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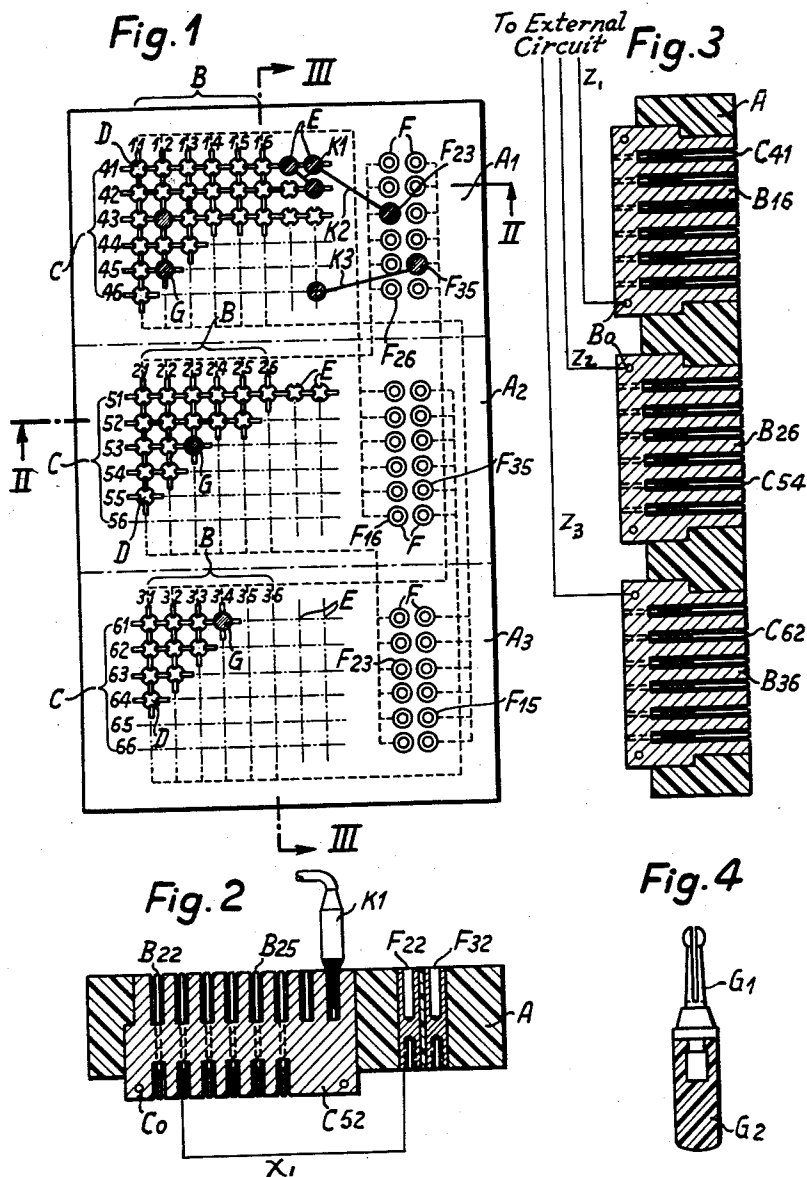
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TERMINAL BOARD ARRANGEMENT FOR SELECTIVE INTERCONNECTION

