April 18, 1967 L. W. PETERSON 3,315,212

CONNECTOR ASSEMBLY

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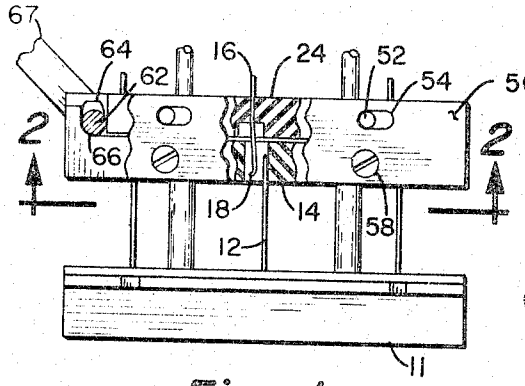


Fig. 1

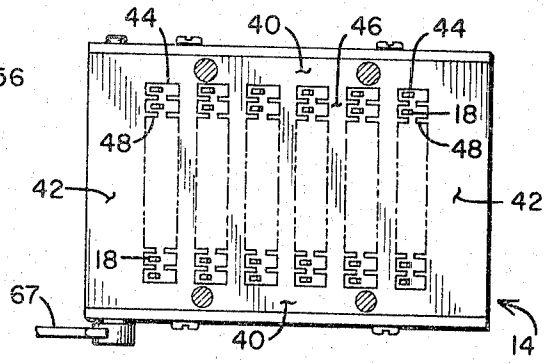


Fig. 2

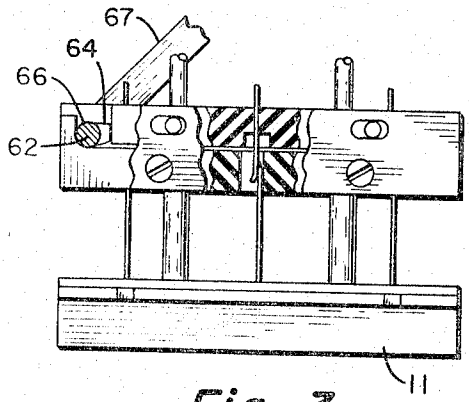


Fig. 3

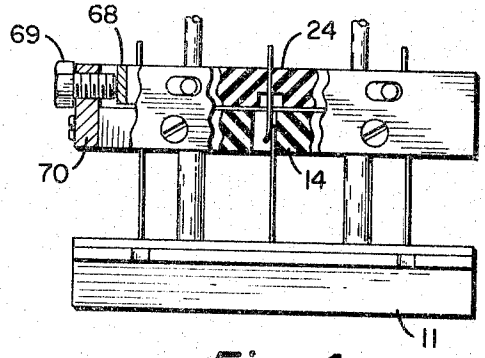


Fig. 4

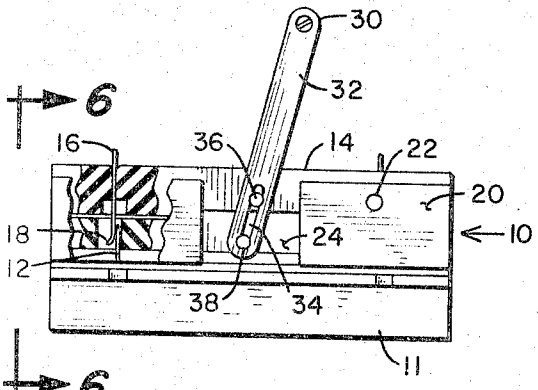


Fig. 5

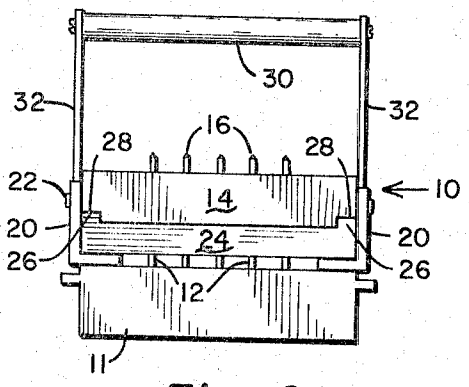


Fig. 6

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# CONNECTOR ASSEMBLY

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The present invention relates generally to a multipin split connector assembly for mechanically and electrically interconnecting large numbers of contact elements mounted in a minimal spatial area.

