United States Patent [19]

Ojima et al.

[11] **3,825,877**

[45] **July 23, 1974**

[54] **PRINTED CIRCUIT ASSEMBLY AND METHOD FOR FABRICATION THEREOF**

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[73] Assignee: **Matsushita Electric Industrial Company, Limited,** Osaka, Japan

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[21] Appl. No.: **258,336**

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[51] **Int. Cl.**..... **H05k 1/04**

[58] **Field of Search**. 174/68.5; 317/101 C, 101 CC, 317/101 D, 101 B; 339/17, 18, 176, 206, 210, 220, 217, 275 B

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Primary Examiner—Bobby R. Gay
Assistant Examiner—Terrell P. Lewis

[57] **ABSTRACT**

A printed circuit assembly is herein proposed which has a multiplicity of generally L-shaped external terminal elements each of which is connected at one end to a printed circuit on the printed base panel through a soldered joint and which is formed at the other with a plug portion which is to be inserted into a plug socket. The plug portion projects usually perpendicularly from the printed base panel and extends on the same side as the joints on the base panel. The joints on the base panel are therefore soldered in a single dip-soldering operation in which the plug portions of the external terminal elements are kept intact with the result that no changes in size and configuration are invited as a result of the dip-soldering operation. The external terminal elements are thus readily inserted into the plug socket and are prevented from being dislocated or deformed when the plug socket is connected to or disconnected from the group of the terminal elements. The assembly may further include retaining means for securely holding the terminal elements in position relative to the printed base panel.