Filed April 3, 1957

2 Sheets-Sheet 1



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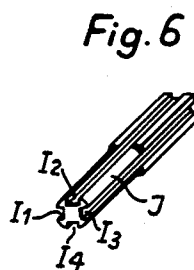
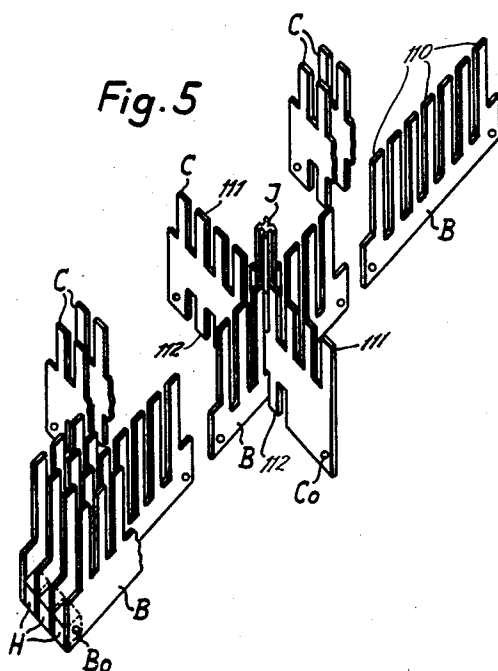
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2 Sheets-Sheet 2



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**TERMINAL BOARD ARRANGEMENT FOR
SELECTIVE INTERCONNECTION****Manfred Prosper Dorizzi, Zurich, Switzerland, assignor
to Contraves AG, Zurich, Switzerland****Filed Apr. 3, 1957, Ser. No. 650,377****Claims priority, application Switzerland Apr. 4, 1956****10 Claims. (Cl. 339—18)**

The present invention relates to a terminal board arrangement. More particularly, the present invention relates to a method of making a terminal board arrangement and a terminal board arrangement for permitting various interconnections to be made between a large plurality of conductive members.

In many types of apparatus constructed today it is necessary and advantageous to be able to make a large variety of changes in the electrical connections of the apparatus. For example, in different types of electronic computing machines it is necessary to make a large number of changes in the connections between the various elements of the machine each time that a new problem is set up for the machine. It is also clear that equipment such as amplifiers, filters, measuring devices, control and regulator units, all of which are used for a variety of purposes, require connections which can be easily varied and interchanged.

In conventional apparatus of this type various selector switches having a plurality of stages are used or else large bays of sockets are arranged for connections to the units. The selector switches are quite expensive and require a great degree of maintenance due to the likelihood of breakdown at the moving contacts. The use of large numbers of sockets for making connections leads to a large maze of cables and wiring which results in a great deal of errors and the necessity for constant checking of the connections.

On the other hand, the present invention permits a large variety of different connections to be made while eliminating any requirement for long connecting cables or for selector switches.

It is accordingly an object of the present invention to overcome the disadvantages of the prior art described hereinabove.

A second object of the present invention is to provide a new and improved terminal board arrangement.

Another object of the present invention is to provide a new and improved terminal board arrangement wherein a large number of different electrical connections can be made by inserting shorting plugs in specified positions of the terminal board.

Still another object of the present invention is to provide a new and improved terminal board arrangement including a plurality of crossing connecting members which cross at openings in the terminal board and thereby permit the same to be connected to each other.

With the above objects in view, the present invention mainly consists of a terminal board arrangement including a base member made of an electrically insulating material and being formed with a plurality of openings therein, at least a first electrically conductive elongated connecting member arranged in the base member and extending in a first direction, the connecting member having a plurality of spaced connecting elements, each of which communicates respectively with at least one of the openings of the base member, and at least a second

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electrically conductive elongated connecting member arranged in the base member, extending in a second direction, and crossing the first connecting member without contacting the same, the second electrically conductive member having a plurality of spaced connecting elements, each of which communicates respectively with at least one of the openings of the base member, whereby connecting elements of the first and second connecting members communicate with the same opening of the terminal board where the connecting members cross each other so that the first and second connecting members can be electrically connected to each other at the same opening.

A preferred method for carrying out the present invention includes the steps of inserting groups of electrically conductive plates in a casting mold, the plates crossing each other, maintaining the electrically conductive plates electrically insulated from each other, inserting molding core elements between the electrically conductive plates wherever the same cross each other, and filling the casting mold with solidifiable electrically insulating material in a flowable form so that upon hardening of the solidifiable material and removal of the molding core elements, a terminal board is produced having openings wherein the conductive plates may be electrically connected to each other.

