United States Patent

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[54] **ELECTRICAL CONNECTOR AND SWITCHING DEVICE**
8 Claims, 7 Drawing Figs.

[52] **U.S. Cl.** **200/16,** 200/168, 200/166, 200/76
[51] **Int. Cl.** **H01h 15/00**
[50] **Field of Search** 200/166B3, 168S, 67B, 67A, 76, 16.1, 51

[56] **References Cited**

UNITED STATES PATENTS

2,653,198	9/1953	Krenke	200/67 A (UX)
3,294,931	12/1966	Lanza	200/67 B (UX)
3,317,886	5/1967	Norden	339/198

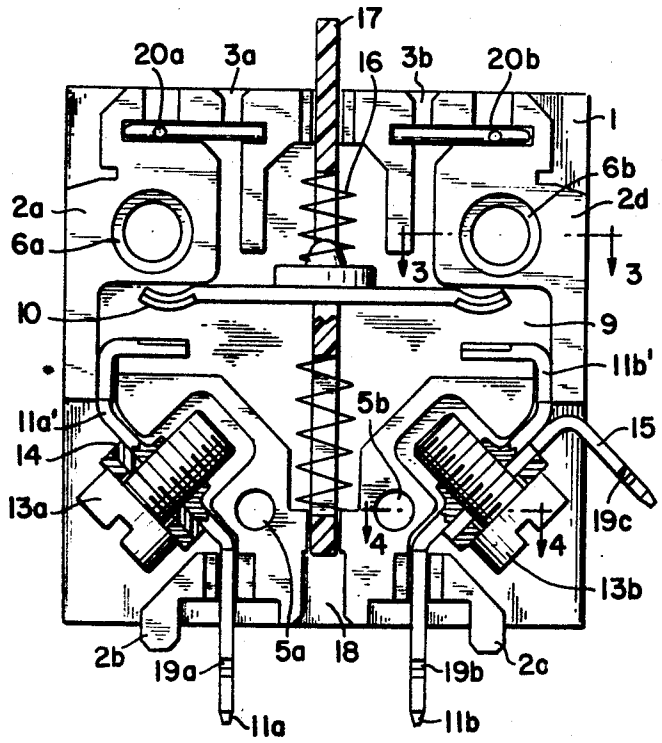
OTHER REFERENCES

Machat, German App. No. 1,050,861, publ. 2— 59, 1 sht. dwg. 2 pp. spec. (copy 200— 168S(ux)

Kohn, German App. No. 1,245,471, publ. 7— 67, 1 sht. dwg. 2 pp. spec. (copy 200— 166B3(UX))

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ABSTRACT: The housing of an electrical device has connector sockets on one side and connector plugs on the opposite side. The housing comprises a backplate and a front plate each made of molded plastic material. The backplate has integral ledge members. The front plate, which is preferably transparent, to reveal the interior, is placed on top of the ledge members and has integrally formed tubular and full-bodied rivets which pass through the ledge members and have their ends secured in corresponding recesses on the backface of the backplate. The ledge members surround a switching chamber within the housing. A switching bridge is movable in the chamber between two switching positions and is engageable with fixed contacts depending upon the position occupied at a time. The fixed contacts comprise sheet-metal strips each having a curved shape at three localities along its length, the end of each strip extending through the ledge members to the outside of the housing so as to form one of the connector plugs of the device. Terminal screws are in threaded engagement with corresponding strips in the housing, but are accessible from the outside. A spring-biased tappet is longitudinally displaceable between the connector plugs and in parallel relation thereto for actuating the switching bridge. The tappet extends to the outside of the housing when the bridge is in one of its limit positions, so that the tappet can then be actuated directly or by engagement with the tappet of an analogously designed device. Two or more such devices can be plugged together to form a desired switching or connection arrangement.