7 Claims, 16 Drawing Figures

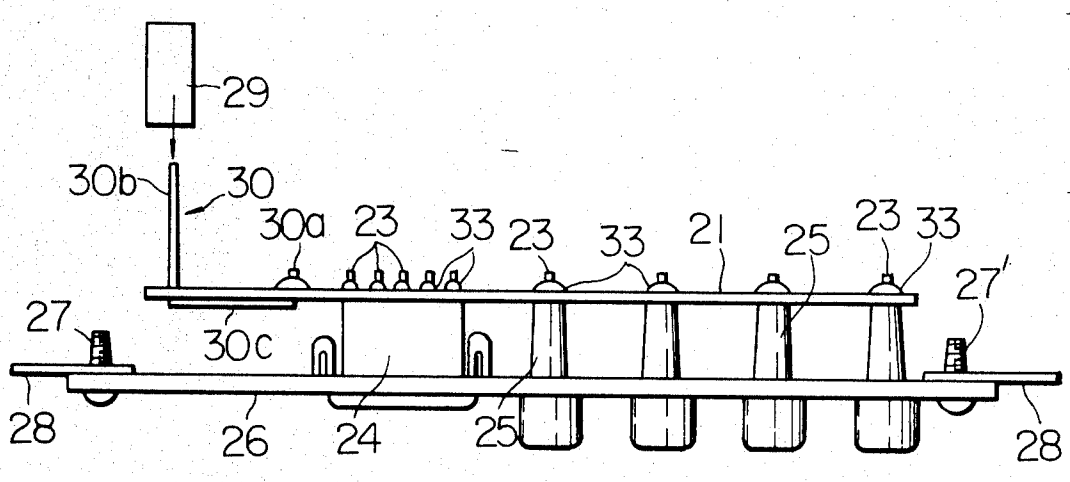


Fig. 1

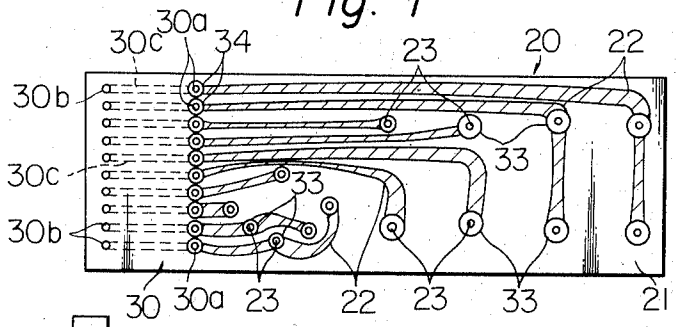


Fig. 2

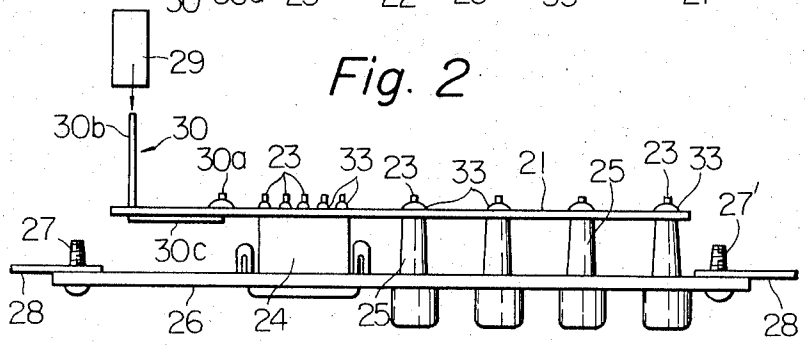


Fig. 3

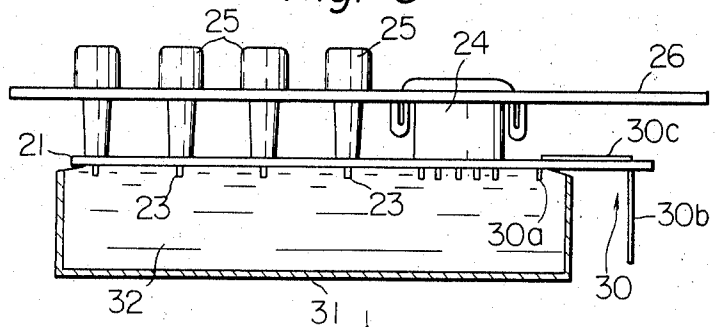


Fig. 4

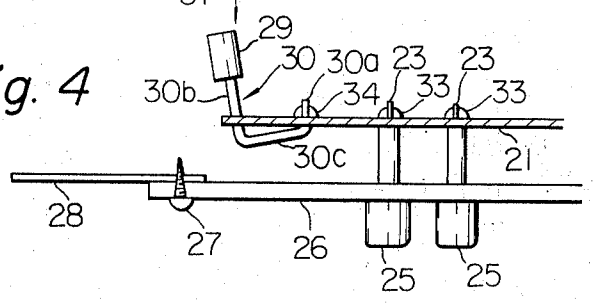


Fig. 5

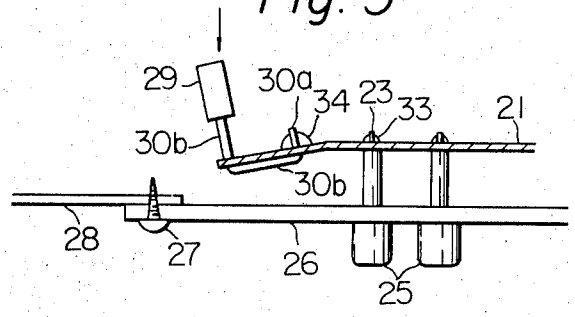
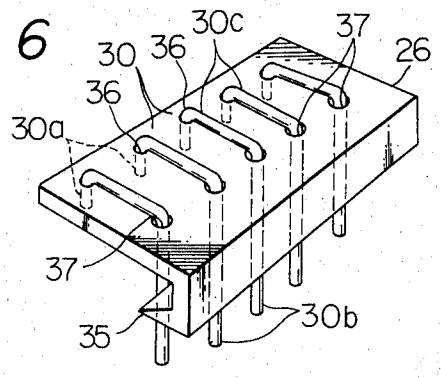

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30a
34
23
33
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30b
30b
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26
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Fig. 6


30c
37
30
36
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30a
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35
30b

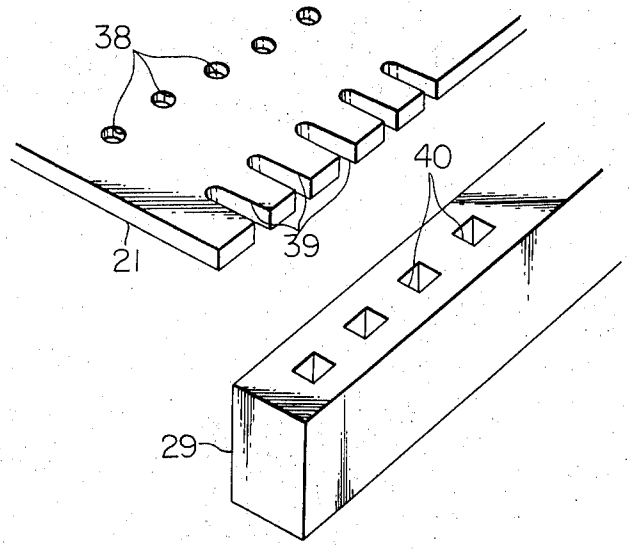

38
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21
39
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Fig. 7