In a preferred embodiment of the present invention, the terminal board arrangement includes a plurality of separate units each of the units including openings permitting the interconnection between electrical plates thereof. In addition, each unit contains terminals which are internally connected to the conducting members arranged in the other units.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawings, in which:

Fig. 1 is a front elevational view of a terminal board arrangement constructed in accordance with the principles of the present invention;

Fig. 2 is a transverse sectional view taken along line II—II of Fig. 1;

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

Fig. 4 is a diagrammatic view partly in section showing a connecting plug used with the terminal board arrangement;

Fig. 5 is a perspective diagrammatic representation showing the constructional elements of the conductive members of the terminal board arrangement; and

Fig. 6 is a perspective view of a molding core element used for making the terminal board arrangement.

Referring to the drawings and more particularly to Figs. 1, 2 and 3 it can be seen that the terminal board includes three terminal board units A1, A2 and A3. The terminal board A which includes the above three units is made of electrically insulating material such as a synthetic resin, for example. The units A1, A2 and A3 of the terminal board A are each formed with a plurality of openings D therein. In the illustrated embodiment, the holes D are arranged in a first horizontal direction and in a second vertical direction transverse to the horizontal direction.

Arranged within each of the units of the terminal board are sets of conductive members B and C. As best seen in Fig. 5, the members B, each of which is electrically conductive, are formed with a plurality of finger-like

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connecting elements 110. The elements 110 extend in a direction transverse to the direction in which the elements B are elongated. Each of the elements B therefore forms a comb-like member.

In Fig. 5 it can also be seen that the members C are arranged transverse to the members B and accordingly cross over these members. Each of the members C is formed with a plurality of connecting elements 111 which extend in a first direction transverse to the direction of elongation of the members B and a plurality of second spaced elements 112 which extend in the direction opposite to the elements 111. This provides a doubled comb-like effect for each of the members C.

In Fig. 5 an intersection between the element B and the element C in the central unit is shown. It can be seen that the spacing between the elements 112 permit the members C to cross the members B without contacting the same so that the members B and C can remain electrically insulated from each other as they are supported in the terminal board arrangement.

Referring again to Figs. 1-3, it is apparent that in units A1 six members C are arranged, including the members C41-C46. These members each extend in the horizontal direction so that the finger-like connecting elements 111 thereof communicate with the series of horizontal holes D in the unit A1. That is, it can be seen that in the unit A1, the member C41, for example, includes elements 111 which communicate with two separate openings D in the terminal board unit. These elements 111 are spaced so as to be on opposite sides with respect to the axis of the opening in the terminal board unit.

Similarly, the terminal board unit A1 includes six B members respectively identified as members B11-B16. These members extend in a direction transverse to the C members and have the finger-like connecting elements 110 thereof communicating with the D openings in the unit A1. The elements 110 of the B members communicate with adjacent openings D in a manner similar to the members C.

It is clear that with the above arrangement, the B and C members cross each other in the A1 unit without contacting each other. Also, each time that a B member crosses a C member, the crossing occurs at an opening D in the terminal board. For example the member B11 crosses the member C41 at the opening D which is the upper left hand opening of the terminal board in the view shown in Fig. 1. Similarly, the member B11 crosses the member C46 at the lowermost left hand opening D of the unit A1. It is therefore possible to make an electrical connection between any one of the members C41-C46 and the members B11-16 by inserting in the corresponding opening of the terminal board, an electrical connecting member. Such a member is shown in Fig. 4. This plug member G is formed with a resilient electrically conductive contacting portion G1 and an electrically insulating handle portion G2.

If the plug G is inserted in any one of the D openings in the unit A1, an electrical connection is immediately made between the B and C members which cross at the respective opening. For example in Fig. 1, a plug G is shown inserted in the openings corresponding to the positions where the member B12 crosses the members C43 and C45, respectively. It is therefore apparent that, for the illustrated example, the member B12 is connected to both the C43 member and the C45 member.