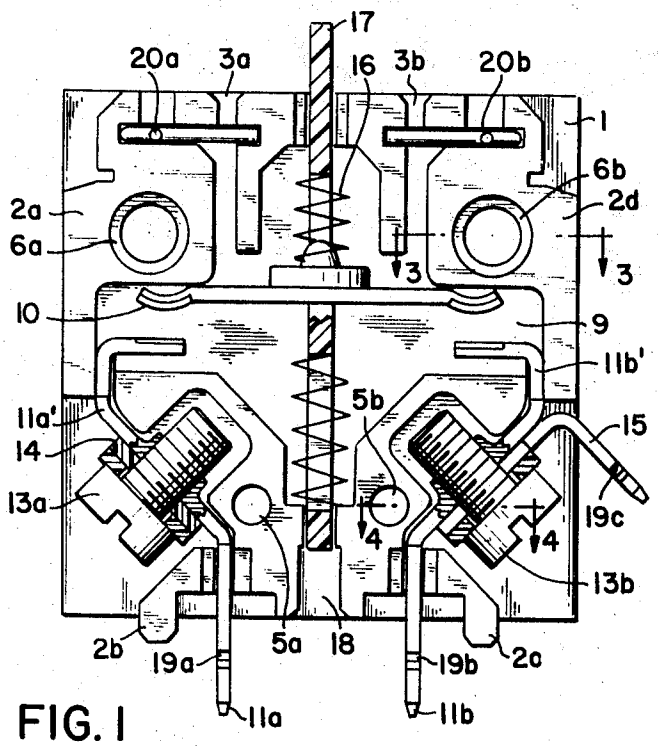


FIG. 1

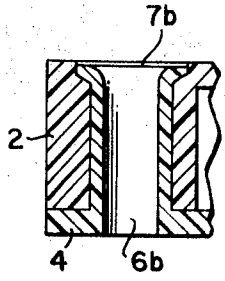


FIG. 3

FIG. 2

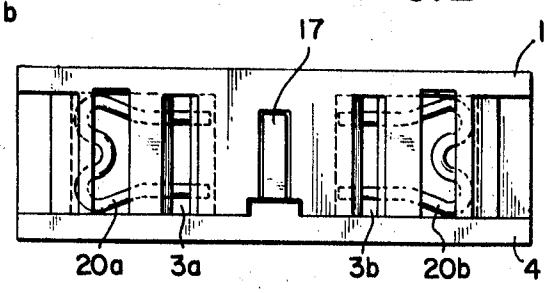
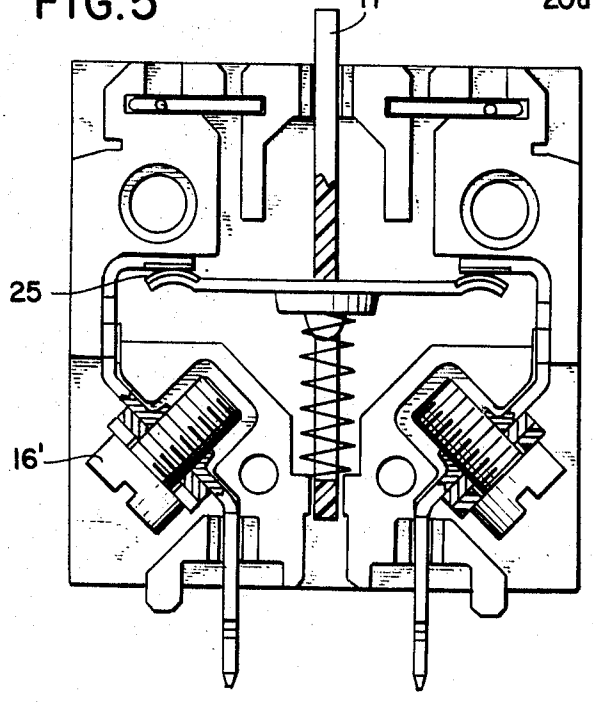


FIG. 5



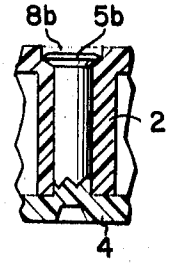


FIG. 4

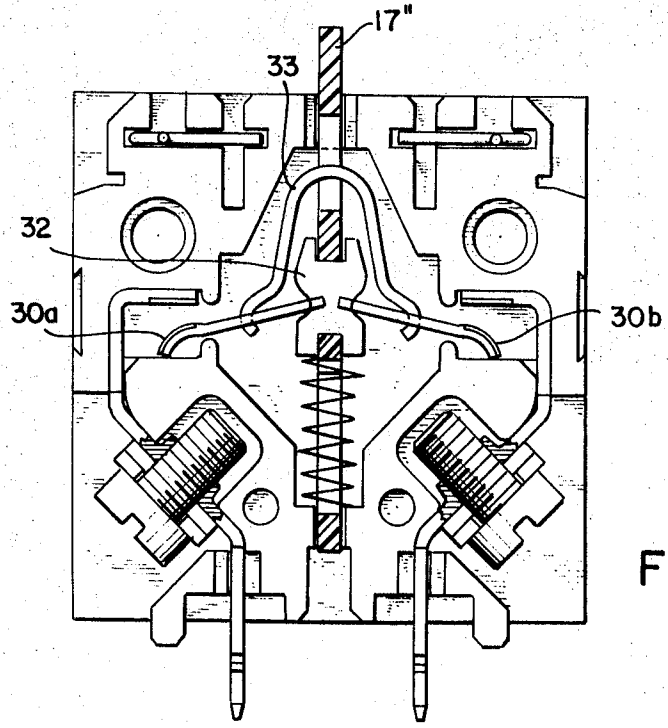


FIG. 6

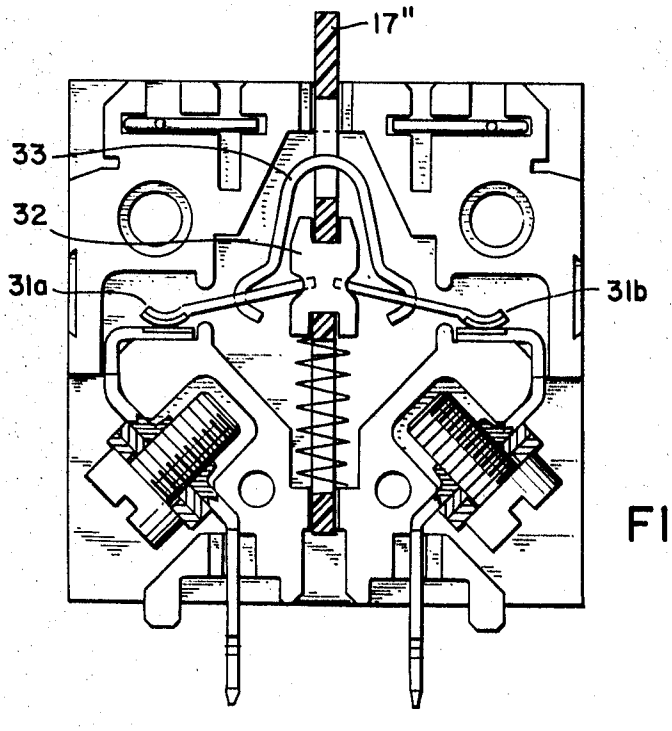


FIG. 7

ELECTRICAL CONNECTOR AND SWITCHING DEVICE

Our invention relates to an electrical connector and switching device whose housing is equipped with connector sockets on one side and with connector plugs on the opposite side, so that any desired number of similar devices may be plugged into one another to form a series group.

It is an object of the invention to provide a device of the aforedescribed type which is applicable, as desired, as a normally open or normally closed switch and which may have dimensions so small that several devices plugged together, and thus forming a series of mutually adjacent components, may be controlled by a single operation or a single control member. In conjunction therewith, it is a more specific object to devise a system of such plug-connectable units which affords, by a corresponding selection of normally closing or normally opening switches, to perform or release the largest feasible number of different switching functions.

It is another object of our invention to design the housing of the device in such a manner that it consists of a minimum number of parts which can be assembled and fastened together by particularly simple means.

A further object of the invention is to provide devices of the aforedescribed type with openings which extend through the device so as to permit cables or bolts to pass therethrough.

It is also an object of our invention, relating to devices generally of the aforedescribed type, to locate all the components which cooperate in the performance of switching operations into the housing from one and the same side thereof and to permit fastening these components from the same side. It is a subsidiary object to have the positioning and fastening of these components remain visible so that their proper arrangement, connection and functioning may be supervised by visual inspection.

It is a further object of the invention to permit the use of the fixed switch contacts arranged in the housing as connecting conductors for several connections which are suitable not only for a plug in connection, but also for receiving cable shoes, or for the attachment of connector cables by means of screws.

Another object of the invention is to provide a safe latching or catching of the plug pins in the sockets into which they are inserted.

Furthermore, the invention aims at providing devices which, aside from one or more of the foregoing objects, may be utilized as limit switches, door switches, and the like. To achieve these objects, and in accordance with our invention, the housing of our electrical device comprises two main parts, namely a backplate of plastic material with ledge members, integrally molded together with the backplate and protruding therefrom, and a preferably transparent front plate, also of plastic material, which has integrally molded rivet members. The front plate is placed on top of the ledge members and the rivets of the front plate pass through corresponding openings of the ledge members to the opposite face of the backplate where the rivets are molded into recesses of the backplate, thus holding the two plates tightly together. The two plates and the ledge members conjointly form the housing and the corresponding cavities in which the electrical socket members, the plug connector members, and the components of a switching device are accommodated. More specifically, the ledge members surround a switching chamber in which a switching bridge is movable between two positions and is engageable with fixed contacts in a selected position. Each of the fixed contacts comprises a sheet-metal strip having a curved shape at three localities along its length. The ends of each strip extend to outside the housing to form one of the connector plugs of the device. A terminal screw is in threaded engagement with the middle portion of each strip and is accessible from outside the housing. A spring-loaded tappet is longitudinally displaceable in the housing between the connector plugs and is in parallel relation with the plugs and controls the movements of the switching bridge. The tappet extends to outside the housing when the bridge is in one of its switching positions. The tappet may thus be actuated directly or by the tappet of an adjacent device plugged together with the one described. Conversely, the tappet may engage the tappet of an adjacent device and thus control the latter.

It is preferable to provide the plug pins with lateral recesses and to provide the connector sockets of a device according to the invention with wire springs designed for catching the corresponding recesses of the plug pins of an adjacent plugged-in device of similar type.

The terminal screws in the housing may serve for the attachment of cable shoes within the housing and/or for the fastening of additional plug pins which have a bent or curved shape and a sufficient length to extend to outside the housing.

The invention will be further described with reference to embodiments thereof which are illustrated by way of example in the accompanying drawings, in which:

FIG. 1 is a front view of an embodiment of a device of the invention designed as a normally open switch with a rigid switching bridge;

FIG. 2 is a lateral elevation seen from the top of FIG. 1;

FIG. 3 is a cross-sectional view, taken along the lines III–III of FIG. 1;

FIG. 4 is a cross-sectional view, taken along the lines IV–IV of FIG. 1;

FIG. 5 is a front view of an embodiment of a device of the invention designed as a normally closed switch with a ridge-switching bridge;

FIG. 6 is a front view of an embodiment of a normally open switching device of the invention with snap-action bridge members; and

FIG. 7 is a front view, similar to that of FIG. 6, of an embodiment of a snap-action switch device of the invention which is normally closed.

Details of the normally open switch device of FIGS. 1 to 4 are hereinafter described, and such details are in the devices of FIGS. 5 and 6, with the exception of the modifications hereinafter described.

A housing of the device comprises a backplate 1 with integral ledge members 2*a*, 2*b*, 2*c*, and 2*d* which protrudes from the backplate proper and are formed conjointly therewith as a single piece by injection molding. Molded into the ledge members are recesses 3*a* and 3*b*, which form the socket openings of the device. A front plate 4 of transparent plastic is placed face to face onto the tops of the ledge members 2*a*, 2*b*, 2*c* and 2*d*.

The front plate 4 is also molded from plastic material and conjointly with integral rivets 5*a* and 5*b* and hollow or tubular rivets 6*a* and 6*b*; the molding being preferably done by injection molding. The rivets 5*a* and 5*b* and 6*a* and 6*b* pass through openings of the ledge members 2*a*, 2*b*, 2*c* and 2*d* and are molded at their ends into recesses 7*a* and 7*b*, respectively, 8*a* and 8*b*, respectively, one of which is shown in FIG. 3 and the other of which is shown in FIG. 4, at the backface of the backplate 1, thus joining the two parts of the housing tightly and firmly together.

The ledge members 2*a* to 2*d* surround a switching chamber 9 in which a switching bridge 10 and fixed switch contacts 11*a*′ and 11*b*′ are arranged. Each of the switch contacts 11*a*′ and 11*b*′ is a sheet-metal strip of angular shape, curved at three places spaced from each other along the length of the strip. The ends of each strip extend out of the ledge members and out of the confines of the housing so as to form the plug pins 11*a* and 11*b*, respectively, of the device.

The two plug pins 11*a* and 11*b* of FIG. 1 are spaced from each other the same distance as the two sockets 3*a* and 3*b* on the opposite side of the housing and are arranged in symmetrical relation to the vertical center axis of the device, as shown in FIG. 1. It will be recognized, therefore, that a second device of the same design may be joined with the one illustrated by plugging the pins of the second device into the sockets 3*a* and 3*b* of the device shown. In this manner, any desired number of switching devices may be aligned to form a series of tightly adjacent components.

Terminal screws 13*a* and 13*b* are in threaded engagement with the middle portion of each corresponding strip which forms a fixed contact 11*a'* and 11*b'* of the plug pins 11*a* and 11*b*. The terminal and clamping screws 13*a* and 13*b*, although located within the confines of the housing, are freely accessible from the outside, namely from the lower left side and lower right side of the device of FIG. 1. Connector wires or cables may be directly fastened to the strips 11*a'* and 11*b'* by means of the screws 13*a* and 13*b*. However, as shown in FIG. 1, a cable shoe 14 may be seated on one or both of the screws for thus fastening a cable to the corresponding strip. FIG. 1 also shows an additional plug pin 15 which has a seat or eye portion seated on the right-hand terminal screw 13*b* and thus is fastened to the corresponding strip. The pin 15 is of angular shape and extends beyond the confines of the housing to the outside.

A tappet 17 extends between the sockets 3*a* and 3*b* and the plug pins 11*a* and 11*b*. The tappet 17 is guided by and between the ledges 2*a*, 2*b*, 2*c* and 2*d*, loaded by a biasing spring 16, and which carries the switching bridge 10. The tappet 17, in the illustrated open position of the bridge 10 (FIG. 1), protrudes from the housing at the top side thereof, as illustrated in FIG. 1, whereas in this position the tappet is fully located within the confines of the housing. A somewhat broadened recess 18 formed by the ledge members 2*b* and 2*c* serves for receiving the protruding portion of a tappet which may form part of an adjacent device whose sockets are engaged by the plug pins 11*a* and 11*b*.

In order to permit such a series plug in connection of two or more devices of similar type, the spacing between the sockets 3*a* and 3*b* is the same as between the plug pins 11*a* and 11*b* and each socket is aligned with a corresponding one of the pins.

Each of the plug pins 11*a* and 11*b* and the additional plug pin 15 has a lateral notch, recess or bore 19*a*, 19*b* and 19*c*, respectively. Wire springs 20*a* and 20*b* are placed in cavities of the ledge members 2*a* and 2*d*, respectively, so that the legs of each wire spring are located on opposite sides of the corresponding one of the socket openings 3*a* and 3*b* in order to catch into the recess 19*a* and 19*b* of an inserted plug pin 11*a* and 11*b*, respectively, appertaining to an adjacent device, when the latter device is plug-connected with the one shown.

As will be seen, all parts 10, 11*a'*, 11*b'*, 11*a* and 11*b*, together with such parts as 13*a* and 13*b* and 14 which may also serve to perform or coact in electrical function may be placed from one and the same side into the corresponding recesses or cavities of the ledge members 2*a* to 2*d*. This also applies to the tappet 17. Once these parts are placed in proper position, and the top plate is fastened to the backplate, the positioning of all parts within the housing is secured by the backplate 1 and its ledge members 2*a* to 2*d*, as well as by the front plate 4, so that no further fastening means are needed.

The backplate and the front plate 4 are held together exclusively by the rivets 5*a* and 5*b* and 6*a* and 6*b*. The tubular rivets 6*a* and 6*b* are available for the passage of wires or cables. The tubular rivets 6*a* and 6*b* may serve to receive mounting screws if the device is to be fastened to a panel or wall. In such case, either the backplate or the front plate may face the panel or wall.

