

[54] **ELECTRICAL CONNECTOR WITH
VIBRATION RESISTANCE**

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339/176 MP

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[58] Field of Search. 339/17, 65, 66, 93, 176;
317/101 DH

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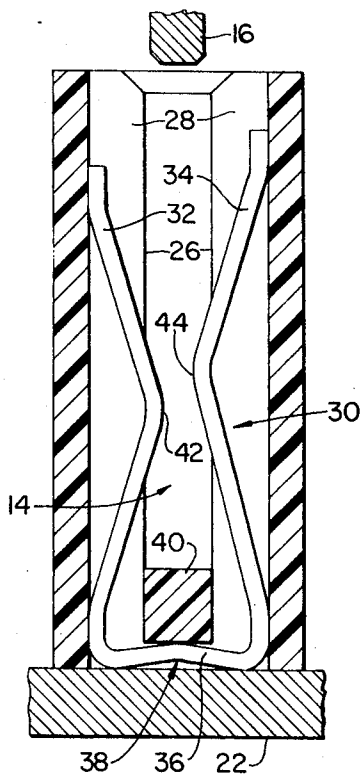
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[57]

ABSTRACT

A printed circuit card connector having upwardly extending card guides at its ends, each card guide having a heightwise end slot formed therein to receive the side edge of an inserted circuit card. Retention of the printed circuit card in the connector is enhanced by a pair of spaced, heightwise extending, resilient fingers which are supported within each end slot and which are adapted to receive and grip the circuit card therebetween. Each pair of fingers engages opposite faces of the inserted circuit card at a level which is above the socket and the fingers are of unequal length to retard vibration or common resonance. The fingers also may be employed as electrical contacts or terminals.

