

2
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MULTIPLE ELECTRICAL CONNECTOR WITH SELECTIVELY
POSITIONABLE POLARIZING MEMBER
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FIG. 2

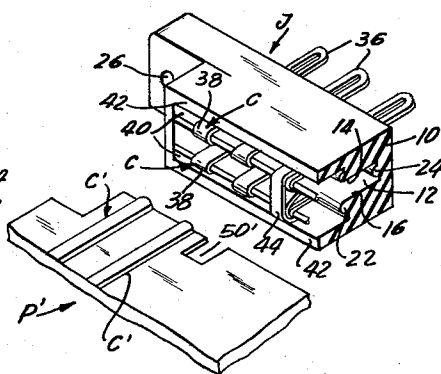
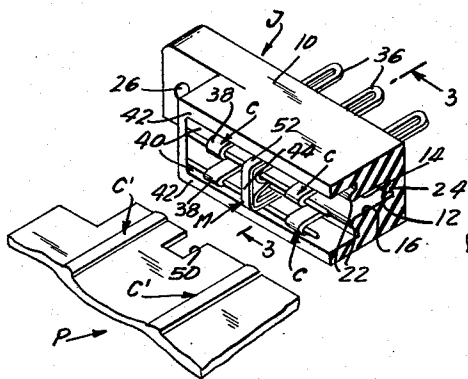


FIG. 3

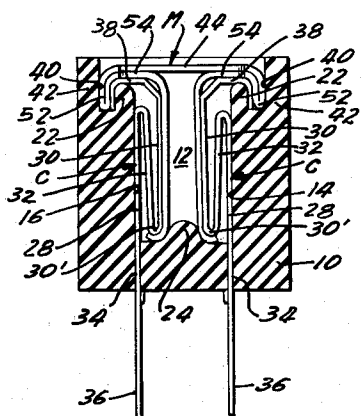
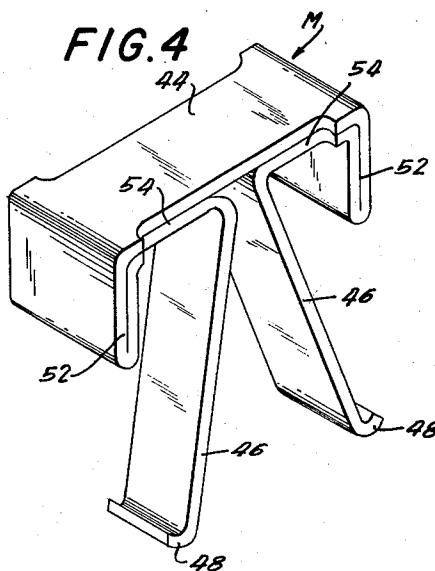


FIG. 4



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1

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MULTIPLE ELECTRICAL CONNECTOR WITH SELECTIVELY POSITIONABLE POLARIZING MEMBER

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16 Claims. (Cl. 339—184)

This invention relates to improvements in multiple electrical connectors, and in particular to the use in conjunction therewith of a member selectively positionable so as to ensure that only predetermined elements can be assembled together, and only when those predetermined elements are in proper relative orientation.

The invention is particularly adaptable for use, and is here specifically illustrated as embodied in, connectors of the miniature type comprising a jack or socket having multiple miniature contact elements, which jack or socket is adapted or designed to receive printed cards, panels or plugs provided with mating multiple circuit contacts. One type of such connector is disclosed and claimed in my application Ser. No. 533,114 of September 8, 1955, now Patent No. 2,875,425, entitled "Multiple Electrical Connector," and assigned to the assignee of this application.

