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Description

The present invention relates to a connector using prismatic or rectangular contact pins and cylindrical receptacle contacts for receiving the prismatic contact pins and, more particularly, to a connector suitable as a waterproof surface-mounting connector.

A known conventional connector of this type uses cylindrical contact pins and cylindrical receptacle contacts. When this connector is to be mounted on, eg., a surface of a printed circuit board, the pins cannot be perfectly brought into surface contact or soldered with the surface of the board because the pins are cylindrical. This drawback is very important when the number of contact pins is increased. Strong demand therefore has arisen for the development of a highly reliable connector free from the above drawback.

It is an object of the present invention to solve the conventional problem described above, and has as its object to provide a connector coping with an increase in the number of contact pins and suitable as a waterproof connector.

US-A-4505531 discloses a connector comprising a plurality of contact pins each having a rectangular shape in section, a plurality of receptacle contacts each having a substantially circular shape in section, and a housing having a plurality of slots each for receiving one of the plurality of receptacle contacts, each of the receptacle contacts having a contact spring provided therein and a transversely extending wall segment provided at an opposed portion to the contact spring, the contact pin being clamped and held between said contact spring and said recess. However, US-A-4505531 is not concerned with receptacle contact orientation, as indicated by the fact that it is intended for use with plug terminals of circular or rectangular sections. In the context of the applicants' invention, receptacle contact orientation is a problem.

According to the invention there is provided a connector, comprising:

- a plurality of contact pins each having a rectangular shape in section;
- a plurality of receptacle contacts each having a substantially circular shape in section; and
- a housing having a plurality of slots each for receiving one of said plurality of receptacle contacts;
- each of said receptacle contacts having a contact spring extending from an outer circumferential wall thereof into the receptacle contact and a recess provided at an opposed portion to the contact spring on the outer circumferential wall;

said contact pin being clamped and held between said contact spring and said recess wherein said receptacle contact has a dimple provided on a part of the outer circumferential wall thereof, and said housing has a groove provided on an inner wall of said slot in spatial correspondence to the dimple of said re-

ceptacle contact.

By way of example, embodiments of a connector according to the invention will now be described with reference to the accompanying drawings, in which:-

Figure 1A is a perspective view showing a contact pin and a receptacle contact of a connector according to the present invention;

Figure 1B is a longitudinal sectional view of a connecting portion between the contact pin and the receptacle contact;

Figure 1C is a sectional view of the connecting portion along the line A-A of Figure 1B;

Figure 2A is a longitudinal sectional view showing the main part of a connector according to the present invention;

Figure 2B is a partially cutaway front view showing the main part shown in Figure 2A;

Figure 2C is a partially cutaway rear view of the main part shown in Figure 2A;

Figure 3 is a longitudinal sectional view showing a state wherein male and female housings of the connector according to the present invention are fitted to each other;

Figures 4A and 4B are perspective views showing the main part of the male housing;

Figure 5A is a front view showing another embodiment of the present invention;

Figure 5B is a sectional view of the embodiment of Figure 5A along the line A-A thereof; and

Figure 6 is an exploded perspective view of the female housing of the embodiment shown in Figure 5A.

Figure 1A shows a contact pin 10 used in a connector according to the present invention and a receptacle contact 20 for receiving the contact pin 10. The contact pin has a square cross-section (the cross-section could be rectangular), and the receptacle contact has a circular cross-section. There are pairs of contacts which are housed in storage grooves 31 in a housing 30, as shown in Figures 2 to 4B. In this embodiment, each receptacle contact has a dimple 23 on part of its outer circumferential surface (the dimple 23 will be described in detail later). A ferrule may be formed at the front end of each receptacle contact.

Figures 1B and 1C show a connecting state of each contact pin and a corresponding receptacle. As shown in Figures 1B and 1C, the receptacle contact has a contact spring 21 formed on its outer circumferential surface and a recessed portion 22 formed on the outer circumferential surface portion opposite to the contact spring 21. The contact spring 21 and the opposite recessed portion 22 hold the inserted contact pin. In this embodiment, the wall of a main body of the contact is partially cut and bent inward to constitute the tongue-like contact spring 21.

Figures 2A to 2C show the housing in which receptacle contacts are mounted. As shown in Figures 2A to 2C, the housing has lance members 32. Each



lance member is engaged with the recessed portion of the corresponding receptacle contact inserted into the housing and holds this receptacle contact therein.

