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3,086,189

ELECTRICAL CONNECTORS FOR USE WITH PRINTED CIRCUIT BOARDS

Filed Nov. 9, 1961

2 Sheets-Sheet 1

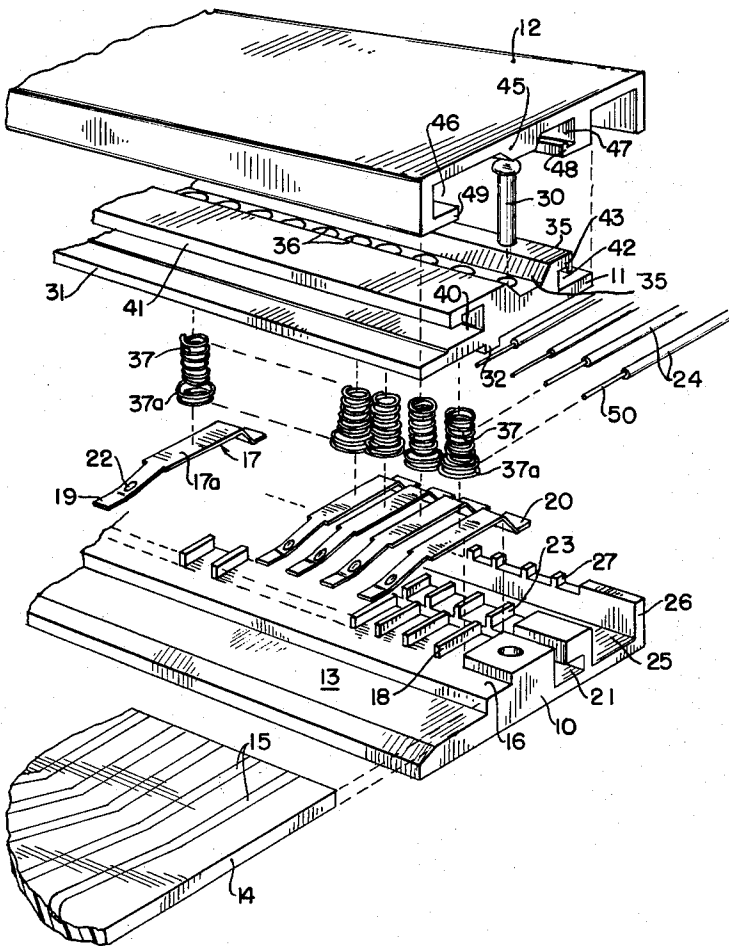
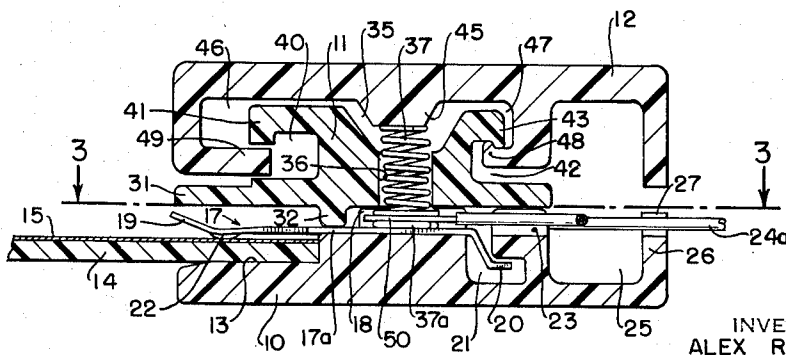


