United States Patent

[11] 3,569,789

[72] Inventor **Franz Jenik**
Munich, Germany

[21] Appl. No. **827,695**
[22] Filed **May 26, 1969**
[45] Patented **Mar. 9, 1971**

[73] Assignee **Siemens Aktiengesellschaft**
Berlin, Germany

[32] Priority **May 30, 1968**
[33] **Germany**
[31] **P 17 65 506.0**

[54] **PLUG-IN TYPE CONNECTOR HAVING SHORT SIGNAL PATH**
5 Claims, 3 Drawing Figs.

[52] U.S. Cl. **317/101**, 339/17, 339/273
[51] Int. Cl. **H05k 1/12**
[50] Field of Search ..... 339/17, 48, 273; 317/101 (C), 101 (CM), 101 (D), 101 (DH)

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Primary Examiner—Marvin A. Champion
Assistant Examiner—Patrick A. Clifford
Attorney—Hill, Sherman, Meroni, Gross & Simpson

ABSTRACT: A connector for releasably connecting lines of a first conductor plate carrying modules with lines of a multilayered wiring plate at prescribed raster points in which contact pins having beveled ends extend from the first conductor plate and are receivable into cooperable openings in the other conductor plate and wherein springs having mating beveled ends are positioned in the openings for being wedged with the pins and for exerting a force thereon in a direction perpendicular to the first conductor plate.

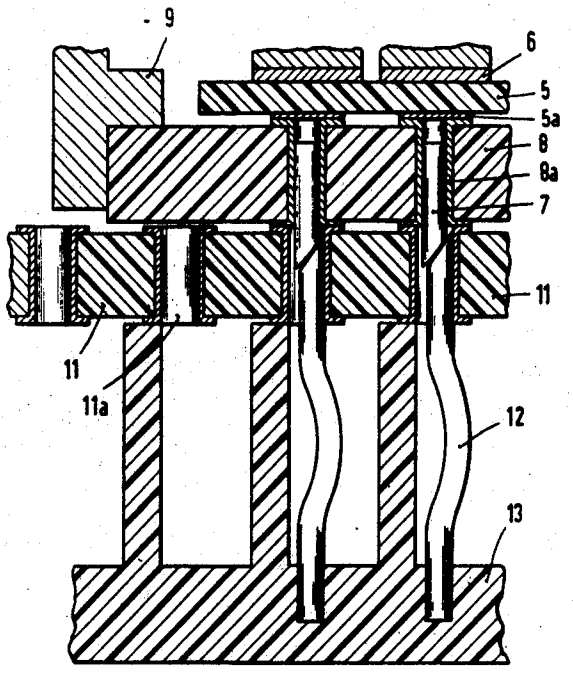


Fig.1
PRIOR ART

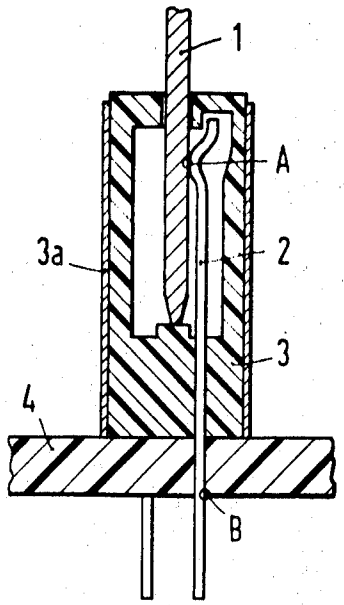
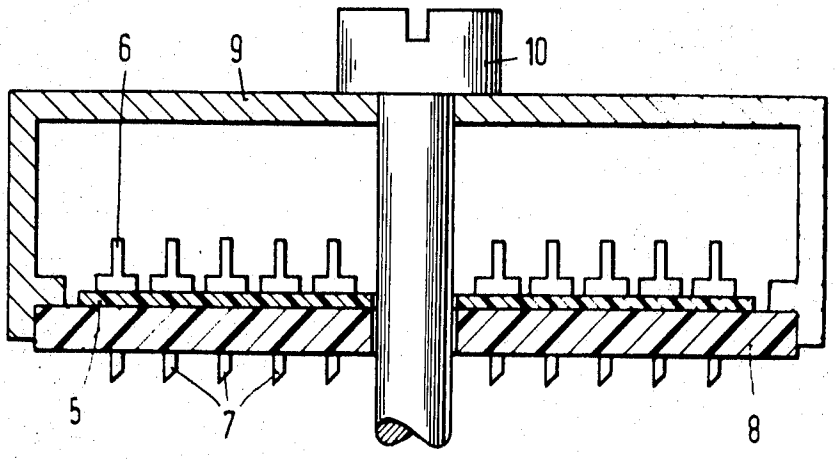