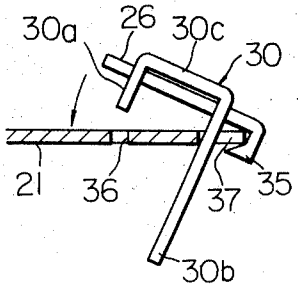


Fig. 8

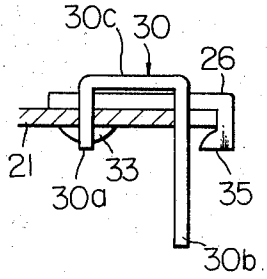


Fig. 9

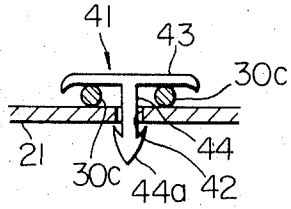


Fig. 10

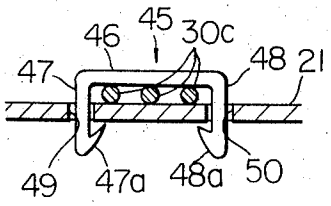


Fig. 11

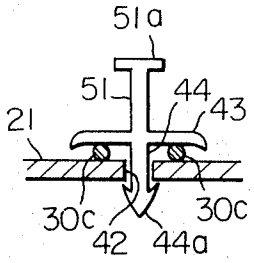


Fig. 12

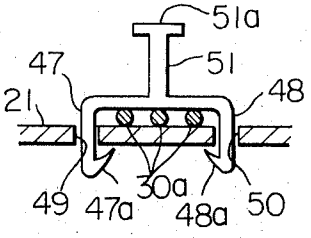


Fig. 13

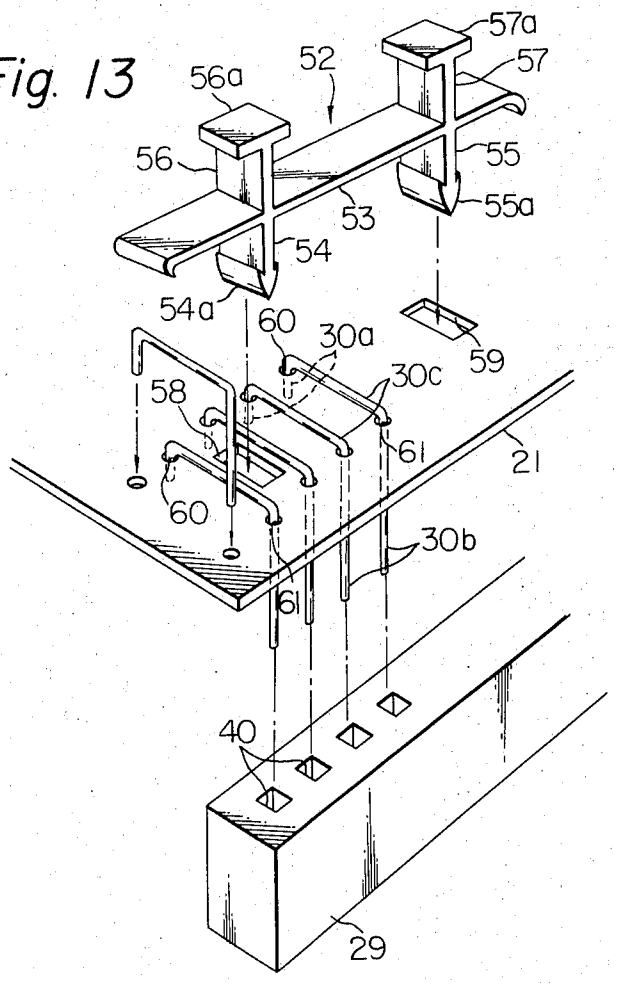

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56a
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55a
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54a
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30a
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30c
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30b
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Fig. 14

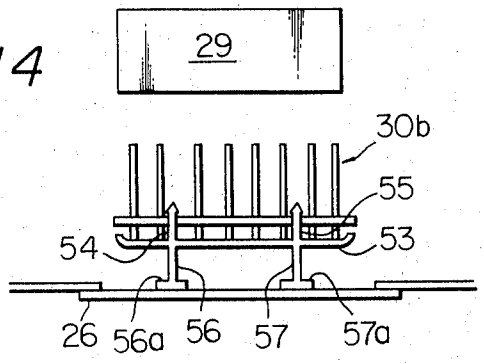

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30b
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57a

Fig. 15

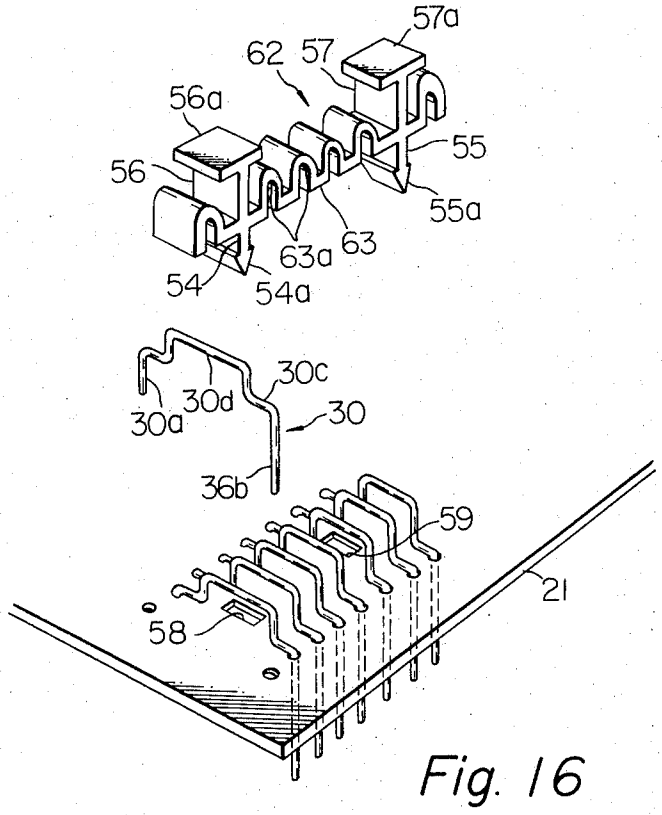
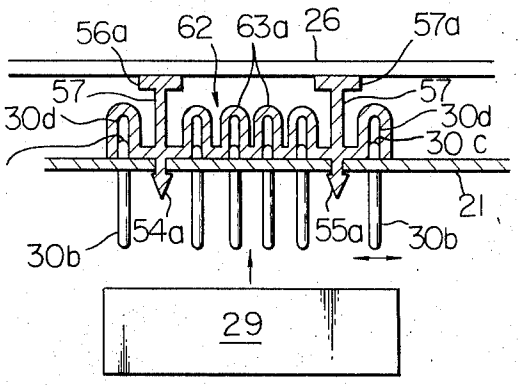

57a
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56a
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63a
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54a
30c
30d
30a
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36b
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Fig. 16


56a
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63a
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57a
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57
30d
30d
30 c
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30b
54a
55a
30b
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PRINTED CIRCUIT ASSEMBLY AND METHOD FOR FABRICATION THEREOF

The present invention is concerned generally with printed circuits which are generally used in radio and television receives, stereophonic phonographs and other electrical appliances and equipment for houshold and industrial uses. The present invention relates, more specifically, to printed circuits which are assembled and soldered by a dip soldering method and also to a method for dip-soldering the printed circuits of the constructions to be described.

There are almost as may variations in the methods of assembling and soldering of the printing circuits as there are types of circuits, including manual and automatic soldering and mass soldering methods. Because of the fact that the printed circuits permit substantially all the soldered connections to be made in one plane, it is possible to use a mass dip-soldering method which is well known in the art. Where the dip-soldering method is carried out efficiently, an appreciable saving in operating time and cost will be achieved. Experience has also confirmed that since all the soldered joints are produced in a single repeatable operation greater reliability and consistence can be achieved as compared with hand soldering.