FIG. 1

FIG. 2



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2 Sheets-Sheet 2

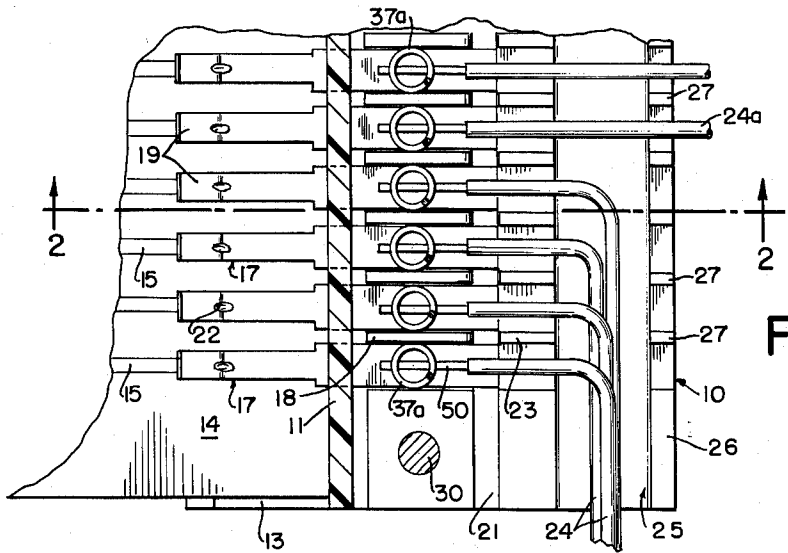


FIG. 3

FIG. 4

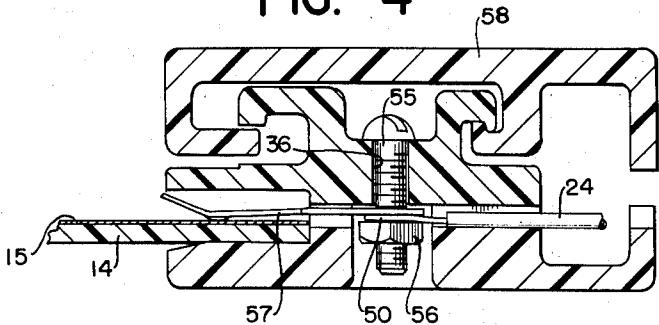


FIG. 5

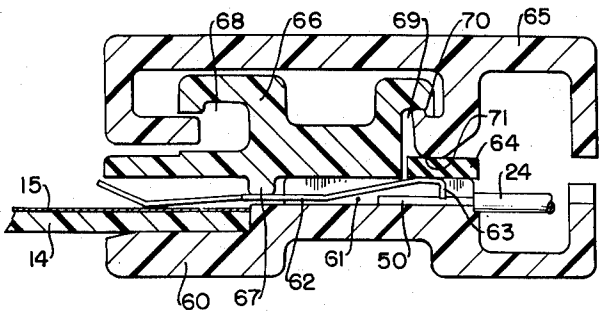
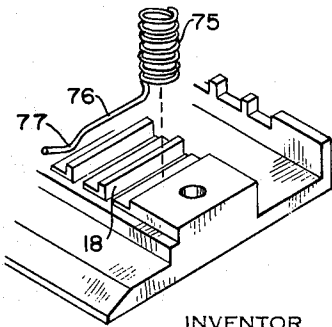


FIG. 6



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ELECTRICAL CONNECTORS FOR USE WITH PRINTED CIRCUIT BOARDS

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This invention relates to electrical connectors for use with printed circuit boards or the like.

One of the serious problems involved in the use of such connectors is the necessity for effecting positive, reliable, and yet simplified connections with external circuitry.

With the foregoing in mind, I have devised an electrical connector of the above type which provides unusually excellent electrical contact with external wires while nevertheless being of utmost simplicity of installation. Thus I achieve a sharp, substantially biting contact with such wires without, for the most part, even requiring a screw driver. In the preferred embodiments, such contact can be achieved by simply snapping two parts of the connector, and without requiring the use of any tool whatsoever. Further, the connector may be easily disassembled for making replacement or repairs.

In the preferred embodiment, a spring which permits the two parts to be snapped together, also serves as an effective terminal post while serving the further function of mechanically fixing the input contact springs in position.

The invention will be further understood from the following description and drawings in which:

FIGURE 1 is an exploded, perspective view of a preferred form of the connector;

FIGURE 2 is a cross-sectional view of the assembled connector, the view being taken substantially along the line 2-2 of FIGURE 3;

FIGURE 3 is a fragmentary plan view of the connector base as taken along the line 3-3 of FIGURE 2;

FIGURE 4 is a cross-sectional view of a modified embodiment;

FIGURE 5 is a cross-sectional view of a second modified embodiment; and

FIGURE 6 is a fragmentary exploded view of a third modified embodiment.

Referring to FIGURES 1-3, the connector comprises three basic, superimposed sections, i.e. the base 10, mid-section 11, and cover 12. These may be fabricated of plastic and, it will be observed, they may be manufactured as continuous extrusions, and cut up into desired lengths with only minimal additional working to provide finished parts.

Base 10 is formed with a front platform 13 which serves as a rest for printed circuit board 14. Board 14 is conventional. Briefly it comprises a base plate of insulating material having a number of parallel conductive terminal strips 15 which are printed or otherwise plated on the base plate.

Base 10 is formed with an upper platform 16 which supports the elongated, substantially horizontal leaf springs 17 in parallel relationship by means of front, parallel, integral strips 18 which divide platform 16 into parallel slots or receptacles. Leaf springs 17 rest in these slots with the spring front ends 19 extending over platform 13 and the spring rear ends or tails 20 being downwardly inclined and disposed in longitudinal slot 21 which is L-shaped. The leaf springs are thereby held in position. Leaf springs 17 have a central, normally relatively raised portion 17a adapted to support contact effecting compression springs as will hereinafter appear.