Fig. 2

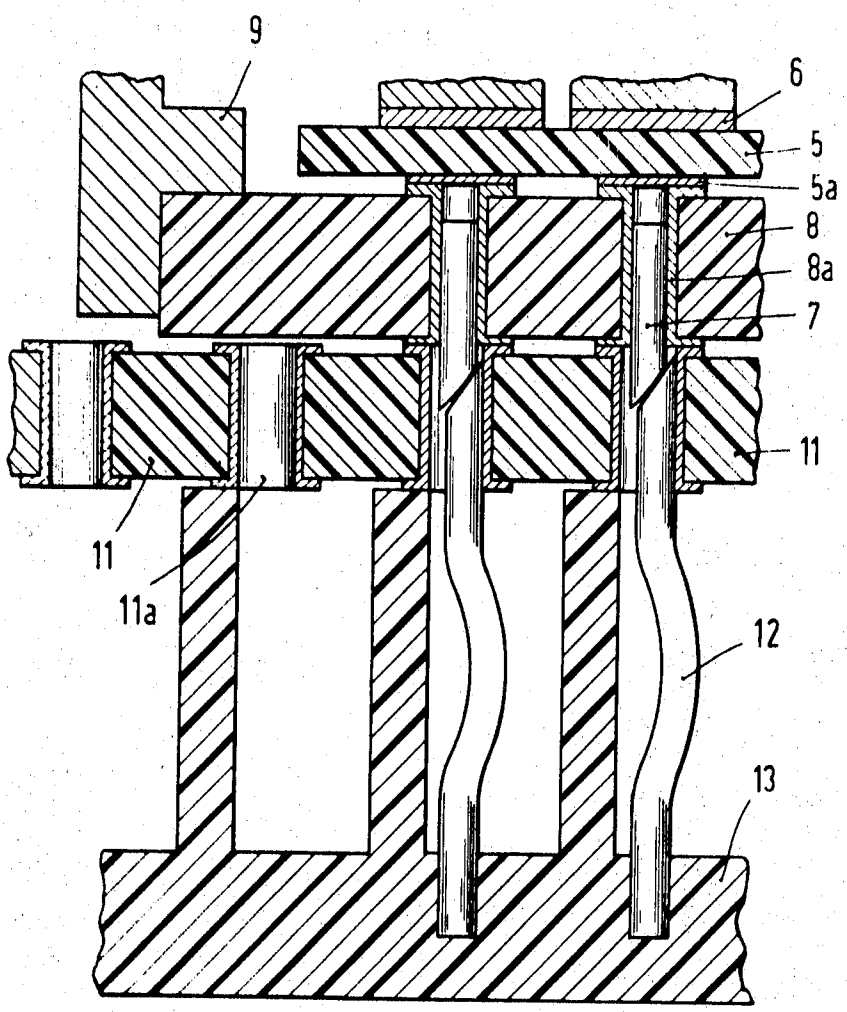


INVENTOR
Franz Jenik

Kill, Sherman, Morris, Gross & Simpson

BY ATTYS.

Fig. 3



INVENTOR
Franz Jarnik

BY

ATTYS.

PLUG-IN TYPE CONNECTOR HAVING SHORT SIGNAL PATH

BACKGROUND OF THE INVENTION

The continually increasing use of fast-acting integrated switching circuits in the form of micromodules in connection with the construction of large electronic systems, particularly data processing installations, has resulted, not only in a reduction of space requirements, but has also made possible an increase in switching speeds as a result of the shorter line length required. A further improvement in switching characteristics can be achieved by the utilization of a construction in which the signal lines are in the form of strip lines with a predetermined wave resistance. As a result, the trend has been predominantly toward the utilization of micromodules assembled on a platelike multilayered carrier of insulating material, in which on each layer there are arranged suitably formed conductor paths, constructed, for example, in accordance with printed circuit techniques. Obviously, the shortest signal lines would be obtained with a predetermined wave resistance, selectable within limits, and it will be appreciated that the highest switching speed would be achieved if all the micromodules or units of a system were accommodated in a single large constructional assembly. This, however, is contradictory to the requirement that an installation be composed of small, easily separable subassemblies to enable and facilitate fast and simple maintenance operations.

