

Description

This invention relates to an electronic connector enabling a contact to be inserted or removed with low force.

US-A-3727173 and WO-A 8505500 discloses an electronic connector comprising a housing, a plurality of spring contacts associated in one or more rows in the housing, and a shape-memory spring associated in the housing and coupled to the spring contacts to transmit a recovery force to the spring contacts when the shape-memory spring reaches its transformation temperature, the recovery force urging the spring contacts from a first position towards a second position, each spring contact returning to its first position when the shape-memory spring falls below its transformation temperature. Thus, depending which of its two temperature-dependent states the shape-memory spring is in, the spring contacts are either in an open position to enable an opposite contact to be inserted or removed with little or no force, or the spring contacts are in a closed position to apply strong spring pressure to the inserted contact.

In accordance with this invention, there is provided an electronic connector comprising a housing, a plurality of spring contacts associated in one or more rows in said housing and a shape-memory spring having two temperature-dependent states associated in said housing and coupled to said spring contacts to transmit a recovery force to said spring contacts when the shape-memory spring reaches its transformation temperature, said recovery force urging each said spring contact from a first position towards a second position, each spring contact returning to its first position when the shape-memory spring falls below its transformation temperature, characterised in that each spring contact has an auxiliary portion arranged, when the contact is in one said position, to apply weak spring pressure on an inserted contact and each spring contact has a main spring portion arranged, when the spring contact is in its other said position, to apply strong spring pressure on an inserted contact.

Also in accordance with this invention, there is provided an electronic connector comprising a housing, a plurality of spring contacts associated in one or more rows in said housing, and a shape-memory spring having two temperature-dependent states associated in said housing and coupled to said spring contacts to transmit a recovery force to said spring contacts when the shape-memory spring reaches its transformation temperature, said recovery force urging each said spring contact from a first position towards a second position, each spring contact returning to its first position when the shape-memory spring falls below its

transformation temperature, characterised in that each spring contact comprises an engagement portion intermediate its ends, to press against an inserted contact, one end portion of the spring contact being supported in cantilever manner by said housing so that when the shape-memory spring is in one of its temperature-dependent states said engagement portion applies weak spring pressure on an inserted contact, in that a transmitting member is carried by said one end portion of the spring contact, the shape-memory spring being coupled to said transmitted member, and in that when said shape-memory spring is in its other temperature-dependent state, said shape-memory spring urges said transmitting member against an opposite end portion of the spring contact, so that said opposite end portion of said spring contact forms a strong spring for applying a strong spring pressure to an inserted contact.

Thus, the electronic connectors in accordance with this invention exhibit one condition in which the spring contact applies a strong spring force to the inserted contact, and another condition enabling that contact to be inserted or removed with low force, but in which the spring contact applies a weak spring force to the inserted contact.

Embodiments of this invention will now be described by way of examples only and with reference to the accompanying drawings, in which:

FIGURE 1 is a perspective view of an electronic connector, although not in accordance with this invention, shown partly in section;

FIGURES 2 and 3 are explanatory views showing the operation of the connector of Figure 1;

FIGURE 4 is an enlarged view of a modified portion of the connector of Figure 1;

FIGURE 5 is a cross-sectional view of an embodiment of electronic connector of the invention;

FIGURE 6 is a front view of a contact used in the embodiment of Figure 5;

FIGURE 7 is a front view of an alternative contact for use in the embodiment of Figure 5;

FIGURES 8 and 9 are explanatory views showing the operation of the connector when using the contact shown in Figure 7;

FIGURES 10 and 11 are cross-sectional views of a portion of a second embodiment of this invention, showing the operation of this embodiment of electronic connector;

FIGURES 12 to 14 are explanatory views showing the spring forces generated by the contact of the embodiment of Figures 10 and 11;

FIGURE 15 is a cross-sectional view showing a portion of a modification to the electronic connector of Figures 10 and 11;

FIGURE 16 is a plan view of the portion shown in Figure 15;

FIGURE 17 is a perspective view of a contact of the connector of Figure 15;

FIGURE 18 is a plan view, corresponding to Figure 16, of an alternative modification to the connector of Figure 15; and

FIGURE 19 is a perspective view of a contact used in the alternative modification shown in Figure 18.

