

ELECTRICAL CONNECTOR MATING GUIDE

BACKGROUND

[001] A hermaphroditic connector is disclosed in United States Patent No. 5,098,311 to Roath.

SUMMARY

[002] An electrical connector according to the present invention may include a first housing having a first guide bore and a first guide pin positioned adjacent to the first guide bore, wherein the first guide pin partially defines the first guide bore. Hermaphroditic guidance is preferable incorporated, either integrally or separately, with the first housing and with a mateable hermaphroditic second housing.

[003] An electrical connector according to the present invention may include a first housing having a housing alignment guide. The first housing may define four sides, the housing alignment guide may include a first guide pin and a first guide bore, and the first guide pin and the first guide bore are both located along a common side of the first housing. The first guide bore may receive a second guide pin from a second housing. The second guide pin may be identical in exterior shape to the first guide pin. The first and second connector housings are not gender specific. A second housing that is identical to the first housing is also disclosed. The first housing may include a first electrical conductor and the second housing may include a second electrical conductor. A first contact beam of the first electrical conductor may engage a second contact beam of the second electrical conductor when the first and second connector portions are mated to one another. The first guide pin may be adjacent to the first guide bore in a first direction and the first housing may include a third guide bore and a third guide pin adjacent the third guide bore in the first direction.

[004] The first guide pin and the third guide pin and the first guide bore and the third guide bore may define an arrangement that facilitates a proper orientation of the first housing and a second housing during mating of the first housing and the second housing.

The first guide pin and the third guide pin may lie along a first longitudinal axis, the first guide bore and the third guide bore may lie along a second longitudinal axis, and the first longitudinal axis and the second longitudinal axis are parallel to each other. A second housing may include a second wall portion that defines an inwardly-facing recess. The first housing may include a first wall portion that defines an outwardly-facing recess configured to abut the inwardly-facing recess when the first housing and the second housing are mated to one another.

[005] The first bore may define an inner surface and friction between an outer surface of a second guide pin and the inner surface of the first bore creates a retention force. Any housing described herein may include a plurality of first electrical conductors arranged along a common centerline, wherein the plurality of first electrical conductors are all uniform in shape.

[006] Alternatively, any of the housings may include an array of electrical conductors, wherein a portion of the array of electrical conductors are arranged along a common centerline, a first one of the portion of the array of electrical conductors arranged along the centerline comprises a first mating end, a last one of the portion of the array of electrical conductors arranged along the centerline comprises a second mating end that is physically different than the first mating end.

BRIEF DESCRIPTION OF THE DRAWINGS

[007] The foregoing summary, as well as the following detailed description of a preferred embodiment, are better understood when read in conjunction with the appended diagrammatic drawings. For the purpose of illustrating the invention, the drawings show an embodiment that is presently preferred. The invention is not limited, however, to the specific instrumentalities disclosed in the drawings. In the drawings:

[008] FIG. 1 is a perspective view of an electrical connector, depicting first and second connector portions of a connector, the connector portions in position to be mated together.

[009] FIG. 2 is a perspective view of the first connector portion shown in FIG. 1.

[010] FIG. 3 is a perspective view of an alternative embodiment of the connector portion shown in FIG. 2.

[011] FIG. 4 is a perspective view of an alternative embodiment of a connector portion.

DETAILED DESCRIPTION OF ILLUSTRATIVE EMBODIMENTS

[012] FIG. 1 depicts an electrical connector 300. The electrical connector 300 may include a first connector portion 302 and a second connector portion 304 that mates with the first connector portion 302 in a mating direction 309. The first and second connector portions 302, 304 may each include one or more electrical conductors 326. The first connector portion 302 may be mounted to one surface, such as printed circuit board (not shown), and the second connector portion 304 may be mounted to another surface, such as another printed circuit board (not shown). The first and second connector portions 302, 304 may each be electrically and mechanically connected to the respective surfaces by any suitable means. For example, each electrical conductor 326 may include a solder ball 328 that may be soldered to a solder pad, or a compliant terminal end that may be inserted into a plated-through hole. The first connector portion 302 and the second connector portion 304 may be hermaphroditic, *i.e.*, the first connector portion 302 and the second connector portion 304 may be non-gender-specific.

[013] The first connector portion 302 and the second connector portion 304 of the connector 300 may be substantially identical. For example, the first connector portion 302 and the second connector portion 304 may include the same number, type and/or arrangement of electrical conductors 326. Moreover, the first connector portion 302 and the second connector portion 304 may include respective housings that each define an identical size, shape and/or feature. As such, the following comments concerning the components of the first connector portion 302 may apply equally to the second connector portion 304, unless otherwise noted.