In the present stage of connector technology, various structural configurations have been utilized to provide proper mechanical and electrical interconnections for connector terminals. In accordance with the above mentioned inventive arrangements, utilizable in computers and similar equipment, any one of a wide variety of male connector blocks may be utilized all in connection with either the stationary connector blocks or the movable connector block, respectively, to produce a wide variety of electrical circuits, although it is to be understood that the present invention is not to be regarded as limited to use with computers or like equipment. The Bishop Patent, 2,802,189, discloses an electrical panel structure consisting of a cam actuated movable panel and a stationary panel mounting flexible contacts. Several disadvantages of the patented arrangement result, the first of which is the requirement for carefully inserting the detachable movable panel behind the guide means, manipulating the dog member out of position, and locating the shaft member over the notch. The arrangement also requires the use of a dual leaf spring assembly pivotable about an axis to move the slidable panel connectors in contact with the flexible contacts of the stationary panel.

More importantly still, the invention is characterized in one form by apparatus wherein a multipin male connector may be mated to or separated from a female connector group with a minimum (effectively zero pounds) of insertion or withdrawal force. More specifically, the invention pertains to the practical design for a multipin electrical connector assembly in which a movable connector block is used to exert spring contact pressure on or release pressure from the mating contacts of the male connector block. The entire connector assembly is characterized by a multilayered block arrangement which includes a first and fixed connector block having mounted therein an array of terminals or contacts, such contacts extending transversely beyond the block. The contacts, being spring-like, project and terminate within apertures of a second and movable connector block. The second connector block is operatively mounted below the first connector block and held in slidable contact therewith by suitable guide means and is actuated by a member operatively connected with the connector blocks. The assembly further includes a third and male connector block having extending contacts mechanically and electrically engageable with selected ones of the terminals or contacts of the first connector block when the third connector block is placed in an operative position parallel to and in proximity to the second or movable block with its contacts engageable with the fixed connector block's flexible contacts. The flexible terminals or contacts projecting from the fixed connector block, arranged in rows and columns, cooperate with ribbed channels in the movable connector block. The male connector block terminals, similarly arranged in rows and columns, mate with the flexible contacts within the cavity portion. In effect, the slidable connector block provides a mating area for the above contacts.

In a preferred embodiment of the invention, the connector assembly includes a cam actuated, movable connector block mounting flexible contacts. The multiblock layer is arranged such that the movable connector block is positioned in a superior position with respect to the fixed connector block positioned beneath. The latter is adapted to receive the flexible contacts. In the embodiment, the fixed connector block instead provides the mating area for the terminals of the movable and male connector blocks, respectively.

In a modification, the cam is replaced by a screw member cooperating with the movable block.

The primary object of this invention in a preferred embodiment is to provide a connector assembly wherein one of the connector blocks is movable relative to the other connector block so as to locate the contact ends within the fixed block laterally into engagement with the contacts of a male connector block.

Another primary object of this invention, with respect to another embodiment, is to provide a connector assembly wherein one of the connector blocks is movable relative to the other connector block so as to locate the contact ends within a movable block laterally into engagement with the contacts of a male connector block.

Another important object of the invention is to provide actuating means for causing interconnection between male connector block contacts and mating contacts.

Yet another object of the invention is to provide a compact connector assembly to permit the mating of large numbers of contacts in a minimal area and requiring little or no insertion or withdrawal force.

A further object of this invention is to provide a connector assembly enabling high contact pressure between mating contact elements when in a closed position.