In order that the circuits formed on a printed circuit be connected to an external electrical component or components such as sources of signals, each of the circuits is connected to the external component through an external terminal element which is attached to the printed circuit board. The external terminal element is connected at one end to the soldered joint of each circuit and at the other to a plug socket. To enable the terminal element to be snugly and accurately fitted into the plug socket, it is important that the terminal element be sized and configured in strict conformity to the receiving hole in the socket. Where, thus, the joints in the printed circuit are soldered by the mass dip-soldering method, the leading end of the external terminal elements is also subjected to soldering with the consequent change or increase in the size and configuration of the terminal element. The terminal element formed in this manner is apparently incompatible with the socket of the given dimensions so that poor contact between the socket and terminal element will result, causing deterioration of the performance quality of the circuit and incidental disconnection of the terminal element from the socket due to application of shocks and impacts to the socket or to the circuit board or to both. In order to ensure reliable operation of the printed circuits which are fabricated by the mass dip-soldering method, it is of considerable significance that the leading end of the external terminal element to be received in the plug socket be prevented from being soldered while the remaining joints are soldered in a satisfactory condition.

It is, therefore, an important object of the present invention to provide an improved printed circuit assembly having an external terminal element which is sized and configured in strict conformity to the receiving hole in a plug socket to which the terminal element is to be fitted.

It is another important object of the invention to provide an improved printed circuit assembly which is assembled and soldered in a mass dip-soldering method and which has an external terminal element free from

an excess of size as would otherwise result from the soldering process.

It is still another important object of the present invention to provide an improved method for forming a printed circuit assembly in a manner that the particular portion of the external terminal element which is to be received in the plug socket is prevented from being soldered and at the same time all the remaining joints on the base panel of the circuit assembly are soldered in a satisfactory manner.

The circuit assembly formed in this manner has an external terminal element which has one end portion passed through a hole in the base panel and soldered to the panel on the surface carrying the remaining joints of the printed circuit and the other end portion projecting outwardly of the base panel on the same side as the surface carrying the joints. The external terminal elements has its intermediate portion bearing against the underside of the base panel so that the terminal element in its entirety has a generally L-shaped configuration with its shorter end forming a joint on the surface of the base panel and its longer end projecting from the base panel so as to be inserted into a hole in a socket during operation. The longer leading end portion is usually perpendicular to the plane of the base panel of the circuit assembly so that the soldered joints on the surface of the base panel can be formed by immersing or floating the assembly in a dip soldering bath with the longer leading end portion of the terminal element placed outside the bath during processing.

The external terminal element forming part of the printed circuit assembly having the above described general construction is secured to the base panel at its shorter end portion soldered to the panel. When, therefore, the terminal element is forced into or removed from the socket with its longer leading end portion subjected to a pressure in either direction, then the terminal element tends to be deformed or dislocated from its initial condition and, in some cases, the portion of the base panel carrying the terminal element is warped or bent. Where the printed circuit assembly has a number of printed circuit elements and accordingly the external terminal elements are connected to the base panel in a great number, the deformation or dislocation of the terminal elements or the base panel results in disarray or malalignment of the leading end portions to be inserted into the respective receiving holes in the socket so that difficulties are encountered in fitting the socket to the terminal elements and in maintaining the socket and terminal elements to be coupled in a stable condition.

It is, accordingly, further and another important object of the present invention to provide an improved printed circuit assembly in which the external terminal plates forming part thereof are satisfactorily secured in position.

It is a still another important object of the invention to provide an improved printed circuit assembly having a number of external terminal elements which are prevented from being deformed or dislocated from their initial positions.

Yet, it is an important object of the present invention to provide an improved printed circuit assembly which is economical for production and simple in construction.

To accomplish these objects, the printed circuit assembly according to the present invention has retaining

means by which the individual external terminal elements are securely held in position in association with a terminal plate spaced apart from the base panel of the assembly and carrying various electrical components such as for example transistors, capacitors, inductors, resistors, pin jackets, plug receptacles and so forth. In one preferred embodiment of the circuit assembly herein proposed, the retaining means comprises a retaining member having at least one pair of aligned holes through which the end portions of the external terminal element are passed with its intermediate portion bearing against an outer face of the retaining member. The external terminal element is thus securely supported on the base panel with the retaining member forced against the surface of the panel and with the intermediate portion of the external terminal element bearing against the outer face of the retaining member. The retaining member may be preferably formed with an inboardly turned edge extending in a direction substantially transversely to the aligned pair or pairs of holes in the retaining member for thereby gripping between the turned edge and inner face of the retaining member an aligned edge of the base panel. To provide ease of assembly, the base panel may be formed with an elongated groove extending from the edge of the panel for receiving therein the longer leading end portion of the external terminal. In another preferred embodiment of the printed circuit according to the present invention, the retaining means comprises a unitary retaining member having a presser portion positioned over the surface of the base panel for retaining between the faces of the panel and presser portion the intermediate portion of the external terminal element and at least one engaging portion extending transversely from the presser portion through an opening formed in the base plate adjacent the intermediate portion of the terminal element and securely held in position relative to the base plate. To have the retaining member securely held on the base panel, the engaging portion of the retaining member may preferably have a tip of a generally arrow form with at least one inboardly turned edge in abutting engagement with the surface of the base plate. If desired, the retaining member of the above described construction may be formed with at least one extension extending from the presser portion of the member in an opposite direction to the engaging portion and securely connected to the terminal plate which is spaced part from the base panel of the circuit assembly. The provision of such extension will be useful for the purpose of preventing the base panel from being warped when the external terminal element is inserted into the plug socket. Where the retaining member is to be used for retaining a number of external terminal elements, it may preferably be formed with two or more engaging portions and extensions extending from a common presser portion. If desired, furthermore, the intermediate portion of the external terminal element may be partly raised outwardly, in which instance the presser portion of the retaining member is formed with at least one portion raised away from the surface of the base panel and gripping therein the partly raised intermediate portion of the terminal element. This arrangement will be useful for preventing the terminal element from being dislocated or swaying from its initial position in a direction transverse to the direction of the intermediate portion of the element.

