Oct. 27, 1959 R. L. KEENER 2,910,628

RIGHT ANGLE PRINTED CIRCUIT CONNECTOR

Filed Sept. 26, 1955 2 Sheets-Sheet 1

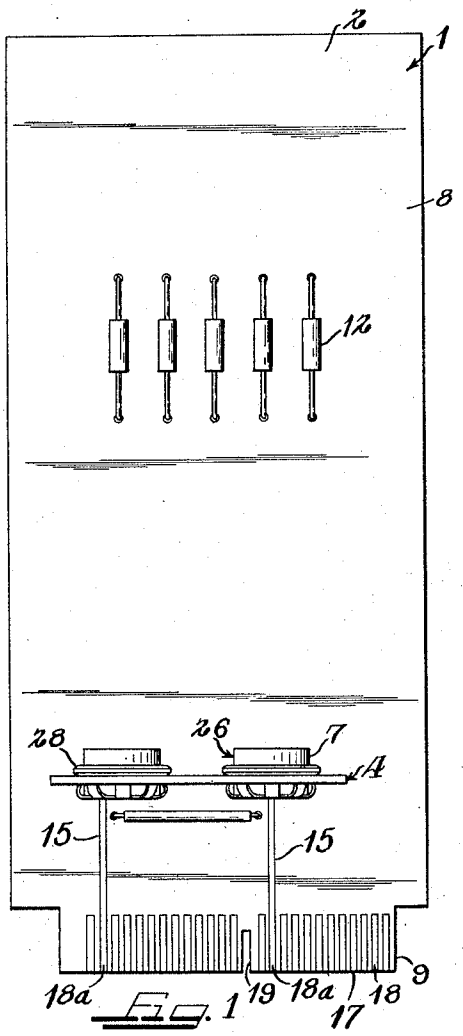


Fig. 1

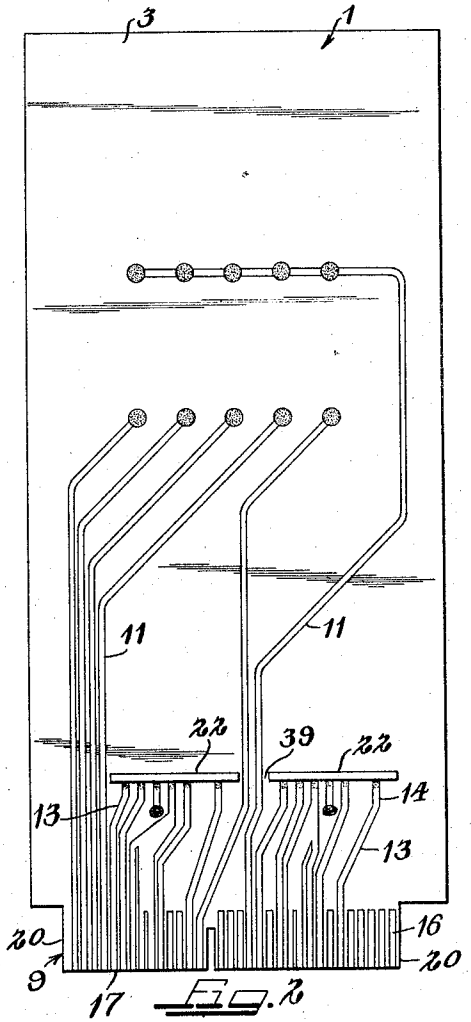


Fig. 2

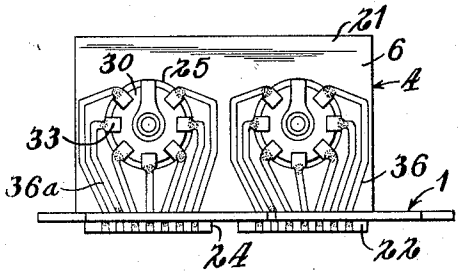


Fig. 3

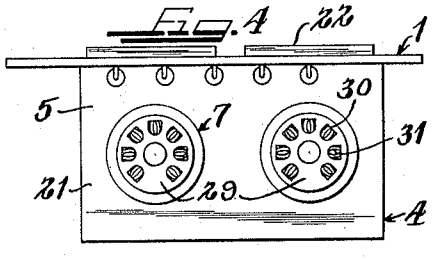


Fig. 4

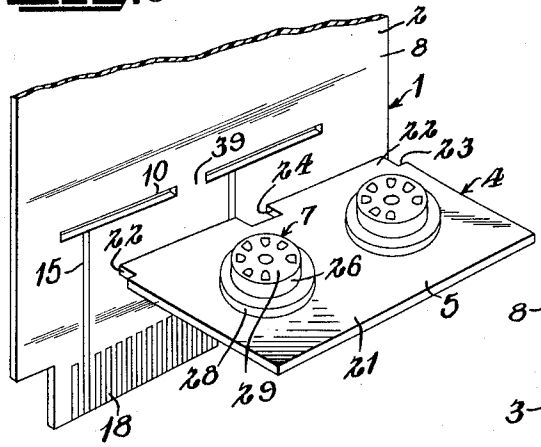
Inventor
Robert L. Keener
John Todd
Atty.

