July 19, 1966 W. H. WEST 3,262,088

CONNECTOR AND JACK THEREFOR

Filed May 19, 1964

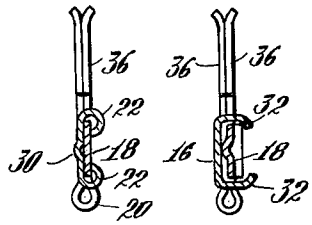


Fig. 4

Fig. 5

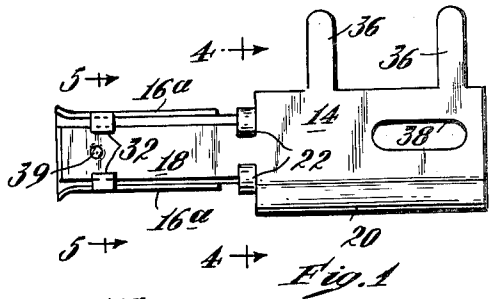


Fig. 1

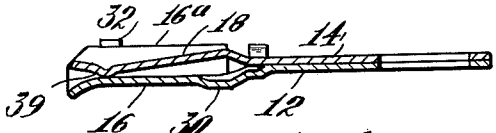


Fig. 6

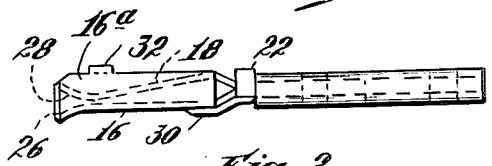


Fig. 2

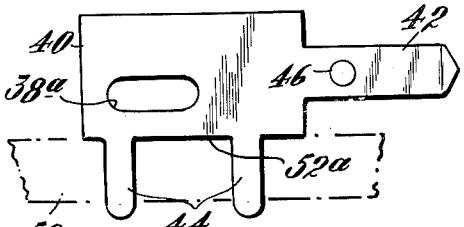


Fig. 7

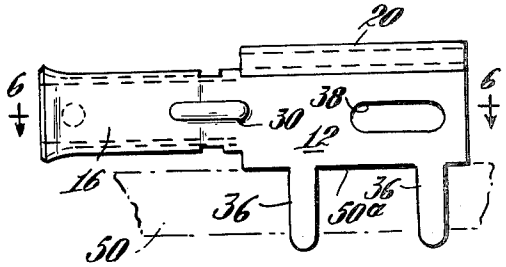


Fig. 3

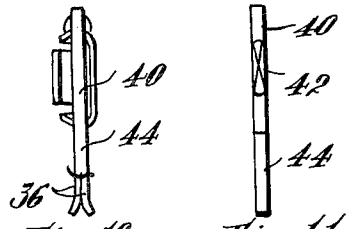


Fig. 10

Fig. 11

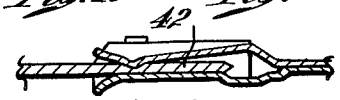


Fig. 9

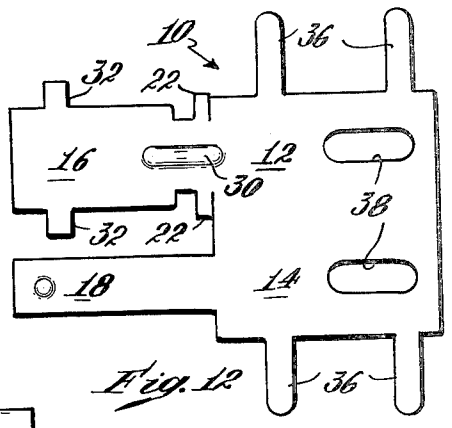


Fig. 12

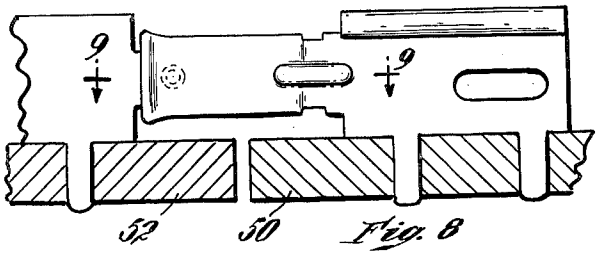


Fig. 8

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CONNECTOR AND JACK THEREFOR

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The field of this invention relates broadly to electrical connectors and more particularly to a subminiature plug and jack which can be advantageously fabricated from sheet metal.

The development of miniaturization techniques for electronic components and the complexity of many of the devices in which these components are used has created a need for connecting devices in which blocks of circuitry and especially modular units can be quickly and conveniently interchanged. The design of such circuitry hinges upon the means for establishing separable electrical connections between each block or unit component and the associated apparatus or adjacent component. As the total apparatus becomes more complex, the requirement as to the reliability of each connection becomes more stringent.

Objects of the present invention are to provide a novel subminiature connector which is suitable for use with highly miniaturized electronic apparatus, which is compatible with preferable methods of modular construction, which forms a highly reliable electrical connection, which forms a connection which can be easily separated and re-established, which is long lasting and resistant to fatigue, which is conveniently usable with printed circuit boards, and which can be constructed relatively simply and inexpensively from sheet metal.

