Feb. 6, 1968 G. BENOIT ETAL 3,368,186

ELECTRICAL CONNECTOR

Original Filed June 2, 1964

FIG.1

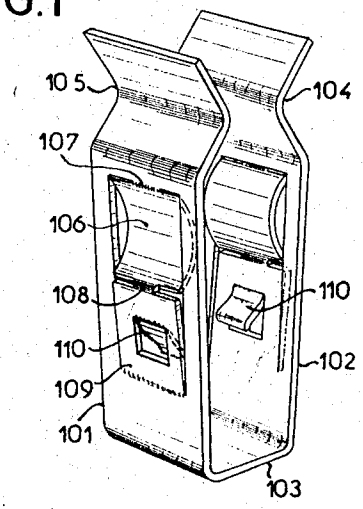


FIG.2

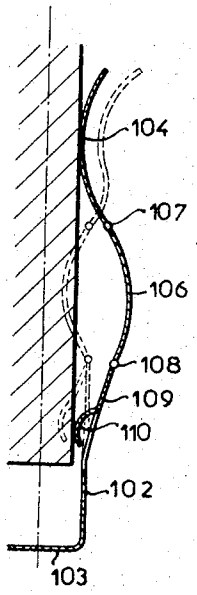


FIG.3

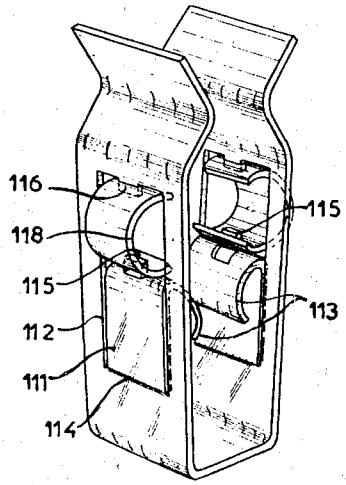


FIG.4

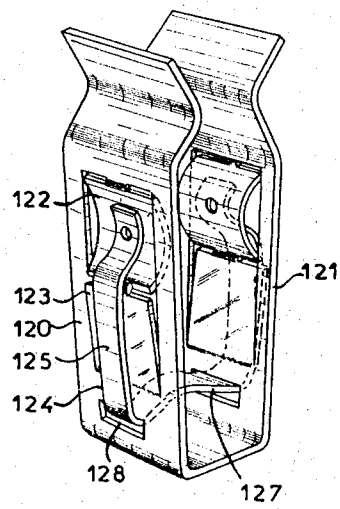
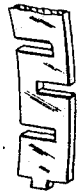


FIG.5



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ELECTRICAL CONNECTOR

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Original application June 2, 1964, Ser. No. 371,905, now Patent No. 3,300,752, dated Jan. 24, 1967. Divided and this application Jan. 17, 1967, Ser. No. 617,748

Claims priority, application France, June 24, 1963, 939,143

7 Claims. (Cl. 339—253)

ABSTRACT OF THE DISCLOSURE

An elastically deformable socket for receiving an electrical connector plug, a portion of the socket being laterally deformable between a normally open position in which it offers little resistance to the movement of the plug and a closed position in which it tightly grips the plug, the socket including a control member disposed in the path of movement of the plug and operatively associated with the deformable plug portion for causing this portion to move abruptly into its closed position when the plug comes to bear against the control member, the deformable plug portion abruptly returning to its open position when the plug moves out of contact with the control member.

This is a division of applicant's copending application Ser. No. 371,905, filed on June 2, 1964, now Patent No. 3,330,752.

Background of the invention

The present invention relates to electrical connectors, and more particularly to electrical plug sockets of the elastically deformable type.

It is a primary object of the present invention to assure, in an electrical circuit, a positive contact between a plug and a socket.

It is another object of the present invention to achieve such a contact through the action of the pressure applied to insert the plug into the socket.

It is still another object of the present invention to provide mechanically simple receptacles which apply a positive lateral force to their mating plugs, the application of such force being triggered by the insertion of the plug.

Yet another object of the present invention is to provide a more forceful contact than that which is obtainable in the prior art spring contact devices.

Summary of the invention

Briefly stated, the present invention involves socket members made of elastically deformable material and arranged to pass abruptly from an open state to a closed state, under the influence of a force exerted by a plug on a control member when the plug encounters the control member during insertion.

This arrangement permits the simple act of inserting a plug to automatically produce a tight gripping action by the socket, thus assuring a connection which is extremely solid, both electrically and mechanically. Such an arrangement also permits plugs having various sizes and shapes to be firmly held in a given socket.