It is a known practice to combine a number of micromodules which, individually, may consist, for example, of several gate and/or sweep circuits employing integrated circuit techniques, in the form of flat construction units which are constructed for plug-in assembly. Such a construction subassembly may, for example, consist of a multilayered conductor plate, on which the integrated modules are soldered in place. It is adapted to be connected by means of plug-in contacts with a wiring or circuit plate which is specifically designed to provide signal lines with defined wave resistances, as well as achieve a high effective conductor density, which plate, likewise, is multilayered.

A common type of plug-in connection (described in Elektronik, 1966, No. 10, pages 311—315) is illustrated in FIG. 1 of the drawings. As subsequently discussed in detail, the connector illustrated is of generally elongated construction, utilizing an elongated pin and cooperable elongated contact spring, as well as an elongated supporting structure therefor, resulting in a long conductive path across the connector, that is not compatible with maximum switching speeds.

The present invention, therefore, has among its objects the production of a connector structure of the plug-in type in which the conductive path between the circuits to be connected is of a minimum length, at the same time enabling the realization of a high component density.

Another object of the invention is the production of such a connector structure which is extremely simple in construction, having a minimum number of parts, and which will provide a highly efficient conductive connection.

A further object of the invention is the production of such a plug-in type of connector which may be fabricated, not only with small transverse dimensions, but also with very small longitudinal dimensions.

BRIEF DESCRIPTION OF THE DRAWINGS

Other objects, features and advantages of the invention will be readily apparent from the following description of a preferred embodiment thereof, taken in conjunction with the accompanying drawings, in which like reference characters indicate like or corresponding parts, although variations and modifications may be effected without departing from the spirit and scope of the novel concepts of the disclosure, and in which:

FIG. 1 is a longitudinal sectional view of a known type of plug-in connector construction;

FIG. 2 is a transverse section through a construction subassembly illustrating the male portion of the plug-in connector structure in simplified form; and

FIG. 3 is an enlarged FIG. of a portion of the structure illustrated in FIG. 2, illustrating additional details of the connector structure and its cooperation with the female portion of the connector.

DESCRIPTION OF A PREFERRED EMBODIMENT

As briefly mentioned previously, the known plug-in connector illustrated in FIG. 1 is of elongated construction, in which the flat construction subassemblies (not illustrated) are provided with a plurality of conductor pins, such as the pin 1 which, for example, may have a transverse width greater than the thickness thereof illustrated in FIG. 1, and, for example, may be electrolytically reinforced or thickened. The pin 1 is adapted to be contacted at point A by a contact spring 2 mounted in a body or base member 3 which, in turn, is secured to a multilayered wiring or circuit plate 4, the contact spring 2 being suitably connected as, for example, by soldering at point B with a conductor path of the multilayered wiring plate 4.

As the contact spring 2 must engage the pin 1 at point A with a sufficiently high contact pressure, which will not appreciably diminish with frequent plug-in and disconnection, the spring 2 must be constructed with a free length of sufficient magnitude. Furthermore, the spring must be securely supported in the insulating portion of the base of body member 3, as the wiring or circuit plate 4 is not designed for absorption of the torque created by the lateral deflection of the springs. Consequently, there is required, between the points A and B, a distance of about 15 to 20 mm., which, for constructional reasons, cannot be materially reduced.

The relatively long line sections formed by the contact springs not only unfavorably influences crosstalk between adjacent lines, but also results in a substantial increase in wave-resistance over that of the strip lines or conductors on the multilayered construction and circuit plates. Furthermore, the abutting portions cause a deformation of the pulses which must pass over such conductive line sections, and since there must be a delay up to the actual evaluation or further processing of the impulses for the dying out of the buildup processes, there arises therefrom a reduction in the switching speed. Of course, by mounting grounded shield members 3*a*, as illustrated in FIG. 1, on the exterior of the base or body member 3, the *L*/*C* ratio of the line section within the plug can be reduced, and thereby the line conduction characteristics can be improved, but a matching to the relatively low wave-resistance of the strip lines is not possible.

Although theoretically there are also known requisite measures for the production of impact-free connections, their use in present applications is usually prohibited by space requirements and cost. For example, in the construction of a system with integrated modules, in practice the raster points at which respective plug-in contacts are to be disposed may have a spacing of 2.54 mm.