The substance of this invention may be shortly stated as involving a flat type connector, by which is meant a connector in which an essentially flat blade (preferably of sheet metal) is held in electrical contact with an essentially flat surface of a jack (also of sheet metal). A flat type connector affords the best possibility for miniaturization, and the construction now to be explained is such as to accomplish the above objects with such flat type connectors. The invention involves various original structural features of the blade and of the jack that accomplish these objects.

Other objects, advantages, and aspects of the substance of the invention will appear from the following description which explains a preferred embodiment of the invention.

The description refers to an accompanying drawing in which, all considerably enlarged:

FIG. 1 is a plan view of a jack;

FIG. 2 is an edge view of the jack;

FIG. 3 is a face view of the jack from the side opposite to that seen in FIG. 1;

FIG. 4 is a section on the line 4—4 of FIG. 1;

FIG. 5 is a section on the line 5—5 of FIG. 1;

FIG. 6 is a section on the line 6—6 of FIG. 3;

FIG. 7 is a face view of a plug having a blade for engagement with the jack of FIG. 1;

FIG. 8 is an assembly view showing the plug of FIG. 7 connected with the jack of FIG. 3;

FIG. 9 is a sectional view taken on the line 9—9 of FIG. 8;

FIG. 10 is a left end view of the assembled plug and jack of FIG. 8 with portions of the legs of the plug broken away;

FIG. 11 is an end view of the plug, as viewed from the right side of FIG. 7; and

FIG. 12 is a plan view of a sheet metal blank from which the jack of FIG. 1 can be fabricated.

It may be explained that FIGS. 3 and 7 are referred to as face views rather than plan views because they show the jack and plug associated with printed circuit boards which can lie in any plane, such as horizontal or vertical.

The blank 10 shown in FIG. 12 may be considered as including two flat plate portions 12 and 14. From a side edge of each plate at one side of the blank there projects a jaw-forming portion, 16 and 18 respectively. Although certain operations are performed on the blank 10 before folding, it may be noted that views showing the completed jack show the blank folded so that the plates 12 and 14 are in overlapped relation, forming a two-thickness jack body. The fold is rolled as shown at 20 so that although the plates 12 and 14 are brought into close engagement fracturing of the metal of the blank is avoided.

Preliminary to folding the blank at 20 the jaw-forming portions are displaced from the plane of the plate portions from which they extend. Jaw 16, as best seen in FIG. 6 is in large part flat, but this flat portion is displaced, in a direction perpendicular to the face of plate 12, by an amount which is preferably approximately equal to the thickness of the sheet metal of the jack body. Jaw 16 is provided with lateral flanges 16*a* which tend to render this jaw relatively rigid, and constitute this jaw a trough for reception of the blade of the plug. This jaw is stiffened against bending relative to the jack body by a stamped channel 30 mainly in the jaw, but extending a little into the adjacent plate portion 12. The outer part of jaw 16 is flared downwardly as viewed in FIGS. 2 and 6 and the outer parts of its flanges 16*a* are flared away from each other as seen in FIGS. 1 and 3, such flaring facilitating entry of the blade of the plug.

The other jaw 18 is provided with a circular protuberance or "dimple" 39 for engagement in a recess in the blade. Jaw 18 near its base is arched away from its plate portion 14, and is reversely bent so that upon folding of the blank the dimple 39 lies against the flat portion of jaw 16. Then out beyond the dimple 39 jaw 18 is flared away from the other jaw. Jaw 18 constitutes a spring member. That part of the blank which is to form one of the thicknesses of the jack is provided with two tabs 22. After folding the blank at 20, these tabs are bent around and over the other thickness, binding the two thicknesses in the folded relation. Preferably these tabs 22 are projections from the base of the jaw portion 16 so that when bent over and around the previously arched jaw 18 the tabs apply a prestress thereto, resisting displacement of the outer end of the jaw away from the jaw 16.

Preferably also, the extent to which the jaw 18 may be sprung is limited by two stop tabs or ears 32 extending over the jaw 18 from the flanges 16*a* of jaw 16.

For mounting the jaw there are provided leg members 36 extending from each of the plate portions 12 and 14, at right angles to the jaws 16 and 18. These leg members are adapted to fit through slitted apertures in the phenolic boards conventionally used for printed circuits

and electrical connections can also be made thereto by dip-soldering or otherwise. A fragment of such a circuit board is diagrammatically indicated at **50**. The ends of the legs can be bent over to secure the jack to the board. FIGS. 4 and 5 show the legs as slightly divergent at their ends. Their springiness enables them to come together and pass through a slit hardly any wider than twice the gauge of the jack sheet metal. Preferably each of the plates **12** and **14** is also apertured as at **38** so that conventional wiring can also be soldered thereto.

A simple corresponding plug **40**, which may be stamped in the shape shown from sheet metal, is shown in FIGS. 7 and 11. A blade **42** projecting from the plug body is shaped to fit within the trough **16** of the jack and to be resiliently held therein by the jaw **18**. The plug **40** also includes leg members **44**, at right angles to the blade **42**, which may be utilized for mounting the plug on a phenolic printed circuit board, indicated diagrammatically at **52**, and for electrical connections. Legs **44** are spaced the same distance as legs **36** of the jack. Preferably the plug body is also apertured at **38***a* for wiring.

