TWO-PART ELECTRICAL COUPLING

FOREIGN PATENTS OR APPLICATIONS
1,305,383 8/1962 France ........................................ 339/186 R

ABSTRACT
A two-part electrical coupling has a plurality of electrical connectors on one part for electrically engaging respective electrical connectors of the other part. The parts are provided with mating keys and keyways for ensuring that the electrical engagement can be effected only following a mechanical engagement of the parts when in one predetermined alignment and orientation with respect to one another. The keys and keyways are disposed on respective parts of the coupling and the keys are slideable along respective keyways as the two parts are urged together to establish the electrical engagement. Each key and keyway has a transverse section that is in the form of a sawtooth with unequal flanks.

10 Claims, 7 Drawing Figures
This invention relates to two-part electrical couplings. The invention is particularly concerned with electrical couplings of the kind having two parts that are adapted to engage one another in a unique mechanical engagement before they can be finally urged together to establish the mating of electrical connectors of one of the parts with respective electrical connectors of the other part. By a "unique mechanical engagement" is meant a mechanical engagement that can be effected only when there is a predetermined alignment and orientation of the parts with respect to one another.

It is common practice to provide an electrical coupling with each of its parts provided by a housing of elongate form carrying two rows of electrical connectors extending longitudinally thereof. With this form the parts are arranged with a view to ensuring that the electrical engagement can be effected only when the housings have firstly been correctly aligned and orientated with respect to one another. In one known arrangement two keyways of rectangular form are disposed in one of the housings at opposite ends of the rows of electrical connectors, and a pair of keys is disposed in the other housing to mate with respective ones of the keyways, the keys being arranged to slide along their respective keyways when the two housings are urged together to establish the electrical mating. The two keyways, and similarly the keys mating therewith, are provided with different cross-sectional dimensions from one another, with a view to inhibiting mechanical engagement of the housings unless they are correctly orientated with respect to one another. Such an arrangement is effective to prevent mating of all connectors of one part with respective connectors of the other part, unless these housings are correctly aligned and orientated. However, it has been found that such an arrangement is not completely foolproof in that it is still possible in some states of incorrect alignment or orientation of the housings to obtain mating of some electrical connectors of the two parts.

In view of overcoming this disadvantage, it has further been proposed to provide one of the housings additionally with a locating pin which is offset with respect to the center of that housing, and to provide the other housing with a hole which is positioned to co-operate with the locating pin only when the housings are correctly aligned and orientated. Such an arrangement has been found substantially to overcome the aforementioned disadvantage but itself suffers from a number of disadvantages. One of these disadvantages is that the locating pin must essentially extend beyond the ends of the electrical connectors carried by its housing and is therefore liable to be snapped off if the two housings are brought together in incorrect alignment or orientation. A further disadvantage is that the locating pin and its co-operating hole reduce the space available for the electrical connectors on the housings, and hence reduce the number of electrical connectors that may be carried by the housings.

According to the present invention there is provided an electrical coupling comprising two parts that are adapted to engage one another in a unique mechanical engagement before they can be finally urged together to establish the mating of electrical connectors of one of the parts with respective electrical connectors of the other part, wherein said mechanical engagement includes essentially the insertion of a key of one part into a mating keyway of the other part to slide further along the keyway as the two parts are urged together in the establishment of the mating of the connectors with one another, and wherein the key and the keyway each have a transverse section that is in the form of a sawtooth with unequal flanks such that establishment of the mating of the connectors can be effected only following the said mechanical engagement of the two parts.

A two-part electrical coupling in accordance with the invention will now be described, by way of example, with reference to the accompanying drawings in which:

FIG. 1 is a sectional end view of the coupling which consists of a plug and socket;

FIG. 2 is an underneath plan view of the plug;

FIG. 3 is a side view of the plug;

FIG. 4 is a sectional plan view on the line AA of FIG. 3;

FIG. 5 is an underneath plan view of the socket;

FIG. 6 is a side view of the socket; and

FIG. 7 is a plan view of the socket.