10 Claims, 6 Drawing Figures



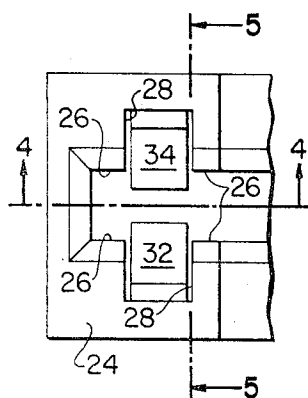


FIG. 3

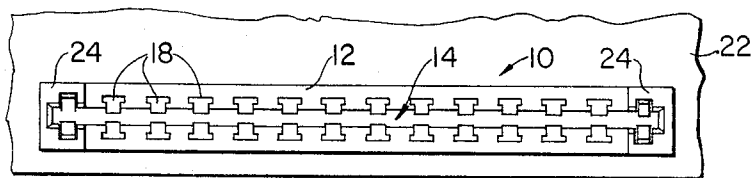


FIG. 1

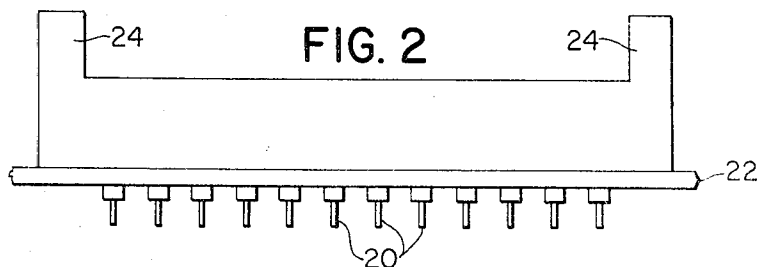


FIG. 2

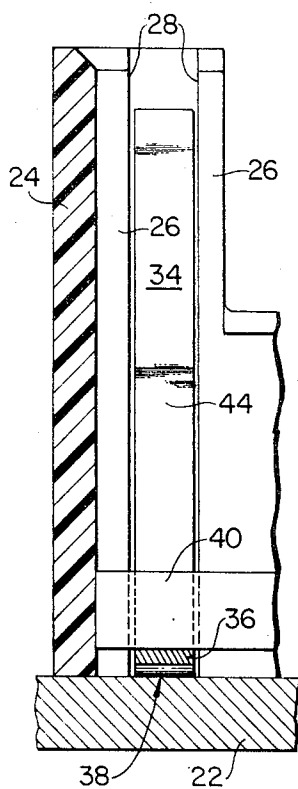


FIG. 4

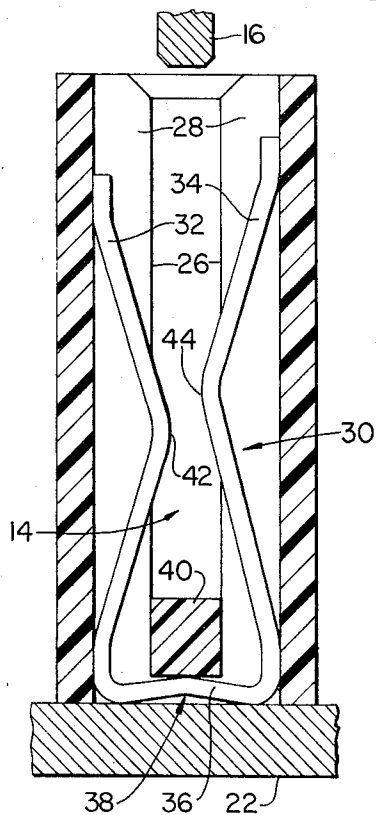


FIG. 5

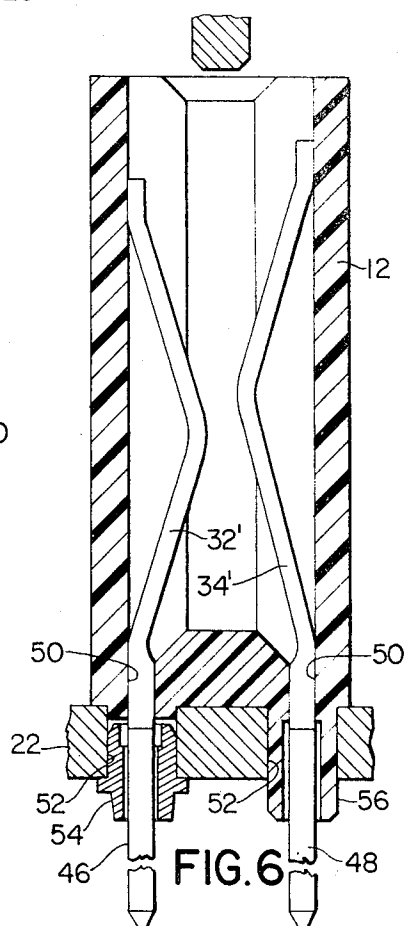


FIG. 6

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ELECTRICAL CONNECTOR WITH VIBRATION RESISTANCE

My invention relates to printed circuit card connectors of the type which are adapted to receive the lower marginal edge of a circuit card so that most of the circuit card protrudes upwardly away from the connector. More particularly, the invention is directed to an arrangement for providing an improved support for the upwardly extending portion of the circuit card, in addition to the support provided at the lower edge by reason of its marginal engagement with the electrical contacts in the connector socket. Because these circuit board connectors grip only the lower, inserted margin of the circuit card there is little support for the free end of the card, particularly when a number of electrical components are mounted to the upper, free end of the card. In order to obtain a more effective grip on the circuit card, it has become common practice in the prior art to provide supplementary supports for the card, particularly in those instances where the connector and card may be subjected to shock, vibration, acceleration or other environmental stresses.

In printed circuit card connectors of the type described, the socket is provided with rows of resilient standard contacts which are engaged by and connected electrically to the terminals formed on the lower, inserted edge of the printed circuit card. These standard contacts are of identical length and are relatively frail so that, although they are suitable for making an electrical contact, they are unable to provide an adequate support for the circuit board. In addition, should the connector be subjected to vibration at a frequency equal to the resonant frequency of the identical standard contacts, the slight grip of the standard contacts on the circuit board may be reduced further. For these reasons the gripping and dampening properties of the standard contacts are ineffective when the connector is subjected to variable and amplified conditions of stress.

As suggested above, it has been attempted, in the prior art to overcome the foregoing disadvantages, by providing means, external and separate from the connector, to grip or support the free end of the printed circuit card. These supports, generally, are mounted to the same plate or connector plane as the connectors themselves and occupy space which otherwise might be used to enable the connectors to be arranged in a more compact, dense array. Such compact arrangement of connectors has become highly desirable with the increased complexity and tendency toward miniaturization of electronic circuitry. Because the supports proposed in the prior art are separate from the connectors themselves, they must be manufactured, assembled and connected separately, all of which adds to the labor and expense of the final product.

In contrast to the prior art, my connector provides a supplementary support for the circuit card which is formed integrally with the connector itself, thus eliminating the need for a separately manufactured support and which permits the connectors to be arranged in a more dense, compact array. Additionally, by forming the support integrally with the connector itself the cost of the completed article is reduced.