An aperture **46** in the plug blade receives the protuberance or dimple **39** of the jaw **18** and detachably locks the plug and jack in connecting relation as in FIGS. 8 and 9.

The lower edge **50***a* of the jack body between and to the left and right of the legs **36**, and the similar edge **52***a* of the plug body are adapted to seat on the faces of the respective circuit boards. When these edges are thus seated the blade **42** and the jaws **16** and **18** are aligned as to height or spacing from the circuit board, as shown by comparing FIGS. 3 and 7. As shown by these figures, the central axes of the blade and of the jaws are offset equal amounts from the edges **52***a* and **50***a* respectively.

Alignment in the direction toward or away from the viewer of FIGS. 3 and 7, so that the parts will come into engagement as in FIG. 9 is secured if the leg-receiving openings of the two boards are aligned, and the connector is especially constructed so that it can be installed in circuit boards which when associated will have their leg-receiving openings in alignment, and hence can be installed either-end-to, or even mixed as to direction, in circuit boards having a standarized pattern of pairs of punched openings.

The plug **40** is a single-thickness piece of sheet metal, and as will be seen from the drawing this single thickness is of a gauge twice that of the sheet metal of the jack. Thus a given pair of openings of a circuit board can receive either the plug or the jack. As seen in FIG. 10 the legs **44** of the plug (there partly broken off) are in alignment with the legs **36** of the jack. Thus the relative position of the two circuit boards toward or away from the observer in FIG. 8 will be the same if the plug and jack are interchanged, right for left. The displacement of the main flat part of jaw **16** from its associated plate element **12** by one thickness of the jack sheet metal enables the plug to be not bent, i.e., manufacturing operations involving bending are restricted to the jack part of the connector.

The parts may be efficiently and economically fabricated from sheet metal and are adapted to establish a highly reliable electrical connection, which connection may be easily separated and re-established.

While the particular embodiment has been shown by way of illustration it should be understood that this disclosure is for the purpose of illustration only and that the invention includes all modifications and equivalents falling within the scope of the appended claims.

I claim:

1. A jack adapted to receive a blade, the jack comprising as elements of an integral sheet metal structure:

a pair of essentially flat plate portions joined by a fold in the sheet metal and together forming a two-thickness body;

a first jaw extending from one of said plate portions; and

a second jaw extending from the other of said plate portions;

the two plate portions lying close together and the two jaws being oppositely divergent at their base portions;

one of said jaws then extending substantially parallel to but offset perpendicularly from the plate portion from which it extends and being provided with lateral flanges and being essentially flat between said flanges;

the other of said jaws approaching the flat portion of the flanged jaw to bear against a blade inserted flatwise against the flat portion of the flanged jaw.

2. A connector adapted for printed circuit boards comprising:

a blade body;

parallel legs extending from an edge of said body for insertion in apertures in a circuit board;

a blade extending from said body at right angles to the direction of extent of the legs; and

a jack in the form of an integral sheet metal structure including a two-layer jack body having its two layers in close relation and joined by a fold along one edge of the jack;

parallel jack legs extending from the edge of said jack body opposite to said fold for insertion in apertures in a circuit board; and

jaws extending from the respective layers of the jack body portion at right angles in the direction of extent of the jack legs;

said jaws receiving the blade between them.

3. A connector according to claim **2** in which the blade and the legs which extend from the blade body are integral portions of sheet metal having a gauge which at least approximates twice the gauge of the sheet metal of the jack.

4. A connector according to claim **2** in which one of said jaws has a longitudinally extending essentially flat portion parallel to the body layer from which this jaw extends and displaced perpendicularly of said body layer by an amount which at least approximates the gauge of the sheet metal of the jack.

5. A connector according to claim **2** in which the blade body and the jack body have portions, at the edges from which the legs extend, which seat against a circuit board face;

the blade and jaws being offset from said seating portions, away from the legs;

the central axes of the blade and jaws being substantially the same distance from the respective seating portions of the blade body and jack body.

6. An electric connector jack adapted to receive a connector blade, the jack comprising as portions of an integral sheet metal structure:

a pair of essentially flat plate portions joined by a fold in the sheet metal and together forming a two-thickness body;

a first jaw extending from one of said plate portions in a direction parallel to said fold;

a second jaw extending from the other of said plate portions in said direction of said fold;

one of said jaws including marginal flange means forming a channel receiving the other jaw, the two jaws accommodating a blade inserted flatwise therebetween,

and the other said jaw being resilient and yieldingly displaceable by an inserted blade; and

two tabs each extending from a jaw as a portion of the integral sheet metal structure and bent over the other jaw in the base region where the jaws extend from the plate portions.

7. A jack according to claim **6** further comprising

ears extending from said marginal flange means inwardly over said resilient jaw.

8. A jack according to claim 6 further comprising leg elements projecting from the edges of said plate portions opposite to said fold.

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