A still further object of this invention is to provide a connector assembly wherein the mating action of respective contact points provide excellent wiping action for maintaining the contacts in a gas tight condition.

Another object of this invention is to provide a reliable, compact and low cost connector assembly of simplified construction.

An additional object of this invention is to provide guide means for guiding a movable connector block with respect to a fixed block in a plane parallel to the fixed block.

A still further object of this invention is to provide mechanical and electrical connection between flexible portions of female connector block contacts and male contacts mounted on a male connector block.

These and other more detailed and specific objects will be disclosed in the course of the following specification, reference being had to the accompanying drawings in which:

FIG. 1 is a side elevational view of a preferred embodiment of the invention showing the connector assembly in the open position with the fixed connector block providing the mating area for the contacts.

FIG. 2 is a bottom view taken on line 2—2 of the invention of FIG. 1.

FIG. 3 is a side elevational assembled view of the invention of FIG. 1 in a closed position.

FIG. 4 is a side elevational view of the invention described in FIGS. 1 and 2 showing a modification of the actuating means for the movable connector block.

FIG. 5 is a side elevational view of another embodiment of the invention described in FIGS. 1–4 with the movable connector block providing the mating area for the contacts.

FIG. 6 is an end view taken on line 6—6 of the invention described in FIG. 5.

With reference to another embodiment of the preferred form of the invention, illustrated in FIGS. 5 and 6, the major elements comprising the female connector assembly 10 are the male connector block 11 having mounted

therein a plurality of rows and columns of compactly spaced terminal contacts or elements **12**. The upper fixed block **14** has mounted transversely therein a plurality of rows and columns of compactly spaced terminals **16** having flexible ends **18**. Channel-like guide means **20** are secured to the block **14** by fastening with pins, screws, or other suitable means **22**. A movable connector block **24** with guide rails **26** is positioned between the guide means **20** and the connector block **14** to move in a direction parallel to block **14** in a notched guide means **28** of connector block **14**. An actuating member **30** has two extending arms **32**, one on each side of the blocks, with a slot **34** near the lower end thereof adapted to contain two pins, or similar means, **36** and **38** with pin **36** mounted in fixed connector block **14** and pin **38** mounted in movable block **24**. The movable block **24** is translated along its longitudinal axis by actuation of the arms **32** such that the arms substantially pivot around the upper pins **36** to translate the movable block from a closed to an open position or vice versa. It should be noted that the particular actuating means and connector block configuration described is only considered to be illustrative and not limitative. The movable connector block **24** aforementioned may be formed of plastic by conventional molding techniques commonly employed in the art. By way of reference to FIG. 2, there is illustrated the fixed connector block **14** of the preferred embodiment describing the cavity area wherein mating interconnection takes place. The embodiment illustrated in FIGS. 5 and 6 provides the cavity area in the movable block **24**. The cavity area remains the same in both embodiments. While in one arrangement the upper connector block is movable, in the other the intermediate connector block is movable, the intermediate block in both embodiments providing the cavity mating area. The cavity portion of the block includes a plurality of channels **44** separated by walls **46**. Each of the walls **46**, except the walls **40** and **42**, have integrally formed therewith a plurality of ribs **48** at spaced intervals along their length which restrain the flexible ends **18** of the terminals **16** from excessive transverse movement to assure proper connection with the terminals **12** of the male connector block **11**. The ribs also prevent arcing between contact or terminal elements. The flexible end **18** of the terminals **16** are curved to facilitate insertion of the terminals **12** from the male connector block **11**, to limit longitudinal movement of movable block **24** and aid in maintaining the contacts in a gas tight cleansed condition as more particularly described below. The male connector block terminals **12** are inserted within the movable connector block **24** of the female connector block assembly. Actuation of arms **32** translates the movable block **24** in a longitudinal direction parallel to fixed connector block **14** causing the flexible ends **18** to be forced against the terminals **12** under sufficient force to obtain a gas tight connection between the terminals **16** from the fixed block **14**, and terminals **12** from block **11**. It is observed from the FIGS. 5 and 6 that mating of the terminals occurs within the movable connector block **24**. Due to the wiping action of the contacts during the interval that the movable connector block is translated and the high mating force exerted between the contacts when interconnected, formations of foreign deposits upon the contact portion of the terminals are removed thus assuring proper electrical interconnection between the contact elements. The wiping action is achieved by designing the flexible ends **18** of the terminals **16** to be slightly curved. Upon moving to a closed position, an arcuate movement occurs between terminal ends **12** and **18**. Due to the high mating forces the contacts are maintained in a gas tight condition when interconnected.