In multiple electrical connectors of this referred to type, a large group of miniature contact elements, ranging from ten to twenty or more, are mounted in closely spaced relation in a single socket designed to receive a printed circuit board or card or similar plug containing a correspondingly large group of closely spaced circuit elements adapted for mating contact with said contact elements. In many applications a given socket is adapted to be used with a given printed circuit board or with a preselected plurality of such boards when the contact elements in the socket are connected to external circuitry in a particular way or when a particular task or family of tasks is to be accomplished, and to be used with a different printed circuit board or with a different preselected plurality of such boards when the socket contacts are connected to different external circuitry or when a different task or family of tasks is to be accomplished. It is most desirable that some way be provided for ensuring that, with the socket contacts connected to external circuitry in a particular way or for a given task or family of tasks, only the printed circuit cards appropriate thereto can be used, and when the external connections to the socket contacts are changed only the appropriate printed circuit cards can be used. Moreover, for any given situation, it is important to ensure that the printed circuit cards are inserted into the socket with the correct orientation relative thereto.

It has been proposed in the past to provide a polarizing member on the socket, usually in the form of an irregularity in the interior of the socket and formed integral therewith, which will cooperate with a corresponding irregularity in the printed circuit card in order to ensure that the card is inserted with the proper relative orientation. These polarizing members of the prior art were effective for that limited purpose, but, because they were a permanent part of the socket, could not be used to differentiate between different groups of printed circuit cards. Hence it was necessary to replace one socket with a differently constructed socket if positive rejection of inappropriate printed circuit cards was to be effected. This not only made for lack of flexibility in

2

operation of the equipment in which these connectors are employed, e.g. electronic computers, but also necessitated the use of non-standard components, aggravated inventory problems, and made for increased expense of manufacture.

In accordance with the present invention a polarizing member is formed separate from the socket and is adapted to be inserted into the socket in any desired position, the member being so constructed as to engage the elements in the socket, and specifically the contacts themselves, to the end that the polarizing member will retain itself in the position where it is placed. Thus when such a member is placed in one position it will permit the socket to accept only those printed circuit cards which are appropriately configured and to reject all other cards, and if, as will usually be the case, the polarizing member is inserted off-center relative to the length of the opening in the socket into which the printed circuit card is inserted, the appropriate cards will enter the socket only when in proper relative orientation thereto. The polarizing members may be disengaged from the socket at will and reinserted at a new position, then conditioning the socket for receiving a different group of appropriately configured printed circuit cards and rejecting all other cards, including the cards of the first mentioned group.

As a result the same socket may be used for all purposes, it being necessary only to change the location of the polarizing member in order to adapt the socket to receive a different group of printed circuit cards.

When the polarizing member is formed of conducting material and when the socket is provided with opposed pairs of contacts, the polarizing member can serve the additional function of electrically connecting the contacts of a given opposed pair whether the printed circuit card is inserted or not.

The polarizing member of the present invention is particularly well adapted for use with sockets having contacts in the form of resiliently compressible bellows such as those disclosed in my aforementioned application Ser. No. 533,114, the polarizing member compressing the bellows of the contacts with which it is engaged, so that the resiliency of those contacts aids in retaining the polarizing member in position.

While the present invention is here specifically disclosed in connection with a socket of the type shown in my aforementioned application Ser. No. 533,114, it will be apparent that in its broader aspect it is applicable for use in other types of connectors and with other types of contacts.

To the accomplishment of the above, and to such other objects as may hereinafter appear, the present invention relates to the construction of a multiple electrical connector with which a specially designed polarizing member is associated, as defined in the appended claims and as described in this specification, taken together with the accompanying drawings, in which:

Fig. 1 is a fragmentary three-quarter perspective exploded view of a multiple electrical connector and a printed circuit card adapted to be used therewith, the polarizing member of the present invention being located in a given position;

Fig. 2 is a view similar to Fig. 1 but showing the polarizing member in a different position and illustrating the type of printed circuit card which would cooperate therewith;

Fig. 3 is a cross sectional view taken along the line 3—3 of Fig. 1; and

Fig. 4 is a three-quarter perspective view on an enlarged scale of the polarizing member itself.

