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 [73] Assignee **International Business Machines Corporation**

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[54] **COAXIAL CONNECTOR GUIDE AND GROUNDING STRUCTURE**
 8 Claims, 5 Drawing Figs.

[52] U.S. Cl. **339/14, 339/18**
 [51] Int. Cl. **H01r 3/06**
 [50] Field of Search **339/14, 17, 18; 52/667, 668; 220/21; 217/18, 29**

ABSTRACT: A grid structure is provided defining rows and columns of square openings therein which when connected to a circuit board provides a guide means for positively indexing coaxial wire terminals with contact pins extending from terminals on the circuit board. The grid structure also serves as a common grounding means for the shield conductor of each of the coaxial wires.

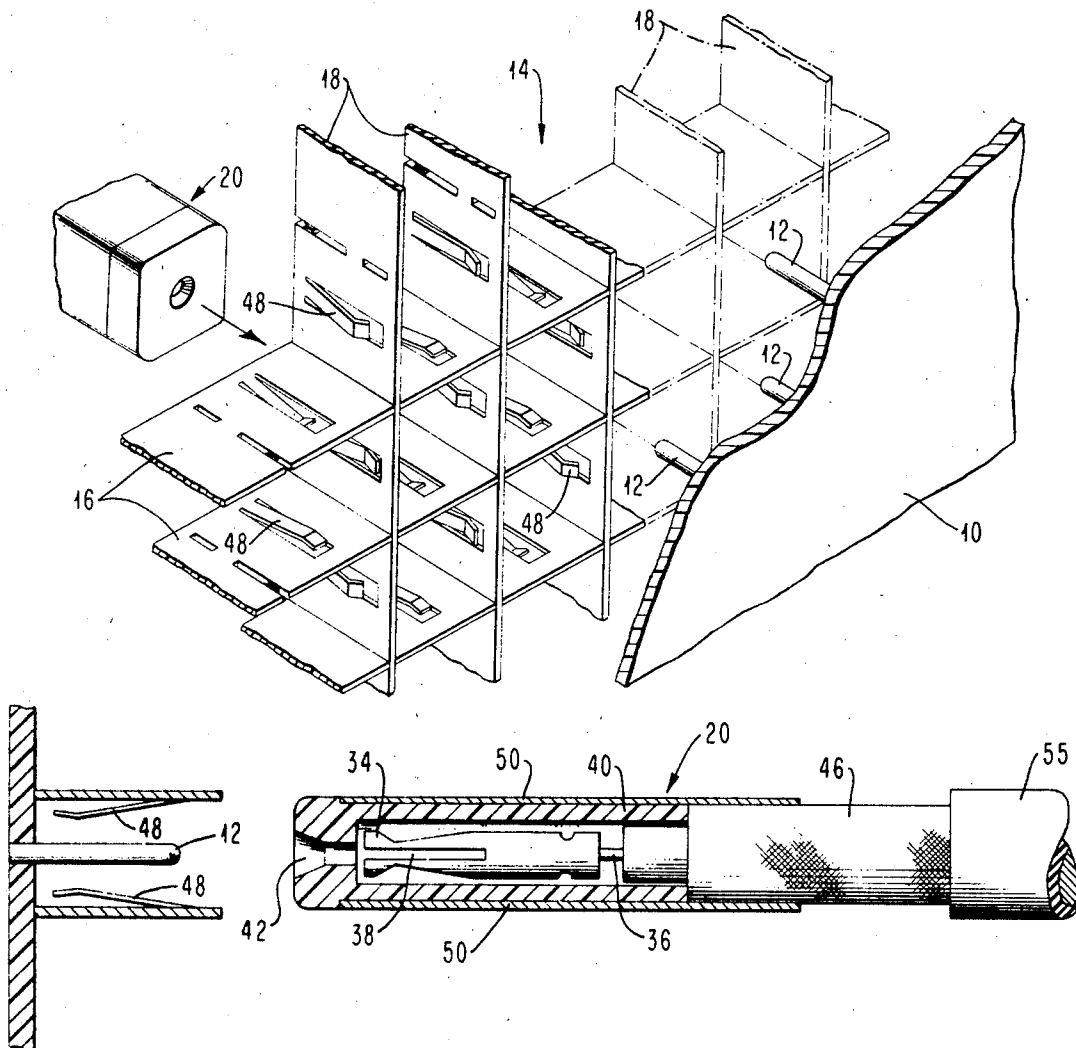


FIG. 1

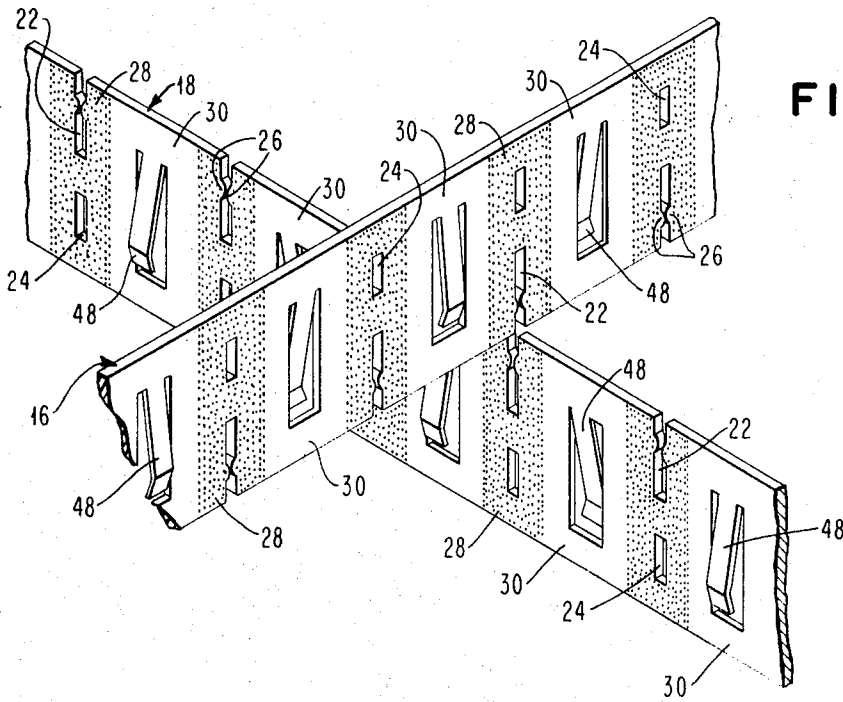
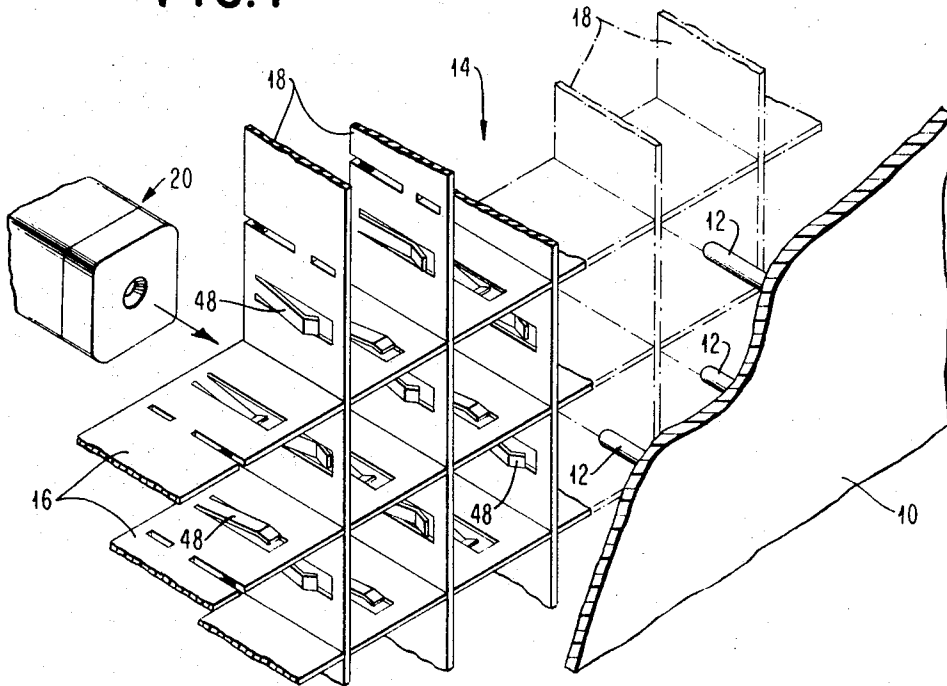


