United States Patent

Tinkelenberg et al.

[15] **3,660,799**

[45] **May 2, 1972**

[54] **CONNECTOR DEVICE**

[72] Inventors: **William G. Tinkelenberg**, Phoenix; **James D. Fredenberg**, Glendale, both of Ariz.

[73] Assignee: **Honeywell Information Systems Inc.**

[22] Filed: **June 17, 1969**

[21] Appl. No.: **833,986**

[52] **U.S. Cl.** ....**339/61 M,** 339/17 CF, 339/174

[51] **Int. Cl.** **H01r 13/48**

[58] **Field of Search** ....339/17 CF, 59, 61, 95, 174, 339/176 M, 176 MP, 221, 191 M, 192, 220, 244, 247; 317/101 A, 101 C, 101 CC

[56] **References Cited**

UNITED STATES PATENTS

2,225,460	12/1940	Porth	136/135
3,341,806	9/1967	Joachim	339/192
3,441,853	4/1969	Bodine	324/158

FOREIGN PATENTS OR APPLICATIONS

841,556	6/1956	Great Britain	339/220 T
525,325	4/1931	Germany	339/61
660,187	10/1951	Great Britain	339/59 M

OTHER PUBLICATIONS

Stark et al., "Incandescent Lamp Holder," IBM Tech. Disclosure, Vol. 3 No. 3, August 1960, P. 3

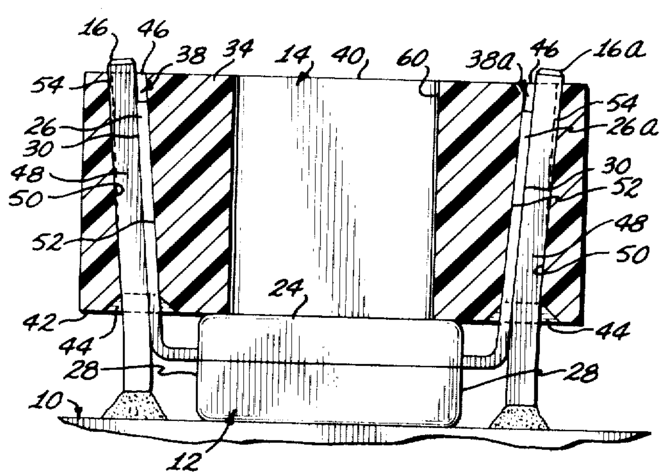
Morgan et al., "Joining Dip Modules To P/C Cards," IBM Tech. Disclosure, Vol. 11 No. 7, Dec. 1968 p. 736

Primary Examiner—David H. Brown
Assistant Examiner—Lawrence J. Staab
Attorney—Edward W. Hughes, Frank L. Neuhauser, Oscar B. Waddell, Joseph B. Forman and James A. Pershon

[57] **ABSTRACT**

A demountable connector for electrically and mechanically attaching a multi-lead electronic element to a wiring panel.

2 Claims, 9 Drawing Figures



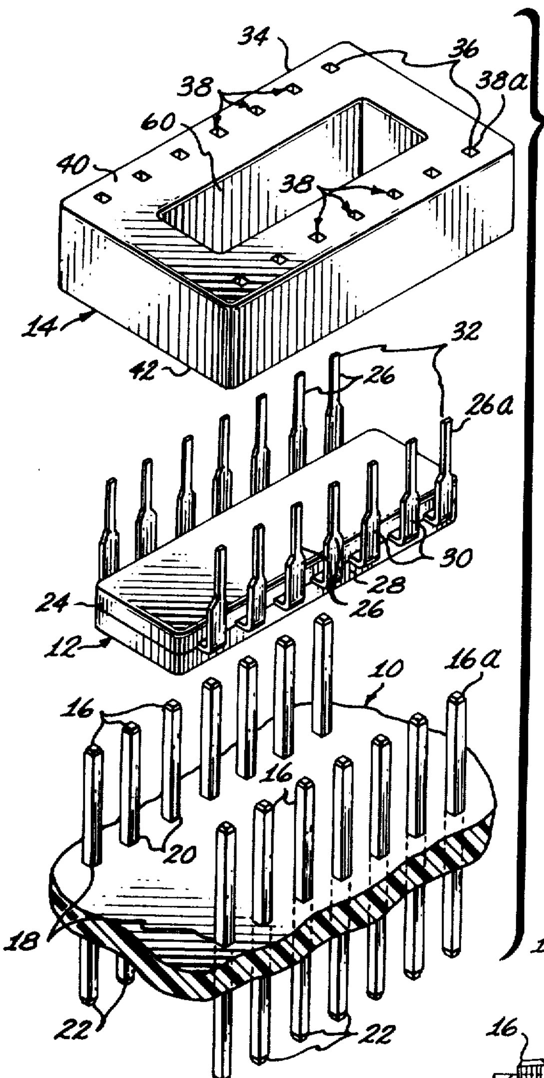


Fig-1

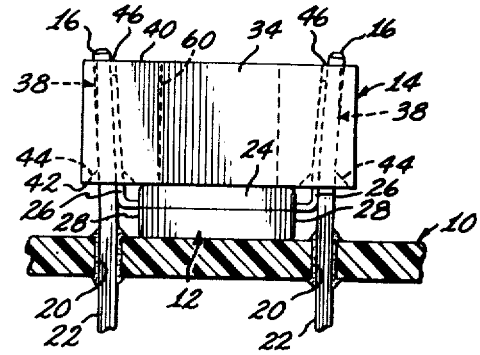


Fig-2

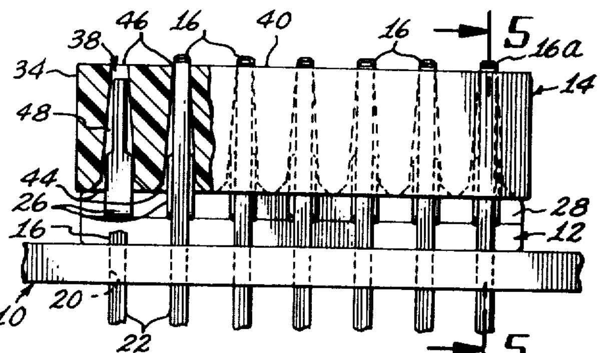


Fig-3

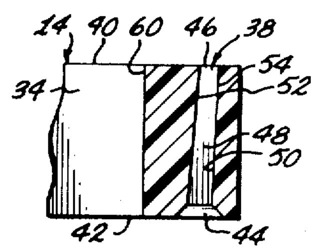


Fig-4

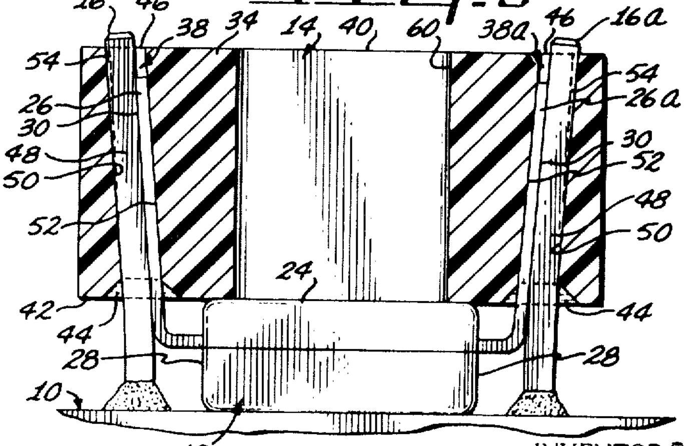


Fig-5

INVENTORS
WILLIAM G. TINKELENBERG
JAMES D. FREDENBERG
BY
Herbert C. Haynes Jr.
AGENT

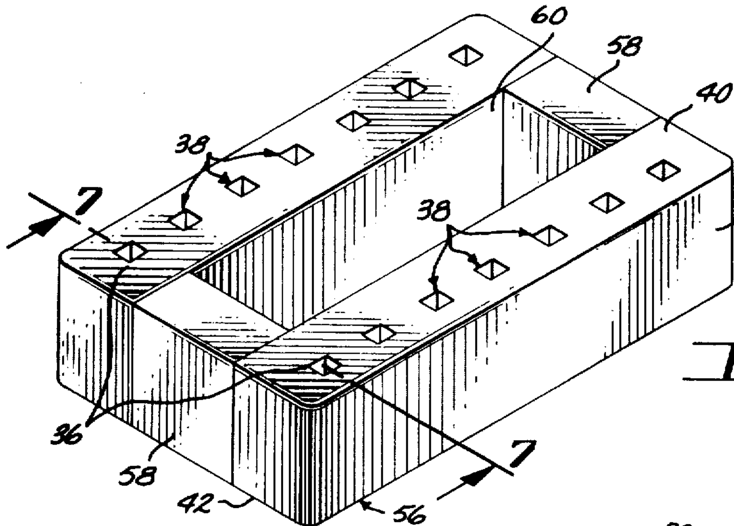


Fig. 6

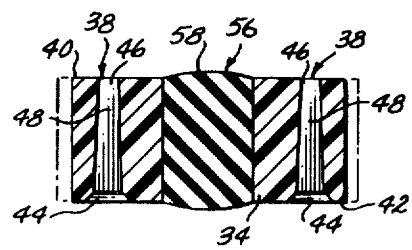


Fig. 7

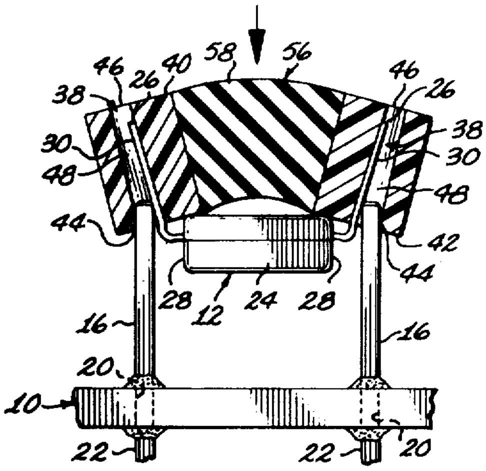


Fig. 8

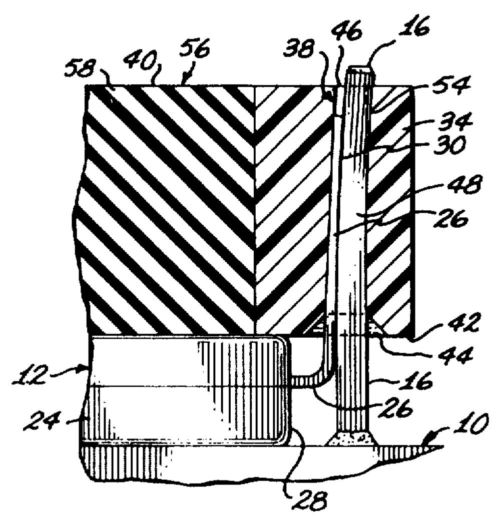


Fig. 9

CONNECTOR DEVICE

BACKGROUND OF THE INVENTION

This invention relates to connectors and more particularly to a connector for demountably attaching a multi-lead electronic element to a wiring panel.

FIELD OF THE INVENTION

One of the primary objects in the design of modern electronic equipment is to increase their electronic operating speeds and, electronic signals travel at approximately 13 inches per nanosecond, the trend is to shorten the distances that the signals must travel.

New manufacturing techniques have reduced the size of the individual components such as resistors, capacitors, diodes and the like. Other technological advances have resulted in the creation of integrated circuit packages all of which decrease the signal travel time within and between the individual elements.

To minimize the distances that the signals must travel, it is desirable to mount the elements in very dense arrays on wiring boards.

It has long been known that soldering is a good type of electrical connection because it is gas-tight. The desirable feature of a gas-tight connection is that no air or moisture can enter the pores and irregularities in the metal to cause corrosion which would decrease signal strength due to the increased impedance of the connection.

The dense packaging arrays desirable in modern electronic equipment has increased the cost of individual wiring boards to the point that stockpiling a spare of each type of board at equipment installations is very expensive and impractical. The current trend therefore is to repair the boards at the installation whenever possible. In the process of trouble shooting a wiring board, it is often necessary to resort to the substitution method; that is, removal and replacement of one or more elements until the trouble has been corrected. The soldered connections of elements in densely packaged arrays has made the removal and replacement of elements hazardous as many costly elements and wiring boards have been destroyed by the application of excessive heat.

PRIOR ART

In an attempt to circumvent the problems associated with the solder mounting of integrated circuits on wiring boards, a prior art solderless connector was developed. This prior art connector is shown in U. S. Pat. No. 3,341,806, and comprises a plurality of cavities in an insulative housing, each cavity containing a metallic spring element. Each of the cavities is positioned within the housing to receive one lead of the integrated circuit and one aligned pin of the wiring board. During insertion of the leads and pins into this prior art connector, the spring elements force the leads and pins into frictional contact with each other to apply a wiping action therebetween which smooths and cleans the metal surfaces. The spring elements are then employed to maintain a force on the juxtaposed surfaces to provide a gas-tight connection between the leads and pins. Besides being relatively expensive to manufacture, the force of the spring element is applied to a very small area of the lead so that the area of gas-tight connection between the pins and the leads is also relatively small, certainly not significantly larger than the area contacted by the spring element. The small area of gas-tight connection between the pins and the leads provides little, if any, margin for error, that is, by way of example, any corrosion residue dirt, irregularities, flaw in the metal, and the like which may be present in the small contact area could expose the connection to corrosion.

SUMMARY OF THE INVENTION

In accordance with the present invention, a new and improved demountable solderless connector is provided which facilitates the mounting the removal of integrated circuits

called more particularly the dual in-line package, hereinafter called "DIP." The connector comprises an insulative housing having a plurality of apertures formed therein; each aperture is located to receive a lead of the DIP and an aligned pin of the wiring panel. When the DIP leads are inserted into the apertures followed by the insertion of the pins, a wiping action takes place along the length of the juxtaposed surfaces of the inserted leads and pins. The wiping action cleans and reduces metal irregularities so that a gas-tight connection of substantial area is produced.

The connector and its apertures are designed so that a force is applied and maintained on the juxtaposed pins and leads to provide a gas-tight connection along substantially their entire inserted length.

The apertures are also designed to provide an interference fit between the leads and pins to firmly mount the connector and DIP to the wiring board. The interference fit and the large gas-contact area results in a connector which withstands the vibrations, corrosive atmosphere and the like that are normally present in the hostile environment of electronic equipment. Test samples have been subjected to exhaustive tests, such as heat soaking followed by exposure to H_2S, with excellent corrosion resistant results.

Accordingly, it is an object of the present invention to provide a connector which is simple and inexpensive to manufacture.

Another object of this invention is to provide an improved solderless demountable connector.

A further object of this invention is to provide a connector which, during insertion, applies a wiping action along the entire inserted length of the DIP leads and the wiring board pins.

A further object of this invention is to provide a connector which applies and maintains a force on the inserted leads and pins to provide a gas-tight connection along the entire inserted length of the leads and pins.

A still further object of this invention is to provide a connector which forms an interference fit between the DIP leads and the wiring board pins to firmly attach the DIP to the wiring board.

The foregoing and other objects of this invention, the various features thereof as well as the invention itself, may be more fully understood from the following description when read in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a fragmentary, isometric, exploded view incorporating features of the present invention; environments

FIG. 2 is an end view of a wiring panel with an integrated circuit package attached by the connector of the present invention;

FIG. 3 is a side view partly broken away of a wiring panel with the integrated circuit package attached by the connector of the present invention;

FIG. 4 is an enlarged, fragmentary, sectional view of the connector of the present invention illustrating the internal aperture configuration;

FIG. 5 is an enlarged, fragmentary, sectional view taken on line 5—5 of FIG. 3;

FIG. 6 is an isometric view of a connector showing a modification of the present invention; FIG. 7 is a sectional view of the modified connector taken on the line 7—7 of FIG. 6;

FIG. 8 is a sectional view of an intermediate step in the assembly of the modified connector;

FIG. 9 is an enlarged fragmentary sectional view of the modified connector of FIG. 6.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring more particularly to the drawings, FIG. 1 shows a fragmentary, isometric view of a type of wiring panel 10, with a DIP integrated circuit 12, and a connector 14 exploded therefrom. Wiring panel 10 utilizes standard wire-wrap pins 16 arranged in two substantially parallel rows 18; the pins 16 are inserted in holes 20 and are soldered, crimped or otherwise secured therein. The pins 16, as can be seen in FIG. 1, have a substantially square or rectangular cross section of uniform area substantially throughout their length. The type of wiring panel 10 is shown for illustrative purposes only as any type of wiring board would work equally as well. By way of example, a multilayer laminated printing wiring board (not shown) could be utilized by installing pins 16 in the standard plated-through holes which heretofore would have received the component leads. The pins 16 could be modified for this application as the lower portion, or wire-wrap area 22, would not be needed. The material from which the pins 16 are made may be, for example, phosphor bronze, beryllium copper, etc.; the material should be selected not only for its excellent electrical characteristics, but also for its resilience, as will be described in detail hereinafter.

The standard dual in-line integrated circuit package 12 comprises a housing 24 which contains miniature internal circuitry. Electrical contact to the internal circuitry is made through a plurality of leads or prongs 26 extending laterally from the sides 28 of the housing 24. The prongs 26 extend from the housing 24 a short distance and are formed to approximately a 90° angle to provide the prong contact areas 30. Cross sections of prongs 26 are substantially rectangular as can be seen in FIG. 1. The thickness of the prongs is substantially constant but their widths vary so that the cross sectional area is not constant throughout their length. The prongs 26 having been formed as hereinbefore described will provide two substantially parallel rows 32 best seen in FIG. 1.

The connector 14 may be formed as by casting, molding, etc., from a suitable dielectric material. The materials used in forming the connector 14, must not only be of good insulative quality, but should resist creep, that is, the slow change of dimensions due to prolonged exposure to stress, and the material should also be resilient, that is, attempt to return to its natural state after deflection. A certain amount of connector deflection is expected during installation due to the forces exerted by pin deflection and an interference fit designed into each aperture as will hereinafter be described in detail. Materials possessing the hereinbefore described characteristics are generally of the resilient synthetic class and cover both the thermosetting and thermoplastic types. Experiments have been conducted and excellent results have been obtained with polycarbonate, polypropylene and alloyed synthetic materials.

The connector 14 comprises a block 34 in which two substantially parallel rows 36 of receiving means or aperture means 38 are formed. Each aperture means 38 is formed to interconnect a top surface 40 and bottom surface 42 of the block 34.

With particular reference to FIGS. 1, 2 and 3, it will be seen that the spatial relationships between rows 18 and the individual pins 16, between rows 32 and the individual prongs 26 and between the rows 36 and the individual apertures 38 is such that, when assembled as shown in FIGS. 2 and 3, each prong 26 is juxtaposed to a respectively aligned pin 16, and are retained in this position by their respectively aligned aperture 38. By way of example, pin 16*a* is juxtaposed with prong 26*a*, and held in mechanical and electrical contact by aperture 38*a*.

In actual practice, it has been found that mounting DIP 12 on connector 14 and then assembling them onto pins 16 of panel 10 is the best assembly technique, as this method assures proper alignment and provides a wiping interaction between the prongs 26 and the pins 16. The wiping action cleans and smooths metal irregularities to provide a gas-tight connection of substantial area.

With particular reference to FIG. 5, it will be seen that the wiping interaction of the prongs 26 and pins 16 and the mechanical retention of the entire assembly is accomplished by the design of apertures 28 which deflects the pins 16 outwardly, thereby providing the wiping interaction over substantially the entire contact areas 30 of prongs 26 and a correspondingly large area on pins 16, and also applies a bias toward the contact areas 30 to maintain a gas-tight surface-to-surface contact. A lower opening 44 of aperture 38 formed in bottom surface 42 of block 34 is of larger dimension than the combined dimensions of the prong 26 and the pin 16 inserted therein. An upper opening 46 of aperture 38 formed in the top surface 40 of block 34 is of a smaller dimension than the combined dimensions of the prong and pin. Passage 48, which is of decreasing dimension, interconnects the openings 44 and 46 may accomplish the transition from the large opening to the small opening in a number of ways, for example, a conical passage, a three wall pyramidal passage, a four wall pyramidal passage, etc.

The aperture 38*a*, shown in FIGS. 4 and 5, is illustrated as having a truncated, four wall, pyramidal passage 48. The outside wall 50 and the inside wall 52 of passage 48 slope upwardly, outwardly and convergingly from opening 44 to opening 46. The inside wall or surface 52 forms an incline plane which angularly supportingly receives the prong 26 and deflects the pin 16 outwardly during insertion. The outside wall or surface 50 acts as a support surface for the deflected pin 16. This internal configuration of passages 48 has been found to provide an excellent wiping action between the prongs 26 and pins 16 during assembly. This design also deflects pins 16 outwardly within their elastic limits, thus the natural resiliency of the pins 16 coupled with the material of block 34 attempting to return to its undistorted or original shape will maintain a gas-tight surface-to-surface contact over substantially the entire inserted length of the prongs 26 and pins 16. It may also be seen in FIGS. 4 and 5 that the uppermost portion 54 of passages 48 provides an interference fit of the prongs 26 and pins 16, due to the different slope angles of outside wall 50 and insider wall 52. The interference fit firmly mounts the connector and the integrated circuit to the wiring panel.