Figure 1 shows an electronic connector, although not in accordance with this invention, comprising a contact containing chamber 2 open at a front surface of a connector housing 1 made of an insulating material. A plurality of contacts 3 are associated in two rows in parallel longitudinally of the contact containing chamber 2. The contacts 3 of the two rows are arranged so that the contacting portions 3B of the contacts 3 of the two rows are opposed to each other as pairs, and a shape-memory spring 5 (U-shaped or V-shaped in section) is arranged between the two rows of contacts 3, to drive these contacts 3. Further, the shape-memory spring 5 is common to all contacts 3, and has opposite side edges received in grooves 12 formed in respective operation transmitting members 9 made of an insulating material. The contacts 3 are partly buried in the respective operation transmitting members 9, each operation transmitting member 9 being at a position midway along the contacts 3. The contacts 3 may be buried in the operation transmitting member 9 by moulding or by press-fitting the contacts 3 in openings preformed in the operation transmitting member 9. In this case, it is necessary to eliminate play between the contact 3 and the operation transmitting member 9 to reliably transmit the force of the shape-memory spring 5 to the contact 3. The material of the operation transmitting member 9 may, for example, comprise heat resistant resin having sufficient physical strength, such as polyphenylene sulfide, polyetherimide, etc. When a groove 12 for connecting the shape-memory spring 5 to the operation transmitting member 9 is continuously formed from one end to the other end of the operation transmitting member 9, the contacts 3 are assembled in the connector housing 1, and then the shape-memory spring 5 is slid from one end to become mounted to the operation transmitting members 9. In this connector, the shape-memory spring 5 may be bonded to the operation transmitting members 9 after inserting the shape-memory spring 5 into the grooves 12 of the operation transmitting members 9. The transformation temperature of the shape-memory spring 5 of this connector is typically 80°C. When the atmospheric temperature reaches 80°C or higher, the shape-memory spring 5 adopts its austenitic phase and generates a large recovery force. The operation of this connector is shown in Figures 2 and 3. Figure

2 shows the state of the shape-memory spring 5 at ambient temperatures. In this state, the shape-memory spring 5 is in the martensitic phase and is soft and readily plastically deformed. The shape-memory spring 5 is overcome by the spring force of the contacts 3 and opened by the spring force of the contacts 3, via the operation transmitting members 9. In this state, the opposite contact 10 may be inserted or removed without any force. Then, Figure 3 shows the state when the atmospheric temperature reaches 80°C or higher and the shape-memory spring 5 adopts the austenitic phase. In this case, the shape-memory spring 5 is recovered to the shape stored in advance, i.e. closing its ends towards each other to pull the contacts 3 towards each other via the operation transmitting members 9, so that a predetermined spring contact pressure is exerted by the contacting portion 3B of the contacts 3 on the opposite contact 10.

The above-described connector is designed to give a strong spring contact pressure at high temperature. However, the memory shape of the shape-memory spring 5 may be altered so that the predetermined spring contact pressure is exerted by the contacts 3 at ambient temperature, the spring force of the contacts 3 overcoming that of the shape-memory spring 5 at ambient temperatures, and the shape recovery of the shape-memory spring 5, at its transformation temperature or higher, opens the shape-memory spring 5 and correspondingly opens the contacts 3.

The electronic connector described above has two rows of contacts 3, but either row of the contacts 3 may be omitted. In this case, the other end of the shape-memory spring 5 is inserted in a groove formed on the connector housing 1.

In the connector described above, the shape-memory spring 5 may be mounted in the groove 12 of each operation transmitting member 9 by means of a T-shaped member 14 as shown in Figure 4. Thus, the shape-memory spring 5 cannot become dislodged from the groove 12 of the operation transmitting member 9, and there is no possibility that the inserting end of the shape-memory spring 5 will be excessively bent when inserted.

Figure 5 shows an embodiment of electronic connector of this invention. This connector is modified and improved from the connector of Figure 1. More specifically, in the connector of Figure 1, when the shape-memory spring 5 is heated, it takes several tens of seconds to reach its transformation temperature and for the spring contacts 3 to close, and it is not possible to execute even a simple continuity check via the opposite contact 10 during this period. In the alternative arrangement, in which the contacts 3 will close as the shape-