Similarly, the unit A2 is provided with six B members, B21-B26 and six C members, C51-C56; the A3 unit includes six B members, B31-B36 and six C members, C61-C66.

In the A2 unit, the plug G is inserted at the opening wherein the member B23 crosses the member C53 and in the A3 unit, the plug G is inserted at the opening wherein the member B34 crosses the member C61.

Accordingly, with the invention as embodied in the arrangement shown in Fig. 1, it is possible to obtain an

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electrical connection between any one of six different conductive members and any one of six other conductive members in each of the units of the terminal board. A plug G need only be inserted at the opening corresponding to the crossing position of the two conducting B and C members. It is apparent that such connections can be carried out without any cables so that the terminal board presents a neat appearance and it is immediately apparent by a cursory study of the terminal board, which of the conducting members are connected to each other.

The embodiments shown in Figs. 1, 2 and 3 also have some additional features. It can be seen that in the unit A1, for example, the conductive member C41 actually communicates with eight different openings in the terminal board. The first six openings, identified as D openings, correspond to the crossing points with the members B11-B16. The next two openings which are actually shown with plugged inserts in Fig. 1, identified as E openings, do not provide any connection with any of the B members ranged in the unit A1. Rather, the purpose of these two additional holes for the C member C41 is to permit this C member to be connected to any of the other C members, if desired. For this purpose, a cable connector such as shown partially in Fig. 2 is provided having a plug at one end similar to the G plug illustrated in Fig. 4 but the pin portion G1 of the G plug being connected to a cable and the other end of the cable having a similar plug.

Therefore, in Fig. 1, in the unit A1, the unit C41 is shown connected to the member C42 by means of two G plugs connected in the E openings of the terminal board, the plugs being connected by means of the cable K1. The E openings in the terminal board are the openings which correspond only to one of the members in the unit. This can be seen in the E openings C51 of the unit A2, for example.

Therefore, with the embodiment thus far described it is not only possible to make connections between the crossing members B and C, as desired, but also to make connections between the C members by the use of two plugs and a very short cable length therebetween. It is clear that such a short cable length is not objectionable since it does not cover any of the pins or holes to obscure from view the exact connections of the terminal board arrangement.

An additional feature of the illustrated embodiment is the use of the F sockets. The F sockets, for the illustrated embodiment, are 12 sockets arranged in two rows of six each in each of the units A1, A2 and A3. Two such F sockets, F22 and F32 can be seen in the cross sectional view of Fig. 2, for example. Each of the F sockets or terminals, is arranged in one unit and is connected electrically to a B member of another unit. Dotted lines are shown in Fig. 1 to indicate the electrical connection between the units and the F sockets. For example, the unit F26 which is the lowermost F socket at the left-hand side is electrically connected to the member B26 in the unit A2 and solely to this member. Similarly, the F member F22 is connected to the B member B22 of the unit A2 and solely to this member. This is shown in Fig. 2, wherein a conductor x_1 connects the F member F22 to the B member B22. The conductor x_1 comprises any suitable electrical conductor and may be supported in or behind the molded terminal board A in any suitable manner known in the art. Similarly, the F member F35 is connected to the B member B35 of the unit A3 and solely to this B member. Accordingly, in the A1 unit, the two columns of F sockets correspond respectively to the members B21-B26, at the left hand column and the members B31-B36 in the right hand column. In Fig. 1, in the unit A1, the member C41 is shown connected to the socket F23 by means of two G plugs and a cable K2. Such a connection clearly connects the member C41 to the member B23 of the unit A2.

Also shown in the unit A1 of Fig. 1 is the connection

between the member C46 and the socket F35 by means of the cable K3. The socket F35 clearly is connected to the member B35 of the unit A3 so that the member C46 is electrically connected to the member B35 of unit A3 by the illustrated connection.

