

Jan. 5, 1971

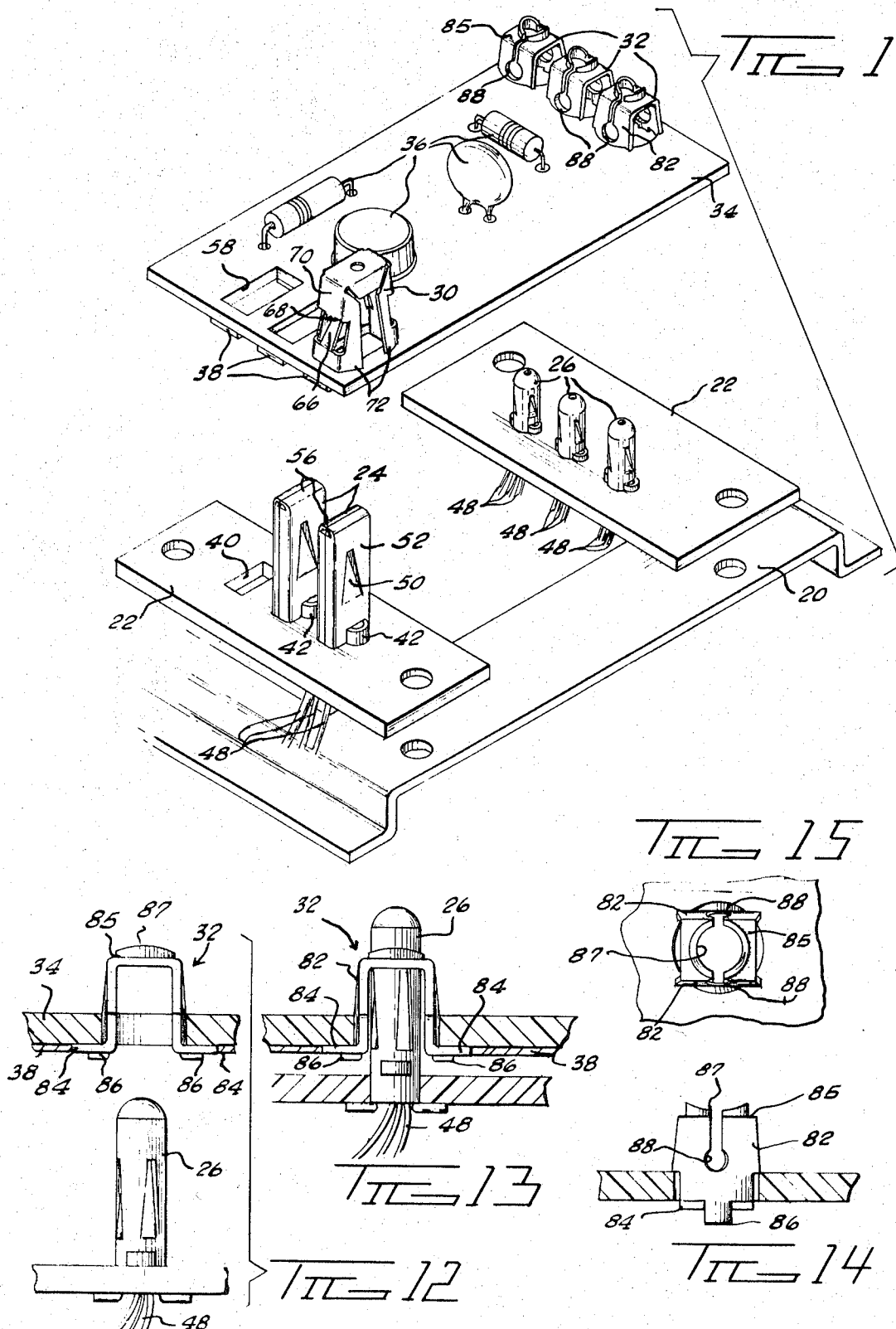
R. G. LUNDERGAN ET AL

3,553,634

ELECTRICAL INTERCONNECTING SYSTEM AND PARTS

Original Filed Sept. 27, 1967

4 Sheets-Sheet 1