Briefly, the plug and socket each include a molded housing of elongate form having apertures, for receiving electrical connectors, disposed in two parallel rows extending longitudinally of the housings. At the ends of the rows of connectors the housings are provided with locating surfaces which are so shaped that the locating surfaces of the socket will mate with the respective locating surfaces of the plug only when the housings are correctly aligned and orientated with respect to one another. The locating surfaces thus provide for a unique mechanical engagement between the housings of the plug and socket and it is arranged that mating of the respective pairs of plug and socket connectors can be effected only when the respective locating surfaces have been mated together.

With reference to FIGS. 1 to 4, the plug includes a molded housing 1 of plastic which is of elongate form and has two rows of holes extending longitudinally thereof. Each hole has inserted therein an electrical connector 2 having pins 3 and 4 which project upwardly and downwardly respectively from the housing 1. The connectors 2 are inserted into the holes from the bottom of the housing 1, and have, intermediate the pins 3 and 4, parts 5 of increased diameter which provide circumferential shoulders that engage circumferential shoulders in the holes to limit the extent of insertion of the connectors 2 into their holes. The lower ends of these holes are countersunk to assist insertion of the connectors 2. The pins 3 have parts 6 of increased diameter, the connectors 2 being retained in position by circlips 7 which surround the pins 3 between the parts 6 and the upper surface of the housing 1.

The housing 1 has on its upper surface a wall 8 which extends longitudinally of the housing 1 between the two rows of pins 3, and walls 9 which extend transversely of the housing 1 between each pair of adjacent pins 3. The wall 8 and the parts of the walls 9 between the two rows of pins 3 have a height which is less than that of the other parts of the walls 9, to provide a longitudinal slot 10 (shown in FIG. 1) adapted to receive an edge of a printed circuit board 11.

The board 11 has a printed circuit on each side thereof, the conductors of the printed circuits being connected by leads 12 (not shown) to appropriate ones of the pins 3. These leads are conveniently wound round the respective pins 3 by a wiring tool. The board 11 is secured to lugs 12 provided at the ends of the housing 1.

The housing 1 also includes two transverse walls 13 which are positioned at respective ends of the housing 1 and which project downwardly from the lower edge of the housing 1 beyond the ends of the pins 4. The sides 14 of the walls 13 are shaped to form keyways (shown most clearly in FIG. 2) which, as will be described hereinafter, mate with respective keys on the socket shown in FIGS. 1, 5, 6 and 7. More specifically, the keyways are each bounded by a pair of convergent and converging flanks of unequal lengths that are joined at a point intermediate the width of the respective keyways so that the transverse sections of the keyways are, as shown in FIG. 2, each in the form of a sawtooth and have a width which is very nearly equal to the width of the housing 1. The lower ends of the sides 14 are chamfered to assist mechanical engagement of the plug and socket.

The lower face of the housing 1 is stepped at each side as shown in FIG. 1.

The socket is shown in FIGS. 1, 5, 6 and 7, and comprises a moulded housing 16 of plastics having holes in which are inserted electrical connectors 17 for engaging respective pins 4 of the electrical connectors 2 carried by the plug. The electrical connectors 17 are inserted into the tops of the holes in the housing 16 and comprise sockets 18, for receiving the respective pins 4, housed within the housing 16, and pins 19 which project downwardly from the undersides of the housing 16. The connectors 17 have parts 20 (shown in FIG. 1) which have circumferential shoulders and engage circumferential shoulders.
provided in the holes in the housing 16 to limit the extent of insertion of the connectors 17 into these holes. The tops of these holes are countersunk to assist insertion of the connectors 17. The pins 19 have parts 21 of increased diameter, the connectors 17 being retained in position by circlips 22 which surround the pins 19 between the parts 21 and the underside of the housing 16.

The housing 16 has a longitudinal wall 23 which extends between the two rows of pins 19 and has walls 24 which extend transversely of the housing 16 between each pair of adjacent pins 19.

The upper face of the housing 16 is stepped so that this face has full surface abutment with the stepped lower face of the housing when the plug and socket are fully engaged with one another, as shown in FIG. 1.

The housing 16 has transverse end-surfaces 25, shown most clearly in FIG. 7, that are shaped to form keys which mate with respective keyways of the plug shown in FIGS. 1 to 4. The keys are each bounded by a pair of convergent and conterminous flanks of unequal lengths that are joined at a point intermediate the width of the respective keys so that the transverse sections of the keys are, as shown in FIG. 7, each in the form of a sawtooth and have a width which is very nearly equal to the width of the housing 16. The upper edges of the end-surfaces 25 are chamfered to assist mechanical engagement of the plug and socket.