memory spring 5 cools, it takes a considerable time before contact pressure is developed between the contacts 3, i.e. until the temperature of the shape-memory spring 5 falls below its transformation temperature. In this case also, the continuity test described above cannot be performed. In other words, in the above-mentioned connector, it takes several tens of seconds to transform the shape-memory spring 5, and there is a problem that even a simple initial check cannot be executed during this period. Therefore, connectors of this invention have the feature that an initial check such as a continuity check can be executed during the period that the shape-memory spring 5 is transforming to the desired phase. In the embodiment of connector shown in Figure 5, the contacts 3 have weak spring force auxiliary contacting portions 3E on standby at positions to contact the opposite or inserted contact 10 before a strong spring force main contacting portion 3B contacts the opposite contact 10. This weak spring force auxiliary contacting portion 3E is formed as a narrow auxiliary spring portion 24 by a slit 23 formed in the contact 3, as shown in Figure 6, and the auxiliary spring portion 24 is bent towards the center of the contact containing chamber 2 as shown in Figure 5.

In the electronic connector of Figure 5, when the shape-memory spring 5 is in the martensitic phase, the weak spring force auxiliary contacting portion 3E projects inwards as a standby. Accordingly, the opposite contact 10 can contact the weak spring force auxiliary contacting portion 3E before contacting the strong force main contacting portion 3B, and even if the shape-memory spring 5 is not transformed to the austenitic phase, i.e. is not heated, the initial check can be executed. When the shape-memory spring 5 is heated to be transformed to the austenitic phase, the contact 3 is moved to the center of the contact phase, the contact 3 is moved to the center of the contact containing chamber 2 via the operation transmitting member 9 under the force of the shape-memory spring 5, and the strong spring force main contacting portion 3B presses against the opposite contact 10. More particularly, in Figure 5, the shape-memory spring 5 is in the martensitic phase at ambient temperature. Since the strong spring force main contacting portion 3B is disposed at an open position, retracted with respect to the opposite contact 10, only the weak spring force auxiliary contacting portion 3E is contracted when the opposite contact 10 is inserted. Thus, the opposite contact 10 can be inserted with extremely weak force. The necessary minimum contacting pressure is generated for an initial check at this time. After the initial check is completed, and when the shape-memory spring 5 reaches a high temperature, the shape-memory spring 5 is transformed to the austenitic phase and

recovers its stored shape, i.e. a shape as shown by broken lines in Figure 5. As a result, the strong spring force main contacting portion 3B engages the opposite contact 10 with a large contacting pressure, and a high reliability contact is obtained whilst the high temperature is maintained. When returned again to ambient temperature, the shape-memory spring 5 is returned by the spring contact 3, to the position designated by solid lines in Figure 5, and the opposite contact 10 is engaged only by the weak spring force auxiliary contacting portion 3E.

In a modification of the electronic connector of Figures 5 and 6, the shape-memory spring 5 opens out when above the transformation temperature, and a heater is included to raise its temperature: an initial check can be executed immediately after the heater is deenergized, relying on the weak contact of the auxiliary contact portion 3E, and a high contact pressure is obtained when the temperature falls below the transformation temperature of the shape-memory spring 5.

Figure 7 shows another modified example of the connector of Figures 5 and 6. The contact 3 is different in that a slit 23 is formed from the upper portion to the lower portion of the contact 3 to form an auxiliary spring portion 24. Thus, a weak spring force auxiliary contacting portion 3E projects to a predetermined position substantially irrespective of the movement of the strong spring force main contacting portion 3B, which is driven by the shape-memory spring 5 having one end coupled to an operation transmitting member 9 carried by the contact 3, and its opposite end engaged in a groove 11 in the housing 1. This electronic connector is used at ambient temperature. In this example, the outwardly-pulling force of the shape-memory spring 5 in the austenitic state, heated by a heater 7 as shown in Figure 8, is transmitted by the operation transmitting member 9 to the contact 3, and the strong spring force main contacting portion 3B of the contact 3 is pulled to the inner wall side of the connector housing 1. In this state, only the weak spring force auxiliary contacting portion 3E remains at the center of the contact containing chamber 2 in standby. Accordingly, the opposite contact 10 is contacted by the weak spring force auxiliary contacting portion 3E and with weak contacting pressure. Therefore, an initial check can be executed via the weak spring force auxiliary contact 3E during the several tens of seconds, after the heater 7 is stopped, that the shape-memory spring 5 returns to the martensitic phase. Then, as shown in Figure 9, the spring force of the contact 3 overcomes the spring force of the shape-memory spring 5 to return to the center of the contact containing chamber 2, with the result that the contacting pressure of the strong spring force main

contacting portion 3B is added to the contacting pressure of the weak spring force auxiliary contacting portion 3E to apply a large contacting pressure on the opposite contact 10.