Other features and advantages of the printed circuit assembly and the method for fabricating the circuit assembly according to the present invention will become more apparent from the following description taken in conjunction with the accompanying drawings in which like reference numerals and characters designate corresponding parts and elements throughout the figures and in which:

FIG. **1** is a plan view showing a preferred embodiment of the printed circuit assembly according to the present invention;

FIG. **2** is a side elevational view of the printed circuit assembly shown in FIG. **1**;

FIG. **3** is also a side elevational view showing the dip-soldering method carried out to form the printed circuit assembly having the construction illustrated in FIGS. **1** and **2**;

FIG. **4** is a side elevational view showing a condition in which the external terminal element of the printed circuit assembly shown in FIGS. **1** and **2** is being dislocated by application thereto of a pressure as in a process of fitting the terminal element to a plug socket;

FIG. **5** is similar to FIG. **4** but shown a condition in which the base panel carrying the external terminal element is deformed by application thereto of a pressure as in a process of fitting the terminal element to the plug socket;

FIG. **6** is an exploded perspective view showing, on an enlarged scale, another preferred embodiment of the printed circuit assembly according to the present invention;

FIG. **7** is a sectional view showing the printed circuit assembly of FIG. **6** in the process of being assembled;

FIG. **8** is also a sectional view showing the printed circuit of FIG. **6** in an assembled condition;

FIG. **9** is a fragmentary sectional view of still another preferred embodiment of the printed circuit assembly according to the present invention;

FIGS. **10** to **12** are similar to FIG. **9** but show modification of the embodiment shown in FIG. **9**;

FIG. **13** is an exploded perspective view showing still another preferred embodiment of the printed circuit assembly according to the present invention;

FIG. **14** is a side elevational view showing the printed circuit assembly, in an assembled condition, shown in FIG. **13**;

FIG. **15** is also an exploded perspective view showing a modification of the embodiment shown in FIG. **13**; and

FIG. **16** is a side elevational view showing the printed circuit assembly, in an assembled form, of FIG. **15.**

Reference is now made to the drawings, first concurrently to FIGS. **1** and **2** showing a first preferred embodiment of the printed circuit assembly according to the present invention. As illustrated, the printed circuit assembly, generally designated by reference numeral **20,** has a base panel **21** which is usually formed of a plastic mass material having a laminated foil of copper or other conductive material. The base panel **21** carries on its surface a multiplicity of printed circuits **22** formed in suitable geometrical patterns of conductors and having joints **23** through which the printed circuits **22** are electrically connected to various electrical components forming part of the assembly. These electrical components, which may include transistors, resistors, capacitors, inductors, pin joints, plug receptacles and

so forth, as previously mentioned. In the embodiment herein shown and in those which will be described, these components are exemplified as including a plug receptacle **24** and a series of pin jacks which are commonly designated by reference numeral **25.** The plug receptacle **24** and pin jacks **25** extend underneath the base panel **21** through holes pierced in the panel and are carried on a terminal plate **26** which is positioned substantially in parallel to and at a suitable spacing from the base panel **21,** as seen in FIG. **2.** The terminal plate **26** is connected through suitable fastening means such as screws **27** and **27'** to a chasis **28** of an electric appliance which may be a radio or television receiver or a stereophonic phonograph.

To provide electric connection between the individual printed circuits **22** and a plug socket **29** which is positioned customarily externally of the printed circuit assembly **20,** the circuit assembly is provided with a number of external terminal elements **30** respectively connected to the printed circuits **22** as seen in FIG. **1.** As better seen in FIG. **2,** each of the external terminal elements **30** has substantially parallel relatively shorter and longer opposite end portions **30***a* and **30***b*, respectively, and an intermediate portion **30***c* intervening between the end portions **30***a* and **30***b*. Both the shorter and longer end portions **30***a* and **30***b*, respectively, extend in directions normal to the plane of the base panel **21** through spaced holes formed in the panel. The intermediate portion **30***c* of the external terminal element **30,** on the other hand, bears against the underside of the base panel **21,** thus extending substantially at right angles to the opposite end portions **30***a* and **30***b*. The shorter end portions **30***a* of the individual terminal elements **30** form joints respectively providing electrical connections between the terminal elements **30** and the associated printed circuits **22** as seen in FIG. **1.** The longer end portions **30***b*, which are positioned in a row on the surface of the base panel **21,** form plugs to be inserted into respective receiving holes (not shown) formed in the plug socket **29.** The joints **23** between the printed circuits **22** and the associated plug receptacle **24** and the joints between the circuits and the associated terminal elements **30** of the assembly having the above described construction are then fluxed for being dip-soldered in a dip-soldering bath **31** illustrated in FIG. **3.**