When the plug is to be plugged into the socket to connect the electrical connectors 2 electrically with their respective electrical connectors 17, the electrical engagement is prevented until the end-surfaces 25 of the housing 16 have been mated with the walls 13 on the housing 1. The shaping of the end-surfaces 25 and the walls 13 is such that they will mate only when the housings 1 and 17 are correctly aligned and orientated, thereby preventing incorrect electrical engagement between the electrical connectors 2 and the electrical connectors 17.

The housing 16 has a mounting lug 26 at each end thereof.

When two-part electrical couplings are used in, for example, aircraft electrical equipment, moisture may enter the coupling and short circuit adjacent pairs of the electrical connectors. In the electrical coupling described, the likelihood of these short-circuits occurring is reduced by the walls 8 and 9, and the walls 23 and 24, which increase the moisture path-lengths between adjacent pairs of, respectively, the pins 3 and the pins 19 and thereby serve to improve the climatic grading of the electrical coupling. The climatic grading of the electrical coupling is further improved by the steps in the abutting faces of the housings 1 and 16, which increase the moisture path-lengths between the pins 4 and the sides of the housings 1 and 16.

Although in the embodiment described the electrical connectors 2 and 17 are inserted into holes provided in the respective housings 1 and 16, it is visualized that the electrical connectors 2 and 17 may be molded as inserts in their respective housings 1 and 16.

We claim:

1. In an electrical two-part coupling of the kind in which the two parts of the coupling engage one another in mechanical engagement before they can be finally urged together to establish the mating of a plurality of parallel rows of electrical connectors of one of the parts with respective electrical connectors of the other part, and each part comprises a housing carrying the respective electrical connectors and includes a plurality of locating surfaces extending transversely of the respective rows of electrical connectors, with the locating surfaces of one housing engaging respective locating surfaces of the other housing to provide the said mechanical engagement, and the two locating surfaces of one of the mutually engaging pairs of surfaces defining respectively a keyway and a key which is inserted in the keyway in said mechanical engagement and which is slid further along the keyway as the two parts are urged together in the establishment of the mating of the electrical connectors, the improvement that the key and keyway each have a transverse section that is in the form of a sawtooth having unequal flanks with the junction of the two flanks in said sawtooth spaced from both ends of the respective locating surface.

2. A coupling according to claim 1, wherein the said flanks of the sawtooth-section are conterminous.

3. A coupling according to claim 2, wherein the key and keyway are completely bounded by their respective pairs of flanks, and the junction of each pair of flanks is intermediate the width of the respective key or keyway.

4. A coupling according to claim 3, wherein each said housing includes two parallel rows of electrical connectors, and the junction of the pair of flanks on that housing is located in alignment with one of these rows.

5. A coupling according to claim 1, wherein each housing is of elongate form and includes two said locating surfaces extending transversely of the housing at the two ends respectively of the rows of connectors.

6. A coupling according to claim 5, wherein the locating surfaces extend across the whole widths of their respective housings, and the width of the keyway is very nearly equal to the width of its respective housing.

7. A coupling according to claim 11, wherein the two locating surfaces of each mutually-engaging pair of surfaces define respectively a key and keyway that each have a transverse section in the form of a sawtooth with unequal flanks with the junction of the two flanks of the sawtooth spaced from both ends of the respective locating surface.

8. A coupling according to claim 7, wherein one housing includes all of the keys and the other housing includes all of the cooperating keyways.

9. A coupling according to claim 1, wherein the said housing have respective co-operating faces for abutting one another when the two parts are fully mated, the said co-operating faces having co-operating steps for increasing the moisture path-lengths from the exterior of the coupling to the electrical connectors when the said parts are fully mated.

10. A coupling according to claim 1, wherein the electrical connectors are removably-mounted in the said housing.
CERTIFICATE OF CORRECTION

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It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Foreign Application Priority Date
May 23, 1969 Great Britain ............. 26,336/69

Signed and sealed this 22nd day of August 1972.

(SEAL)
Attest:
EDWARD M. FLETCHER, JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents