This invention relates to an improved connecting or switching device of the type used to interconnect a relatively large number of electrical circuit paths.

Advances in the art of solid state devices have permitted a considerable reduction in the size of electronic components with a comparable and highly desirable reduction in size of computers and office equipment. Such advances have, in the usual manner, sponsored development of compatible supporting equipment such as relays, connecting devices, switches and the like. In attempts to miniature connecting assemblies of the type shown in U.S. Patents No. 2,927,295 and No. 2,949,737 to Cunningham, however, problems have arisen due to the basic characteristics of the operating mechanism of such devices which demand a considerable opening space for withdrawal of contact carrying panels or plugboards.

In one known computer installation, for example, wherein the entire computer is installed in a cabinet about the size of a large office desk, interconnecting assemblies having operating mechanisms in accordance with the prior art occupy a disproportionate volume of the available space. In even more compact installations, interconnecting assemblies of the prior art necessitate an outside mounting which detracts from both the appearance and general utility of the equipment. Additionally, in installations requiring protection against adverse environment the usual practice has heretofore been to employ special temperature, dust, moisture or explosion proof covers. Unfortunately, the use of such covers complicates and delays access to the movable panel of the assembly. Finally, most of the prior interconnecting assemblies have closure means which limit the use of the assembly to either vertical or horizontal mounting.

Accordingly, it is one object of the present invention to provide an improved interconnecting assembly occupying less space than prior devices of the same capability.

It is another object of this invention to provide a novel interconnecting assembly accommodating efficient enclosure within the cabinets of equipment served by the assembly.

It is a further object of this invention to provide an improved interconnecting assembly incorporating a cover member operable to automatically position the panels of such assembly in either a closed position or in an open position for panel access.

It is a still further object of this invention to provide an improved interconnecting assembly having a novel closure mechanism.

Other objects and attainments of the present invention will become apparent to those skilled in the art upon a reading of the following detailed description when taken in conjunction with the drawings in which there is shown and described an illustrative embodiment of the invention; it is to be understood, however, that this embodiment is not intended to be exhaustive nor limiting of the invention but is given for purposes of illustration in order that others skilled in the art may fully understand the invention and the principles thereof and the manner of applying it in practical use so that they may modify it in various forms, each as may be best suited to the conditions of a particular use.

In the drawings:

FIGURE 1 is a perspective view of the assembly of the invention sectionalized to show the operating mechanism of the device;

FIGURES 2, 3 and 4 are elevations of the device shown in FIGURE 1 taken from the left side thereof in the operative positions, respectively, of closed, half open and open;

FIGURES 2A and 4A are sectional elevations of the panel actuating members of the device in the positions shown in FIGURES 2 and 4, respectively;

FIGURES 5-8 are schematic diagrams of the relative positions of the panels and contacts of the assembly in the various operative positions; and

FIGURE 9 is a schematic diagram of the panel movement of a typical prior art device.

Referring now to FIGURE 1 there is shown a connecting assembly 20 incorporating the improvements of the invention. The panel or plugboard construction may be of a configuration and composition as is described in U.S. Patent No. 2,927,295, above mentioned. The particular wiping movement between the contacts of the fixed and movable panels of the device may also be as described in Patent No. 2,927,295 in the final motion of closure. The contact assemblies may be as described in U.S. Patent No. 2,882,508 to us.

In general, the unit 20 includes a fixed panel 46 carrying an array of contact members and a movable panel 42 carrying an identical array of contact members; side rails 22 and 24 secured to the fixed panel member 46; and a cover 50 operably connected to a panel operating mechanism 56 secured to each side rail 22 and 24. Briefly summarized, the device 20 is operated by moving the cover 50 from the position shown in FIGURE 2 to the position shown in FIGURE 4, thereby driving the movable panel 42 from the position shown in FIGURE 5 to the position shown in FIGURE 7 through the operation of the mechanism 56.

This movement acts to drop the panel 42 with respect to panel 46 by rotation of cams 94 and 96 located at the bottom portion of the panel and, thereafter, drive panel 42 by members such as 32 to a position wherein the contacts of each panel no longer overlap. Following full movement, the panel 42 may be withdrawn vertically from the side rails 22 and 24 without danger of contact damage caused by reason of the contacts of the movable panel striking the contacts of the fixed panel. The improved space requirement of the present invention, with respect to the prior art, may be made by comparing the dimension O1, FIGURE 7, with the dimension O1, FIGURE 9.

The assembly 20 may be mounted within a computer cabinet with the cover 50 flush with the cabinet outer surface, or alternatively, overlying a portion of the cabinet. The only interior space requirement of the assembly 20 is the dimension O2, times the height and width of the panel members including clearance for the linkage mechanism 56. It is contemplated that the cover 50 may be substantially reduced in width with an incident but not prohibitive reduction of the effective force attributed to the cover side member 52 through its lever action. It is further contemplated that the cover member 50 may be provided with a peripheral gasket cooperating with a similar gasket mounted on the opening of the assembly housing the unit to effect a dust-tight and/or explosion proof sealing of the assembly.