These and other objects of the present invention are achieved by the provision of an electrical connector socket having a plug contacting portion, deforming means operatively associated with the contacting portion, and control means operatively associated with the deforming means. The plug contacting portion is arranged for receiving a plug inserted in a longitudinal direction

therein, the portion being transversely deformable between a normally open position, in which it offers substantially no resistance to plug insertion, and a closed position, in which it tightly grips an inserted plug. The deforming means are arranged for deforming the plug contacting portion abruptly between its two positions. Finally, the control means is biased into a non-deflected position in which it is disposed in the path along which such plug moves during insertion in the socket, and is deflected out of such position when encountered by the plug being inserted, for causing the deforming means to normally maintain the plug contacting portion in its open position when the control means is in its non-deflected position and to abruptly deform the plug contacting portion into its closed position when the plug deflects the control means out of its non-deflected position during insertion.

In one specific embodiment of the present invention, the plug contacting portion is composed of at least one elastically deformable blade, or leaf spring, while the deforming means are constituted by a bistable elastic means which maintains the blade in its open position when no plug is present in the socket and which is acted on by the control means, when the control means are deflected by an inserted plug, to urge the blade into its closed position.

Brief description of the drawings

FIGURE 1 is a perspective view of one embodiment of the present invention.

FIGURE 2 is a longitudinal, cross-sectional view of one portion of the embodiment of FIGURE 1 showing the socket deformation produced by the insertion of a plug.

FIGURE 3 is a perspective view of another embodiment of the present invention.

FIGURE 4 is a perspective view of a further embodiment of the present invention.

FIGURE 5 is a perspective view of a part from which modified elements of the embodiments of FIGURES 1 to 4 may be constructed.

Description of the preferred embodiment

In the embodiment shown in FIGURES 1 and 2, the plug contacting portion of an abrupt closing female connector is composed of two clamping portions **101**, **102**, integral with a base portion **103**; the portions **101**, **102**, terminating in respective inwardly arched plug engaging portions **105**, **104**. By means of suitable cutting and deforming operations, each of the portions **101** and **102** has formed, integrally therewith, deforming means constituted by a lateral inwardly arched spring member **106** effectively pivoted, at **107**, to the body of its respective portion and, at **108**, to a control means constituted by an elastic restoring and control member **109**. The member **109** has a finger member **110** cut in its center and folded so as to extend into the region enclosed by the female connector and into the path along which a plug will move during insertion.

The spring member **106** is permanently deformed in such a way that it can assume either one of two stable states, in one of which it flexes inwardly of the region defined by the connector, as shown in FIGURE 1, and in broken lines in FIGURE 2, and in the other of which it is flexed outwardly thereof, as shown in solid lines in FIGURE 2. The flipping from one stable state to the other is caused by the lateral deflection of control member **109**, this deflection being urged by a pressure applied against finger **110**. When no pressure is being applied on this finger, the elastic forces existing between member **110** and its respective clamping portions tend to urge the spring **106** towards its inwardly deflected state. It thus results that, in the normally open state of the connector the

springs **106** have their concave faces toward the exterior, causing the plug engaging members **104** and **105** to be in an open state.

When a plug is inserted into the female connector thus formed, it moves thereinto until its leading edge encounters the fingers **110**, at which time it exerts an outward pressure thereon which causes the members **109** to bend outwardly. This movement induces an abrupt flexure of springs **106** from their inwardly curved state to an outwardly curved condition, the new spring positions abruptly moving plug engaging portions **104** and **105** firmly against the side walls of the inserted plug. Upon plug withdrawal, the plug need only move against the strong gripping pressure of members **104** and **105** for a short distance until clearing fingers **110** because once these fingers no longer bear against the plug, the elastic forces on member **109** and the pressure of the plug against portions **104** and **105** combine to cause the spring **106** to return to its original stable state, thus inducing an abrupt opening of the plug engaging contacts **104** and **105**.

In the embodiment shown in FIGURE 3, a bistable spring element **111** constitutes the rear portion of a strip produced by a series of cuts **112** taken in the body of the female connector contacting portion. The front portion **113** of this strip is folded towards the interior of the region enclosed by the connector unit to form a control means having an abutting surface for a plug to be inserted. The element **111** thus has one end integrally and elastically joined to the body of the connector along linear region **114**. The front edge of this element comprises a salient finger **115** extending across from a similar finger **116** formed in the front edge of the opening created in the wall of the connector by cuts **112**. An arched spring member **118**, having appropriate slots therein, is held in place in the opening in the connector wall by the fingers **115** and **116**, inserted into respective ones of these slots. The spring **118** constitutes, together with fingers **115** and **116**, the deforming means of this embodiment and serves to return the contacting portion to, and maintain it in, its open position. This closing of the connector is here produced by the outward deflection of spring elements **111** under the pressure of plug (not shown) against abutting surfaces **113**, which deflection is translated into a closing of the forward portions of the female connector arms through the intermediary of rotation induced in the spring member **118**.