The improved connector described herein enables a printed circuit card to be inserted directly into the socket while simultaneously engaging the integral supplementary support without requiring any further manipulative steps, as connecting separately the support to the free end of the circuit card. Additionally, the connector enables the circuit card to be inserted into the socket and into engagement with the support means under a minimal force yet which effects a firm grip on the circuit card.

SUMMARY

In accordance with my invention, a connector is provided having an insulative body and an elongated socket formed therein for reception of the terminal edge of a printed circuit card. Standard contacts are disposed along the bottom of the socket in a conventional manner to engage electrically the terminals on the lower, inserted edge of the printed circuit card.

The connector includes upstanding card guides formed integrally with the ends of the insulative body, and which have heightwise end slots formed therein in which the side edges of the inserted printed circuit card are received. A supplementary supporting means, in accordance with the invention, is provided at each end of the connector and comprises a pair of transversely spaced heightwise extending fingers which engage and grip resiliently the opposite faces of the inserted circuit card. The fingers are considerably more massive and larger than the standard contacts in the socket and extend upwardly well beyond the level of the standard contacts. The fingers engage the circuit board at a level well above the standard contacts to reduce the mechanical advantage or leverage of the free, relatively heavy end of the circuit card. In addition, the fingers are unequal in length so that they will not resonate at the same vibratory frequency, thus enhancing their dampening effect and reducing further the likelihood of malfunction as a result of vibration.

Another aspect of my invention resides in the utilization of the foregoing dampening fingers as electrical connection terminals. In this aspect of my invention each of the fingers is formed with an integral contact tail which is adapted to protrude downwardly through both the bottom of the connector and the ground plane on which the connector is mounted.

It is among the objects of my invention to provide a circuit card connector which displays superior dampening characteristics.

Another object of my invention is to provide a printed connector adapted to receive and support a circuit card and to resist malfunction under amplified conditions of stress such as shock, vibration, acceleration and the like.

A further object of my invention is to provide a printed circuit card connector having a card edge guide and resilient dampening fingers retained within the edge guides and in which the fingers are effective to grip the circuit board inserted therebetween at an elevated level.

Also among the objects of my invention is to provide a printed circuit card connector having integrally formed dampening fingers at its ends which are adapted to engage and support the side edges of an inserted circuit card and which may be employed simultaneously as electrical terminal contacts.

An additional object of my invention is to provide a printed circuit card connector having a self-contained supplementary dampening support which does not interfere with the compact, dense arrangement of such connectors in an array.

Another object of my invention is to provide a circuit card connector which achieves the foregoing objects and advantages, yet which is of a simple construction and may be manufactured at relatively low cost.

Other objects and advantages of my invention will be apparent from the following detailed description of my invention with reference to the accompanying drawings wherein:

FIG. 1 is a plan view of a connector modified in accordance with the invention;

FIG. 2 is a front elevation of the connector shown in FIG. 1;

FIG. 3 is an enlarged, plan view of the left end of the connector shown in FIG. 1 and illustrating the card edge guide and dampening fingers;

FIG. 4 is an end view, in section, as seen from the line 4—4 of FIG. 3;

FIG. 5 is a front elevation, in section, of the left end of the connector as viewed from the line 5—5 of FIG. 1; and

FIG. 6 is an illustration of a modified form of the invention, similar to that of FIG. 5, and in which the dampening legs are employed as electrical contacts in addition to providing their supporting function.

As shown in FIGS. 1 and 2, the connector 10 includes an insulative body 12 which may be molded or otherwise fabricated from any conventional insulator such as nylon, diall or other material offering good electrically, insulative properties. An elongated socket 14 is formed in the insulative body 12 along its length and is adapted to receive the lower edge of the

printed circuit card 16 on which conventional terminals (not shown) are formed. A number of standard socket contacts 18 are mounted to the insulative body and extend along the socket 14 so that they may engage the terminals of the inserted circuit cards 16. The contacts 18 commonly are formed integrally with contact tails 20 which protrude downwardly through the bottom of the insulative body 12 and through the connector plane 22 on which the connector 10 is mounted. The exposed contact tails 20 are connected to the desired wires by any conventional means such as wire wrapping.

Each end of the insulative body 12 is formed with a heightwise extending card edge guide 24, and a heightwise extending end slot 26 is formed in the edge card guide 24. The end slot 26 is adapted to receive the side edge of the circuit card 16 as it is inserted into the connector. Because of manufacturing tolerances inherent in the construction of the insulative body 12, its edge guides 24 and the circuit card 16 itself, the side edges of the circuit card 16 are retained within the end slots 26 in a relatively loose fit. Although the card guides 24 do provide some support for the circuit card, the support may not be sufficient when the assembly is subjected to amplified conditions of stress.