The receptacle contacts stored in the storage grooves of the housing respectively receive the external contact pins inserted into the housing through insertion holes 33. As is apparent from Figure 2B showing the front surface of the housing, each insertion hole has a square cross-section to receive a prismatic or rectangular pin.

As shown in Figures 2A to 2C, each receptacle contact is housed in the corresponding storage groove such that a leading end of a wire 38 is terminated, and the terminal end extends through a corresponding rubber bushing 35 fitted in a corresponding opening 34 formed at the rear portion of the housing. This bushing seals the corresponding contact to obtain a waterproof structure.

The illustrated housing is a male housing which is then fitted in a female housing 40. In this case, the male housing is fitted in the female housing 40 such that a latch projection of the female housing is fitted in a lock hole 37 formed in a latch spring 36.

Figure 3 shows a detailed structure when the male and female housings are engaged with each other. A member 41 for fixing the lance members respectively engaged with the receptacle contacts is fitted in the front end portion of the male housing. However, the member 41 may be omitted such that each lance member can be biased in the corresponding storage groove.

The male and female housings are engaged with each other through a waterproof O-ring 42.

Each receptacle contact has directivity given by the dimple formed on its outer circumferential surface. A guide groove 39 is formed in each storage groove of the housing to receive the receptacle contact with a dimple.

The contact pins of this embodiment are mounted in a header surface-mounted on a printed circuit board 50.

Figures 4A and 4B show a structure in which each groove 35B is formed in a through hole 35A of each bushing to receive the corresponding receptacle contact with a dimple.

Figure 5 shows another embodiment in which an opening for housing the bushings is partitioned by a partition wall 61. A plurality of receptacle contacts are housed in the housing through each divided opening. Other arrangements of this embodiment are the same as those of the previous embodiment. A plurality of bushings can be used by forming a plurality of openings, so that an improvement of the waterproof effect of the bushings can be expected. In order to improve the waterproof effect, the opening can be partitioned by a large number of partition walls. For example, openings defined by partition walls may be formed in units of storage grooves, and wires each with a rubber

bushing may be fitted in the openings, respectively. Alternatively, a rib is formed at a lower portion of the rubber bushing in place of the partition wall, and a fitting portion which can fit with the rib may be formed.

Figure 6 is an exploded view of the female housing. As shown in Figure 5, the female housing comprises a housing body, O-rings 42, boards 50, and frames 51 from which various pins 10 extend outward. In this case, a two-storey frame structure is sandwiched between the upper and lower boards 50.

The structure of the connector has been described in detail and derives the following unique effects.

Since the prismatic pin is used in the connector of the present invention, the connector can be easily surface-mounted on, e.g., a surface of a printed circuit board. At the same time, since the contact area between the connector and the board is increased, soldering can be appropriately performed.

The prismatic pins can be formed by pressing and result in low cost as compared with cylindrical pins (for example, the pins are connected by a plurality of carriers).

Since each prismatic pin can be clamped between the contact spring and the recessed portion which latter two are formed in the corresponding receptacle contact, the pin can be appropriately brought into contact with and electrically connected to the receptacle.

Although the prismatic connecting pin is used, the receptacle contact which receives this has a circular cross-section, and therefore each pin easily extends through a waterproof rubber bushing. Therefore, the connector of the present invention can also serve as a waterproof connector.

Claims

1. A connector, comprising:
 - a plurality of contact pins (10) each having a rectangular shape in section;
 - a plurality of receptacle contacts (20) each having a substantially circular shape in section; and
 - a housing (30) having a plurality of slots (31) each for receiving one of said plurality of receptacle contacts;
 - each of said receptacle contacts having a contact spring (20) extending from an outer circumferential wall thereof into the receptacle contact and a recess (22) provided at an opposed portion to the contact spring on the outer circumferential wall;
 - said contact pin being clamped and held between said contact spring and said recess wherein said receptacle contact has a dimple (23) provided on a part of the outer circumferential wall thereof, and said housing has a groove (39)

lance member is engaged with the recessed portion of the corresponding receptacle contact inserted into the housing and holds this receptacle contact therein.

The receptacle contacts stored in the storage grooves of the housing respectively receive the external contact pins inserted into the housing through insertion holes 33. As is apparant from Figure 2B showing the front surface of the housing, each insertion hole has a square cross-section to receive a prismatic or rectangular pin.

As shown in Figures 2A to 2C, each receptacle contact is housed in the corresponding storage groove such that a leading end of a wire 38 is terminated, and the terminal end extends through a corresponding rubber bushing 35 fitted in a corresponding opening 34 formed at the rear portion of the housing. This bushing seals the corresponding contact to obtain a waterproof structure.