FIG. 2

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FIG. 3

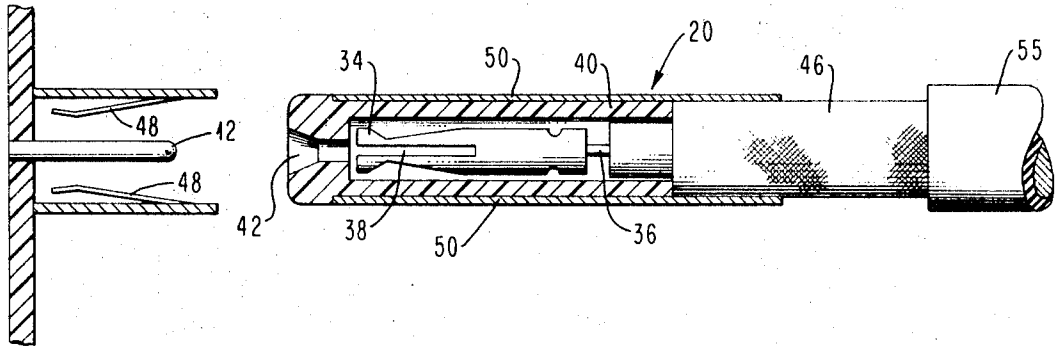


FIG. 4

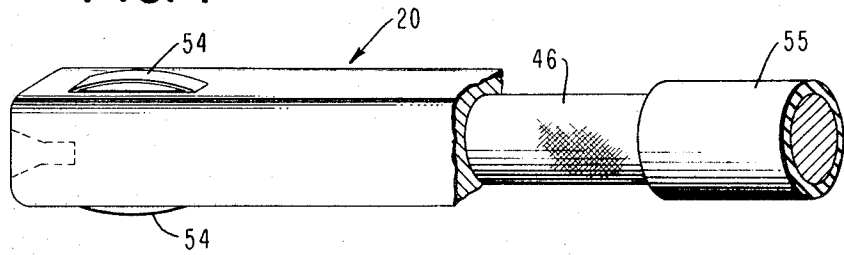
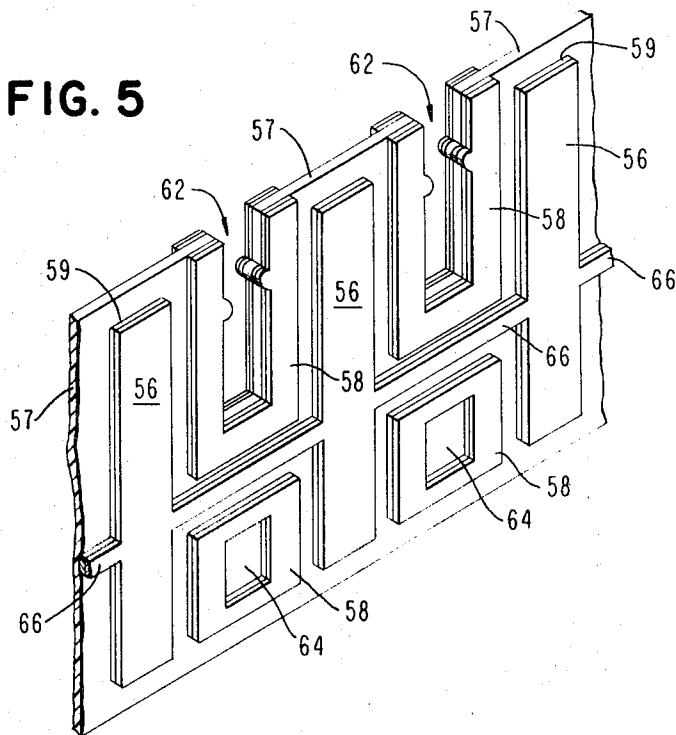