As seen in FIG. **3,** the printed circuit assembly **20** is immersed in or floated on a molten solder **32** which is contained in the drip-soldering bath **31** in a usual manner. It is, however, important in the method according to the invention that the circuit assembly **20** be positioned with the joints **23** for the plug receptacle **24** and pin jacks **25** and the joints for the terminal elements **30** immersed in the molten solder **32** and concurrently with the plugs or longer end portions **30***b* of the terminal elements **30** located outside the dip-soldering bath **31.** As a consequence, the joints **23** for the components **24** and **25** are affixed to the conductors of the printed circuits **22** as at **33** while the joints for the terminal elements **30** are affixed to the conductors of the printed circuits **22** as at **34,** as seen in FIGS. **1** and **2.** Thus, the plugs or longer end portions **30***b* of the individual external terminal elements **30** are left intact during the dip-soldering process and accordingly no changes in size and configuration of the longer end portions **30***b* result from such process. The plugs or longer leading end portions **30***b* of the external terminal elements **30** can therefore be accurately and assuredly inserted into and removed from the holes (not shown) with prescribed sized or diameters formed in the plug socket **29.**

Since, thus, the printed circuit assembly **20** heretofore been described in detail has generally L-shaped external terminal elements **30** having their intermediate portions **30***c* held in abutting engagement with the underside of the base panel **21** and their shorter end portions **30***a* joined to the base panel **21,** substantially no unusual force is directly imparted to the soldered joints **34** and accordingly the conductors of the printed circuits **22** are prevented from being disconnected from the shorter end portions **30***a* of the terminal elements **30** even though a force is applied to the plugs or longer leading end portions **30***b* of the terminal elements **30** either in the direction of arrow in FIG. **2** or in the opposite direction when the terminal elements **30** are being inserted into or removed from the plug socket **29.**

In spite of the above noted outstanding features of the printed circuit assembly **20** having the construction shown in FIGS. **1** and **2** and dip-soldered in the method shown in FIG. **3,** a problem may still be encountered when the external terminal elements **30** are inserted into or removed from the plug socket **29** due to application of a considerable force to the group of the plugs **30***b* forming part of the terminal elements **30.** When, thus, a force is imparted to the plugs or longer end portions **30***b* of the individual terminal elements **30** for fitting the plug socket **29** thereto as indicated by an arrowhead in FIG. **4,** then it may happen that some or all of the terminal elements **30** are dislocated in a manner to have their intermediate portions **30***c* moved or turned about the soldered joints **34** of the shorter end portions **30***a* away from the underside of the base panel **21.** This causes the plugs or longer end portions **30***b* of the terminal elements **30** to be disarrayed from their initial positions, thereby raising a difficulty in fitting the socket **29** to the terminal elements. Where such dislocation and disarray of the terminal elements **30** is not brought about, then the base panel **21** of the circuit assembly **20** may be dent or warped at its portion carrying the terminal elements **30** by application of a force to the plugs or longer end portions **30***b* of the elements **30** when in fitting the plug socket **29** to the terminal elements, as seen in FIG. **5.** Thus, the present invention further contemplates elimination of the problems of the kind above discussed through provision of retaining means which is specifically adapted to hold the individual terminal elements **30** in position. An embodiment of the printed circuit assembly having such retaining means is now illustrated in FIGS. **6** to **8.**

Referring first to FIG. **6,** the terminal plate **26** is formed at one end with an inboardly turned edge **35** extending at a spacing from the face of the plate for gripping therebetween as associated edge portion of the base panel **21.** The terminal plate **26** has formed therein a pair of aligned rows of holes **36** and **37** which are located at spacings substantially equal to the lengths of the intermediate portions **30***c* of the external terminal elements **30.** The shorter and longer opposite end portions **30***a* and **30***b*, respectively, of the external terminal elements **30** are thus inserted across the terminal plate **26** through these holes **36** and **37,** respectively so that the longer end portion **30***b* are located adjacent the inboardly turned edges **35** of the terminal plate **26,** as seen in FIG. **6.** Openings are formed in the circuit carrying base panel **21** in a suitable manner to have the

end portions 30*a* and 30*b* of the terminal elements 30 inserted therethrough. For this purpose, the base panel 21 is preferably formed with a row of holes 38 remote from the edge of the base panel and respectively aligned with the holes 36 in the facing terminal plate 26 and a row of elongated grooves 39 which are aligned with both the holes 38 in the base panel 21 and the holes 37 in the terminal plate 26. The grooves 39 are opened at the edge of the base panel 21 and terminate at spacings substantially equal to the lengths of the intermediate portions 30*c* of the terminal elements 30 from the aligned holes 38. For assemblying the base panel 21, terminal plate 26 and external terminal elements 30, the shorter and longer end portions 30*a* and 30*b*, respectively, of the external terminal elements 30 may be first inserted through the aligned holes 36 and 37 in the terminal plate 26 with the intermediate portions 30*c* bearing against the outer face of the terminal plate, and then the terminal plate 26 thus carrying the terminal elements 30 should be fitted to the printed base panel 21 with the end portions 30*a* and 30*b* of the terminal elements 30 inserted through the aligned holes 38 and elongated grooves 39 in the base panel 21. For this purpose, the terminal plate 26 complete with the external terminal elements 30 may be first positioned relative to the base panel 21 in a manner to have the longer end portions 30*b* of the terminal elements 30 inserted through the grooves 39 in the panel and have the inner face of the inboardly turned edge 35 abutting against the under side of the panel as seen in FIG. 7. Then, the terminal plate 26 should be turned about the inboardly turned edge 35 toward the base panel 21 until the shorter end portions 30*a* of the external terminal elements 30 are fully inserted through the aligned holes 38 in the base panel as seen in FIG. 8.

The external terminal elements 30 thus carried by the printed base panel 21 and terminal plate 26 are fitted to the plug socket 29 which is shown in FIG. 6 as having a number of receiving holes 40 which are respectively aligned with the plugs or longer end portions 30*b* of the individual terminal elements 30. When, thus, the plug socket 29 is to be fitted to the plugs or longer end portions 30*b* of the external terminal elements 30, the inboardly turned edge or extension 35 serves not only to securely hold the base panel 21 in position but to provide mechanical resistance or reinforcement to the external terminal elements 30. The external terminal elements 30 are accordingly prevented from being dislocated and deformed from the initial condition and can thus be fitted to the plug socket 29 in a reliable and stabilized fashion, while the printed base panel 21 is prevented from being deformed by application thereto of a force.