The embodiment shown in FIGURE 4 is similar to that shown in FIGURE 1 in that the same cutting and forming steps can be followed to produce the elastic restoring element **123** and the bistable arched spring **122** in each of arms **120** and **121** as were employed to produce the corresponding elements **109** and **106** of FIGURE 1. The manner of operation and the way in which a plug gripping action is achieved in the FIGURE 4 device are exactly the same as those described in connection with the embodiment of FIGURES 1 and 2. On the other hand, the control means is constituted in FIGURE 4 by a spring clip **124** permanently bent into the form of a U having two upright elements **125**, of which the forward ends are each arranged on the outside of the connector and are attached to a respective spring element **122** by appropriate means. The rear portions of upright elements **125** are integrally associated with a base portion **127** of spring **124** which passes through the openings **128** in the lower ends of the connector arms **120** and **121** and traverses the bottom of the female connector unit.

When a male plug (not shown) is inserted, it traverses the female connector arms **120** and **121** until its leading edge abuts on base **127**. Continued insertion of the plug causes a rearward movement of base **127**, which is translated into a spreading of uprights **125** which induces a sudden outward deflection of spring elements **122**, resulting in the abrupt closing of the forward ends of connector arms **120** and **121**.

FIGURE 5 shows a preferred manner of producing the deflecting springs described above, in which a series of lateral slots are cut in order to achieve the desired flexibility.

It will be understood that the above description of the present invention is susceptible to various modifications, changes and adaptations and the same are intended to be comprehended within the meaning and range of equivalents of the appended claims.

We claim:

1. An electrical connector socket for receiving a plug and comprising, in combination:

(a) a plug contacting portion for receiving the plug when the same is inserted into the socket in a longitudinal direction, said portion being transversely deformable between a normally open position, in which it offers substantially no resistance to plug insertion, and a closed position, in which it tightly grips an inserted plug, said plug contacting portion being composed of at least one longitudinally extending, elastically deformable strip having an opening therein;

(b) deforming means operatively associated with said contacting portion for deforming said portion abruptly between its said positions, said deforming means being composed of at least one bistable arched leaf spring, one for each said strip, held in a longitudinally flexed state in said opening of its associated strip and between the longitudinally separated edges thereof; and

(c) control means operatively associated with said deforming means, said control means being biased into a non-deflected position in which it is disposed in the path along which such plug moves during insertion into the socket and being deflectable out of such position when encountered by the plug being inserted, said control means being arranged for causing said deforming means to normally maintain said portion in its said open position when said control means is in its said non-deflected position and to abruptly deform said portion into its said closed position when such plug deflects said control means out of said non-deflected position during insertion.

2. An arrangement as defined in claim **1** wherein said control means are constituted by at least one finger rigidly connected to said deforming means and extending into the region enclosed by said socket.

3. An arrangement as defined in claim **1** wherein said deforming means are integral with said contacting portion.

4. An arrangement as defined in claim **1** wherein there are provided two longitudinally extending, elastically deformable strips and two bistable arched leaf springs, each associated with a respective one of said strips, and wherein said control means is constituted by a substantially U-shaped spring clip having two longitudinally extending legs, each associated with a respective one of said strips, and a base portion extending between said legs and disposed in the path along which such plug moves during insertion, said clip being arranged to be moved in a longitudinal direction by such plug during its insertion.

5. An arrangement as defined in claim **1** wherein said control means, when in its non-deflected position, maintains said leaf spring in an inwardly-deflected position, and said control means deflects said leaf spring outwardly, with respect to the region enclosed by said socket, when such plug deflects said control means out of said non-deflected position during insertion.

6. An arrangement as defined in claim **1** wherein said control means is disposed near the end of the path along which such plug moves during insertion, in consequence of which said contacting portion remains in its said open position until such plug has been substantially completely inserted into the socket.

7. An electrical connector socket for receiving a plug and comprising, in combination:

(a) a plug contacting portion for receiving the plug when the same is inserted into the socket in a longitudinal direction, said portion being transversely deformable between a normally open position, in which it offers substantially no resistance to plug insertion, and a closed position in which it tightly grips an inserted plug, said contacting portion being constituted by at least one longitudinally extending, elastically deformable strip having an opening formed therein;

(b) deforming means operatively associated with said contacting portion for deforming said portion abruptly between its said portions; and

(c) control means operatively associated with said deforming means and constituted by at least one strip element, one for each said strip, disposed in said opening of its associated strip and connected to the rear edge of said opening, taken in the direction of plug insertion, said control means being biased into a non-deflected position in which it is disposed in the path along which such plug moves during insertion into the socket and being deflectable out of such position when encountered by the plug being inserted, said control means being arranged for

causing said deforming means to normally maintain said portion in its said open position when said control means is in its said non-deflected position and to abruptly deform said portion into its said closed position when such plug deflects said control means out of said non-deflected position during insertion;

(d) wherein said deforming means are composed of at least one substantially rigid curved member, one for each said strip, disposed in said opening of its associated strip and connected between its associated control means and the forward edge of its associated opening, taken in the direction of plug insertion.

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