Accordingly, a supplementary support is provided and includes a clip 30 which is retained in each end of the connector 10. The clip 30 is of somewhat U-shaped configuration, having a pair of upstanding resilient legs 32, 34 which are joined at their lower ends at the bight 36. The clip 30 and connector are assembled by means of a hole or opening 38 formed in the bottom of the connector through which the clip 30 is inserted below the end slot 26. Each end slot 26 is provided with secondary slots 28 which face inwardly toward each other so that legs 32, 34 of the clip 30 may be inserted upwardly through the opening 38 and be retained within the secondary slots 28. The extent to which the clip 30 may be inserted is limited by means of a retaining member 40 which may be formed integrally with the insulative body 12 at the bottom of the socket 14 and which engages the bight 36 of the clip 30. After the clip 30 has been assembled with the insulative body 12, the connector 10 may be fastened to the connector plane 22 which will cause the bight 36 to be gripped firmly between the connector plane 22 and retaining member 40.

The legs 32, 34 of the clip 30 are formed specially to effect a firm grip on the inserted printed circuit card 16 and to retard and effect a dampening of any vibration or other detrimental stress to which the connector and circuit card may be subjected. To this end, each of the legs 32, 34 is bowed intermediate its ends to define the apexes 42 and 44 respectively. Each of the apexes 42, 44 protrudes inwardly into the end slot 26 to an extent sufficient to engage both sides of the inserted circuit card 16. The apexes 42, 44 engage the circuit card 16 at a location that is well above the lower edge of the inserted card 16 and thus provide a more firm support than the relatively short standard contacts 18. It should be noted that the apexes 42, 44 are arranged at different elevations to engage the opposite faces of the circuit card at different levels. This arrangement has been found to reduce further the likelihood of connector malfunction as a result of vibration or shock. It should be noted also that the legs 32, 34 are of unequal length to prevent common resonance in response to an applied vibration. In addition, the unequal length of the legs 32, 34 and the heightwise spacing of the apexes 42, 44 tend to reduce the force required to insert the circuit card, as compared to previously proposed supplementary supports yet provide the desired firm grip and superior dampening effect.

Another aspect of my invention, in which the legs 32', 34' are employed as electrical contacts, in addition to their dampening and gripping functions, is shown in FIG. 6. In this arrangement the legs 32', 34' are arranged in the same configuration as described above except that they are separate members and are not joined to each other at their lower ends. When employed as contacts the legs 32' and 34' should be formed from a resilient material having desirable conductive properties such as beryllium copper or phosphor bronze. As

shown, contact tails 46, 48 are formed integrally with each of the legs 32', 34' and are adapted to be retained within and protrude downwardly through holes 50 formed in the bottom of the insulative body 12. Suitable holes 52 are formed in the connector plane 22 to permit the contact tails to protrude beyond the back face of the plane 22. The contact tails may be electrically connected to the plane 22 by means of a ground bushing 54 as shown in connection with the contact tail 46 or, alternatively, may be insulated from the connector plane 22 by an insulative sleeve 56 formed integrally with the insulative body 12, as shown in connection with the contact tail 48. The contact tails 46, 48 may be connected to leads or wires by any conventional means. This aspect of my invention is advantageous particularly in that it provides a means for supplying voltage or grounding electrically the circuit card without utilizing any of the standard contacts 18 so that the standard contacts 18 may be employed in connection with the signal circuit. When employing this aspect of my invention the printed circuit card must be etched or otherwise metallized, in accordance with the particular circuit, to provide a connection between the desired apex or apexes 42, 44 and the circuit imprinted on the card.

It will be understood that in the foregoing description of my invention and in the following claims, terms such as "heightwise", "lateral", "upper", "lower", and the like have been employed primarily for ease in explaining the relative locations and positions of the elements of the connector. Thus, it should be understood that the connector described herein may be employed to support a circuit board which extends in a horizontal or other plane.

It should be understood further that the foregoing description of my invention is intended merely to be illustrative and that other modification and embodiments thereof will be apparent to those skilled in the art without departing from its spirit.

Having thus described my invention what I desire to claim and secure by Letters Patent is:

1. In a circuit card connector having an insulative body in which is formed a socket adapted to receive a lower, contact-bearing marginal edge of a circuit card, an improved arrangement for supporting both side edges of said circuit card, said improvement comprising

a pair of co-extending card guides, each card guide being formed integrally with said insulative body at a different end of said socket and extending outwardly beyond said insulative body and having a heightwise extending, edge-receiving slot formed therein in fixed alignment with said socket to receive a side edge of said inserted card guide, and

resilient dampening means on each card guide, each said dampening means having a pair of opposed card-engaging protrusions protruding toward each other into the edge-receiving slot of that card guide for engaging between them opposed faces of said inserted circuit card adjacent the side edge received in that card guide and at a level that is above both said lower card edge and said socket-forming portion of said insulative body, each said dampening means being formed by a single structural element that provides both protrusions of that dampening means.