Figures 10 to 14 show another embodiment of electronic connector. The connector of Figure 5 forms an auxiliary spring portion 24 by forming a slit 23 in the contact 3, while the connector of Figures 10 to 14 is improved to provide the same advantages. The connector, except the contact 3, is constructed fundamentally the same as the connector of Figure 1, and only the features of difference will be shown and described. In the connector of Figures 10 to 14, each contact 3 is composed of a weak spring portion 3F erected from the bottom of the connector housing 1 in the contact containing chamber 2 and the upper end of the contact 3 is bent in a predetermined radius of curvature downwards, and a strong spring portion 3G is formed continuously at the end of the contact weak spring portion 3F by a V-shape bend. The portion 3B of the contact 3, which is to engage the opposite contact 10, lies between the weak spring portion 3F and the strong spring portion 3G. A block-like operation transmitting member 9 is formed on the weak spring portion 3F opposite the strong spring portion 3G. One end of the shape-memory spring 5 is press-fitted into the groove 12 in the operation transmitting member 9. A portion 3K is bent substantially perpendicularly at the end of the strong spring portion 3G. The bent portion 3K is engaged on the upper surface of the operation transmitting member 9.

In the electronic connector of Figures 10 to 14, at ambient temperature, the shape-memory spring 5 is in its martensitic state, and the contacting portion 3B is disposed at a position where it is contacted by the opposite contact 10 when inserted as shown in Figure 10. In this state, the spring force of the weak spring portion 3F (shown as a black solid portion in Figure 12) at load-acting point 3H is balanced by the force of the shape-memory spring 5. Then, when the opposite contact 10 is inserted as shown in Figure 13, the contacting portion 3B is pressed back to the surface line of the opposite contact 10 to generate a predetermined weak contacting pressure, so that an initial check can be executed. At this time, the spring force of the contact 3 affecting the contacting pressure is generated in the weak spring portion 3F (shown as a black solid portion in Figure 13). The stiffness at this time is that generated by the weak spring portion 3F and is very weak as compared with the state shown in Figure 14 to be described later, and even if the position of the contacting portion 3B is slightly displaced, the contacting pressure does not alter to a great extent.

When this electronic connector is exposed to high temperature, i.e. above the transformation temperature of the shape-memory spring 5, after the opposite contact 10 is inserted, the shape-memory spring 5 in the austenitic phase overcomes the spring force of the contact 3, and tends to recover its stored shape, thereby stopping steadily in the position shown in Figure 11. As a result, the contacting point 3B contacts the opposite contact 10 with a large contacting pressure to obtain high reliability in the continuous operation of the connector at high temperature. At this time, the spring force of the contact 3 affecting the contacting pressure is initially generated by the contact weak spring portion 3F (shown as a black solid portion in Figure 13), but as the shape-memory spring 5 recovers its shape, the spring force of the contact 3 is generated from when the operation transmitting member 9 is contacted with the oblique surface of the strong spring portion 3G (shown as a black solid portion in Figure 14). At this time there are two load acting points 3H and 3M in Figure 14, and particularly the black solid portion imparts substantial stiffness to the strong spring portion 3G, and the shape recovering force of the shape-memory spring 5 is transmitted substantially directly to the contacting portion 3B.

In the electronic connector of Figures 10 to 14, it is preferable to deform the contact 3 as little as possible, i.e. to increase the stiffness so as to utilize the force of the shape-memory spring 5 as the contacting pressure, but when, on the contrary, it is necessary to contact the opposite contact 10 with the contact 3 by weak spring force for the purpose of initial check, the stiffness of the contact 3 is smaller. This requirement is satisfied by altering the stiffness at the load acting point of the contact 3 during the period while the operations of the contact 3 and the shape-memory spring 5 are completed upon raising the temperature after the opposite contact 10 is inserted.

The opposite contact 10 wipes on the surface of the contacting portion 3B of the contact 3 when the opposite contact 10 is initially inserted, but the point of contact between the contacting portion 3B and the opposite contact 10 is not altered during a series of operations of the contact 3 and the shape-memory spring 5 described above. Therefore, a contact is obtained of extremely high reliability, from the electrical point of view.