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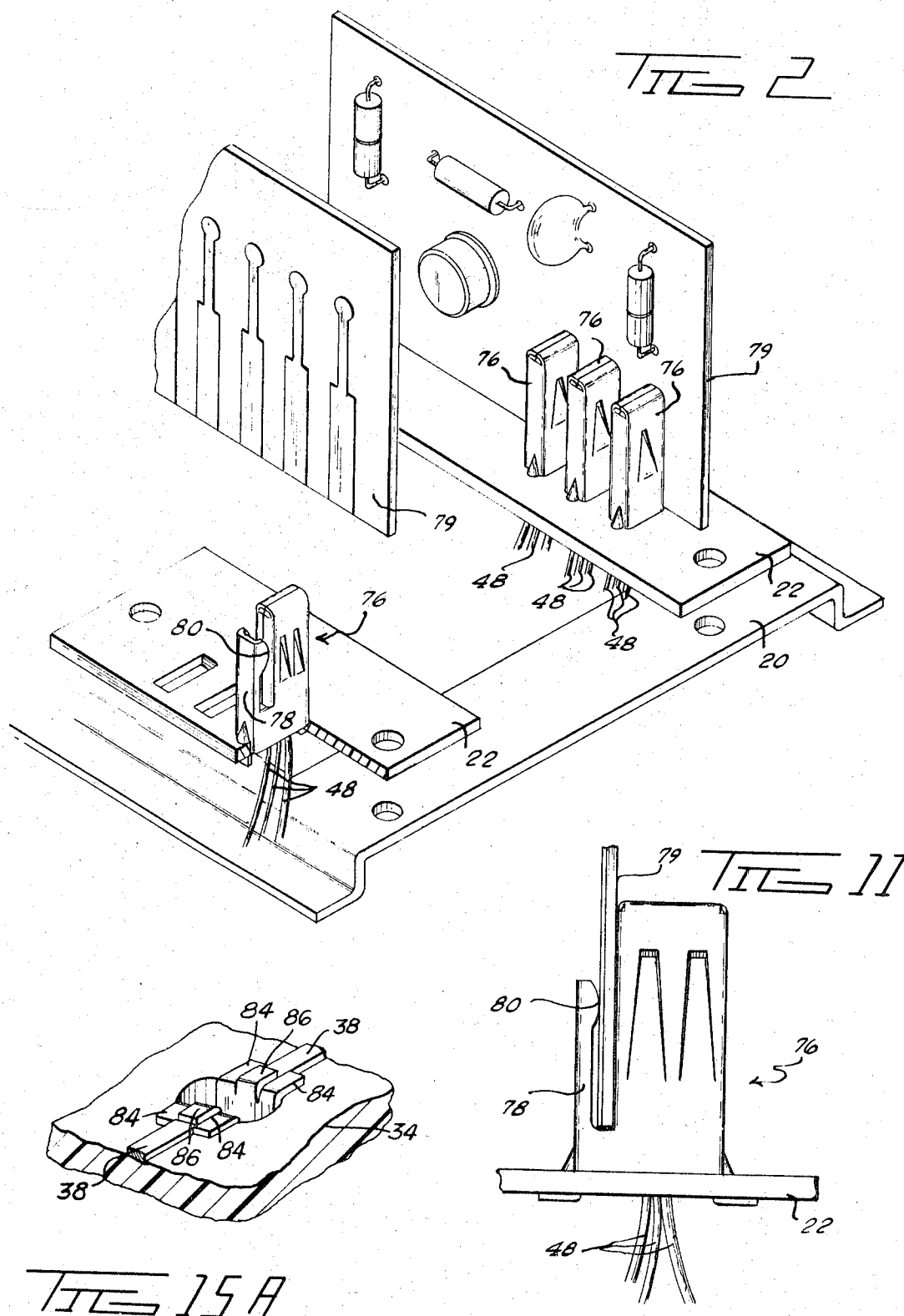
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## ELECTRICAL INTERCONNECTING SYSTEM AND PARTS