The problem underlying the invention thus is that of providing a plug-in connection which can also be utilized for circuit arrangements which operate with pulse lengths in the subnanosecond range. The invention proceeds from the premise that the lengths of the signal paths extending over the connector must be considerably shortened in order to reduce reflection at the abutment or impact locations to a sufficient degree that they are no longer troublesome.

This is accomplished, according to the invention, in a plug-in connector for the detachable electrical connection of lines of a multilayered conductor or assembly plate carrying micromodules at one side thereof, with lines of a multilayered wiring or circuit plate at predetermined raster points, by an arrangement in which there are disposed perpendicularly to the plane of the conductor plate on the side thereof not occupied by micromodules, contact pins which may be secured in a pin-supporting plate disposed adjacent the conductor plate, and preventing the bending thereof.

The free ends of the contact pins protruding from the pin-supporting plate are provided with free end faces which extend angularly relative to their respective pin axes to form respective wedge-shaped end portions. The wiring plate is provided with openings therein at each corresponding cooperable raster point, in which are disposed respective hollow contact elements of a size to receive the free ends of the pins, and cooperable therewith are respective spring members, of elongated construction, each of which is supported at one end, with the opposite free end extending from the opposite side of the wiring plate into a cooperable contact element. The free end of each spring member is provided with an end face which extends angularly relative to the respective axis of the associated hollow contact element to form a wedge-shaped end portion arranged for engagement with the corresponding end portion of the cooperable contact pin upon insertion of the latter into the associated hollow contact element. The respective spring members have a configuration and are so supported that they are operative to exert pressure in a direction perpendicular to the plane of the wiring plate whereby the angular faces of the contact pins are operative to direct the corresponding ends of respective cooperable spring members into wedging engagement between such pins and the adjacent inner wall of the associated hollow contact member to provide a conductive connection therebetween. The resulting signal path across the connector structure is thereby shortened to substantially a minimum.

Referring to FIGS. **2** and **3**, there is illustrated a multilayered conductor or assembly plate **5** which may be provided with conductor layers for respective signal lines, as well as conductor layers for voltage supply, etc., which is provided at one side with a plurality of micromodules, indicated generally by the numeral **6**.

In the example illustrated, the respective modules **6** are arranged in 12 rows of **12** each, with the exception of the intersection points of the sixth and seventh rows with the sixth and seventh columns, which are not occupied. To provide mechanical reinforcement and support for the respective contact pins **7**, there may be provided adjacent the free face of the plate **5** a pin-supporting plate or board **8** of insulating material, which is suitably secured in a protective cover member **9**, which thus forms a housing for the modules **6** and associated structure, with the assembly thus described being adapted to be secured to a cooperable assembly by a screw **10**, disposed in the center of the assembly, which may be suitably constructed to prevent complete removal and loss of the screw when separated from the cooperable assembly.

As illustrated in FIG. **3**, the pin-supporting board **8** is provided with bores or holes therein, each of which is lined with a metallic conductive layer **8***a*, formed with annular areas which encircle the respective openings at the outer surfaces of the plate **8**. The contact pins **7** are inserted into the respective openings in the plate **8** in engagement with the metallized lining **8***a* thereof, and suitably secured, for example, by soldering.

The conductor or assembly plate **5**, likewise, may be provided at the various raster points with metallized areas **5***a*, which may be constructed in the same manner as the linings **8***a* in the pin-supporting board **8** to facilitate connection of the linings **8** with the terminals of the micromodules **6**. The metallizations **5***a* and **8***a* may be suitably conductively connected as, for example, by a soldering or welding process.

The substantially cylindrical contact pins **7** are provided at their free ends, projecting from the pin-supporting plate **8**, with angularly extending end faces forming wedge-shaped end portions.

As clearly illustrated in FIG. **3**, the multilayered wiring or circuit plate **11**, which serves for the connection of the various subassemblies and for providing the supply voltages, is provided, at least at each raster point adjacent a pin **7**, with an opening or bore therethrough which is lined with a metallized coating **11***a* terminating in annular areas which encircle the associated bore or hole at the outer surfaces of the plate **11**, the lining **11***a* thus generally corresponding to the lining **8***a* of the plate **8**.

