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ELECTRICAL CONNECTORS

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This invention relates to electrical connectors, and particularly to a unique configuration of a dielectric connector body and to an improved arrangement of the parts of the metallic contacts carried therein.

It is among the primary objects of the invention to provide sheet metal contacts of improved and novel form, together with a molded dielectric receptacle having contact cavities so related to the contacts that they may be easily, quickly and conventionally mounted or removed, either before or after the conductor wires associated with the individual contacts are attached thereto. More specifically, it is an object of the invention to provide sheet metal contacts so designed that they may be soldered or crimped to the terminal ends of flexible wire conductors prior to assembly and assembled with the connector housing by manually snapping the contacts into place without the necessity for any type of tool to accomplish the installation. It is a related object, however, to provide a contact and housing therefor of such mechanical design that the individual contacts, while adapted to hold themselves firmly in their respective cavities under normal circumstances, may nonetheless be easily removed without unsoldering the terminals and without disturbing adjacent contacts in the same connector.

An extremely important object of the invention is the provision of contacts adapted for use in multiple connectors of the smaller types, and in the so-called "printed circuit" connectors, wherein a thin sheet or "board" of dielectric material provided with conductive strips on its face surfaces is employed as the plug of the connector. According to the present invention, both the connector receptacles and the metallic contacts thereof are of such design as to be capable of establishing and maintaining a dependable high conductivity electrical union between each contact and its corresponding circuit board terminal, and of such design as to lend themselves to production methods whereby an unusually high degree of uniformity may be maintained as to insertion and withdrawal forces before and after an extended period of use, as well as between the several contacts which may be included in a single connector.

A further object of the invention is to provide an electrical contact having the characteristics indicated above and of such mechanical design as to be capable of repeatedly engaging and releasing the coating terminal portion of a circuit board smoothly and dependably without perceptible tendency toward scratching, galling or otherwise damaging the rather delicate surfaces of the circuit board.

Another object of the invention is the provision of an improved circuit board connector having the desirable qualities indicated above, wherein provision is not only made for polarizing the connector to prevent improper insertion of the circuit board in the receptacle, but wherein in each of the individual contacts are also polarized with respect to their separate cavities so that they cannot be inadvertently reversed or otherwise improperly inserted therein.

The above objects are accomplished in the present invention by the combination of a plurality of metal contacts and a molded dielectric receptacle of the forms hereinbefore disclosed. The dielectric body, which in its preferred form is designed as a circuit board connector, may consist of a single one-piece molded part formed of dielectric material throughout, with a plurality of individual contact cavities of novel form each arranged to house one of the contacts. The contacts themselves are also of novel configuration and structure, as well as being of mechanical design particularly suited to mass production, and so constructed that they may achieve minimum variation of operating characteristics without resorting to impractical manufacturing tolerances.

As illustrated, the connector may be of the form shown in the attached drawing, wherein:

FIGURE 1 is a plan view of a typical circuit board connector constructed in accordance with the present teachings, showing the formation of the central channel in which the circuit board may be inserted between opposite rows of opposed contact cavities. The view is shown with most of the metal contacts removed from the cavities for clarity.

FIGURE 2 is a detail sectional view taken substantially on the plane of the line 2-2 of FIGURE 1 and showing the contacts;

FIGURE 3 is a detail sectional view similar to FIGURE 2 but showing the manner in which the blades of the metal contacts are flexed by the insertion of the terminal edge of a circuit board;

FIGURE 4 is a detail sectional view taken substantially on the plane of the line 4-4 of FIGURE 2 and showing the relationship between the metal contacts and the cavities in which they are housed;

FIGURE 5 is a detail sectional view taken substantially on the plane of the line 5-5 of FIGURE 2; and

FIGURE 6 is a perspective view of a preferred embodiment of metallic contact employed in the connector.

The connector illustrated includes a molded dielectric body portion or receptacle 10 formed of relatively hard dielectric material throughout and of elongated rectangular shape. The mounting ears 11 provided at each end of the piece are pierced at 12 to provide for attachment to other equipment. The length of the receptacle may vary in accordance with individual requirements, particularly as to the number of contacts required.

As illustrated, the receptacle has a long, narrow, deep longitudinal channel 13 extending inwardly from the front face 14 of the connector to a bottom wall 15 continuous with the back surface 16. This narrow channel 13 is thus adapted to receive a leading terminal edge of a printed circuit board 17 (FIGURE 3) which may include conventional conductive strips 18 on one or both of its opposed face surfaces. The channel 13 is preferably beveled around its forward edges as illustrated at 19, to facilitate insertion of the circuit board. Also, if desired, one or both of the ends of the channel may have an offset recess 21 to provide clearance for polarizing keys (not shown) which may be mounted on the edges of the circuit board.