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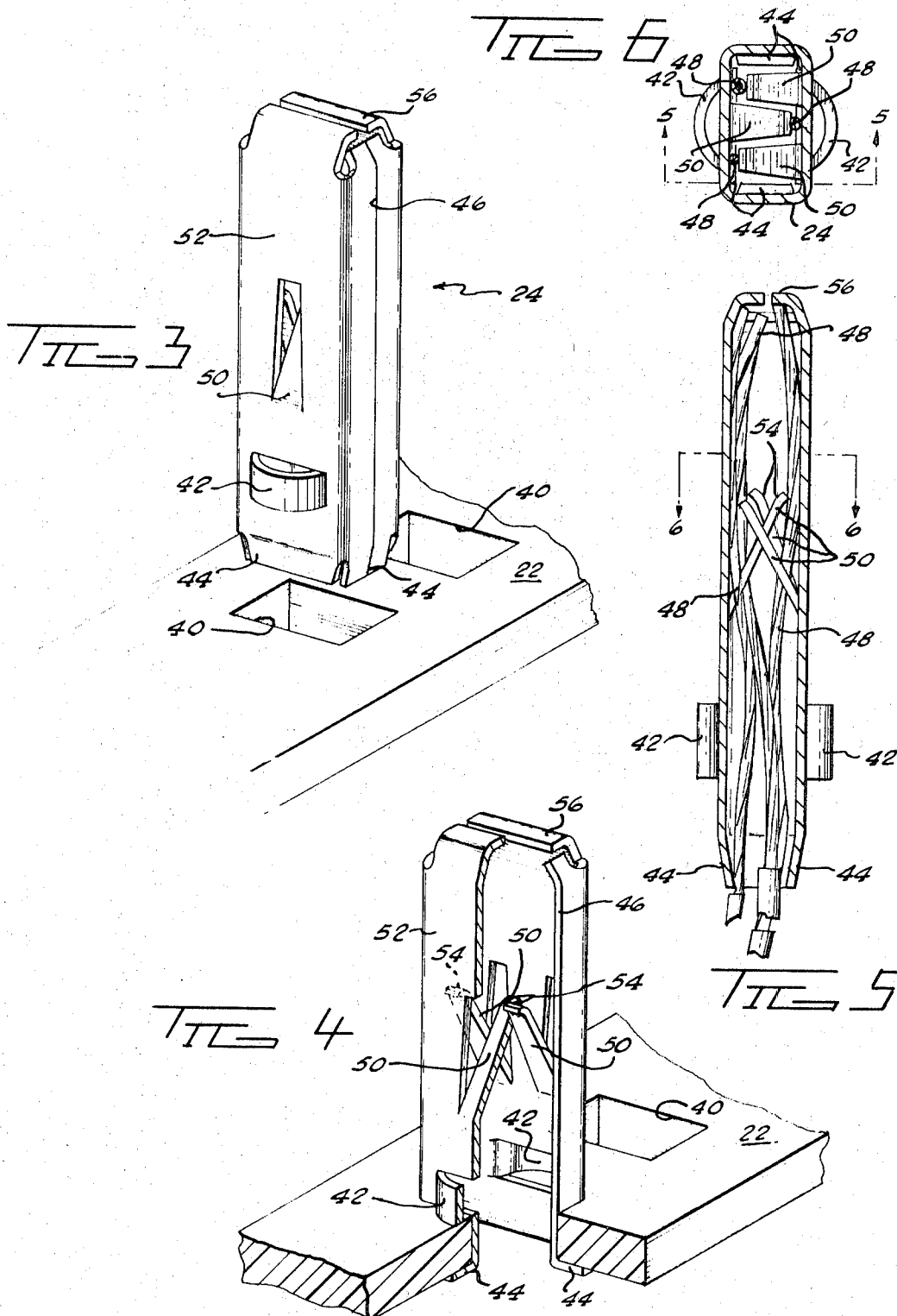
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ELECTRICAL INTERCONNECTING SYSTEM AND PARTS