It is therefore apparent that with the distribution of the F sockets as shown in the units A1, A2 and A3, it is possible for any one of the members in any one of the units to be connected to any one of the members in any one of the other units. It is apparent that this arrangement takes place of a grid pattern which would include 18 columns and 18 rows or a total of 324 individual connections on the terminal board. In place of such a large terminal board, the terminal board arrangement of the present invention utilizes a total of 144 openings in the terminal board arrangement. Yet, with these 144 openings it is possible to make any one of the desired connections between the 18 B members and the 18 C members or among the B or C members themselves. In this respect it should be noted that it is possible to connect B11 to B12, for example, by connecting the corresponding F sockets in the A units or the A3 units together.

It is clear that the arrangement shown in Figs. 1, 2 and 3 provides a terminal board arrangement wherein the openings for plugging in the plugs G are provided with four different radially inwardly projecting elements, each of which are displaced 90° from each other in the illustrative example. Two of these elements are the elements 111 of the C member and the other two are the elements 110 of the B member. Therefore when the resilient portion G1 of the G plug is inserted in the D opening corresponding to the proper crossing point of the B and C members, a positive electrical connection is made between these members since two separate elements of each of the members are connected together resiliently.

The insulating handle portion G2 of the G plug can preferably be made of a distinctive color so that the connection points on the terminal board quickly stand out to an observer. It should also be noted that the small cables which are used to connect the K plugs are all arranged so that they are connected outside of the crossing D openings of the terminal board and therefore do not cover any of the D openings. Such is not the case in the conventional terminal board arrangements using cables.

In a preferred method of making the terminal board arrangement shown in Figs. 1-3, the connecting members B and C are arranged as shown in Fig. 5. The B members are shown held spaced from each other by spacers H. Similar spacers are provided for the C members. In this arrangement, core plugs J as shown in Fig. 6 are inserted at each crossing point of the B and C members as shown in the central unit of Fig. 5. The molding core pins J are provided with four angularly spaced grooves 11-14, each of which cooperate respectively with one of the connecting elements of the B and C members. That is two of the grooves 11 and 13, for example, cooperate with the elements 111 of the C member and the grooves 12 and 14 cooperate with the elements 110 of the crossing B member.

After all the core pins J have been inserted corresponding to the proper D openings and the spacers H have been set up to maintain the B and C members in electrically insulating relationship, the entire unit, which has been thus assembled in the casting mold, is surrounded by solidifiable insulating material in flowable form. The insulating material is introduced into the casting mold and surrounds the various conducting B and C members. After the material hardens, the core plugs J and the spacers H are removed. The D openings are left by the core plugs J.

It should be noted that each of the B members is provided at opposite ends thereof with small connecting

holes B₀ and the C members are provided at opposite ends thereof with small connecting holes C₀. It is therefore possible to make electrical connection to each of the B and C members, separately, without making any electrical contact with the other connecting members. Thus, electrical connections, such as for example, conductors z₁, z₂ and z₃, may connect selected ones of the B and C members to the external circuit; the conductor z₁ being connected to one of the holes B₀, the conductor z₂ being connected to another of the holes B₀ and the conductor z₃ being connected to one of the holes C₀.

It is apparent that the spacers H which are preferably made of rubber, keep the connecting holes B₀ and C₀ clear during the molding operation.

After the molding operation, the front face of the entire terminal board arrangement can be milled so as to be planar to present a smooth front face which can be mounted in an appropriate manner.

It can be seen that with the arrangement illustrated in the drawings of the present application, the various electrical connections can be easily and quickly changed by inserting or removing the G plugs or by connecting the cables with the K plugs therein. All the connections that are made are readily apparent since the G plugs are never covered by the hanging cables. By properly marking each of the openings on the terminal board face, the proper D opening is quickly found regardless of the particular connection to be made.

It is also clear that it is not absolutely necessary that the various B and C conducting members be arranged in the regular rectangular grid pattern shown but can be replaced by a similar arrangement which might consist of a number of concentric circles with crossing radii, for example. In addition the parallel B members could cross the parallel C members at some angle other than 90°, if desired.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of terminal board arrangements and methods for making the same differing from the types described above.