Now, with reference to the preferred form of the invention best illustrated in FIGS. 1 and 3, the terminals **16** are securely mounted in the upper and movable connector block **24**. In this embodiment, the fixed block **14** is adapted to receive the flexible ends **18** of the terminals **16** of connector block **24**. Block **24** has formed integrally therewith guide stubs **52** which ride in slots **54** of guide elements **56** securely mounted by screws **58**, or in any other suitable manner, to stationary connector block **14** on both longitudinal sides thereof. Apparatus which is not part of the instant invention includes vertical guide columns utilized to separate the male connector block from the female assembly as well as to mount thereon at the opposite end a modular element.

Movement of movable block **24** in a longitudinal direction is defined by the slots **54**. The guide elements **56** serve the same general purpose as the guide rails **26** and corresponding slots **28** of the embodiment illustrated in FIGS. 5 and 6. The guide elements **56**, contain at one end thereof a circular recess (not shown) cooperating with a bearing portion or cut down portion of a cam shaft **62** extending transversely across the top surface of stationary block **14**. Shaft **62** has an overcenter cam portion **64** integral with the shaft. The recesses act as bearing surfaces for the ends of the shaft **62**. The cam shaft may be formed by an extruding technique for example or by some other suitable method. The ends of the shaft **62** thus cooperate with the recesses in the side plates **56** (or guide elements) in a bearing manner. The circular portion **66** of the cam follower also rests in a bearing manner upon the surface of the connector block **14** to aid in holding the cam shaft in position. It is also evident from the figures that the connector block **24** is shorter in length than the fixed block **14** positioned beneath it. It is pointed out that the use of the particular type of overcenter cam and follower arrangement is only illustrative and not intended to be restricted to that shown and described since one skilled in the art could conceive a variety of arrangements for applying motion to the movable block. An actuating member **67** is mounted on one end of the cam shaft to provide the means by which force may be transmitted to the shaft **62**, cam portion **64**, and to the movable connector block **24**.

Now referring to FIG. 4, there is illustrated a modification of the means for applying motion to the movable connector block **24**. The connector assembly is of the type illustrated in FIGS. 1 and 3, however, with the movable block **24** having mounted at its end a metal plate **68** cooperating with a screw **69** mounted in another metal plate **70** secured in a suitable manner such as by screws to the fixed connector block **14**. By adjusting the screw, the movable block can be translated back and forth to close or open the female connector assembly with the corresponding terminals of the male conector block **10**.

*Operation*

In operation of the preferred embodiment illustrated in FIGS. 1–3, the movable connector block which is operatively associated with the assembly by the guide stubs riding within the guide slots of the side plates (guide elements) transverses the fixed connector block when the cam is actuated accordingly. The cam and cam actuating apparatus is used to impart a preferred direction of movement to the movable connector block. With the cam lever operated from the initial position, the cam action against the movable conector block end will impart motion to the movable block. Since the spring contacts are fixed in the movable block, movement of the movable block will, corresponding to the direction of movement, result in an increase or decrease of spring contact pressure. Once the cam passes through the center line of the cam follower, the cam will remain in the "latched" condition, applying a continuous force upon the movable connector block and attendant force upon the spring contacts to maintain the flexible ends of the contacts against the terminals of the male connector block, thus maintaining the whole assembly in a closed or latched position. Returning the cam lever to its initial position serves to relieve the cam force from the movable connector block. Concurrently, the

spring force (in opposition to the force applied by the cam) will be unopposed, causing the movable connector block to move in the opposite direction, releasing spring contact tension in the fixed connector block. Thus as is evident from the foregoing, a multipin male connector may be mated to or separated from a female connector when desired without frictional forces opposing such action.