FIG. 5



COAXIAL CONNECTOR GUIDE AND GROUNDING STRUCTURE

This invention relates to a coaxial connector guide and grounding structure and more particularly to a grid structure for guiding coaxial wire terminating contacts into engagement with complementary contacts and for providing a common ground for the shield conductors of the coaxial wires.

With the continuing trend toward miniaturization of electronic components and circuits, it has become necessary to provide a greater number of electrical connections in a very small space. For example, it has become desirable to be able to make connections to a circuit board on 0.050-inch centers. The usual way of making such connections is to make a solder connection to a contact pin extending from a terminal on the circuit board. These contact pins are extremely small and delicate. It has become extremely difficult to make a connection to these closely packed pins without some more positive guide means. The problem is especially critical in connection with coaxial wires which require separate termination to two pins on the board. The center conductor must be connected as well as the shield conductor. For example, a coaxial line connector is shown in U.S. Pat. No. 3,179,914, which shows two separate contacts 38 and 28. One of these contacts is the center conductor or signal conductor contact while the other is the shield or braid conductor contact. It will be readily appreciated that separate contact means are needed to engage each of the contacts of the connector to complete the connection.

Accordingly, it is the main object of the present invention to provide a coaxial wire connector means which can be terminated to a circuit board through one contact pin.

It is another object of the present invention to provide a coaxial connector guide means for guiding a coaxial cable terminator into positive engagement with a complementary contact.

It is a further object of the invention to provide a coaxial connector guide means which also serves as a common grounding structure for the shield conductors of the coaxial wires.

It is another object of the present invention to provide a coaxial connector guide means and common grounding structure which is constructed of strips which are easily engageable into a locked grid structure and which are manufacturable economically utilizing known mass production techniques.

The invention includes a combination of a coaxial wire connector guide and shield grounding structure having a grid structure which defines small equal size apertures therein. The grid structure is connected to an electrical unit which has a plurality of contact terminals extending therefrom. Each of the apertures in the grid structure surrounds a different one of the contact means extending from the unit but is spaced therefrom so that there is no contact therebetween. Coaxial wire terminators having signal wire contact means are provided for connection to respective contact terminals on said electrical unit. The coaxial wire terminators each include a shield potential sleeve forming the outer wall of the terminator and being slightly smaller in width than said apertures so as to be guided therein into positive engagement with a contact terminal of the electrical unit. At least one of the grid walls of each of said apertures is electrically conductive and connected to ground. A further contact means is provided between the coaxial wire terminator shield potential sleeve and one or more of the electrically conductive grid walls of the aperture.

The foregoing and other objects, features and advantages of the invention will be apparent from the following more particular description of a preferred embodiment of the invention, as illustrated in the accompanying drawings.

FIG. 1 is a perspective expanded view of a grid structure, circuit board and coaxial wire terminator.

FIG. 2 is a perspective view of strips out of which the grid structure is formed and illustrating their interconnecting means.

FIG. 3 is a cross-sectional view of an aperture in the grid structure showing the male contact and the coaxial cable terminator to be plugged therein.

FIG. 4 is a perspective view of a cable terminator showing spring biased contact means for contacting the walls of the aperture.

FIG. 5 is a perspective view of a strip made of an insulative material showing predetermined interconnections by printed circuit means.