The multiple electrical connector here illustrated comprises a jack or socket assembly generally designated J

3

adapted to receive a printed circuit plug assembly generally designated P or any like assembly, the said jack assembly J being provided with a plurality of miniature contact elements *c*, the printed circuit plug assembly P being provided with a plurality of circuit elements or strips *c'* the termini of which define contact elements for mating cooperation with the contact elements *c* of the jack assembly J.

The jack assembly J comprises more specifically a receptacle or socket member 10 made of a single molded piece of insulation formed with a central longitudinal trough or open-topped opening 12 for receiving the plug assembly P, the said trough being defined by two oppositely facing walls 14 and 16. The receptacle 10 is also formed at its top with shoulders 22, 22 extending the length of the trough and with a boss or protuberance 24 at its bottom also extending the length of the trough. The receptacle 10 may also be formed with terminal lug portions 26, 26 for the reception of attaching elements.

Each of the contact elements *c*, *c* comprises a bellows shaped spring unit made from strip spring stock such as spring tempered Phosphor bronze (which may be gold plated over silver for obtaining low contact resistance) having three branches, an innermost branch 28 being lodged against the inside wall such as the wall 14 or the wall 16 of a pocket 18, an outermost branch 30 defining the contact which is engageable by a mating contact of the plug assembly and an intermediate branch 32 forming a spring connection between the other two branches. The lower end of the innermost branch 28 of each bellows shaped contact *c* is anchored as at 34 to the body of the receptacle 10 and the protruding ends 36 thereof define terminal ends to which conductors may be connected as by soldering. The outermost branch 30 of the contact *c* terminates at its upper end in a hook portion 38 which is engaged by and over the shoulder wall 22, the end of the hook portion having a limited freedom of movement in a recess 40 formed between said shoulder and the outer walls 42 of the receptacle. The wall shoulder 22 forms a stop for limiting the outward movement of the top of the contact elements *c* and the boss 24 forms a stop for limiting the outward movement of the bottom of the contact elements *c*. It is preferred to have a double line of contact elements *c*, *c* arranged in oppositely facing pairs. The manner in which this particular type of bellows-shaped contact functions to receive printed circuit boards P of widely varying thicknesses and to make effective electrical connection over an appreciable surface area with the circuit strips *c'* is explained in my aforementioned application Ser. No. 533,114.

The polarizing member of the present invention, generally designated M, is here disclosed as formed from a single strip of resilient conductive material such as Phosphor bronze, but it is not essential, and in some instances it may not be desired, that the material of which it is formed be conductive. It comprises a top portion 44 having a width which is but a minor fraction of the length of the opening 12, and which preferably corresponds to the width of the socket contacts *c*. Depending from the top portion 44 at points spaced inwardly from the ends thereof are a pair of legs 46 which are resiliently urged outwardly into diverging relationship, as clearly shown in Fig. 4, these legs 46 having outwardly projecting hooked parts 48 at their free ends. The legs 46 are adapted to extend into the opening 12 through the open top thereof and make snap engagement with an opposed pair of socket contacts *c*, thereby to releasably but reliably retain the polarizing member M in a desired position along the length of the opening 12 as determined by the location of the contacts *c* with which it engages. In the form here specifically disclosed, and as may clearly be seen in Fig. 3, the arms 46 of the polarizing member M engage and extend along the outer surfaces of the outermost branches 30 of the bellows contacts *c*, the hooks 48 engaging under the free end portions 30' of