FIG. 9 illustrates a modified form of retaining means adapted to prevent dislocation of the terminal elements 30 and deformation of the printed base panel 21. As shown in FIG. 9, the retaining means comprises a retaining member 41 which is held in position relative to the printed base panel 21 through an opening 42 which is formed in the base panel 21. The retaining member 41 has a substantially flat presser portion 43 overlying the face of the base panel 21 and holding the intermediate portions 30*c* of the terminal elements 30 between the opposite faces of the presser portion 43 and the base panel 21. The retaining member 41 also has an engaging portion 44 projecting substantially perpendicularly from the underside of the presser portion 43 and extending through the opening 42 in the base panel 21. The engaging portion 44 has a tip 44*a* of generally an arrow form with its backwardly turned edges in abutting engagement with the underside of the base panel 21, as seen in FIG. 9. The retaining member 41 is usually formed of a plastics and the arrow-shaped tip 44*a* of the engaging portion 44 and the opening 41 in the base panel 21 should be so sized that the engaging portion 44 can be forced through the opening 41 during assembly and prevented from being removed from the base panel 21 once assembled.

A modified configuration of the retaining member 41 is illustrated in FIG. 10. The modified retaining member, now designated in its entirety by reference numeral 45, has a substantially flat presser portion 46 overlying the printed base panel 21 with the intermediate portions 30*c* of the external terminal elements interposed between the faces of the presser portion and the base panel, similarly to the retaining member 41 shown in FIG. 9. Different from the retaining member of FIG. 9, the modified retaining member 45 has a pair of spaced substantially parallel engaging portions 47 and 48 projecting from the underside of the presser portion 46 and having backwardly and inwardly turned tips 47*a* and 48*a*, respectively. The printed base panel 21, on the other hand, is formed with a pair of holes 49 and 50 which are spaced apart from each other and which are aligned with the engaging portions 47 and 48, respectively, of the retaining member 45. The engaging portions 47 and 48 are inserted through the aligned holes 49 and 50, respectively, with their backwardly turned tips 47*a* and 48*a* closely held in abutting engagement with the underside of the base panel 21, as illustrated. It may be noted that, although the engaging portions 47 and 48 are herein shown as having the tips 47*a* and 48*a* turned inwardly of the engaging portions, the tips may be formed outwardly of the engaging portions 47 and 48 if desired.

Each of the retaining members 41 and 45 shown in FIGS. 9 and 10, respectively, may be further provided with an extension 51 formed on the opposite side to the engaging portion 44 and portions 47 and 48, as illustrated in FIGS. 11 and 12. As seen in FIGS. 11 and 12, the extension 51 is formed on the outer face of the presser portion 41 or 45 and preferably has an enlarged end 51*a*. The extension 51 is bonded or otherwise secured to the face of the terminal plate (not herein shown) which is spaced apart from the printed base panel 21 so as to provide the base panel with a reinforcement which prevents the base panel from being wraped or otherwise deformed when pressed upon by application of a force to the external terminal element as in the process of fitting the plug socket to the terminal element.

The retaining means which are shown in FIGS. 9 to 12 are all adapted for the purpose of securely in position a relatively small number of external terminal elements because of the limited coverages of the presser portions forming part of such means. Where, therefore, the printed circuit assembly should be incorporated with a relatively large number of printed circuits as is usually the case, the retaining means may be modified in a manner to have the coverage of the pressure portion augmented so as to be capable of retaining all of the printed circuits, an embodiment adapted to meet this purpose being shown in FIGS. 13 and 14.

Referring first to FIG. 13, the retaining means has a construction which is essentially similar to the configuration of the retaining member shown in FIG. 11. The retaining member, now designated by reference numeral, has a presser portion 53 in the form of an enlongated strip which is positioned over the outer face of the printed base panel 21. A suitable number of spaced parallel engaging portions, which are herein exemplified as two in number as designated by reference numerals 54 and 55, extend perpendicularly from the underside of the printed base panel 21. These engaging portions 54 and 55 have tips 54*a* and 55*a* of generally arrow forms with their edges turned backwardly, similarly to their counterparts in FIGS. 9 and 11. The retaining member 52 further has spaced parallel extensions 56 and 57 which are formed on the outer face of the presser portion 53 opposite to the engaging portions 54 and 55, the extension having enlarged ends 56*a* and 57*a*, respectively, as shown. Although the extensions 56 and 57 are herein shown as aligned respectively with the engaging portions 54 and 55 formed on the opposite side, such is merely by way of example and, thus, the extensions 56 and 57 and the engaging portions 54 and 55 may be located suitably relative to each other where desired. At those locations in the printed base panel 21 aligned with the engaging portions 54 and 55 of the thus constructed retaining member 52 are formed spaced openings 58 and 59, respectively.

For assembly, the external terminal elements 30 in a relatively large number are fitted to the printed base panel 21 through insertion of the shorter and longer opposite end portions 30*a* and 30*b*, respectively, through spaced rows of aligned holes 60 and 61, respectively, which are pierced in the base panel 21, as seen in FIG. 13. The engaging portions 54 and 55 are then forced through the aligned openings 58 and 59, respectively, so that the arrow-shaped tips 54*a* and 55*a* thereof are closely held in abutting engagement with the underside of the base panel 21. The presser portion 53 is consequently forced against the intermediate portions 30*c* of the individual external terminal elements 30. The intermediate portions 30*a* of the terminal elements 30 are in this manner closely secured between the presser portion 53 of the retaining member 52 and the printed base panel 21. The extensions 56 and 57 of the retaining member 52, on the other hand, are bonded or otherwise secured to the terminal plate 26 through their enlarged ends 56*a* and 57*a*, as seen in FIG. 14 which illustrates the printed circuit assembly constructed as above described. The external terminal elements 30 are in this manner securely held in position by the presser portion 53 of the retaining member 52 and can thus be stably and reliably inserted into aligned holes 40 in the plug socket 29.