One or both of the inside face walls 22, 23, of the receptacle channel 13 are provided with a series of contact cavities 24 which, in the preferred construction of the invention, may be of identical formation and regularly spaced on opposite sides of the channel 13. Each of these cavities consists of a generally rectangular core opening extending entirely through the dielectric body from the front face 14 through the bottom wall 15 and to the rear face 16 of the receptacle. These core cavities are spaced slightly beyond the sides of the channel walls 22 and 23, but are connected to the channel by means of narrow central slots 25, so that a pair of relatively thin, oppositely disposed retaining flanges 26 are provided along the inside edges of each of the barrier walls 27 formed between the contact cavities (FIGURE 4). Each of the cavities is also provided with a relatively small rectangular groove 28 extending downward the outer wall of
the cavity 24 and terminating in a retaining shoulder 29 (FIGURE 2). The metallic contacts of the connector are preferably sheet metal stampings with each of the individual contacts formed from a single integral sheet die cut and folded upon itself to provide a relatively rigid mounting Shank supporting a comparatively yieldable spring contact blade. The formation of the parts of the contacts is such that they are adapted to be retained in the contact cavities heretofore described by a snap action latch so designed that the contacts may be inserted without tools and may be easily removed if required. The arrangement of parts illustrated also provides the connector with integral yieldable contact blades having sufficient resiliency to maintain adequate surface-to-surface pressure on the mating circuit board, but with means for limiting the flexing movement of the contact blades.

To accomplish the above objectives, the individual metal contacts are formed with a relatively rigid elongated shank member 31 consisting of a fairly wide, flat outside web 32 having a pair of relatively narrow reinforcing flanges 33 disposed along its opposite longitudinal edges and extending from the flanges 33 at an intermediate point along their length. Thus, when the contact shank 31 is inserted into one of the cavities 24 of the dielectric receptacle, a terminal portion 35 of the shank will extend therefrom to permit easy access to the individual contacts. The contact shanks are thus formed in a shape to be received in close fitting relationship within the cavities 24 (FIGURE 4) and provision is made for releasably retaining the contacts in the cavities by the provision of a latching tab 36 bent outwardly from a portion of the web 32 of the contact shank. In practice, this tab will be flexed into the plane of the web by each action of the back wall of the cavity as the contact is inserted in the cavity from the back of the receptacle, but the tab will then spring outwardly to the position of FIGURES 2 and 3, and will thereby prevent accidental displacement of the individual contacts from the assembly.

The contacts each include a yieldable blade portion generally designated as 42, comprising an integral extension of the outer web 32 of the contact shank, but of narrower dimensions as best shown in FIGURE 6. This blade extends from the contact shank to a relatively sharp return bend 43 and thence to a yieldable bow portion 44. The bow portion 44 of the contact blade has a smoothly rounded face surface 45 and includes an extension brace 46 interconnecting it with a supporting roller 47. As seen in FIGURES 2 and 3, the roller 47 is normally disposed between the side flanges 33 of the contact shank and in slightly spaced relation with the outer web 32 thereof, but moves back to engage the web 31 and support the contact blade when the circuit board is plugged into the receptacle. A limit tab 48 extends from the roller 47 to engage the abutment wall 49 on the bottom portion 15 of the receptacle body, to limit forward flexing of the contact blade.

From the above it will be apparent that the teachings of the present invention provide a connector structure having important advantages over the prior art in several respects. For one thing, the contacts and the receptacle in which they are formed provide maximum rigidity in the mounting and terminal portions of the contact, together with an arrangement whereby the relatively thin contact blades are braced at the proper point to provide adequate contact pressure. At the same time the flexing of the individual blades is limited in a manner to effectively withstand flexural forces. This renders the performance characteristics of the contacts quite uniform, and aids in protecting the parts from accidental damage.

In addition to achieving these results, it is to be noted that the individual contacts may be soldered or crimped to their respective conductors prior to assembly, so that they may be put in place merely by slipping each contact into its designated cavity from the back face 16 of the receptacle. The contacts are held against accidental displacement by the retaining latches 36 provided, but may be individually removed for inspection or replacement merely by slipping a small tool, such as a wire or straight pin, down the groove 28 to release the latching tine 36 from the retaining shoulder 29. The arrangement of the contacts in the dielectric body is such that they may be closely grouped, yet with comparatively long metal-to-metal crease paths sufficed on the flanges 26 on the sides of the barrier walls 27. In addition, it is to be noted that both the metallic parts and the molded receptacle of the connector are well suited to economical mass production methods of manufacture whereby satisfactory tolerances may be maintained without prohibitive manufacturing costs.