4

those contacts *c* and being interposed between those free end portions 30' and the socket boss 24 which normally ensures their separation. The top portion 44 of the polarizing member M extends across the open top of the opening 12 from one side to the other thereof. Consequently, as may clearly be seen from a comparison of Figs. 1 and 2, for a given location of the polarizing member M, only those printed circuit cards P having an appropriately positioned recess 50 in its lower edge, that is to say, a recess 50 which registers with the polarizing member M, can be inserted into the socket or jack assembly J. In Fig. 1 the polarizing member M is located between the second pair of socket contacts from an end of the socket, whereas in Fig. 2 it is positioned between the third pair of socket contacts *c* from the end. The printed circuit panel P of Fig. 1 is provided with a recess 50 positioned corresponding to the location of the polarizing member of Fig. 1, while the printed circuit card P' of Fig. 2 has its recess 50' located corresponding to the position of the polarizing member M of Fig. 2. Consequently the printed circuit card P will be received in the socket of Fig. 1, but the printed circuit panel P' will not, since the lower edge of the latter will engage the polarizing member M in the socket of Fig. 1 and thus prevent movement of the panel P' into the socket. Similarly the panel P of Fig. 1 could not be inserted into the socket of Fig. 2. Moreover, since the polarizing member M is located off-center with respect to the socket opening 12, each of the panels P and P' could be inserted into their corresponding sockets only when properly oriented relative thereto.

In order to rigidify and strengthen the polarizing member M and enhance its engagement with a selected opposed pair of socket contacts *c*, particularly when those contacts take the form here disclosed, the top portion 44 extends from one socket recess 40 to the other and therefore completely across the open top of the opening 12, and is provided with a downturned portion 52 which enters into the recesses 40 outside the hook portions 38 of the socket contacts *c* and substantially fills those recesses 40, thus preventing any outward movement of the contact hook portions 38. Integral extensions 54 from the downturned portions 52 extend under the top portion 44, and the legs 46 extend integrally therefrom. With this particular design of polarizing member M the force resiliently urging the legs 46 outwardly may be greater than the resilient force of the bellows contacts *c*, with the result that when the polarizing member M is inserted in a given position it will be very reliably retained there, the bellows contacts *c* being compressed and serving to hold the free ends of the legs 46 against the boss 24, thereby effectively inhibiting their release. Moreover, the top portion 44 of the polarizing member M, against which pressure will be exerted if an undesired or improperly aligned printed circuit panel P is urged into the socket, is rigidified by being of two-ply construction over substantially its entire length and is further supported over an appreciable area adjacent its ends by the contacts *c* and by the shoulders 22 of the socket J. Hence it is much less liable to accidental damage or distortion and may be made of thinner material than would otherwise be the case.

If for any reason it is desired that a different set of printed circuit panels P be accepted by the assembly, as if the external connections to the sockets *c* are changed or if a different set of problems are to be solved by a computer and the possibility of human mistake in inserting the wrong panel into the socket is to be eliminated, one can readily disengage the polarizing member M from the socket C by inserting an appropriate tool into the opening 12 when the panel P is removed therefrom and manipulating the contacts *c* and the polarizing member legs 46 so as to disengage the hooks 48 from beneath the free end portion 30' of the contacts *c*. The polarizing member M may then be lifted out and brought to its new

position. The legs 46 may be moved toward one another sufficiently to permit them to enter the opening 12 and the polarizing member M may then be slid downwardly into place, the hooks 48 snapping into position when the polarizing member M has been fully inserted.

Thus through the use of the present invention a manufacturer may produce and sell a single socket or jack assembly for all applications of a given type, that assembly being modifiable at the point of use through the use of a polarizing member of the type here disclosed in accordance with the particular operating conditions then existing, and the socket or jack assembly can be modified at will at the point of use in order to correspond to other operating conditions. Consequently parts may be standardized despite the lack of standardization of the manner of use. The resultant savings, from the point of view of initial manufacture, repair, maintenance and replacement, are obvious. The polarizing member can also be used as a "jumper" or connector between contacts either independently of, or in addition to, its polarizing function. The parts involved, while they can be made very small, are nevertheless sturdy and reliable.

While but a single embodiment of the present invention has been here disclosed, it will be apparent that many variations may be made therein, for example, and without limitation, with respect to the specific structure of the polarizing member and contacts and the manner in which snap or releasable engagement is attained between the polarizing member and the contacts or other elements of the socket, all within the scope of the present invention as defined in the following claims.