2. A connector as defined in claim 1 wherein each said dampening means comprises

a pair of heightwise extending fingers disposed within said edge-receiving slot and spaced apart laterally of said socket for receiving said printed circuit card therebetween, and means for securing the lower end of each said finger to said insulative body.

3. A connector as defined in claim 1 wherein each said dampening means comprises a pair of heightwise extending fingers of electrically conductive material disposed within said edge-receiving slot and spaced apart laterally of said socket to enable a side edge of said circuit card to be inserted therebetween, each said finger having a contact tail formed in-

tegrally therewith and extending downwardly through and beyond the bottom of said connector body.

4. A connector as defined in claim 1

wherein each said dampening means comprises a pair of heightwise extending fingers disposed within each edge-receiving slot and spaced apart laterally of said socket for receiving a printed circuit card therebetween, each finger being bowed at a point intermediate its ends to define an apex which protrudes into said end slot and which constitutes said protruding portion of said dampening means adapted to engage said inserted circuit card, and

further comprising means securing the lower end of each said finger to said insulative body for mounting said resilient dampening means at each end of said insulative body and disposing at least a portion of said dampening means in engagement with the face of said inserted circuit card adjacent its side edge and at a level that is above said lower marginal edge thereof.

5. A connector as defined in claim 4 wherein said apexes of said fingers of each dampening means are disposed at different levels.

6. A connector as defined in claim 4 wherein said fingers of each dampening means are of unequal length.

7. A connector as defined in claim 6 wherein said apexes of each dampening means are spaced heightwise with respect to each other.

8. In a circuit card connector having an insulative body in which is formed a socket adapted to receive the lower marginal edge of a circuit card, an improved arrangement for supporting a side edge of said circuit card comprising, in combination

a card guide formed integrally with said insulative body at an end of said socket, said card guide extending outwardly beyond said insulative body and having a heightwise extending end slot formed therein to receive a side edge of said inserted circuit card,

resilient dampening means comprising a pair of heightwise extending fingers of unequal length disposed within said end slot and spaced apart laterally of said socket for receiving a printed circuit card therebetween, and means securing the lower end of each said finger to said insulative body, and

means mounting said dampening fingers on said insulative body at each end thereof and disposing at least a portion of said fingers in engagement with said inserted circuit card adjacent its side edge and at a level that is above said lower marginal edge thereof.

9. In a circuit card connector having an insulative body in which is formed a socket adapted to receive the lower marginal edge of a circuit card, an improved arrangement for supporting a side edge of said circuit card, said improvement comprising

a card guide formed integrally with said insulative body at an end of said socket and extending outwardly beyond said insulative body and having a heightwise extending end slot formed therein to receive a side edge of said inserted circuit card,

resilient dampening means comprising a pair of spaced apart and heightwise extending fingers joined at their lower ends at a bight, and

means mounting said resilient dampening means on said insulative body at each end thereof and disposing at least a portion of said dampening means for engagement with the face of said inserted circuit card adjacent its side edge and at a level that is above said lower marginal edge thereof and which comprises a retaining member disposed at the bottom of said socket and passing through said bight.

10. In an electrical connector for a printed circuit card having a contact edge spaced from an outer edge and having two side edges normal to said contact and outer edges, said connector including

i. an elongated body having two ends and recessed with a contact-seating channel extending therebetween for receiving said contact edge,

ii. two elongated card guides, each of which is fixedly secured to said connector body adjacent an end thereof and extends from said body in the direction in which said channel faces, and each of which is recessed with a slot extending therealong and facing the slot in the other card guide, said card guide guidingly receiving in said slots the side edges of a card inserted into said connector,

the improvement comprising

a single structural member forming a pair of opposed and conjoined slot-constricting card-engaging means on each said card guide in fixed alignment with said contact-seating channel and protruding on that guide into said slot therein for interferingly engaging with resilient force opposite surfaces of said card adjacent said respective side edge, each pair of slot-constricting means protruding into a card-guide slot at a position along the card guide which is spaced from said connector body to engage said card at a location removed from said contact edge thereof in the direction toward said outer edge thereof.

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