Oct. 27, 1959 R. L. KEENER 2,910,628

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Filed Sept. 26, 1955 2 Sheets-Sheet 2

Fig. 5



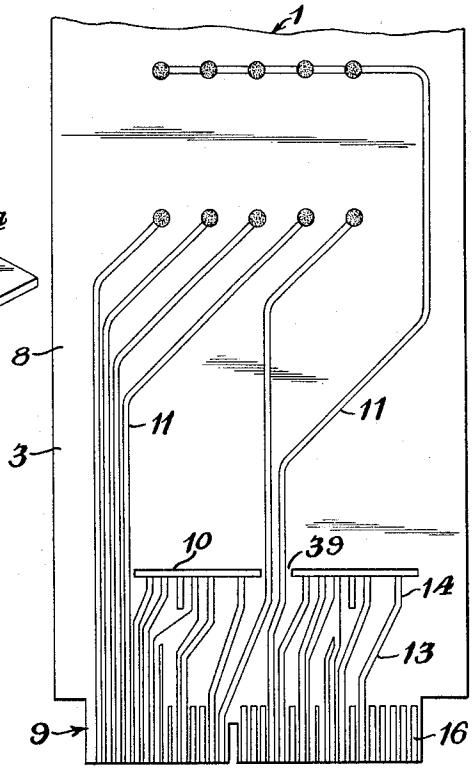


Fig. 6

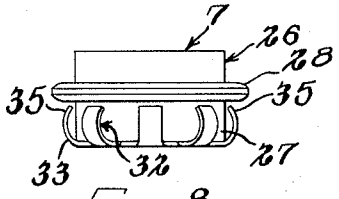


Fig. 8

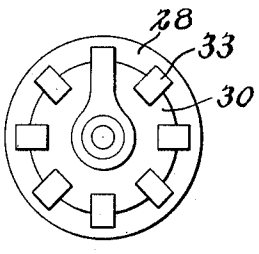


Fig. 9

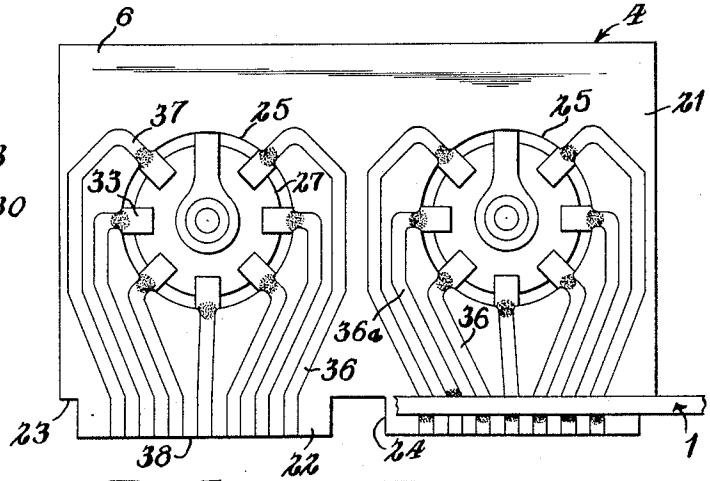


Fig. 7

Inventor
Robert L. Keener
John Todd
Atty.

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RIGHT ANGLE PRINTED CIRCUIT CONNECTOR

Robert L. Keener, Rosemead, Calif.

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2 Claims. (Cl. 317—101)

This invention relates to an assembly of panels carrying printed conductors wherein the panels are arranged in right angular fixed relation to join the conductors in electrical connection.

One object of my invention is the provision of an assembly comprising a main insulating panel carrying a preformed or printed circuit pattern and a second insulating panel carrying printed conductors in electrical connection with components such as tube sockets carried by the second panel whereby the second panel, which is preferably of relatively smaller dimensions, may operate as an adapter to connect varying forms of tube sockets into the printed conductor pattern carried by the first panel.

Another object of my invention is to provide a printed conductor panel assembly which is particularly adaptable to mass production methods and applicable for efficient use in radio, television and other types of electrical apparatus.

Other objects and uses of my invention will be apparent from inspection of the specification and drawings hereinbelow set forth.

