the distance between the flanges at the end which will be inserted first into the recess is greater than the distance between the flanges at the end adjacent to the mouth of the recess. Again, this ensures that the flanges are stressed when inserted and thereby retain the separator. This separator also has a transverse web 21 extending across the channel at the end adjacent to the mouth of the recess in use. It is provided with retaining ribs 8 as in Figure 4, and these ribs together with the web 21 define a groove for receiving marking tags 12 as shown in Figure 7.

The separator shown in Figures 8 and 9 is broadly similar to that shown in Figures 6 and 7, but has a dovetail-section rib 9 on the web 21, for receiving and retaining marking tags 13.

It will be seen that each of the illustrated separators projects downwardly beyond the main part of the flanges 2. This downward extension, and in particular the web portion thereof, fits a small ledge or shoulder (not shown) provided on the inner surface of the insulating side wall 22. The purpose of this is to increase the tracking or creepage path between adjacent cross-connections. The separator shown in figure 1 has an upward extension which also serves to increase the tracking or creepage path and effective length of air gap between adjacent cross connections; these functions in the other illustrated separators are provided by the webs 21, marking tag 10 or marking strip 11 which effectively close the upper end of the associated separator.

WHAT WE CLAIM IS:—

1. An electrical connector of the kind referred to, provided with a separator which comprises a body of resilient electrically insulating material, of substantially rectangular channel-section, having along the edges of the flanges of said channel laterally out-

wardly directed projections for engaging the recess provided in the connector housing and retaining the separator therein by virtue of the resilience of the separator, the web of said channel serving to separate a cross-connection means in the connector from such means in an adjacent connector.

2. A connector as claimed in Claim 1 having at one end of the channel integral means for receiving and retaining a marking strip or tag.

3. A connector as claimed in Claim 2 in which the said means comprises ribs on the inwardly facing surfaces of the said flanges.

4. A connector as claimed in Claim 2 having a transverse web extending across the said channel at one end thereof, the said means being a rib on the outwardly facing surface of the said web.

5. A connector as claimed in any preceding Claim wherein the distance between the flanges, in the unstressed state, increases from the web of the channel towards the said edges.

6. A connector as claimed in any of Claims 1 to 5 wherein the distance between the flanges, in the unstressed state, increases from one end of the channel towards the other end thereof.

7. An electrical connector as claimed in any of Claims 1 to 6, the connector having, extending into the said recess from the said intervening surface, opposed grooves for slidably receiving respective projections of the separator.

8. The connector claimed in Claim 7 wherein the separator is such as to be wholly within the thickness of the housing, when inserted in the recess.

9. The connector claimed in Claim 7 or 8 wherein the said flanges extend throughout substantially the entire thickness of the housing.

10. The connector claimed in Claim 7, 8 or 9 wherein the separator when inserted in the recess extends throughout substantially the entire depth of the recess.

11. In combination, an electrical connector and an insulating separator, substantially as herein described with reference to, and as shown in, Figure 1, Figures 2 and 3, Figures 4 and 5, Figures 6 and 7 or Figures 8 and 9 of the accompanying drawings.

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of these ribs, a marking tag 10 can be retained in the separator.

The separator shown in Figures 4 and 5 also has retaining ribs 8, but in this case the portions of the flanges on which the ribs are provided stand proud of the terminal block housing as shown in Figure 5, so as to receive and retain a marking strip 11 which extends over several terminal blocks.

The separator shown in Figures 6 and 7 differs from those of Figures 1 to 5 in that, in the unstressed state, the distance between the flanges increases from one end of the channel towards the other end, and in particular the distance between the flanges at the end which will be inserted first into the recess is greater than the distance between the flanges at the end adjacent to the mouth of the recess. Again, this ensures that the flanges are stressed when inserted and thereby retain the separator. This separator also has a transverse web 21 extending across the channel at the end adjacent to the mouth of the recess in use. It is provided with retaining ribs 8 as in Figure 4, and these ribs together with the web 21 define a groove for receiving marking tags 12 as shown in Figure 7.

The separator shown in Figures 8 and 9 is broadly similar to that shown in Figures 6 and 7, but has a dovetail-section rib 9 on the web 21, for receiving and retaining marking tags 13.

It will be seen that each of the illustrated separators projects downwardly beyond the main part of the flanges 2. This downward extension, and in particular the web portion thereof, fits a small ledge or shoulder (not shown) provided on the inner surface of the insulating side wall 22. The purpose of this is to increase the tracking or creepage path between adjacent cross-connections. The separator shown in figure 1 has an upward extension which also serves to increase the tracking or creepage path and effective length of air gap between adjacent cross connections; these functions in the other illustrated separators are provided by the webs 21, marking tag 10 or marking strip 11 which effectively close the upper end of the associated separator.

WHAT WE CLAIM IS:—

1. An electrical connector of the kind referred to, provided with a separator which comprises a body of resilient electrically insulating material, of substantially rectangular channel-section, having along the edges of the flanges of said channel laterally out-

wardly directed projections for engaging the recess provided in the connector housing and retaining the separator therein by virtue of the resilience of the separator, the web of said channel serving to separate a cross-connection means in the connector from such means in an adjacent connector.

2. A connector as claimed in Claim 1 having at one end of the channel integral means for receiving and retaining a marking strip or tag.

3. A connector as claimed in Claim 2 in which the said means comprises ribs on the inwardly facing surfaces of the said flanges.

4. A connector as claimed in Claim 2 having a transverse web extending across the said channel at one end thereof, the said means being a rib on the outwardly facing surface of the said web.

5. A connector as claimed in any preceding Claim wherein the distance between the flanges, in the unstressed state, increases from the web of the channel towards the said edges.

6. A connector as claimed in any of Claims 1 to 5 wherein the distance between the flanges, in the unstressed state, increases from one end of the channel towards the other end thereof.

7. An electrical connector as claimed in any of Claims 1 to 6, the connector having, extending into the said recess from the said intervening surface, opposed grooves for slidably receiving respective projections of the separator.

8. The connector claimed in Claim 7 wherein the separator is such as to be wholly within the thickness of the housing, when inserted in the recess.

9. The connector claimed in Claim 7 or 8 wherein the said flanges extend throughout substantially the entire thickness of the housing.

10. The connector claimed in Claim 7, 8 or 9 wherein the separator when inserted in the recess extends throughout substantially the entire depth of the recess.

11. In combination, an electrical connector and an insulating separator, substantially as herein described with reference to, and as shown in, Figure 1, Figures 2 and 3, Figures 4 and 5, Figures 6 and 7 or Figures 8 and 9 of the accompanying drawings.

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