Leaf springs 17 are of high conduction metal such as

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Phosphor bronze or beryllium copper, and may be plated with a noble metal such as gold. Their front ends 19 are upturned to form a lip and are struck to form a bump 22 which rests normally by spring pressure on front platform 13.

Base 10 is further formed with center parallel strips 23 designed to channel an external wire, such as wire 24, into electrical engagement with a leaf spring as will hereinafter be described. Base 10 is also formed with a wide channel 25 designed to accommodate a plurality of wires 24 for lateral egress from the connector as illustrated in FIGURE 3. However, since external wires such as wire 24a may be led directly rearwardly, the end wall 26 of base 10 is formed with rear parallel narrow strips or teeth 27.

Connected to base 10 as by rivets 30 at both ends, is the mid-section 11. Mid-section 11 has a planar bottom surface except for a longitudinal rib 32 adapted to press firmly against leaf spring portions 17a as illustrated in FIGURE 2, as well as to provide adequate space for insertion of board 14.

Mid-section 11 is formed with a central trough 35 and a series of longitudinally aligned holes 36. These holes permit vertically disposed compression springs 37 to be maintained therein with their upper ends in the trough 35. Stop means are provided to keep the springs 37 in place when the connector cover is not in place as will be explained hereinafter. Such stop means, in the particular form shown, take the form of two enlarged bottom coils 37a of a diameter greater than that of holes 36 and disposed below the holes.

Mid-section 11 has a front longitudinal groove 40 partially defined by downward lip 41, and a rear longitudinal groove 42 partially defined by a downward lip 43. Lip 43 serves as a hooked locking element as will hereinafter be explained.

Cover 12 is formed with a central, longitudinal downwardly depending rib 45 somewhat complementary in shape to trough 35 in which it is received. Cover 12 is further formed with a front groove 46 adapted to receive lip 41 as well as a rear groove 47 adapted to receive lip 43. Groove 47 is partially defined by an upward lip which, as will be made clear, hooks and locks with lip 43 in a snap fit when the connector is assembled during installation. Groove 46 is partially defined by front reentrant plate 49.

In order to install the external wires 24 and 24a, the cover 12 is removed. Referring to FIGURE 2, this is easily done by pressing down on cover 12 against the action of all the compression springs 37, thus disengaging or unhooking the lips 43 and 48. At the same time, cover 12 is urged rearwardly so that it can be removed from mid-section 11.

The bared external wires 24 and 24a may then have their bare ends 50 slipped across any lower coil, preferably above the bottom one, of a compression spring 37. The end 50 may thus extend linearly between two bottom coils between which it may be firmly clamped as will be explained.

Compression springs 37 are used as electrical contact members. Accordingly, they may be formed of any high conduction material like the leaf springs 17 and may also be plated to provide reliable, low contact resistance.

With any number of external wires 24 and 24a deposited in position, the cover 12 will be applied and locked in position. This action will compress springs 37 and achieve a very forceful contact pressure. This is particularly true because the bare ends 50 extend linearly between two clamping coils so that substantially point contact is achieved at four points, two at the upper clamping

coil and two at the lower one. The diameter of the spring wire consisting spring 37 may be about .015" and that of ends 50 may be somewhat the same. It will be recognized, therefore, that the contact pressure will be considerable. Bare wire ends 50 will most likely be of soft copper which will deform somewhat under such pressure to insure good electrical connection.

The installation of the printed circuit board 14 will be evident. Briefly, it is simply inserted and slipped over platform 13 under lips 19 where they are retained by the leaf spring action, the bumps 22 contacting the strips 15.

As will be recognized, no tools or any special equipment are required for either installation or dismantling while forceful and reliable connections are nevertheless provided without even requiring the wires to be bent, whether around terminal posts or otherwise.

In FIGURE 4 I show a modification wherein bolts 55 with nuts 56 replace the compression springs. Of course, a screw driver may be required in the installation. Leaf springs 57 will have a hole through which bolt 55 penetrates while the bare end of the external wire 24 will be clamped between the nut and leaf spring. In this embodiment cover 58 serves primarily to protect the electrical connections against contamination. If desired, the nut may be prevented from turning by complementarily forming the recess in which it is disposed.

In the embodiment of FIGURE 5, the base 60 has parallel strips 61 on its upper surface, dividing it into parallel slots. Leaf springs 62 are disposed in these slots. Rear end 63 of springs 62 comprises a downwardly directed finger. Bare end 50 of wire 24 rests within a surface slot and finger 63 is caused to bite into bare end 50.

Pressure upon the fingers 63 is accomplished by a resilient rubber pad 64 which may be cemented over the strips 61 and subjected to pressure by the cover 65 so that it in turn presses between the slots and against the backs of fingers 63.