Referring to the drawings in which I have illustrated a preferred embodiment of my invention;

Fig. 1 is a front plan view of the printed conductor panel assembly,

Fig. 2 is a rear view of the assembly shown in Fig. 1,

Fig. 3 is a bottom view of the printed panel assembly,

Fig. 4 is a top view of the assembly,

Fig. 5 is a perspective view illustrating the manner in which the adapter panel is applied to the main panel to join the panels in assembled relation,

Figs. 6 is a rear view of the main panel of the device prior to assembly of the adapter panel therewith,

Fig. 7 is an enlarged bottom view of the assembly with a portion of the main panel broken away,

Fig. 8 is a side elevation of the tube socket unit which in my preferred assembly is carried by the adapter panel, and

Fig. 9 is a bottom view of the socket shown in Fig. 8.

Referring to the drawings there is shown a printed conductor panel assembly comprising a base panel **1** having a front surface **2** and a rear surface **3** and a holder or adapter panel **4** which has a top surface **5** and a bottom surface **6**. The adapter panel **2**, in accordance with the invention is assembled in fixed right angular relation with the panel **1** from a position opposite the front surface **2** of the panel **1**. The adapter panel **4** carries components preferably in the form of tube sockets **7** which are electrically connected into the circuit pattern carried by the base panel **1** in a manner to be described.

Referring in detail to the base panel **1**, the panel comprises a sheet of insulating material which may be formed of a glass base epoxy. The panel **1**, in my preferred form, has a main body portion **8** and a terminal portion **9** which is of preferably less width than the body **8** and projects outwardly from one end of the body. The body **8** has a pair of elongated slots **10** (Fig. 6) formed in the material of the body within the margins thereof and disposed in aligned spaced relation for receiving attaching portions forming an integral part of the adapter panel **4** as will be described. The base panel **1** carries a pattern of preformed conductors commonly known as printed wires. The pattern of printed wires may be made by any suitable method, but in my preferred device they are formed by etching away unwanted portions of metal foil which is initially affixed to the outer surface of the panel **1**. The printed wire pattern includes conductors **11** disposed on the rear surface **2** of the panel **1**. The conductors **11** are part of a circuit arrangement carried by the panel **1** and are electrically connected by a solder bond to components included in the circuit arrangement which are illustrated in the drawings by the resistors **12**. It should be understood that the circuit arrangement of the drawings is not complete, but merely illustrative of the uses of the panel assembly in circuit assemblies and subassemblies for radio, television and other electronic devices. The rear surface **2** of the panel **1** carries a second pattern of printed conductors **13** which have ends **14** terminating adjacent the slots **10**. The ends **14** are located in a manner to correspond with printed conductors carried by the adapter panel **4** and are electrically connected with socket contacts for receiving tube pins (not shown).

The printed conductors carried by the panel **1** may be disposed on either the front or rear faces of the panel and in my preferred assembly, a pair of conductors **15** (Fig. 1) for making electrical connection with the contacts of the tube sockets are disposed on the front face **2** of the panel **1**. The conductors **11** and **13** carried by the rear face **3** of the panel **1** are electrically connected with terminal conductors **16** disposed on the rear surface of the terminal portion **9** and arranged to extend in parallel relation from the end edge **17** of the portion **9** and terminate at points spaced a short distance from the end edge **17**. The terminal conductors **16** cooperate to form a connector device at an end of the panel **1** for electrically connecting the printed conductors **11** and **13** with a multi-terminal connector (not shown) which is referred to in the trade as an end connector and which carries metal contacts for resiliently engaging the conductor terminals **16** in the manner well known in the art. The terminal portion **9** also carries a series of terminal conductors **18** on the front face **2** of the panel and the printed conductors **15** carried by the front face **2** are electrically connected with two of the terminal conductors **18***a* as illustrated in Fig. 2. The terminal portion **9** of the panel **1** may have a slot **19** off-centered with respect to the side edges **20** of the terminal portion **9** extending from the edge **17** into the portion **9** for polarizing the terminal conductors with the contacts of the end connector (not shown) as will be understood by those skilled in the art.

The adapter panel **4** is preferably of sufficient size to carry one or more tube sockets or other components together with the printed leads electrically connected therewith. The panel **4**, in my preferred form, is made of the same material as the panel **1** and provides a rectangular body portion **21** having attaching portions **22** projecting from an edge **23** on one side of the body portion **21**. The attaching portions **22** are disposed in the plane of the body portion **4** and are separated one from another by a slot **24**. The body portion **21** has a pair of openings **25** for receiving the tube socket **7**. Each of the tube sockets **7** which are of a form known in the art has an insulating casting **26** providing a base portion **27** of smaller diameter than the opening **5** whereby the portions **27** will project into the openings **25** and a peripheral rib **28** intermediate the top and bottom surfaces **29** and **30** respectively which is of greater diameter than the openings **25** so as to be supported by the front surface **5** of the panel **4**. The top surface **29** of the casting **26** has openings **30**

for receiving prong-engaging portions 31 of the contact members 32 carried by the tube socket. Each of the contacts 31 has a resilient terminal tail 33 which extends through the bottom surface 30 of the casting 26 and then is bent reversely backwardly along the side 34 of the casting to form shoulder elements 35 (Fig. 8) adjacent their free ends. The tube sockets are assembled with the panel 4 by moving the base portion 27 of the castings 26 through the openings 25 of the panel 4. During this action the terminal tails 33 of the contacts will be compressed against their inherent spring tension until the tails 33 have passed substantially through the apertures at which time the tails 33 will expand to engage the shoulder elements 35 behind the lower surface 6 of the panel 4. As a result of this action, the tube sockets are secured in initial fastened assembly with the panel 4.