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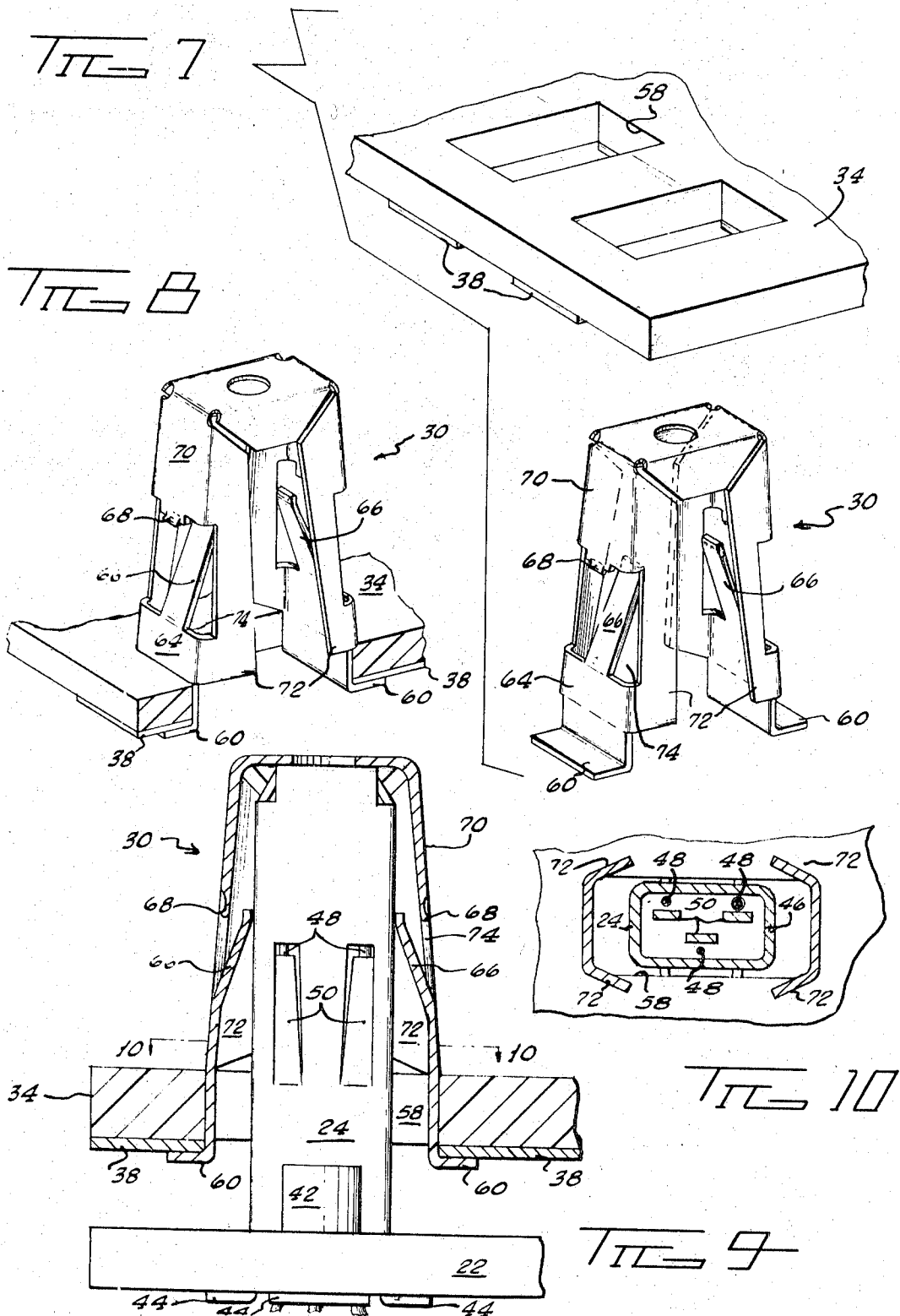
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ELECTRICAL INTERCONNECTING SYSTEM AND PARTS