The operation of the embodiment illustrated in FIGS. 5 and 6 is substantially the same as that of FIGS. 1–3. In the former embodiment, the movable connector block contains the mating area for the respective contacts. Actuation of the arms causes the movable connector block to close or open as mentioned above. The connector assembly may be latched in a closed condition by a suitable means (not shown). The resultant operation of the connector block assembly produces the same results of that described above such that the male connector block terminals may be inserted within and withdrawn from the female portion in the unlatched condition without frictional forces between the contact elements. As in the preferred embodiment, the contact elements undergo a wiping action as the movable block is translated to cause a latched position of the assembly. Such action aids in the removal of foreign deposits on the contact area of the elements. Also, the high interconnection forces between the contacts maintain a gas tight condition.

One of several possible alternative designs as illustrated in FIG. 4 shows a modification in which the cam and cam actuating apparatus is replaced by an adjusting screw impinging upon a metal plate mounted on the movable element. With the screw turned flush with its mounting element, the movable connector block will have traveled its maximum allowable distance, thereby exerting maximum spring tension on the mating contacts in the fixed connector block. Conversely, turning the screw away from the element provides a release for the spring tension, driving the movable block in the opposite direction which in turn removes all pressure on the mating contacts in a fixed connector block.

In accordance with a variety of possible modifications, the connector assembly can be used in a printed circuit card application. With reference to the connector block configuration illustrated in FIG. 2, removal of the ribs to provide an unobstructed channel would permit a direct insertion of a printed circuit card in place of the male connector block terminals.

It is understood that suitable modifications may be made in the structure as disclosed provided that such modifications come within the spirit and scope of the appended claims. Having now, therefore, fully illustrated and described my invention, what I claim to be new and desire to protect by Letters Patent is:

1. A connector assembly comprising in combination:

a first connector block having a plurality of flexible contact elements mounted therein, said contact elements having first and second end portions extending outwardly from said block, the portion extending from one side of said block being slighty curved, said block having a longitudinal notch guide means,

a second block means having a cavity containing a plurality of channels and ribs therein adapted to receive said end portions extending from said one side including guide rail elements cooperating with said



longitudinal notch guide means for providing a bearing surface for said elements and for restraining said end portions extending from said one side in transverse motion and for preventing arcing between mating contacts,

third block means having contacts extending into and freely engageable within said channels and ribs of said second block means, and

motion transmitting means operatively associated with said second means for moving said second means with respect to said first means whereby said flexible contact element ends are biased therein for effecting electrical engagement with said contacts of said third means while in a latched position.

2. A connector assembly comprising in combination:

a first means supporting a plurality of closely spaced flexible contacts having a portion extended therefrom,

a second means operatively associated with said first means having a plurality of channels formed therein for receiving the extended contact portion of said first means,

guide plate elements mounted on each side of said second means along the length thereof, said guide plate elements having longitudinally extending slots therein and a pair of apertures,

guide stubs on said first means cooperating with said slots to limit the longitudinal movement of said first means relative to said second means,

a third means mounting a plurality of electrical contacts which extend therefrom from at least one side thereof and adapted to extend into said channels of said second means,

motion transmitting means including a cam shaft mounted in said pair of apertures in said guide plates having a cam surface bearing upon said first means which when rotated moves said first means the limit of said slots to a closed position whereby said first and third means' contacts are engaged in electrical connection.


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