For use of the connector at ambient temperature, the transformation temperature of the shape-memory spring 5 is set to a low temperature such as 0°C, and in order to insert the opposite contact 10, the electronic connector is cooled. Then, similar effects to those described above are obtained.

In the connector of Figs 10 to 14, the contact 3 is composed of the weak spring portion 3F and the

strong spring portion 3G, the contacting portion 3B is positioned between those two spring portions, the memory recovery force of the shape-memory spring 5 acts through the operation transmitting member 9 to the strong spring portion 3G, and the contacting portion 3B is disposed at a position capable of contacting the opposite contact 10 when the latter is inserted in the standby state. Therefore, the contacting portion 3B is supported by the weak spring portion 3F at the initial check time, to contact the opposite contact 10: there is an advantage that the initial check can be executed yet only a weak inserting or removing force is needed. When the shape-memory spring 5 is operated, the force of the shape-memory spring 5 acts through the operation transmitting member 9 to the strong spring portion 3G of the contact 3. Thus, the attenuation of the force of the shape-memory spring 5 is minimized to transmit the force of the shape-memory spring 5 directly to the contacting portion 3B to obtain a necessary strong contacting pressure different from that applied by the weak spring portion 3F. Further, this embodiment has the advantage that the surface of the opposite contact 10 is wiped when the opposite contact 10 is inserted.

Figs. 15 to 17 show a modification to the electronic connector of Figs 10 to 14. Thus each contact 3 has a first restricting portion 30, comprising a projection for restricting the operating range of the contact 3: projection 30 is formed on the side of the folded portion 3N of the weak spring portion 3F of the contact 3. A second restricting portion 31, comprising a recess for restricting the operating range of the contact 3 in cooperation with the first restricting portion 30, is formed correspondingly on the partition wall 20 between each pair of contacts 3 of the rows. The first and second restricting portions 30, 31 contact with one another to restrict the operating range of the contact 3.

In the electronic connector of Figs 15 to 17, when the opposite contact 10 is inserted at ambient temperature, the first restricting portion 30 stops at the stopper 31B of the second restricting portion 31 to always exert a predetermined contacting pressure. The shape-memory spring 5 is recovered in shape in the direction that the shape-memory spring 5 is contracted inward, i.e. at or above the transformation temperature of the shape-memory spring 5. In this case, even if the shape-memory spring 5 produces a force greater than required, the first restricting portion 30 of contact 3 meets the stopper 31A of the second restricting portion 31 to restrict its movement. Thus, the contact 3 does not exceed a critical strain.

Figs. 18 and 19 show an alternative modification, in which the first restricting portion is formed as a recess the ends of which act as stoppers 30A, 30B, and the second restricting portion 31 is

formed as a projection. The contact 3 overcomes the spring force of the shape-memory spring 5 at ambient temperature to tend to open outwards, but the stopper 30A contacts the second restricting portion 31 to stop the outwards movement of the contact 3, so that a predetermined contacting pressure is provided when the opposite contact 10 is inserted. When the atmospheric temperature reaches or exceeds the transformation temperature of the shape-memory spring 5, the spring force of the shape-memory spring 5 overcomes the spring force of the contact 3 as the shape-memory spring recovers in shape, contracting in an inwardly direction: even if the opposite contact 10 is not inserted, the stopper 30B of the first restricting portion 30 on the contact 3 meets the second restricting portion 31 formed on the partition wall 20 to stop the contact 3 and ensure that its critical strain is not exceeded.

When there is a facing contact 3, i.e. when there are two rows of contacts 3 opposite each other, the stopper 30B prevents the facing contacts 3 from contacting one another. The electronic connector so far described is for use at high temperature. However, for use at ambient temperature, the transformation temperature of the shape-memory spring 5 is set to 0°C for example: the electronic connector is cooled to enable the opposite contact 10 to be inserted, and it is exposed to ambient temperature once the opposite contact 10 has been inserted. Or, a heater may be associated in the contact containing chamber 2 of the connector housing 1, and when the heater is energized, the contact 3 is opened out, by the shape-memory spring 5 opening out to recover its shape stored in advance, to then allow the opposite contact 10 to be inserted or removed without force, and when the energization of the heater is stopped after the opposite contact 10 is inserted and the shape-memory spring 5 allowed to cool, sufficient contacting pressure can be obtained at ambient temperature.