Referring to FIG. 1, there is shown a printed circuit board 10 which has a number of closely spaced circuit termination contacts 12 extending therefrom. These contacts are pins and are located on 0.050-inch centers. It will be appreciated that such close spacing provides a great number of circuit terminations in a small space. A grid structure 14 is provided which fits over the contact pins 12 of the circuit board 10 such that each pin extends into the middle of an aperture of the grid 14. The grid structure 14 is connected rigidly to the circuit board 10, or the like, thus preventing any possibility of short circuiting the contact 12 to the walls of the aperture. Utilizing pin contacts 12 that are only 15 mils in diameter and 6.5 times their diameter in length, approximately 400 terminations per square inch can be made. The strips, 16, 18 from which the grid structure 14 is formed, are made of thin sheets of electrically conductive spring material such as phosphor bronze. Thus, when the grid structure 14 is rigidly connected to the circuit board 10, the apertures formed therein provide a guide means for a coaxial cable terminator 20 so that positive indexing of the terminator with the male contact 12 located in the center of the aperture is obtained and a grounding means is provided.

The strips 16, 18, from which the grid structure 14 is formed, are shown in FIG. 2. Each strip 16, 18 is identically manufactured with slits 22 extending halfway through the width thereof. Below each slit there is a short cutout portion 24 of the same width as the slit. In each slit 22, there is a pair of facing retaining lobes 26 which engage the respective cutout portion 24 of an interconnected strip to hold the strips in place. The interconnection is performed by inverting one of the strips 16, 18 with respect to the other so that the slits 22 fit within each other and the retaining lobes 26 fit into the cutout portions 24 below each of the slits. The slits 22 and cutout portions 24 are surrounded by a stripe 28 of tin-lead plating extending the entire width of the strips on both sides of the strips. The stripes 28 of tin-lead plating are separated by stripes 30 of gold plating. The gold plated stripes 30 include a finger 32 of the strip material 16, 18 which is cut therefrom but attached at one end and biased away from the surface of the strip 16, 18. As will be explained later in more detail, the gold plated spring finger 32 serves as a contact to electrically interconnect a coaxial cable terminator 20, inserted into the apertures, with the grid structure 14.

Once the strips 16, 18 have been interconnected by means of the slits 22, cutouts 24 and retaining lobes 26, heat is applied, for example, by placing the unit in an oven or blowing hot air thereover, so that the stripe 28 of tin-lead plating melts and collects in the joints between the joined strips 16, 18. It has been found that this soldering prevents the strips 16, 18 from moving relative to one-another and thus adds structural strength to the grid structure 14.

Coaxial wire generally consists of an inner signal conductor which is surrounded by an insulation material which in turn is surrounded by an outer shield or braid which serves as the outer conductor. This outer conductor is sometimes referred to as the ground shield. In connecting coaxial wire to a circuit board, the signal conductor is generally connected to a circuit pin and the shield or braid is connected to a separate ground pin. It will be readily appreciated that twice as many pins are required for making connections to a circuit board from coaxial wires.

The coaxial wire terminator 20 of the present invention consists of a forwardly extending receptacle 34 which is attached at its rear end to the signal wire 36, for example, by sol-

dering. This receptacle 34 has a slit 38 running lengthwise from the front toward the rear across the diameter thereof which allows the receptacle 34 to give a little in receiving the pin 12 and thus forms a good tight contact therebetween. The receptacle 34 is surrounded by insulation material 40 to prevent shorting except for a portion in the front which serves as an opening 42 to receive the pin 12. This opening 42 is funnel-shaped with the narrow end extending towards the front of the receptacle 34 to more easily receive and guide the pin 12 into the receptacle. The insulation 40 is surrounded by a conducting sleeve 50 which is electrically connected to the shield conductor 46 of the coaxial wire. The connection can be made by pretinning the portion of the shield 46 and the conductor sleeve 50 portion to be connected and then applying heat to cause the portions to solder together. Thus, the signal wire 36 is connected to the terminal on the circuit board by connecting to the pin 12 while the outer conductor or braid 46 is connected by means of contact elements 48 between the aperture walls and the outer conductive sleeve 50 of the coaxial terminal 20.