The lower surface 6 of the panel 4 carries a pair of patterns of printed wire conductors 36 with the conductors of each pair disposed in electrical relation to one of the tube sockets 7. Each of the conductors 36 has an end element 37 disposed adjacent one of the openings 25 and its opposite end extends to an edge 38 of one of the attaching portions 22. The end elements 37 of the printed conductors 36 of each of the conductor patterns are located in a manner to correspond with the respective terminal tails 33 of the tube sockets 7 engaging the walls of the panel 4 adjacent the openings 25. The terminal tails 33 are joined to the end elements 37 by hand or dip soldering thereby connecting the sockets into the respective patterns of printed conductors 36 and, at the same time, securing the sockets in final fixed assembly with the panel 4.

In assembling the panel 4 with the panel 1, the attaching portions 22 of the panel 4 are moved through the openings 10 of the panel 1 from a position opposite the front surface 8 of the panel 1. During this action, the portion 39 of the panel 1 between the pair of openings 10 will be received in thet slot 24 of the panel 4 and the edge 23 of the panel 4 will abut the outer surface 8 of the panel 1 to limit movement of the attaching portions 22 through the openings 10. As a result of the fact that the lengthwise dimension of each of the attaching portions 22 is substantially equal to the length of its respective opening 10 and the thickness of the attaching portions 22 is substantially equal to the depth of the openings 10, a relatively snug fit will be effected between the attaching portions 22 and the walls of the panel 1 adjacent the openings 10. The panel 4 is fixed in permanent right angular relation to the panel 1 by means of an insulating glue which, preferably, is epoxy resin. The resin acts as an adhesive bond between the panel 4 and the walls adjacent the openings 10. In final assembly of the conductor panels, the printed conductors 36 of the panel 4 extend through the openings 10 and are arranged to correspond and be disposed in contiguous relation to the ends 14 of the printed conductors 13 carried by the rear face 3 of the panel 1. It will be noted that, in my preferred construction, a printed conductor 36*a* (Fig. 7) comprising one conductor of each of the patterns carried by the panel 4 will correspond and be disposed in adjacent relation to a printed conductor 15 on the front face 2 of the panel 1. Electrical connection between the mating conductors 36 and 13 and the conductors 36*a* and 15 is completed by hand or dip soldering so as to connect the pin-engaging contacts 32 carried by the tube sockets 7 into the circuit carried by the panel 1.

As a result of the invention, the adapter panel 4 may be formed to carry any one of a number of forms of tube sockets any type of which may be connected into the circuit of the main panel 1 by the method which has been described. In accordance with this practice, the main circuit may be of predetermined, standard form which is universally adaptable to a variety of forms of tube sockets capable of being connected into the circuit by the efficient and inexpensive adapter type of assembly which has been described.

Although I have illustrated and described a preferred embodiment of my invention, I do not wish to be limited thereby because the scope of my invention is best defined in the following claims.

I claim:

1. A printed conductor panel assembly comprising an insulating panel having a pair of elongated openings in spaced relation, said panel carrying printed conductors having end portions terminating adjacent said opening, a second insulating panel having a pair of attaching portions extending from one edge through said openings of said first panel, said projections being in the normal plane of said second insulating panel and said second panel being disposed in right angular relation to said first panel, said second panel carrying printed conductors disposed in adjacent complementary relation to said end portions of said printed conductors of said first panel, adhesive means for maintaining said attaching portions in fixed assembly with said first panel within said openings thereof, and said printed conductors of said panels being electrically connected by solder.

2. A printed conductor panel assembly comprising an insulating panel having an opening, said panel having front and rear surfaces, said rear surface carrying printed conductors having end portions terminating adjacent said opening, a second insulating panel having an integral attaching portion extending from one edge and disposed in the normal plane of said panel, said second panel being disposed adjacent said front surface of said first panel with said attaching portion extending through said opening of said first panel, said second panel carrying printed conductors on a side thereof terminating adjacent the outer edge of said attaching portion said printed conductors of said second panel being disposed in adjacent complementary relation to the ends of said printed conductors of said first panel, adhesive means for maintaining said attaching portion in fixed assembly with said first panel within said opening thereof, and said printed conductors of said panels being electrically connected by solder.

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