[014] As shown in FIG. 1, the first connector portion 302 and the second connector portion 304 may each include a respective first housing 306 or second housing 306A. The first housing 306 of the first connector portion 302 may be configured to mate with the second housing 306A of the second connector portion 304, which may be substantially identical to the first housing 306 of the first connector portion 302. Each first or second housing 306, 306A may include four sides, including a first end 320, 320A and a second end 322, 322A that is opposite the first end 320, 320A in a direction 305. Each first or

second housing 306, 306A may also include a first side 301, 301A and a second side 303, 303A that is opposite the first side 301, 301A in a direction 307. The direction 305, the direction 307 and the mating direction 309 may be substantially perpendicular to one another.

[015] The second side 303, 303A of each housing 306, 306A may each define a sidewall 312, 312A. The sidewall 312, 312A of the second side 303, 303A may include a first sidewall portion 314, 314A. The first sidewall portion 314, 314A and the second sidewall portion 316, 316A may define respective upper portions of the sidewall 312, 312A of each housing 306, 306A. The first sidewall portion 314, 314A may be thinned so that the first sidewall portion 314, 314A is recessed in relation to an outwardly-facing surface of the second side 303, 303A of the sidewall 312, 312A, thereby defining an outwardly-facing recess 317, 317A.

[016] When mating the first connector portion 302 with the second connector portion 304, the first sidewall portion 314 of the first connector portion 302 may be received within the second connector portion 304. Similarly, the first sidewall portion 314A of the second connector portion 304 may be received within the first connector portion 302.

[017] As will be appreciated by one skilled in the art, the first connector portion 302 and the second connector portion 304 may require proper alignment before the two connector portions 302, 304 may be mated to one another in the mating direction 309. For example, the first connector portion 302 may not be connectable with the second connector portion 304 if the first sidewall portions 314, 314A are aligned along a the mating direction 309. Rather, to mate the first housing 306 to the second housing 306A, either the first connector portion 302 or the second connector portions 304 may be rotated 180 with respect to each other.

[018] Thus, the first sidewall portions 314, 314A are opposed in direction 307 and may provide a visual indication that the first connector portion 302 and the second connector portion 304 are properly oriented during mating. Moreover, the first sidewall portions 314, 314A may help guide the first connector portion 302 and the second connector portion 304 during mating.

[019] As noted above, each first housing 306 and second housing 306A may include the first end 320, 320A and the second end 322, 322A. The first end 320 and the second end 322 of the first housing 306 may each define a first guide bore 324 and/or a third guide

bore 324A. The first end 320A and second end 322A of the second housing 306A may each define a second guide bore 324B and/or a fourth guide bore 324C. Additionally, the first end 320 and the second end 322 of the first housing 306 may each include a first guide pin 325 and/or a third guide pin 325A adjacent to its respective first or third guide bore 324, 324A. The first end 320A and the second end 322A of the second housing 306A may each include a second guide pin 325B or fourth guide pin 325C adjacent to its respective second or fourth guide bore 324B, 324C. Each first and third guide bore 324, 324A and each first and third guide pin 325, 325A may generally extend along the mating direction 309, and each first and third guide bore 324, 324A may be sized and shaped to receive one of the second and fourth guide pins 325B, 325C. In other embodiments, the first and third guide bores 324, 324A and the first and third guide pin 325, 325A may be part of a guide assembly that is separately attached to the first and second ends 320, 322 of the first housing 306. The same is applicable to the second housing 306A.

[020] As shown in FIG. 1, the first guide bore 324 of the first end 320 of the first housing 306 may be adjacent to the first guide pin 325 of the first end 320 in the direction 307 and a portion of the first guide pin 325 may partially define the first guide bore 324. The third guide bore 324A of the second end 322 may be adjacent to the third guide pin 325A of the second end 322 in the direction 307 and may also define a portion of the third guide bore 324A.

[021] As shown in Fig. 2, the first housing 306 is similar to the second housing 306A shown in Fig. 1. The first guide bore 324 of the second end 322 of the first housing 306 may be adjacent to the first guide pin 325 in the direction 307 and the first guide pin 325 may partially define the first guide bore 324. The third guide bore 324A of the first end 320 may be adjacent to the third guide pin 325A in the direction 307.

[022] In other embodiments, as shown in FIG. 3, the relative positions of the first and third guide pins 325, 325A (or second and fourth guide pins 325B, 325C shown in Fig. 1) and the first and third guide bores 324, 324A (or second and fourth guide bores 324B, 324C shown in Fig. 1) on the first housing 306 or second housing 306A may be reversed or offset with respect to each other at opposed first and second ends 320, 322 of the first housing 306 or opposed first and second ends 320A, 322A of the second housing 306A. The first and third guide pins 325, 325A may also partially define the first and third guide bores 324, 324A.

[023] Referring to FIGs. 1 and 2, the first and third guide pins 325, 325A of the first housing 306 may fit snugly within the second and fourth guide bores 324B, 324C of the second housing 306A. Likewise, the second and fourth guide pins 325B, 325C of the second housing 306A may fit snugly within the first and third guide bores 324, 324A of the first housing 306A.