Claims

1. An electronic connector comprising a housing (1), a plurality of spring contacts (3) associated in one or more rows in said housing (1), and a shape-memory spring (5) having two temperature-dependent states associated in said housing and coupled to said spring contacts (3) to transmit a recovery force to said spring contacts (3) when the shape-memory spring (5) reaches its transformation temperature, said recovery force urging each said spring contact (3) from a first position towards a second position, each spring contact (3) returning to its first position when the shape-memory spring (5) falls below its transformation temperature,



strong spring portion 3G, the contacting portion 3B is positioned between those two spring portions, the memory recovery force of the shape-memory spring 5 acts through the operation transmitting member 9 to the strong spring portion 3G, and the contacting portion 3B is disposed at a position capable of contacting the opposite contact 10 when the latter is inserted in the standby state. Therefore, the contacting portion 3B is supported by the weak spring portion 3F at the initial check time, to contact the opposite contact 10: there is an advantage that the initial check can be executed yet only a weak inserting or removing force is needed. When the shape-memory spring 5 is operated, the force of the shape-memory spring 5 acts through the operation transmitting member 9 to the strong spring portion 3G of the contact 3. Thus, the attenuation of the force of the shape-memory spring 5 is minimized to transmit the force of the shape-memory spring 5 directly to the contacting portion 3B to obtain a necessary strong contacting pressure different from that applied by the weak spring portion 3F. Further, this embodiment has the advantage that the surface of the opposite contact 10 is wiped when the opposite contact 10 is inserted.

Figs. 15 to 17 show a modification to the electronic connector of Figs 10 to 14. Thus each contact 3 has a first restricting portion 30, comprising a projection for restricting the operating range of the contact 3: projection 30 is formed on the side of the folded portion 3N of the weak spring portion 3F of the contact 3. A second restricting portion 31, comprising a recess for restricting the operating range of the contact 3 in cooperation with the first restricting portion 30, is formed correspondingly on the partition wall 20 between each pair of contacts 3 of the rows. The first and second restricting portions 30, 31 contact with one another to restrict the operating range of the contact 3.

In the electronic connector of Figs 15 to 17, when the opposite contact 10 is inserted at ambient temperature, the first restricting portion 30 stops at the stopper 31B of the second restricting portion 31 to always exert a predetermined contacting pressure. The shape-memory spring 5 is recovered in shape in the direction that the shape-memory spring 5 is contracted inward, i.e. at or above the transformation temperature of the shape-memory spring 5. In this case, even if the shape-memory spring 5 produces a force greater than required, the first restricting portion 30 of contact 3 meets the stopper 31A of the second restricting portion 31 to restrict its movement. Thus, the contact 3 does not exceed a critical strain.

Figs. 18 and 19 show an alternative modification, in which the first restricting portion is formed as a recess the ends of which act as stoppers 30A, 30B, and the second restricting portion 31 is

formed as a projection. The contact 3 overcomes the spring force of the shape-memory spring 5 at ambient temperature to tend to open outwards, but the stopper 30A contacts the second restricting portion 31 to stop the outwards movement of the contact 3, so that a predetermined contacting pressure is provided when the opposite contact 10 is inserted. When the atmospheric temperature reaches or exceeds the transformation temperature of the shape-memory spring 5, the spring force of the shape-memory spring 5 overcomes the spring force of the contact 3 as the shape-memory spring recovers in shape, contracting in an inwardly direction: even if the opposite contact 10 is not inserted, the stopper 30B of the first restricting portion 30 on the contact 3 meets the second restricting portion 31 formed on the partition wall 20 to stop the contact 3 and ensure that its critical strain is not exceeded.

When there is a facing contact 3, i.e. when there are two rows of contacts 3 opposite each other, the stopper 30B prevents the facing contacts 3 from contacting one another. The electronic connector so far described is for use at high temperature. However, for use at ambient temperature, the transformation temperature of the shape-memory spring 5 is set to 0°C for example: the electronic connector is cooled to enable the opposite contact 10 be inserted, and it is exposed to ambient temperature once the opposite contact 10 has been inserted. Or, a heater may be associated in the contact containing chamber 2 of the connector housing 1, and when the heater is energized, the contact 3 is opened out, by the shape-memory spring 5 opening out to recover its shape stored in advance, to then allow the opposite contact 10 to be inserted or removed without force, and when the energization of the heater is stopped after the opposite contact 10 is inserted and the shape-memory spring 5 allowed to cool, sufficient contacting pressure can be obtained at ambient temperature.