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## ELECTRICAL INTERCONNECTING SYSTEM AND PARTS

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Original application Sept. 27, 1967, Ser. No. 671,061, now Patent No. 3,488,628, dated Jan. 6, 1970. Divided and this application Sept. 5, 1969, Ser. No. 855,511

Int. Cl. H01r 13/12, 13/42

U.S. Cl. 339-258

3 Claims

### ABSTRACT OF THE DISCLOSURE

An interconnection system is disclosed with various connector designs for electrically connecting conductors to printed circuit boards or the like. In one form, the connector receives wire conductors and is pluggable into a receptacle mounted on a printed circuit board. In another form, the connector receives wire conductors and end wise receives a printed circuit board to function as an edge connector for the board.

### CROSS-REFERENCE TO RELATED APPLICATION

This application is a division of application Ser. No. 671,061, filed Sept. 27, 1967, now Pat. 3,488,628, issued Jan. 6, 1970.

### BACKGROUND OF THE INVENTION

#### (1) Field of the invention

The invention is for use in the electrical field for connecting various components in a modular system. The connectors have general utility and are not restricted to the specific system shown in the drawings.

#### (2) Description of the prior art

U.S. Pats. No. 3,060,402 and 3,156,517, disclose solder well terminals which perform a portion of the functions performed by the instant connectors; however, the structural differences between the prior art and the instant connector permits the latter to have extreme versatility in various modular arrangements.

### SUMMARY OF THE INVENTION

The plug connector has inwardly directed prongs for receiving and holding wire conductors prior to dip soldering the connector. The receptacle is insertable in a printed circuit board for frictionally receiving the plug connector. An alternative form connector is not pluggable but rather frictionally receives a printed circuit board to connect the board to wire conductors contained within the connector.

### BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a perspective view of a modular system employing the teachings of the present invention;

FIG. 2 is a perspective view showing another modular system showing a modification of the invention;

FIG. 3 is an exploded perspective view of a connector and mounting block;

FIG. 4 is a perspective view partly in section showing the connector of FIG. 3 in position on a mounting board;

FIG. 5 is a cross-sectional view taken along the line

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5-5 of FIG. 6 and showing interior details of the connector of FIG. 4;

FIG. 6 is a cross-sectional view taken along the line 6-6 of FIG. 5;

FIG. 7 is an exploded perspective view showing a receptacle and circuit board;

FIG. 8 is a perspective view showing the receptacle of FIG. 7 mounted within a board;

FIG. 9 is a view partly in section showing the connector of FIG. 4 mated with the receptacle of FIG. 8;

FIG. 10 is a cross-sectional view taken along the line 10-10 of FIG. 9;

FIG. 11 is a side elevational view of an alternative form of connector;

FIG. 12 is an exploded side elevational view of a further modified form of connector and receptacle;

FIG. 13 is a view similar to FIG. 12 and showing the parts in their assembled position;

FIG. 14 is a front elevational view of the receptacle shown in FIGS. 12 and 13;

FIG. 15 is a top plan view of the receptacle shown in FIG. 14; and

FIG. 15A is a bottom perspective view of the receptacle shown in FIGS. 12-14.

### DESCRIPTION OF THE PREFERRED EMBODIMENTS

The attainments of the present invention will become apparent to those skilled in the art upon a reading of the following detailed description when taken in conjunction with the drawings in which there are shown and described illustrative embodiments of the invention; it is to be understood, however, that these embodiments are not intended to be exhaustive nor limiting of the invention but are given for purpose of illustration in order that others skilled in the art may fully understand the invention and the principles thereof and the manner of applying it in practical use so that they may modify it in various forms, each as may be best suited to the conditions of a particular use.