I claim:

1. In combination, a socket having an elongated open-topped opening into which a terminal board or the like is adapted to be received, a plurality of resiliently compressible contacts in said opening and spaced therealong, a polarizing member comprising a top portion fixedly extending substantially across the top of said opening from one side thereof toward the other, and a leg extending downwardly from said top portion into said opening in registration with one of said contacts, and resiliently urged outwardly toward the side of said opening and toward the registering contact, said leg lockingly engaging the registering contact, thereby to releasably retain said polarizing member in a desired position along said opening.

2. In combination, a socket having an elongated open-topped opening into which a terminal board or the like is adapted to be received, a plurality of contacts in said opening and spaced therealong, said contacts being resiliently compressible and having free end portions remote from the top of said opening, a polarizing member comprising a top portion fixedly extending substantially across the top of said opening from one side thereof toward the other, and a leg extending downwardly from said top portion into said opening in registration with one of said contacts, and resiliently urged outwardly toward the side of said opening and toward the registering contact, said leg having a part engaging with the free end portion of the registering contact, thereby to releasably retain said polarizing member in a desired position along said opening.

3. In combination, a socket having an elongated open-topped opening into which a terminal board or the like is adapted to be received, a plurality of contacts in said opening and spaced therealong, said contacts being resiliently compressible and having free end portions remote from the top of said opening, a polarizing member comprising a top portion fixedly extending substantially across the top of said opening from one side thereof toward the other, and a leg extending downwardly from said top portion into said opening in registration with one of said contacts, and resiliently urged outwardly toward the side of said opening and toward the registering contact with a force greater than the resiliency of said registering contact, said leg engaging with the free end portion of said

registering contact, thereby to releasably retain said polarizing member in a desired position along said opening.

4. In combination, a socket having an elongated open-topped opening into which a terminal board or the like is adapted to be received, a plurality of contacts in said opening and spaced therealong, said contacts being in the form of resiliently compressible bellows having free end portions remote from the top of said opening, a polarizing member comprising a top portion fixedly extending substantially across the top of said opening from one side thereof toward the other, and a leg extending downwardly from said top portion into said opening in registration with one of said contacts, and resiliently urged outwardly toward the side of said opening and toward said registering contact with a force greater than the resiliency of said bellows, said leg having a part engaging with the free end portion of said registering bellows contact, thereby to releasably retain said polarizing member in a desired position along said opening.

5. In combination, a socket having an elongated open-topped opening into which a terminal board or the like is adapted to be received, a plurality of opposed pairs of contacts in said opening and spaced therealong, said contacts being resiliently compressible and having free end portions remote from the top of said opening, a polarizing member comprising a top portion fixedly extending substantially across the top of said opening from one side thereof toward the other, and legs extending downwardly from said top portion into said opening between and respectively registering with an opposed pair of contacts, and resiliently urged outwardly toward the sides of said opening and toward said registering contacts with a force greater than the resiliency of said contacts, said legs having parts engaging with the free end portions of a selected opposed pair of contacts, thereby to releasably retain said polarizing member in a desired position along said opening.

6. The combination of claim 1, in which said socket has auxiliary openings laterally disposed relative to said first mentioned opening and said contacts have portions received in said auxiliary openings, said top portion of said polarizing member extending to at least one of said auxiliary openings and having a downwardly extending part extending into said one of said auxiliary openings and over said contact portion in said one of said auxiliary openings.

7. The combination of claim 2, in which said socket has auxiliary openings laterally disposed relative to said first mentioned opening and said contacts have portions received in said auxiliary openings, said top portion of said polarizing member extending to at least one of said auxiliary openings and having a downwardly extending part extending into said one of said auxiliary openings and over said contact portion in said one of said auxiliary openings.