Claims

1. An electronic connector comprising a housing (1), a plurality of spring contacts (3) associated in one or more rows in said housing (1), and a shape-memory spring (5) having two temperature-dependent states associated in said housing and coupled to said spring contacts (3) to transmit a recovery force to said spring contacts (3) when the shape-memory spring (5) reaches its transformation temperature, said recovery force urging each said spring contact (3) from a first position towards a second position, each spring contact (3) returning to its first position when the shape-memory spring (5) falls below its transformation temperature,



characterised in that each spring contact (3) has an auxiliary portion (3E) arranged, when the contact (3) is in one said position, to apply weak spring pressure on an inserted contact (10), and each spring contact (3) has a main spring portion (3B) arranged, when the spring contact (3) is in its other said position, to apply strong spring pressure on an inserted contact (10).

2. An electronic connector comprising a housing (1), a plurality of spring contacts (3) associated in one or more rows in said housing (1), and a shape-memory spring (5) having two temperature-dependent states associated in said housing and coupled to said spring contacts (3) to transmit a recovery force to said spring contacts (3) when the shape-memory spring (5) reaches its transformation temperature, said recovery force urging each said spring contact (3) from a first position towards a second position, each spring contact (3) returning to its first position when the shape-memory spring (5) falls below its transformation temperature, characterised in that each spring contact (3) comprises an engagement portion (3B) intermediate its ends, to press against an inserted contact (10), one end portion (3F) of the spring contact being supported in cantilever manner by said housing (1) so that when the shape-memory spring (5) is in one of its temperature-dependent states said engagement portion (3B) applies weak spring pressure on an inserted contact (10), in that a transmitting member (9) is carried by said one end portion (3F) of the spring contact (3), the shape-memory spring (5) being coupled to said transmitting member (9), and in that when said shape-memory spring (5) is in its other temperature-dependent state, said shape-memory spring (5) urges said transmitting member (9) against an opposite bent back end portion (3G) of the spring contact (3), so that said opposite end portion (3G) of said spring contact (3) forms a strong spring for applying a strong spring pressure to an inserted contact (10).

Patentansprüche

1. Elektronischer Verbinder, der ein Gehäuse (1), eine Vielzahl von Federkontakten (3), die in einer oder mehreren Reihen in dem Gehäuse (1) verbunden sind, und eine Formspeicherfeder (5) mit zwei temperaturabhängigen Zuständen aufweist, die in dem Gehäuse verbunden und mit den Federkontakten (3) gekoppelt ist, um eine Rückbildungskraft auf die Federkontakte (3) zu übertragen, wenn die Formspeich-

erfeder (5) ihre Umwandlungstemperatur erreicht, wobei die Rückbildungskraft jeden der Federkontakte (3) von einer ersten Stellung in eine zweite Stellung treibt, wobei jeder Federkontakt (3) in seine erste Stellung zurückkehrt, wenn die Formspeicherfeder (5) unter ihre Umwandlungstemperatur fällt, dadurch gekennzeichnet, daß bei jedem Federkontakt (3) ein Hilfsbereich (3E) so angeordnet ist, daß er, wenn der Kontakt (3) in der einen Stellung ist, einen schwachen Federdruck auf einen eingefügten Kontakt (10) ausübt, und daß bei jedem Federkontakt (3) ein Hauptfederbereich (3B) so angeordnet ist, daß er, wenn der Federkontakt (3) in seiner anderen Stellung ist, einen starken Federdruck auf einen eingefügten Kontakt (10) ausübt.