While the invention has been illustrated and described as embodied in terminal boards particularly useful for analogue computers and the like, it is not intended to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of the present invention.

What is claimed as new and desired to be secured by Letters Patent is:

1. In a terminal board arrangement for permitting interconnections between different conductive elements, in combination, a base member made of an electrically insulating material; at least a first electrically conductive elongated connecting member arranged on said base member and extending in a first direction, said connecting member having a plurality of spaced contact fingers having confronting transverse edges; at least a second electrically conductive connecting member arranged on said base member extending in a second direction and crossing said first connecting member between parallel planes without contacting the same, said second electrically conductive member having a plurality of spaced contact fingers having confronting transverse edges, the contact fingers of said first and second connecting members being located between parallel planes and extending in the same direction; and a plug adapted to be inserted in the space between said transverse confronting edges of said first and second contact fingers so that said first and second connecting members may be electrically connected to each other by insertion of said plug.

2. In a terminal board arrangement for permitting interconnections between different conductive elements, in combination, a base member made of an electrically insulating material and being formed with a plurality of openings therein; at least a first electrically conductive

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elongated planar connecting member arranged on said base member and extending in a first direction, said first connecting member having a plurality of spaced contact fingers, each of which communicates respectively with at least one of the openings of said base member; and at least a second electrically conductive elongated planar connecting member arranged on said base member extending in a second direction and crossing said first connecting member without contacting the same, said second electrically conductive member having a plurality of spaced contact fingers extending in the same direction as the contact fingers of said first connecting member, each of which communicates respectively with at least one of the openings of said base member whereby contact fingers of said first and second connecting members are located between parallel planes in the same opening of said terminal board so that said first and second connecting members can be electrically connected to each other in said same opening.

3. In a terminal board arrangement for permitting interconnections between different conductive elements, in combination, a base member made of an electrically insulating material and being formed with a plurality of spaced openings therein located between parallel planes; at least a first electrically conductive elongated connecting member arranged on said base member and extending in a first direction, said first connecting member having a plurality of spaced contact fingers arranged in pairs, each of said pairs being located in one of said openings respectively; and at least a second electrically conductive elongated connecting member arranged on said base member extending in a second direction and crossing said first connecting member without contacting the same, said second electrically conductive member having a plurality of spaced contact fingers extending in the same direction as the contact fingers of said first connecting member and arranged in pairs, each of said pairs being located in one of said openings respectively whereby pairs of contact fingers of said first and second connecting members are located between said parallel planes in the same opening of said terminal board so that said first and second connecting members can be electrically connected to each other in said same opening.

4. In a terminal board arrangement for permitting interconnections between different conductive elements, in combination, a base member made of an electrically insulating material and being formed with a plurality of openings therein located between parallel planes; at least a first electrically conductive elongated planar connecting member arranged on said base member and extending in a first direction, said connecting member having a plurality of spaced finger-like connecting elements, each of which extends in a direction substantially transverse to said first direction and is located in one of the openings of said base member; and at least a second electrically conductive elongated planar connecting member arranged on said base member extending in a second direction and crossing said first connecting member without contacting the same, said second electrically conductive member having a plurality of spaced finger-like connecting elements extending in the same direction as the finger-like connecting elements of said first connecting member, each of which extends in a direction substantially transverse to said second direction and is located in one of the openings of said base member whereby connecting elements of said first and second connecting members are located between said parallel planes in the same opening of said terminal board so that said first and second connecting members can be electrically connected to each other in the same opening.