8. The combination of claim 3, in which said socket has auxiliary openings laterally disposed relative to said first mentioned opening and said contacts have portions received in said auxiliary openings, said top portion of said polarizing member extending to at least one of said auxiliary openings and having a downwardly extending part extending into said one of said auxiliary openings and over said contact portion in said one of said auxiliary openings.

9. The combination of claim 4, in which said socket has auxiliary openings laterally disposed relative to said first mentioned opening and said contacts have portions received in said auxiliary openings, said top portion of said polarizing member extending to at least one of said auxiliary openings and having a downwardly extending part extending into said one of said auxiliary openings and over said contact portion in said one of said auxiliary openings.

10. The combination of claim 5, in which said socket has auxiliary openings laterally disposed relative to said first mentioned opening and said contacts have portions

received in said auxiliary openings, said top portion of said polarizing member extending to at least one of said auxiliary openings and having a downwardly extending part extending into said one of said auxiliary openings and over said contact portion in said one of said auxiliary openings.

11. In combination, a socket having an elongated open-topped opening into which a terminal board or the like is adapted to be received, a plurality of resiliently compressible contacts in said opening and spaced therealong to define pairs of opposed contacts, a polarizing member comprising a top portion fixedly extending substantially across the top of said opening from one side thereof toward the other, and legs extending downwardly from said top portion between and respectively registering with an opposed pair of contacts and resiliently urged outwardly toward the sides of said openings and toward said registering contacts, said legs lockingly engaging the contacts with which they respectively register, thereby to releasably retain said polarizing member in a desired position along said opening.

12. The combination of claim 11, in which said socket has auxiliary openings laterally disposed relative to said first mentioned opening and said contacts have portions received in said auxiliary openings, said top portion of said polarizing member extending completely across the top of said first mentioned opening from one of said auxiliary openings to the other and having downwardly extending parts extending into said auxiliary openings and over said contact portions in said auxiliary openings.

13. In combination, a socket having an elongated open-topped opening into which a terminal board or the like is adapted to be received, a plurality of contacts in said opening and spaced therealong to define pairs of opposed contacts, said contacts being resiliently compressible and having free end portions remote from the top of said opening, a polarizing member comprising a top portion fixedly extending substantially across the top of said opening from one side thereof toward the other, and legs extending downwardly from said top portion between and respectively registering with an opposed pair of contacts and resiliently urged outwardly toward the sides of said opening and toward said registering contacts, said legs having parts engaging with the free end portions of the contacts with which they respectively register, thereby to releasably retain said polarizing member in a desired position along said opening.

14. The combination of claim 13 in which said socket has auxiliary openings laterally disposed relative to said first mentioned opening and said contacts have portions

received in said auxiliary openings, said top portion of said polarizing member extending completely across the top of said first mentioned opening from one of said auxiliary openings to the other and having downwardly extending parts extending into said auxiliary openings and over said contact portions in said auxiliary openings.

15. In combination a socket having an elongated open-topped opening into which a terminal board or the like is adapted to be received, a plurality of contacts in said opening and spaced therealong to define pairs of opposed contacts, said contacts being in the form of resiliently compressible bellows having free end portions remote from the top of said opening, a polarizing member comprising a top portion fixedly extending substantially across the top of said opening from one side thereof toward the other, and legs extending downwardly from said top portion into said opening between and respectively registering with an opposed pair of contacts and resiliently urged outwardly toward the sides of said opening and toward said registering contacts with a force greater than the resiliency of said bellows contacts, said legs having parts engaging with and beneath the free end portions of the bellows contacts with which they respectively register, thereby to releasably retain said polarizing member in a desired position along said opening.

16. The combination of claim 15 in which said socket has auxiliary openings laterally disposed relative to said first mentioned opening and said contacts have portions received in said auxiliary openings, said top portion of said polarizing member extending completely across the top of said first mentioned opening from one of said auxiliary openings to the other and having downwardly extending parts extending into said auxiliary openings and over said contact portions in said auxiliary openings.

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