The contact arrangement between the outer conductive sleeve 50 of each of the coaxial terminals 20, and the walls of the respective aperture in the grid structure 14, can take many forms. As shown in FIG. 2, a cut is made in each gold plated stripe 30 of each strip 16, 18 which outlines a finger 48 but is left attached near one of the side edges of the strip. The end at which the finger 48 is left attached or the direction in which the finger points depends upon whether the strip is to be inverted or not for interconnection. The finger 48 is connected at the end away from the slit 22 for the strip 16 which is shown inverted with respect to strip 18. The finger 48 is connected near the edge where the slit 22 starts on the strips 18 which are shown not inverted for interconnection with strip 16. Thus, the fingers 48 extend or point into the apertures on all the walls. The fingers 48 are bent away from the plane of the strips 16, 18 so that they are displaced into the plane of the strip by a terminal 20 as it is inserted into the aperture into which the finger 48 is bent. Since the finger 48 is cut from a spring material, it will press against the terminal 20 because of the spring bias, thus insuring a good electrical contact between the wall and the shield sleeve 50 of the terminal 20. The spring fingers 48 are bent away from the plane of the strips 16, 18 in alternate directions. The strips 16, 18 are interconnected so that one pair of opposite walls of each aperture will have their fingers 48 bent into the aperture. Accordingly, the other opposite pair of walls will have their fingers 48 bent out of the aperture forming a contact for the aperture into which they are bent. Each aperture, therefore, contains two contacting fingers 48 each of which is on an opposing wall for connecting the shield conductor sleeve 50 of a coaxial terminal 20 to ground. It will be appreciated that each of the coaxial cable shields 46 can be grounded in this way to the common grid structure 14 which is connected to the circuit board by a grounding pin, if desired. Of course, grounding of the grid structure 14 can be accomplished by other means. The contact means between the coaxial terminator 20 and the grid structure 14 can also be made by a contact 54, extending from the coaxial terminal 20, as shown in FIG. 4 for electrically connecting the outer conductor 46 of the coaxial wire 55 to ground. The contact 54 extends from at least one side of the coaxial terminal 20 and is preferably spring biased outward such that when the terminal 20 is inserted into the respective aperture of the grid structure 14 the contact 54 will be pressed inward but yet maintain sufficient force outward to give a good electrical connection along the conductive plated stripe 30 of the adjacent wall of the aperture. Thus, the contacts 54 replace the contacting fingers 48 of the previously described embodiment. Once the coaxial terminals 20 are in place in the grid structure 14, each of the shield conductors 46 of the coaxial wire 55 are connected to the walls within the aperture. Thus, each of the conductive sleeves 50 of the terminals 20 are essentially interconnected by the strips 16, 18 of the grid structure 14 and thus the grounded grid structure 14 serves as a common ground means for each of the coaxial wires 55.

If it is desired to terminate the shields 46 of coaxial cables 55 to different grounds of different potentials, this can be accomplished by utilizing nonconductive grid strips 57 as shown in FIG. 5. That is, the strips 57 can be made of an electrical nonconductor such as epoxy. Each of the conductive stripes 56, to make the electrical connection between the coaxial terminal 20 and the strip 57 of the grid structure, are isolated from the tin-lead plated areas 58. This can be accomplished by copper plating 59 the epoxy wall 57 so that the plating of conductive material 56 such as gold and the tin-lead plating 58 can be applied. The tin-lead plating 58 is applied only adjacent the edges of the slit 62 and cutout portion 64. Once the tin-lead plating 58 and the conductive plating 56, such as gold, are applied, the copper portion 59 between the conductive coating 56 and the tin-lead coating 58 can be easily removed. This isolates the conductive coating 56 from the tin-lead coating 58. It will be appreciated, that the isolated conductive areas 56 can be interconnected by printed circuitry 66 and grounded as desired. Using an arrangement of this type, pairs of adjacent parallel strips 57, for example, can be connected to one ground where other pairs of adjacent parallel strips can be connected to a separate ground of a different desired potential. Of course, the strips forming the walls between the respective pairs will have to be nonconductive in such an arrangement. It will be appreciated that opposite sides of the same strip may be connected to different ground potentials. As a matter of fact, each conducting surface 56 could be connected to a separate ground or any electrically connected surface 56 can be connected to a particular ground potential.