5. In a terminal board arrangement for permitting interconnections between different conductive members, in combination, a base member made of an electrically insulating material and being formed with a plurality of openings therein, said openings being arranged in first

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and second directions; a plurality of first electrically conductive connecting members arranged on said base member spaced from each other, each of said first connecting members being electrically insulated from the others and having finger-type portions extending between parallel planes and located respectively in a different group of said plurality of openings arranged in said first direction; and a plurality of second electrically conductive connecting members arranged on said base member spaced from each other, each of said second connecting members being electrically insulated from the others and crossing over each of said plurality of first connecting members without contacting the same and having finger-type portions extending between said parallel planes in the same direction as the finger-type portions of said first connecting members and located respectively in a different group of said plurality of openings arranged in said second direction whereby each of said first and second connecting members have portions extending between said parallel planes in the same opening of said terminal board so that each of said first connecting members can be electrically connected to each of said second connecting members at said respective openings where said first and second connecting members have portions in the same opening.

6. In a terminal board arrangement for permitting interconnections between different conductive members, in combination, a base member made of an electrically insulating material and being formed with a plurality of openings therein, said openings being arranged in first and second directions; a plurality of first electrically conductive planar connecting members arranged on said base member spaced from and substantially parallel to each other, each of said first connecting members being electrically insulated from the others and having finger-type portions extending between parallel planes and located in a different group of said plurality of openings arranged in said first direction; and a plurality of second electrically conductive planar connecting members arranged on said base member spaced from and substantially parallel to each other, each of said second connecting members being electrically insulated from the others and crossing over each of said plurality of first connecting members without contacting the same and having finger-type portions extending between said parallel planes in the same direction as the finger-type portions of said first connecting members and located in a different group of said plurality of openings arranged in said second direction whereby each of said first and second connecting members have portions extending between said parallel planes located in the same opening of said terminal board so that each of said first connecting members can be electrically connected to each of said second connecting members at said respective openings where said first and second connecting members have portions in the same opening.

7. In a terminal board arrangement for permitting interconnections between different conductive members, in combination, a base member made of an electrically insulating material and being formed with a plurality of openings therein located between parallel planes, said openings being arranged in first and second directions substantially transverse to each other; a plurality of first electrically conductive connecting members arranged on said base member spaced from each other, each of said first connecting members being electrically insulated from the others and having finger-type portions extending between said parallel planes and located in a group of said plurality of openings arranged in said first direction; and a plurality of second electrically conductive connecting members arranged on said base member spaced from each other, each of said second connecting members being electrically insulated from the others and crossing over each of said plurality of first connecting members without contacting the same and having finger-type por-

tions extending between said parallel planes in the same direction as the finger-type portions of said first connecting members and located in a different group of said plurality of openings arranged in said second direction whereby each of said first and second connecting members have portions extending between said parallel planes located in the same opening of said terminal board so that each of said first connecting members can be electrically connected to each of said second connecting members at said respective openings where said first and second connecting members have portions in the same opening.

8. In a terminal board arrangement for permitting interconnections between different conductive members, in combination, a base member made of an electrically insulating material and being formed with a plurality of openings therein, said openings being arranged in first and second directions; a plurality of first electrically conductive connecting members arranged on said base member spaced from each other, each of said first connecting members being electrically insulated from the others and having finger-type portions extending between parallel planes and located respectively in a different group of said plurality of openings arranged in said first direction; and a plurality of second electrically conductive connecting members arranged on said base member spaced from each other, each of said second connecting members being electrically insulated from the others and crossing over each of said plurality of first connecting members without contacting the same and having finger-type portions extending between said parallel planes in the same direction as the finger-type portions of said first connecting members and located respectively in a different group of said plurality of openings arranged in said second direction, said first and second connecting members being arranged with respect to said openings so that said first

connecting members each have portions in respectively at least one additional opening whereby each of said first and second connecting members have portions extending between said parallel planes located in the same opening of said terminal board thereby permitting each of said first connecting members to be electrically connected to each of said second connecting members at said respective openings where said first and second connecting members have portions in the same opening and permitting said first connecting members to be electrically connected to each other by means of said additional openings.

9. Apparatus as claimed in claim 5, wherein each of said portions includes a pair of finger-like connecting elements spaced from each other in the respective openings.

10. Apparatus as claimed in claim 8, wherein each of said portions includes a pair of finger-like connecting elements spaced from each other in the respective openings.

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