Having thus described the invention, what I claim as new and desire to protect by United States Letters Patent is:

1. An electrical connector comprising a body portion consisting of a single unitary receptacle formed of dielectric material of sufficient thickness to hold a narrow elongated channel with a plurality of contact cavities arranged along at least one wall of the channel; each of said cavities consisting of a generally rectangular opening extending between the face of the receptacle and the back thereof and separated from an adjoining cavity by a dielectric barrier wall of T-form having paired flanges partially overlying an edge of each cavity and on opposite sides of a slot narrower than said cavity opening and centrally positioned with respect thereto interconnecting each cavity with the central channel of the receptacle; and with a groove on the outer wall of each cavity extending inwardly from the face of the receptacle to a retaining shoulder; in combination with removable metallic contacts in said cavities; each of said contacts consisting of a single integral sheet metal stamping of relatively thin conductive metal having a rigid elongated mounting shank of channel formation consisting of a flat web portion with a pair of narrow reinforcing flanges formed along the opposite edges of the channel; said rigid shank of a separate contact adapted to be received in the rectangular opening of each of the aforementioned contact cavities; each of said contacts including an integral extension of said shank projecting from the rearward end thereof beyond the back of the receptacle to provide a terminal for the contact; each contact also having a spring blade comprising a relatively flexible flat portion integral with the web of the channel and extending forwardly therefrom at a return bend supporting a rearwardly extending bow biased to extend into the channel of the receptacle and including a smoothly rounded convex face portion therein; together with an extension finger extending from the contact face into closely spaced relation with the web of the contact shank and terminating in a limit tab engaging an abutment to limit the flexing movement of the contact blade.

2. An electrical connector comprising a body portion consisting of a single unitary receptacle formed of dielectric material throughout and including a deep narrow elongated channel with a plurality of contact cavities arranged along at least one wall of the channel; each of said cavities consisting of a generally rectangular opening extending between the face of the receptacle and the back thereof and separated from an adjoining cavity by a dielectric barrier wall therebetween with a pair of opposite disposed retaining flanges projecting towards each other from the inner edge of said barrier wall on the outer wall of each cavity extending rearwardly from the face of the receptacle to a retaining shoulder; in combination with removable metallic contacts in said cavities; each of said contacts having a rigid elongated mounting shank of channel formation adapted to be received in the rectangular opening of each of the aforementioned contact cavities; each of said contacts in-
including an extension of said shank to provide a terminal for the contact; each contact also having a spring blade extending forwardly therefrom to a return bend supporting a rearwardly extending bow biased to extend into the channel of the receptacle and including a smoothly rounded convex face portion therein.

3. In an electrical connector, a removable metallic contact consisting of a single integral sheet metal stamping of relatively thin conductive metal having a rigid elongated mounting shank of channel formation including a flat outer web portion and a pair of narrow reinforcing flanges folded inwardly along the opposite edges of the channel; with abutment portions formed on the flanges of said channel and an integral channel-shaped extension of said shank projecting beyond the abutments and rearwardly thereof to provide a terminal for the contact; each contact also having a spring blade comprising a relatively flexible flat portion integral with the web of the channel and extending forwardly therefrom to a return bend supporting a rearwardly extending bow extending angularly away from the shank and including a smoothly rounded convex face generally parallel with the shank and yieldable with respect thereto, together with an extension finger extending from the contact face into closely spaced relation with the contact shank.

5. In an electrical connector, a removable metallic contact consisting of a single integral sheet metal stamping of relatively thin conductive metal having a rigid elongated mounting shank of channel formation including a flat outer web portion and a pair of narrow reinforcing flanges folded inwardly along the opposite edges of the channel; with abutment portions formed on the flanges of said channel and an integral channel-shaped extension of said shank projecting beyond the abutments and rearwardly thereof to provide a terminal for the contact; each contact also having a spring blade comprising a relatively flexible flat portion integral with the web of the channel and extending forwardly therefrom to a return bend supporting a rearwardly extending bow extending angularly away from the shank and including a smoothly rounded convex face generally parallel with the shank and yieldable with respect thereto.

References Cited in the file of this patent

UNITED STATES PATENTS

2,283,498 Glennon ------------ May 19, 1942
2,436,914 Breisch ------------ Mar. 2, 1948
2,853,689 Jackson et al. -------- Sept. 23, 1958
2,875,425 Gilbert ------------ Feb. 24, 1959
2,937,357 Kennedy ----------- May 17, 1960
UNITED STATES PATENT OFFICE
CERTIFICATION OF CORRECTION

Patent No. 3,015,083

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 4, lines 2 and 3, after "receptacle" insert -- body --; column 6, under the heading UNITED STATES PATENTS, add the following:

2,909,755 Jackson et al. ---- Oct. 20, 1959

Signed and sealed this 24th day of April 1962.

(SEAL)

Attest:

ESTON G. JOHNSON
Attesting Officer

DAVID L. LADD
Commissioner of Patents