2. Elektronischer Verbinder, der ein Gehäuse (1), eine Vielzahl von Federkontakten (3), die in einer oder mehreren Reihen in dem Gehäuse (1) verbunden sind, und eine Formspeicherfeder (5) mit zwei temperaturabhängigen Zuständen aufweist, die in dem Gehäuse verbunden und mit den Federkontakten (3) gekoppelt ist, um eine Rückbildungskraft auf die Federkontakte (3) zu übertragen, wenn die Formspeicherfeder (5) ihre Umwandlungstemperatur erreicht, wobei die Rückbildungskraft jeden der Federkontakte (3) von einer ersten Stellung in eine zweite Stellung treibt, wobei jeder Federkontakt (3) in seine erste Stellung zurückkehrt, wenn die Formspeicherfeder (5) unter ihre Umwandlungstemperatur fällt, dadurch gekennzeichnet, daß jeder Federkontakt (3) einen Eingriffsbereich (3B) zwischen seinen Enden aufweist, um gegen einen eingefügten Kontakt (10) zu drücken, wobei ein Endbereich (3F) des Federkontaktes (3) auslegerartig durch das Gehäuse (1) getragen ist, so daß dann, wenn die Formspeicherfeder (5) in einem ihrer temperaturabhängigen Zustände ist, der Eingriffsbereich (3B) einen schwachen Federdruck auf einen eingefügten Kontakt (10) ausübt, daß ein Übertragungsglied (9) durch den einen Endbereich (3F) des Federkontaktes (3) getragen wird, daß die Formspeicherfeder (5) mit dem Übertragungsglied (9) verbunden ist, und daß dann, wenn die Formspeicherfeder (5) in ihrem anderen temperaturabhängigen Zustand ist, die Formspeicherfeder (5) das Übertragungsglied (9) gegen einen gegenüberstehenden zurückgebogenen Endbereich (3G) des Federkontaktes (3) treibt, so daß der gegenüberstehende Endbereich (3G) des Federkontaktes (3) eine starke Feder zum Ausüben eines starken Federdrucks auf einen eingefügten Kontakt (10) bildet.



Revendications

1. Connecteur électronique comprenant un logement (1), une pluralité de contacts à ressort (3) associés en une ou plusieurs rangées dans ledit logement (1), un ressort à mémoire de forme (5) possédant deux états dépendant de la température, placé dans ledit logement et couplé auxdits contacts à ressort (3) afin de transmettre une force de recouvrement auxdits contacts à ressort (3) lorsque le ressort à mémoire de forme (5) atteint sa température de transformation, ladite force de recouvrement poussant chacun desdits contacts à ressort (3) d'une première position vers une seconde position, chacun desdits contacts à ressort (3) retournant vers sa première position lorsque le ressort à mémoire de forme (5) descend en dessous de sa température de transformation, caractérisé en ce que chacun desdits contacts à ressort (3) possède une portion auxiliaire (3E) disposée, quand le contact à ressort (3) est dans l'une desdites positions, de façon à appliquer une faible pression de ressort sur un contact inséré (10), et chacun desdits contacts à ressort (3) possède une portion principale de ressort (3B) disposée, quand le contact à ressort (3) est dans l'autre desdites positions, de façon à appliquer une forte pression de ressort sur un contact inséré (10).
2. Connecteur électronique comprenant un logement (1), une pluralité de contacts à ressort (3) associés en une ou plusieurs rangées dans ledit logement (1), un ressort à mémoire de forme (5) possédant deux états dépendant de la température, placé dans ledit logement et couplé auxdits contacts à ressort (3) afin de transmettre une force de recouvrement auxdits contacts à ressort (3) lorsque le ressort à mémoire de forme (5) atteint sa température de transformation, ladite force de recouvrement poussant chacun desdits contacts à ressort (3) d'une première position vers une seconde position, chacun desdits contacts à ressort (3) retournant vers sa première position lorsque le ressort à mémoire de forme (5) descend en dessous de sa température de transformation, caractérisé en ce que chacun desdits contacts à ressort (3) comprend une portion d'engagement (3B) entre ses extrémités, pour exercer une pression contre un contact inséré (10), une portion d'extrémité (3F) du contact à ressort étant maintenue en porte-à-faux par ledit logement (1) de façon que, quand le ressort à mémoire de forme (5) est dans un de ses états dépendant de la

température, ladite portion d'engagement (3B) applique une faible pression de ressort sur un contact inséré (10), en ce qu'un élément de transmission (9) est porté par ladite portion d'extrémité (3F) du contact à ressort (3), le ressort à mémoire de forme (5) étant couplé audit élément de transmission (9), et en ce que, quand ledit ressort à mémoire de forme (5) est dans son autre état dépendant de la température, ledit ressort à mémoire de forme (5) pousse ledit élément de transmission (9) contre une portion d'extrémité opposée (3G), coudée en arrière, du contact à ressort (3), de façon que ladite portion d'extrémité opposée (3G) dudit contact à ressort (3) forme un ressort ferme permettant d'appliquer une forte pression de ressort à un contact inséré (10).