Mid-section 66 has a rib 67 bearing against a central portion of leaf spring 62. It is also formed with a front groove 68 and a rear groove 69 just as are the other embodiments. Cover 65 has a snap-lock fit with mid-section 66 by virtue of hook-edge 70 which is engaged by groove 69. The snap fit is achieved through the resilience of pad 64, the hook-edge 70 having a cam-like enlargement 71 which bears against pad 64 to enhance the degree of contact pressure between fingers 63 and ends 50. It will be observed that in FIGURE 5 I have eliminated holes such as holes 36 so as to minimize any further work on the sections after they have been extruded.

In FIGURE 6 I illustrate a modified form of compression spring wherein it is made integral with a front wire spring replacing the leaf springs. Thus compression springs 75 may be employed in the embodiment of FIGURE 1. However, the bottom coil will be extended into front wire section 76 which will rest between strips 18. Of course, it will then be unnecessary to have a slot 21. Wire section 76 will be bent downwardly at 77 to provide the contact for the printed circuit strips 15.

I have shown preferred embodiments of my invention but it is obvious that numerous changes and omissions may be made without departing from its spirit. Thus, while I have described the connector as particularly adapted for use with printed circuit boards, this is merely an illustrative use as will be understood since it may be used in other environments.

What is claimed is:

1. An electrical connector comprising a base section, a mid-section, and a cover, a plurality of elongated, substantially parallel spring members between said base section and said mid-section, an elongated front platform on said base section adapted to receive a flat circuit member to be contacted by said elongated spring mem-

bers, a series of vertical compression springs, each being electrically connected to said elongated spring members, said mid-section resting against the tops of said compression springs, complementary hook means on said mid-section and said cover whereby said mid-section and said cover may be locked by pressing downwardly on cover against the action of said compression springs and may be unlocked by detaching said hook means, and means for introducing an external wire against said compression springs so as to effect electrical contact with said elongated spring members through said compression springs.

2. An electrical connector according to claim 1 and including an external wire having a bare end clamped between coils of said compression springs.

3. An electrical connector according to claim 1 and wherein said elongated spring members comprise leaf springs, said compression springs resting on said leaf springs and in electrical contact therewith.

4. An electrical connector according to claim 3 and wherein said mid-section is formed with holes in which said compression springs are disposed, said mid-section being formed with a trough exposing the upper ends of said compression springs, and a downwardly protruding rib on the underside of said cover bearing against said compression springs.

5. An electrical connector according to claim 3 and wherein said leaf springs have a normally raised central portion upon which said compression springs rest, said base section being formed with an L-shaped slot, and a downward tail on each leaf spring, said tails being disposed in said L-shaped slot.

6. An electrical connector according to claim 5 and including a channel formed across the rear of said base section for receiving a number of external wires, and teeth formed on the top surface of said base section for channeling the external wires toward said compression springs.

7. An electrical connector according to claim 5 and wherein each compression spring has at least one bottom coil of increased diameter relative to the remainder of the spring, said mid-section being formed with holes in which said compression springs are disposed, said one coil being disposed below said mid-section holes and being of larger diameter than said holes.

8. An electrical connector according to claim 5 and wherein each compression spring has two bottom coils thereof of increased diameter relative to the remainder of the spring, said mid-section being formed with holes in which said compression springs are disposed, said enlarged coil being disposed below said mid-section holes and being of larger diameter than said holes, and an external wire having a bare end linearly clamped between said two bottom coils.

9. An electrical connector comprising a base section, a mid-section and a cover, said base section being fixedly connected to said mid-section, a plurality of parallel, substantially horizontal leaf spring members disposed between said base section and said mid-section, a vertically disposed spring member on each leaf spring member and effecting electrical connection therewith, an elongated front platform on said base section and adapted to have inserted thereon a printed circuit board to be electrically contacted by said leaf spring members, said cover member being removably hooked to said mid-section and being operative to compress said vertically disposed spring members by said cover operating to clamp an external wire to said vertically disposed spring members to enhance electrical contact therewith.

10. An electrical connector comprising a base section, a mid-section, and a cover, a plurality of elongated, substantially parallel leaf spring members clamped between said base section and said mid-section, said base section being fixedly connected to said mid-section, an elongated front platform on mid base section and adapted to have inserted thereon a printed circuit board to be electrically

contacted by said leaf spring members, each of said leaf spring members having a downwardly directed finger at the rear end thereof, an elongated resilient pad bearing against all of said fingers, said mid-section and said cover section having complementary hook members so as to removably hook said mid-section to said cover, a cam member on said cover and bearing against said resilient pad whereby when said cover is hooked to said mid-section, said cam member will press against said pad, and means to introduce an external wire under each of said fingers to make firm electrical contact therewith.

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