The device illustrated in FIG. 5 corresponds essentially to the device described with reference to FIGS. 1 to 4. The only difference is that a rigid switching bridge 25 of FIG. 5 is normally held in engagement with the fixed contacts by the biasing force of a spring so that the switch is normally closed. The devices illustrated in FIGS. 6 and 7 are to a large extent also identical with the device described with reference to FIGS. 1 to 4, but are equipped with snap-action bridge contacts 30*a* and 30*b* (FIG. 6) and 31*a* and 31*b* (FIG. 7). The device of FIG. 6 has normally open contacts, whereas the corresponding device of FIG. 7 has normally closed contacts. In both devices, the appertaining tappet 17'' is provided with a carrier 33 which has notches serving as pivots for the ends of the two snap-action switch arms 30*a* and 30*b* or 31*a* and 31*b*. The carrier 33 comprises a substantially U-shaped spring which engages the two snap-action arms 30*a* and 30*b* or 31*a* and 31 *b* of each switching bridge at about the middle thereof. The bight portion of the spring 33 passes through a recess in the tappet 17''.

It will be understood that the particular size and geometric shape of the device may be varied within wide limits, but, while the size is not essential to the invention, it is advantageous that devices according to the invention lend themselves readily to being given very small dimensions without causing undue inconvenience with respect to the manufacture of the parts, the assembling of the parts and the use of the device. For example, devices as shown on the drawings have been made in a square configuration of 30 mm. edge length.

The circuit components to be controlled by a device according to the invention can be electrically connected thereto by means of the terminal screws 13*a*, 13*b* or cable shoes 14 or plug pins 15, unless such components form part of the circuits connected by means of the sockets 3*a*, 3*b* or plug pins 11*a*, 11*b*. Such controlled components may be separate from the controlling devices or may be mounted on the backplate 1 or front plate 4 of the housing, the latter way of mounting being applicable, for example, to signal lamps or relays.

Upon a study of this disclosure it will be obvious to those skilled in the art that with respect to structural details our invention permits of various modifications and may be given embodiments other than those illustrated and described herein, without departing from the essential features of the invention and within the scope of the claims annexed hereto.

We claim:

1. An electrical device having a housing with connector sockets on one side and connector plugs on the opposite side of the housing, said housing comprising a backplate of plastic material with ledge members integral with the backplate and protruding therefrom, and a front plate of plastic material placed on top of said ledge members and having rivet members integral with said front plate and passing through said ledge members and partly through said backplate, said backplate having recesses and each of said rivet members having molded ends fasteningly seated in a corresponding one of said recesses, said housing forming a switching chamber surrounded by said ledge members between said backplate and said front plate; a switching bridge arranged in said chamber and movable therein between two bridge positions; fixed contacts arranged in said chamber for engagement by said switching bridge, each of said fixed contacts comprising a sheet metal strip having a curved shape at mutually spaced localities along its length and having an end extending through said ledge members to the outside so as to form said connector plugs of the device; terminal screws each in threaded engagement with a corresponding one of said strips at the middle portion thereof and accessible from outside said housing; and a spring biased tappet longitudinally displaceable in said housing between said connector plugs and parallel to said plugs, said switching bridge being affixed to said tappet in a manner whereby said bridge is actuated by movement of said tappet, said tappet extending to outside said housing when said bridge is in one of its bridge positions.

2. A device as claimed in claim 1, wherein said front plate is transparent for visual inspection of the internal arrangement of components.

3. A device as claimed in claim 1, wherein said tappet protrudes from said housing at one side thereof when said tappet and bridge are in the spring-biased position, and said tappet is substantially entirely within the confines of said housing when said tappet and bridge are in the other position.

4. A device as claimed in claim 1, wherein said connector sockets of said housing are spaced from each other the same distance as the corresponding connector plugs and each of said connector sockets is aligned with a corresponding one of said connector plugs, whereby any number of said electrical devices are adapted to be plugged together in series.

5. A device as claimed in claim 1, further comprising a cable shoe arranged substantially in said housing and seated on one of said terminal screws whereby said shoe is fastened to one of said strips.

6. A device as claimed in claim 1, further comprising a plug pin having a seat portion seated on one of said terminal screws and fastened thereby to one of said strips, said plug pin having a generally angular shape and extending from said screw to outside said housing.

7. A device as claimed in claim 2, wherein said rivet members are located on each side of said tappet and comprise at least one tubular rivet and at least one full-bodied rivet, said front plate and said rivets forming a single piece of molded plastic.

8. A device as claimed in claim 5, wherein each of said connector plugs has a lateral recess and each of said connector sockets comprises a curve spring arranged in a corresponding one of said ledge members, each of said springs having a catch portion for engaging the recess in the connector plug of another of said electrical devices.