The illustrated housing is a male housing which is then fitted in a female housing 40. In this case, the male housing is fitted in the female housing 40 such that a latch projection of the female housing is fitted in a lock hole 37 formed in a latch spring 36.

Figure 3 shows a detailed structure when the male and female housings are engaged with each other. A member 41 for fixing the lance members respectively engaged with the receptacle contacts is fitted in the front end portion of the male housing. However, the member 41 may be omitted such that each lance member can be biased in the corresponding storage groove.

The male and female housings are engaged with each other through a waterproof O-ring 42.

Each receptacle contact has directivity given by the dimple formed on its outer circumferential surface. A guide groove 39 is formed in each storage groove of the housing to receive the receptacle contact with a dimple.

The contact pins of this embodiment are mounted in a header surface-mounted on a printed circuit board 50.

Figures 4A and 4B show a structure in which each groove 35B is formed in a through hole 35A of each bushing to receive the corresponding receptacle contact with a dimple.

Figure 5 shows another embodiment in which an opening for housing the bushings is partitioned by a partition wall 61. A plurality of receptacle contacts are housed in the housing through each divided opening. Other arrangements of this embodiment are the same as those of the previous embodiment. A plurality of bushings can be used by forming a plurality of openings, so that an improvement of the waterproof effect of the bushings can be expected. In order to improve the waterproof effect, the opening can be partitioned by a large number of partition walls. For example, openings defined by partition walls may be formed in units of storage grooves, and wires each with a rubber

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Since the prismatic pin is used in the connector of the present invention, the connector can be easily surface-mounted on, e.g., a surface of a printed circuit board. At the same time, since the contact area between the connector and the board is increased, soldering can be appropriately performed.

The prismatic pins can be formed by pressing and result in low cost as compared with cylindrical pins (for example, the pins are connected by a plurality of carriers).

Since each prismatic pin can be clamped between the contact spring and the recessed portion which latter two are formed in the corresponding receptacle contact, the pin can be appropriately brought into contact with and electrically connected to the receptacle.

Although the prismatic connecting pin is used, the receptacle contact which receives this has a circular cross-section, and therefore each pin easily extends through a waterproof rubber bushing. Therefore, the connector of the present invention can also serve as a waterproof connector.

Claims

1. A connector, comprising:
 - a plurality of contact pins (10) each having a rectangular shape in section;
 - a plurality of receptacle contacts (20) each having a substantially circular shape in section; and
 - a housing (30) having a plurality of slots (31) each for receiving one of said plurality of receptacle contacts;
 - each of said receptacle contacts having a contact spring (20) extending from an outer circumferential wall thereof into the receptacle contact and a recess (22) provided at an opposed portion to the contact spring on the outer circumferential wall;
 - said contact pin being clamped and held between said contact spring and said recess wherein said receptacle contact has a dimple (23) provided on a part of the outer circumferential wall thereof, and said housing has a groove (39)

provided on an inner wall of said slot in spatial correspondence to the dimple of said receptacle contact.

2. A connector according to Claim 1, further comprising lance members (32) formed in said slots, each said lance member being engaged with the recess of a respective receptacle contact inserted in said housing to hold said receptacle contact in said housing.
3. A connector according to Claim 1 or Claim 2, further comprising a bushing (35) for sealing said receptacle contacts received in said housing, wherein said bushing has through-holes (35A) for inserting therethrough a wire (38) terminated with said receptacle contact, said bushing being fitted in an opening (34) of said housing.
4. A connector according to Claim 3, wherein said housing comprises a plurality of openings for fitting said bushings therein, and said receptacle contacts are inserted through each of said openings to be fitted in said housing.
5. A connector according to Claim 3, wherein said bushing comprises a guide groove (35B) on a part of said through-hole for inserting said wire therethrough, said guide groove corresponding to said dimple provided on the outer circumferential wall of said receptacle contact.