The grid structure 14 serves not only as a guide means for positively indexing the coaxial wire terminator 20 with the male contact pin 12 of the circuit board 10 but also serves as a grounding structure for the shield conductor 46 of the coaxial wire 55.

While the invention has been particularly shown and described with reference to a preferred embodiment thereof, it will be understood by those skilled in the art that various changes in form and detail may be made therein without departing from the spirit and scope of the invention.

What I claim is:

1. A coaxial wire connector guide and shield grounding structure comprising:

a conductive grid wall structure defining small apertures therein securely mounted to a unit which has a plurality of contact means extending therefrom;

each of said apertures surrounding a different one of said contact means but spaced therefrom so that there is no electrical interconnection therebetween;

coaxial wire terminators each having a signal wire contact means for connection to a respective one of said contact means extending from said unit and each having a shield contact means electrically connected to the shield conductor of said coaxial wire and surrounding said signal wire contact means and electrically insulated therefrom;

each coaxial wire terminator being slightly smaller in width than said apertures so as to be guided therein to positively mate with said contact means; and

a grounded grid wall contact means on at least one of said grid walls adapted to complete an electrical circuit through said shield contact means when said coaxial wire terminator is inserted within said aperture in said grid wall structure.

2. Apparatus according to claim 1, wherein said grid structure is made of strips of material having slits extending halfway through a width thereof, said slits being spaced from one another at a distance defining an aperture width;

a cutout portion of the same width as said slit located below said slit in the other half of the width of said strips; and

a pair of opposing retaining lobes extending into each of said slits, whereby said strips may be interconnected by inverting one with respect to another and interconnecting via said slits, the lobes being dimensioned and located along the length of said slits to fit into said cutout portions of the interconnected strip.

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3. Apparatus according to claim 2, wherein both surfaces of the strips are alternately gold plated and tin-lead plated in stripes extending from the top to bottom thereof across the width along the entire lengths, each tin-lead stripe including one of said slits and cutout portions, the gold stripes forming said grounded grid wall contact means.

4. Apparatus according to claim 3, wherein the joints between said interconnected strips are soldered by causing the tin-lead plated stripes to rise above their melting temperature whereby they form a solder joint between the contiguous edges of the interconnected slits, cutout portions and the retaining lobes.

5. Apparatus according to claim 3, wherein said grounded grid wall contact means includes a finger cut from the strip in the area of each of said gold plated stripes except for one end so that they can be bent into said apertures to form a good pressure contact between said shield contact means of each coaxial wire terminator inserted in said apertures and the grounded grid wall.

6. Apparatus according to claim 3, wherein said shield contact means of said coaxial wire terminator includes at least one

outwardly spring biased portion for contacting a gold plated stripe of a wall of the aperture to form a good pressure contact electrical connection between the shield conductor of said coaxial wire and the grounded grid wall.

7. Apparatus according to claim 1, wherein said electrical unit is a circuit board and said contact means are male contact terminals extending vertically from said board and arranged in a predetermined pattern to be compatible with the aperture locations in said grid structure.

8. Apparatus according to claim 1, wherein said coaxial wire terminator comprises a receptacle attached at one end to the center conductor of said coaxial wire and adapted to receive a male contact;

insulation means surrounding said receptacle;

said shield contact means comprising a shield potential sleeve surrounding said insulator and being connected to the shield conductor of said coaxial wire; and said sleeve being shaped the same as said apertures and being of a size to fit snugly therein.

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