[024] Thus, as will be appreciated by one skilled in the art, the novel hermaphroditic mate arrangement of the first to fourth guide bores 324-324C and the first to fourth guide pins 325-325C may help to guide the first connector portion 302 and the hermaphroditic second connector portion 304 as the first housing 306 and the second housing 306A are mated. Moreover, friction between outer mating surfaces of the first to fourth guide pins 325-325C and inner mating surfaces of the first to fourth guide bores 324-324C may create a retention force that inhibits the first connector portion 302 and the second connector portion 304 from separating from one another after mating.

[025] As shown in FIGs. 2 and 4, the first or second housing 306, 306A can be populated with two different types of electrical conductors 326, 326A. For example, as shown in Fig. 2, the electrical conductors 326 are arranged along spaced apart centerlines CL1, CL2, etc. and the electrical conductors 326 along at least one centerline CL1 are all uniform in size and shape, such as blades or receptacle contacts. In FIG. 4, electrical conductors 326A are arranged along spaced apart centerlines CL1, CL2, etc. A first one 500 of the electrical conductors 326A arranged along one of the centerlines CL1 comprises a first mating end and a last one 502 of the electrical conductors 326A positioned along the same centerline CL1 comprises a second mating end. The second mating end is preferably physically different in shape, function, or appearance than the first mating end of the first one 500 of the electrical conductors 326A. For example, the first mating end of the first one 500 of the electrical conductors 326A may define a blade and the second mating end of the last one 502 of the electrical conductors may define a cantilevered beam or other type of receptacle contact. The electrical conductors 326A may also alternate in a blade, cantilevered beam arrangement. When the first and second housings 306, 306A shown in Fig. 1 are populated with electrical conductors 326A, beam conductors of the first housing 306 mate with a cantilevered beam of the second housing 306A, even though both the first and second housings 306, 306A comprise identical or substantially identical electrical conductor 326A patterns.

What is Claimed:

1. An electrical connector comprising:

a first connector portion that mounts on a first surface, wherein the first connector portion includes a first housing having a first bore and a first pin adjacent to the first bore; and

a second connector portion that mates with the first connector portion and mounts on a second surface, wherein the second connector portion includes a second housing having a second bore and a second pin adjacent to the second bore, and

wherein the first pin is received in the second bore and the second pin is received in the first bore when the first and second connector portions are mated to one another,

wherein the first pin defines an outer-surface and the second housing includes an inner-surface that defines the second bore, and

wherein friction between the outer-surface of the first pin and the inner-surface of the second housing creates a retention force that inhibits the first and second connector portions from separating from one another when the first pin is at least partially received in the second bore.

2. The electrical connector of claim 1, wherein the first pin and the second bore are adapted to guide the first and second housings during mating of the first and second connector portions.

3. The electrical connector of claim 1, wherein the first connector portion is identical to the second connector portion.

4. The electrical connector of claim 1, wherein the first connector portion is non-gender specific with respect to the second connector portion.

5. The electrical connector of claim 1, wherein the first and second pins and the first and second bores define an arrangement that facilitates a proper orientation of the first and second connector portions during mating.

6. The electrical connector of claim 1, wherein the first housing defines, at a first end, the first bore and the first pin.

7. The electrical connector of claim 1, wherein an outer surface of the second pin defines a portion of the second bore.

8. The electrical connector of claim 7, wherein the first housing further has a third bore and a third pin adjacent to the third bore, wherein an outer surface of the third pin defines a portion of the third bore,

wherein the second housing further has a fourth bore and a fourth pin adjacent to the fourth bore, wherein an outer surface of the fourth pin defines a portion of the fourth bore, and

wherein the third pin is received in the fourth bore and the fourth pin is received in the third bore when the first and second connector portions are mated to one another.

9. The electrical connector of claim 8, wherein the first and second connector portions are constructed substantially identically.

10. The electrical connector of claim 1, wherein the first housing defines a first pair of sidewalls between the first bore and the first pin, and

wherein the second housing defines a second pair of sidewalls between the second bore and the second pin.

11. The electrical connector of claim 10, wherein the first pair of sidewalls define a first outwardly-facing recess and a first inwardly-facing recess,

wherein the second pair of sidewalls defines a second outwardly-facing recess and a second inwardly-facing recess, and

wherein the first outwardly-facing recess is received in the second inwardly-facing recess and the second outwardly-facing recess is received in the first inwardly-facing recess when the first and second connector portions are mated to each other.

12. The electrical connector of claim 10, wherein the first and second housings define first and second cavities between the first bore and the first pin, and the second bore and the second pin, respectively, the first and second cavities carrying respective first and second pluralities of electrical conductors.