In FIG. 1 there is shown a modular system which may be a portion of a television or radio receiver or the like. A chassis 20 is shown having provision for mounting insulating blocks 22. The blocks 22 have a series of apertures disposed therealong for receiving electrical connectors 24 and 26. The connectors receive wire conductors 48 and are pluggable within receptacles 30 and 32 respectively. The receptacles 30 and 32 are shown mounted for example on a printed circuit board 34 having electrical components 36 on its top surface and printed circuit strips 38 disposed along its slower surface.

The connector 24 will now be described with particular reference to FIGS. 3-6. The insulating board 22 has a series of generally rectangular openings 40 disposed therein for receiving the connectors 24. The connectors are inserted within the opening and are positioned therein by stop means 42 disposed along opposite sides of the connectors. The lower end of the connector has fine means 44 for passing through the openings 40 to be bent outwardly for engaging the lower surface of member 22 to secure the connectors in position.

Connectors 24 are preferably formed from a single flat sheet of metal which sheet is wrapped into a generally rectangular configuration with the two ends of the sheet forming a seam 46. The lower portion of the connector is open for receiving electrical conductors 48 inserted through member 22 into the connector.

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A plurality of contact fingers 50 are struck from the sidewall portions 52 of the connector and are bent inwardly to a position whereat the free ends 54 of the fingers lie closely adjacent the opposite internal surface of the connectors from which the fingers are struck. The free ends of the fingers are bent so as to lie in a plane which is at a steep angle to the plane of the sidewalls of the connector.

The top end portion 56 of the connector is bent over into a generally closed configuration. The conductors 48 are inserted into the connector until their end portions seat against end 56 of the connector. The connector shown in the drawings has three contact fingers and is designed to receive up to three electrical conductors. This number may, of course, vary to suit the conditions of a particular use. Each of the conductors 48 will be held within the connectors 24 by one of the contact fingers 54 acting in cooperation with an internal surface of the connector (see FIGS. 5 and 6). It can be seen that each of the fingers acts independently of the other fingers thereby permitting the connector to receive conductors of varying size such as shown in FIG. 6 of the drawings.

The force exerted by the fingers is sufficient to retain the conductors in position within the connector 24. In normal use the member 22 will have a row of connectors 24 mounted therein with conductors 48 extending within each of the connectors. The entire assembly will then be dip-soldered causing the entire internal area of the connectors to become filled with solder thereby making a permanent electrical connection between the connectors and conductors. The members 22 may then be secured in some fashion to the chassis 20 in position for the upper ends 56 of the connectors to be inserted within mating receptacles.

The connectors 24 will mate with the receptacles 30 shown in FIG. 1 and illustrated in FIGS. 7-10. The receptacles are normally mounted on a printed circuit board on the same side as the electrical component so that the entire assembly can be flow-soldered as one unit. The board 34 will be provided with a row of rectangular openings 58 which openings extend through the board and intersect the circuitry 38 on the lower side of the board. The receptacles 30 are inserted into the board from the lower side and are limited in the direction of insertion by stop means 60 extending outwardly from the lower portion of the receptacle. Stop means 60 is adapted to be bent into contact with the circuitry strips 38 in a manner as shown in FIG. 8. The receptacle comprises a strap portion 64 from which extends a pair of contact members 66 for cooperating with the connectors 24 as will be described. A pair of ears 68 extend from an upper strap portion 70 said ears serving to limit outward movement of the contacts 66. The ears 68 may be conveniently formed by coining or similar operation. A pair of sidewall portions 72 extend between the strap portions 64 and 70 and have their lower portions bowed outwardly (see FIG. 10), for spreading beyond the sides of openings 58 to prevent withdrawal of the receptacles through the board 34. There are large open areas 74 provided around the contacts 66. When the board 34 has all of the receptacles 30 positioned within the openings 58 the entire board will be dip-soldered to permanently connect the stops 60 to the circuitry 38. During the soldering operation the solder will tend to enter the receptacle by capillary action but the large open areas 74 prevent the solder from entering the receptacle. The areas 74 provide a discontinuity in the receptacle to thus offset the capillary action. After the soldering operation the board 34 is ready for assembling onto the chassis 20 and this is done by lowering the board to cause the connectors 24 to enter the receptacles 30 whereby the contacts 66 will engage the side surfaces of the connectors to thereby electrically connect the conductors 48 with the conductors 38.