Patentansprüche

1. Ein Verbinder, umfassend:
 - eine Vielzahl von jeweils Rechteckquerschnitt aufweisenden Kontaktstiften (10),
 - eine Vielzahl von im Schnitt im wesentlichen Kreisform aufweisenden Aufnahmekontakten (20) und
 - ein Gehäuse (30) mit einer Vielzahl von Schlitten (31), jeweils zur Aufnahme eines aus der Vielzahl der Aufnahmekontakte,
 - wobei jeder der Aufnahmekontakte eine Kontaktfeder (20) verlaufend von seiner Außenumfangswand in den Aufnahmekontakt und eine Aussparung (22) aufweist, die an einem der Kontaktfeder auf der Außenumfangswand gegenüberliegenden Abschnitt vorgesehen ist,
 - wobei der Kontaktstift zwischen der Kontaktfeder und der Aussparung eingeklemmt und gehalten ist, wobei der Aufnahmekontakt eine auf einem Teil seiner Außenumfangsfläche vorgesehene Vertiefung (23) und das Gehäuse eine an einer Innenwand des Schlittens in räumlicher Entsprechung zu der Vertiefung des Aufnahmekontaktes vorgesehene Nut (39) aufweist.

2. Ein Verbinder nach Anspruch 1, weiter umfassend in den Schlitten ausgebildete Lanzenglieder (32), wobei jedes Lanzenglied mit der Aussparung eines entsprechenden, in das Gehäuse eingesetzten Aufnahmekontaktes zu dessen Halten in dem Gehäuse in Anlage liegt.
3. Ein Verbinder nach Anspruch 1 oder Anspruch 2, weiter umfassend eine Buchse (35) zum Abdichten des in dem Gehäuse aufgenommenen Aufnahmekontaktes, wobei die Buchse durchgehende Löcher (35A) zum Einsetzen eines mit dem Aufnahmekontakt abgeschlossenen Drahtes (38) aufweist, wobei die Buchse in eine Öffnung (34) des Gehäuses eingepaßt ist.
4. Ein Verbinder nach Anspruch 3, wobei das Gehäuse eine Vielzahl von Öffnungen zum Einpassen der Buchsen in ihnen umfaßt und die Aufnahmekontakte durch jede der in das Gehäuse einzupassenden Öffnungen durchgeführt sind.
5. Ein Verbinder nach Anspruch 3, wobei die Buchse eine Führungsnut (35B) auf einem Teil des durchgehenden Loches zum Einführen des Drahtes umfaßt, wobei die Führungsnut der auf der Außenumfangswand des Aufnahmekontaktes vorgesehenen Vertiefung entspricht.

Revendications

1. Connecteur comprenant :
 - une pluralité de broches de contact (10) ayant chacune une section de forme rectangulaire;
 - une pluralité de contacts femelles (20) ayant chacun une section de forme sensiblement circulaire; et
 - un boîtier (30) ayant une pluralité de fentes (31) destinées à recevoir chacune un contact de ladite pluralité de contacts femelles;
 - chacun desdits contacts femelles ayant un ressort de contact (21) pénétrant dans le contact femelle, depuis sa paroi circonférentielle extérieure, et un renforcement (22) ménagé sur une partie opposée au ressort de contact, sur la paroi circonférentielle extérieure;
 - ladite broche de contact étant serrée et retenue entre ledit ressort de contact et ledit renforcement, ledit contact femelle comportant un bossage (23) prévu sur une partie de sa paroi circonférentielle extérieure, et ledit boîtier comportant une rainure (39) prévue sur une paroi intérieure de ladite fente, en correspondance spatiale avec le bossage dudit contact femelle.
2. Connecteur selon la revendication 1, comprenant

en outre des éléments en forme de dent (32) formés dans lesdites fentes, chacun desdits éléments en forme de dent étant amené en prise avec le renforcement d'un contact femelle respectif inséré dans ledit boîtier, pour retenir ledit contact femelle dans ledit boîtier.

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3. Connecteur selon la revendication 1 ou la revendication 2, comprenant en outre une douille (35) pour étanchéifier lesdits contacts femelles reçus dans ledit boîtier, ladite douille ayant des trous traversants (35A) y permettant l'insertion d'un fil (38) connecté à son extrémité audit contact femelle, ladite douille étant ajustée dans une ouverture (34) dudit boîtier.

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4. Connecteur selon la revendication 3, dans lequel ledit boîtier comprend une pluralité d'ouvertures dans lesquelles sont ajustées lesdites douilles, et lesdits contacts femelles sont insérés à travers chacune desdites ouvertures pour être installés dans ledit boîtier.

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5. Connecteur selon la revendication 3, dans lequel ladite douille comprend une rainure de guidage (35B) sur une partie dudit trou traversant, pour y insérer ledit fil, ladite rainure de guidage correspondant audit bossage prévu sur la paroi circumférentielle extérieure dudit contact femelle.

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