As will be apparent from a reference to FIG. **3**, the linings **11***a* form respective hollow contact elements of a size to receive the adjacent free end portions of the respective pins **7**, and are adapted to cooperate with respective elongated spring members **12**, each having one end inserted in an associated hollow contact element **11***a*, and their opposite ends mounted in a suitable supporting member **13**. The free ends of the respective spring members **12** are provided with angular extending end faces adapted to cooperate with corresponding end faces of the associated pin **7**, and are provided with such configuration, for example, formed with a slight arcuate bend in the intermediate portion thereof, that an adequate amount of resilience is achieved therein in their longitudinal direction whereby they may yield slightly in response to a pressure acting in such longitudinal direction. The respective pins **7** and spring members **12** are so arranged that the angular extending faces of a pin **7** and its cooperable spring member are oppositely disposed for cooperable engagement.

It will be apparent that upon insertion of the pins **7** in corresponding elements **11***a* and engagement of the cooperable angularly extending end faces thereof, the spring members **12** will exert a force on the contact pins **7** in a longitudinal or axial direction, and as a result of the action of the cooperable angularly extending end faces of the pins and spring members, the free ends of the respective spring members will be urged into firm engagement with the sidewall of the associated hollow contact element **11***a*, as well as into firm engagement with the end of the adjacent pin **7**, the end of the spring member thus being, in effect, wedged between the contact pin **7** and the hollow contact element **11***a*, to provide an extremely short, highly efficient conductive connection between the contact pin **7** and the contact element **11***a*. As previously mentioned, the structure may be detachably maintained in assembled relation by means of the mounting screw **10**.

To facilitate the desired action between the contact pin **7** and the spring members **12**, the angularly extending surfaces of the contact pins or of the spring members may be provided with a slightly convex curvature. Likewise, the angularly extending surfaces of the respective pairs of pins and spring members may be so arranged within a constructional group or subassembly that horizontal forces, resulting from engagement of such angularly extending end faces, at least approximately cancel one another.

As illustrated in FIG. **3**, the supporting member **13** may be provided with partition walls between the respective spring members **12**, which provide a double function, serving as stops for limiting relative movement between the separable portions of the connector structure upon the application of forces thereto by the mounting screw **10**, as well as providing insulation between the respective spring members, to prevent short circuits therebetween, for example, as a result of the inadvertent presence of conductive foreign bodies therebetween. While the supporting member **13** can be dimensioned to correspond to those of the wiring or circuit plate **11**, advantageously it may be subdivided into several units in order to facilitate the introduction of the free ends of the spring members **12** into the respective hollow contact elements **11***a* of the circuit plate **11** during fabrication of the structure.

It will be noted that with this construction a practically direct conductive connection between the contact pins **7** and the hollow contact elements **11***a* is achieved, resulting in a considerable shortening of the signal paths across the connector structure, for example, to a length of from 2 to 3 mm.

I claim:

1. In a plug-in type connector for the releasable connection of electrical lines, at predetermined raster points, between a multilayered assembly plate, including micromodules carried thereon at one side thereof, and conductor lines of a multilayered wiring plate, the combination of a plurality of contact pins disposed at respective raster points, means supporting said pins is fixed operative positions with such pins extending adjacent and perpendicularly to said assembly plate, means on said supporting means conductively connecting the respective pins to cooperable conductor lines on said as-

sembly plate, the respective pins having free end faces which extend angularly relative to their respective pin axes, forming respective wedge-shaped end portions, said wiring plate having openings therein at each corresponding cooperable raster point in which are disposed respective hollow contact elements of a size to receive the free ends of said pins, and a plurality of spring members having elongated free end portions extending from the rear side of the wiring plate into respective hollow contact elements, with the end faces of said free ends of the members extending angularly relative to their respective axes, forming respective wedge-shaped end portions arranged for engagement with the corresponding end portions of said contact pins upon insertion of the latter into said hollow contact elements, said spring members having a configuration and supported in such manner that they are operative to exert pressure in a direction perpendicular to the plane of said wiring plate, whereby the angular faces of the contact pins are operative to direct the corresponding ends of respective cooperable spring members into wedging engagement between such pins and the adjacent inner wall of the associated hollow contact member, to provide a conductive connection therebetween.

2. A connector according to claim 1, wherein the respective angularly extending end faces at the free ends of the contact pins are provided with a slightly convex surface.

3. A connector according to claim 1, wherein the respective angularly extending end faces at the free ends of the spring members are provided with a slightly convex surface.

4. A connector according to claim 1, wherein the contact pins are secured in a pin-supporting plate disposed adjacent the assembly plate and arranged to prevent the latter from bending or sagging.

5. A connector according to claim 1, wherein the spring members are of elongated configuration and are formed with a slight bend in their longitudinal direction to provide resilience in such direction, and a supporting device for said spring members in which the opposite ends thereof are secured.