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In FIG. 11 there is shown a connector 76 which is similar to the connectors 24 previously described with the exception that connector 76 is not for insertion within a receptacle but rather has a contact arm 78 which extends from one side of the connector and lies generally parallel to an external surface of the connector. The connector 76 receives a printed circuit board 79 or the like into the opening created by the arm 78 in a manner such as shown in FIG. 2. The arm 78 has a U-shaped section at its free end as indicated at 80 to thus yield a pair of runners which will contact the circuitry of a board inserted into the connector. The connector 76 thus serves to electrically join the conductors 48 which extend into the connector with the circuitry on the printed circuit board 79.

In FIG. 12 there is shown a further modification of the connector and receptacle of the instant invention. The connector 26 is identical to the connector 24 previously described with the exception that connector 26 has a circular rather than rectangular cross-sectional configuration. The receptacle 32 is mounted on board 34 in the same manner as the receptacles 30 previously described except that the receptacle 32 is designed to receive the cylindrical connector 26. Receptacle 32 is generally of an inverted U-shaped configuration. The sidewalls 82 of the receptacle engage the upper surface of board 34 and cooperate with the lower stop means 84 for retaining the receptacle in position. Tines 86 are connected to the circuitry 38 in the same manner as the stops 60 on the receptacle 30. On each sidewall stop means 84 are spaced so as to straddle circuitry 38 which is overlapped by line 86. The sidewalls 82 of the receptacle are jointed by a top portion 85 having a circular opening 87 disposed therein. The diameter of the opening is slightly smaller than the external diameter of connector 26. When the connectors are inserted into the receptacles 82 the connectors will cause the sidewall portions 82 to spread thus causing opening 87 to spread to receive the connector and to engage tightly the external surface of the connectors. The spreading of the receptacle is permitted by the slotted portions 88. The normal resiliency of the receptacle 32 is sufficient to establish a good electrical connection between the receptacle and the connector 26.

Changes in construction will occur to those skilled in the art and various apparently different modifications and embodiments may be made without departing from the scope of the invention. The matter set forth in the foregoing description and accompanying drawings is offered by way of illustration only. The actual scope of the invention is intended to be defined in the following claims when viewed in their proper perspective against the prior art.

We claim:

1. A receptacle for mounting in a board having circuitry on at least one external surface thereof, said receptacle being of a generally trapezoidal configuration comprising stop means for limiting insertion of said receptacle into said board and for making electrical contact with said circuitry, a pair of contact arms extending inwardly from a first pair of sides of said receptacle, an end portion interconnecting said first pair of sides and sidewall portions disposed along a second pair of sides of said receptacle, said sidewalls being angularly disposed for preventing withdrawal of said receptacle from said board, said end portion comprising a stop member, whereby said receptacle may receive a connector inserted through said board and into said receptacle for engagement with said contact arms with said stop member limiting the depth of insertion of said connector.

2. A receptacle as set forth in claim 1 further comprising means on said first pair of sides for limiting the outward movement of said contact arms, and wherein said stop means are located on the ends of said first pair of sides opposite said end portion.

3. A receptacle as set forth in claim 1 wherein said

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contact arms have relatively large open areas surrounding them to prevent solder flow into the receptacle.

References Cited

UNITED STATES PATENTS

|           |         |                      |         |
|-----------|---------|----------------------|---------|
| 3,060,402 | 10/1962 | Olsson et al. ....   | 339—258 |
| 3,156,517 | 10/1964 | Maximoff et al. .... | 339—220 |
| 3,363,224 | 1/1968  | Gluntz .....         | 339—258 |

6

FOREIGN PATENTS

1,250,743 12/1960 France ..... 339—258(A)

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U.S. Cl. X.R.

339—17, 217