FIGS. 15 and 16 illustrate a modification of the printed circuit assembly shown in FIGS. 13 and 14. The modified circuit assembly herein shown incorporates retaining means which is largely similar in construction to the retaining member 52 of the assembly shown in FIGS. 13 and 14. In the embodiment shown in FIGS. 15 and 16, however, the retaining member which is now designated by reference numeral 62 differs from the retaining member 52 of FIGS. 13 and 14 in that it has a presser portion 63 which is generally of a corrugated configuration. Thus, the presser portion 62 is formed with a suitable number of portions 63*a* which are raised on the side of the presser portion opposite to the engaging portions 54 and 55. These raised portions 62*a* of the presser portion 63 are spaced apart from each other distances which are substantially in agreement with the spacings between the external terminal elements 30 which are to be mounted in association with such presser portion. To comply with the specific configuration of the presser portion 63 of the modified retaining member 62, the intermediate portions 30*c* of the external terminal elements 30 have centrally or otherwise partly raised portions 30*d* as seen in FIG. 15. When the retaining member 62 is assembled together with the printed base panel 21 and the external terminal elements 30 carried thereon, each of the raised portions 30*d* of the intermediate portions 30*c* of the individual terminal elements 30 are closely received in the raised portions 63*a* of the presser portion 63 as seen in FIG. 16. The embodiment shown in FIGS. 15 and 16 are thus adapted not only to prevent the external terminal elements 30 from being dislocated each of its plane and prevent the printed base panel 21 from being deformed from its initial position by reason of the retaining force exerted by the presser portion 63 but to prevent the external terminal elements 30 from being laterally moved or turned about their intermediate portions 30*c* when subjected to an external force as applied thereto when the plug socket is being fitted to or disconnected from the group of the terminal elements. The embodiment shown in FIGS. 15 and 16 are otherwise entirely similar in construction to the embodiment shown in FIGS. 13 and 14 and, as such, no further description may not be herein incorporated.

What is claimed is:

1. A printed circuit assembly comprising a base panel carrying thereon at least one printed circuit, a terminal plate which is positioned substantially in parallel to said base panel, at least one electrical component carried on said terminal plate and connected to said at least one printed circuit through at least one soldered joint positioned on a surface of said base panel opposite to said terminal plate, and at least one external terminal element having relatively shorter and longer opposite end portions and an intermediate portion intervening between said end portions, said shorter end portion being inserted through said base panel and connected to said at least one printed circuit through a soldered joint positioned on said surface, said longer end portion being inserted through said base panel outboardly of said shorter end portion and extending substantially perpendicularly from said base panel on the same side as said surface of the base panel, said intermediate portion bearing against the surface of said base panel opposite to said soldered joints, further comprising retaining means operable to secure said at least one external terminal element in position relative to said base panel, and said retaining means comprises an inboardly turned edge formed at an end of said terminal plate, said inboardly turned edge gripping an end portion of said base panel between spaced faces of said turned edge and said terminal plate.

2. A printed circuit assembly as claimed in claim 1, in which said longer end portion of said at least one external terminal element is inserted through said base panel by means of at least one elongated groove formed in said base panel, said elongated groove being opened at said end portion of the base panel and terminating

at a spacing from said shorter end portion of said at least one external terminal element.

3. A printed circuit assembly as claimed in claim 1, in which said longer end portion of said at least one external terminal element is located adjacent said inboardly turned edge.

4. A printed circuit assembly comprising a base panel carrying thereon at least one printed circuit, a terminal plate which is positioned substantially in parallel to said base panel, at least one electrical component carried on said terminal plate and connected to said at least one printed circuit through at least one soldered joint positioned on a surface of said base panel opposite to said terminal plate, and at least one external terminal element having relatively shorter and longer opposite end portions and an intermediate portion intervening between said end portions, said shorter end portion being inserted through said base panel and connected to said at least one printed circuit through a soldered joint positioned on said surface, said longer end portion being inserted through said base panel outboardly of said shorter end portion and extending substantially perpendicularly from said base panel on the same side as said surface of the base panel, said intermediate portion bearing against the surface of said base panel opposite to said soldered joints, further comprising retaining means operable to secure said at least one external terminal element in position relative to said base panel, said retaining means comprises a retaining member having a presser portion closely overlying said intermediate portion of said at least one external terminal element and securely held in position relative to said base panel for securely holding said intermediate portion of the external terminal element between said presser portion and said base panel.

5. A printed circuit assembly as claimed in claim 4, in which said retaining member further has at least one engaging portion substantially perpendicularly projecting from said presser and extending through an opening formed in said base panel, said at least one engaging portion having a backwardly turned edge which is held in abutting engagement with the surface of said base panel opposite to said presser portion.

6. A printed circuit assembly as claimed in claim 4, in which said retaining member further has at least one extension on the surface of said presser portion opposite to said engaging portion, said at least one extension being secured to said terminal plate.

7. A printed circuit assembly as claimed in claim 4, in which said presser portion of said retaining member has at least one raised portion which is raised on the opposite side to said at least one engaging portion and in which said intermediate portion of said at least one external terminal element has partly raised portion which is closely received in said raised portion of said presser portion.

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