The connector 56 shown in FIGS. 6, 7, 8 and 9 is a modification of the present invention which accomplishes the same purposes as connector 14 in a somewhat different manner.

The connector 56 may be formed of a harder material than is connector 14, for example, phenolic diallylpthalate, glass filled epoxy, silicon molding resin, etc. The same general configuration that applies to connector 14, applies also to connector 56, except that a resilient means 58 such as rubber or synthetic resilient material in the form of pads is molded or otherwise inserted between the parallel rows 36 of apertures 38. The apertures 38, as best seen in FIGS. 7 and 8, are shown as four wall passages 48, the walls of which slope upwardly and inwardly toward the center of the aperture to provide an interference fit of the prongs 26 and pins 16 inserted therein.

To provide the wiping action and apply the force needed to maintain a large gas-tight connection, the connector 56 is compressed from its normal position shown in dashed lines in FIG. 7 to the position shown in solid lines. The DIP prongs 26 are then fully inserted and the pins 16 are just started into the apertures 38. Releasing the connector 56 will permit the resilient means 58 to try to expand the connector 56 to its normal position. The connector 56 in attempting to return to its relaxed or expanded state will assume a position as shown in FIG. 8 and exert a biasing force on the DIP prongs 26 which is transmitted to the top portions of the pins 16. Pushing the connector 56 toward the wiring board 10 will provide an excellent wiping action between the prong 26 and pin 16 surfaces. The outwardly exerted biasing forces caused by the connector 14 attempting to return to its relaxed state will deflect pins 16 outwardly. A surface-to-surface gas-tight connection is maintained along substantially the entire inserted length of the prongs 26 and pins 16 by the counteracting forces created by the connector 14, and resilience of pins 16 attempting to return to their undeflected state.

The shape of connectors 14 and 56 are shown as rectangular, and being adapted to accommodate a 14 prong DIP integrated circuit. It should be understood that the rectangular shape of the connector and the number of apertures may be altered to accommodate the number of prongs on a given integrated circuit package. The connectors **14** and **56** may be provided with an inspection aperture **60** so that the integrated circuit package identification data printed thereon may be seen without removing the connector and integrated circuit package from the panel. It should also be noted that this novel method of mounting the DIP integrated circuits lends itself to piggy-back stacking, that is, an increase in the length of pins **16** would permit two or more DIPS to be mounted on the same pin array.

While the principles of the invention have now been made clear in a preferred embodiment, there will be immediately obvious to those skilled in the art many modifications of structure, arrangement, proportions, the elements, materials, and components used in the practice of the invention, and otherwise, which are particularly adapted for specific enviroments and operating requirements without departing from those principles. The appended claims are therefore intended to cover and embrace any such modifications within the limits only of the true scope of the invention.

What is claimed is:

1. A connector for mounting a multi-lead electronic element comprising:

a wiring panel having a plurality of pins spatially arranged thereon in two substantially parallel rows to juxtapositionally align with the leads of the electronic element;

a block of insulative material;

a plurality of apertures formed within said block, said apertures having substantial length and spatially arranged in two parallel rows so that each of said apertures is positioned to receive on lead of the electronic element and one pin of said wiring panel, each of said apertures comprising a walled passage, the walls sloping upwardly from

the bottom surface to the top surface of said block and inwardly toward the center of said passage;

at least one pad of resilient material attached to said block between the parallel rows of said apertures to exert an outward biasing force on said apertures, said biasing force being transmitted to the leads of the electronic element and to the pins of said wiring panel to cause the pins to deflect outwardly whereby, a wiping action between the leads and pins occurs during receipt thereof, and counteracting forces insure tight surface-to-surface contact therebetween; and

an inspection aperture formed in said block.

2. A connector for mounting a multi-lead electronic element to a wiring panel having a substantially planar surface with a plurality of pins spatially mounted on the wiring panel in at least two substantially parallel rows, the pins being substantially normal to the planar surface of the panel and juxtapositionally aligned with the leads of the electronic element, said connector comprising:

a pair of blocks of insulative material;

a plurality of pin and leading receiving means formed in each of said blocks, each of said receiving means having a substantial length and positioned to receive one lead of the electronic element and one pin of the wiring panel; and

at least one pad of resilient material attached to each of said blocks to exert an outward biasing force on said blocks, said biasing force being transmitted to the leads of the electronic element and to the pins of the wiring panel to cause the pins to deflect, whereby a wiring action between the leads and pins occurs during receipt thereof.

* * * * *