Referring now to the assembly of the invention in more detail, the fixed panel includes transverse channel members (not shown) secured thereto which interconnect with end channels 22 and 24 to form a mechanically rigid unitary assembly. Centrally disposed interiorly of each channel 22 and 24 is a slot 25 extending well into the channel thickness and substantially along the length thereof to define a bearing surface confining ver-
tical movement of the movable panel 42 and its contacts to a path free of the contacts of panel 46. Adja-
cent to each end of each channel 22 and 24 further include transverse slots such as 32 and 32A extending to the rear of each channel and intersecting the vertical slots 25. Each of the trans-
verse slots carry and define the motion of a movable panel actuating member such as 34 in the manner shown in FIGURES 2A and 4A. The actuating members, such as 34, include a vertical slot 39, capable of carrying and retaining a projection of the movable panel shown in section as a unitary camlinkage by pin 35, ex-
tending through the end channel via slot 37 into a slot such as 72 in member 60. As is shown in FIGURES 2A and 4A, the movement of member 34 and hence the movement of panel 42 is limited in its transverse sense by the length of the slot 37. The spring member 42, seated in the inner portion of the channel 32, acts in compression to assist the movement of the movable panel to the fully opened position shown in FIGURE 4. The concerted action of four such spring members acting on the corners of the panel 42, assures that the panel members are driven into the withdrawal position regardless of slight variations in either operating pro-
cedure, adjustments in the linkage assembly 56, or by reason of wear at the points defining the limits of move-
ment of the actuating member 34. The length of the channel 39 in member 34 permits vertical movement of the movable panel from the position shown in FIGURE 5 to the position shown in FIGURE 6.

The panel operating linkage mechanism 56 includes two vertical arms 60 and 80, each mounted for independent movement by means of a pivotal connection with the arm 52 of cover member 58. The member 60 is sup-
ported by pins 64 and 64A, as shown in FIGURE 1, se-
cured through slots 62 and 62A to the end channel 24; the length of slots 62 and 62A defining the limits of vir-
tical movement of the member 60. Driving force to the member 60 is supplied by the connection with arm 52 through a pin member 70 and its bearing relationship with the slot 66 in member 60. As will be hereinafter explained with reference to FIGURES 2-4, the slot 66 is curved along a radius about the pin member 54 of arm 52 so that the force applied to lift member 60 occurs only when the pin member 70 reaches the por-
tion 68 of the slot 66. The linkage 80, secured to arm 52 by pin 82, is operatively connected to a bell crank mechanism including member 90, locked by a pin mem-
ber 82 to the cam 94. The linkage 80 may comprise a set of metal links 84 and 84A or an equivalent set of metal members 84 and 84A permitting the length of the unit 80 to be controlled to regulate the movement of the camming member 94 and panel 42 in the vertical direc-
tion.

In the device of FIGURE 1, the assembly 56 is du-
plicated on each side of the unit 20, the cams 94 and 96 mounted on channel 98 operating independently under control of each assembly 56. In certain instances where-
in the panel assembly is relatively narrow, it is com-
templated that the camming mechanism may be con-
tinuous across the assembly from rail to rail replacing channel 98. This construction reduces the pressure per square inch applied to the bottom of the movable panel by distributing the driving force over a broader surface area. In certain other instances where the panel carries a reduced number of spring contacts, this latter construction of the camming member permits the use of only one driving linkage which may be disposed on either side of the panel assembly 20.

Referring now to FIGURES 2-4 the operation of the assembly 20 will be described. FIGURE 2 shows the assembly 20 in the closed position with the panels 46 and 42 and their contacts positioned as shown in FIG-
URE 5. An initial opening of the assembly by lifting the cover 50 in the direction indicated by the con-
current dotted line 52 permits the illustrated as turning the pin 35, locks the member 34 from moving. The curve and length of slot 66 in member 60 permits the pin 70 to slide, without moving the mem-
ber, through an arc sufficient to allow rotation of the member 42 outwardly into the fully engaged position shown in FIGURE 7. In the fully opened position shown in FIGURE 4, the pin 70 has reached the limit of its transverse movement in slot 66, the pin 35 has reached the limit of its movement in slot 73 and the contacts of the panel 42 are displaced from the con-
tacts of the panel 46 by an amount sufficient to avoid contact damage upon the withdrawal of the panel member 42 as shown in FIGURE 8. The panel 42 may then be withdrawn from the assembly 20 by means of handle 48. In the foregoing manner, the assembly of the invention operates to exactly displace the movable panel from the fixed panel in transverse and vertical motions resulting in a substantial savings in space over prior art devices. The linkage mechanism of the assembly assures a posi-
tive control of the movable panel at all times thereby making the device relatively insensitive to mounting attitude and assuring that removal of the movable panel will not result in contact damage. Finally, the provi-
sion of the cover member associated with the panel driv-
ing linkage permits a simplified and economical use of the assembly in diverse applications not possible with prior art devices.

Changes in construction will occur to those skilled in the art and various apparently different modifications and embodiments may be made without departing from the scope of the invention. The matter set forth in the foregoing description and accompanying drawings is of-
fered by way of illustration only.

I claim:

1. In a connecting assembly of the type including a first panel having an array of contacts secured thereto and a second panel having an array of contacts secured thereto, each panel being mounted in an assembly capable of driving the panels in relative movement resulting in an exact engagement and disengagement of the contact member thereof; the improvement comprising rail members secured to the first panel having interiorly disposed slots defining vertical and horizontal move-
ments of the second panel with respect to the first panel, actuating means disposed in certain of the slots includ-
ing a groove housing projections of the second panel and capable of restraining the second panel from horizon-
tal movement wherein the actuating member, a panel driving assembly mounted exteriorly of at least one of the rail members including an actuating member at one end thereof having a first linkage capable of driving cam means located interiorly of the rail mem-
bers at the opposite end thereof to effect vertical move-
ment of the second panel, and further including a sec-
2. The combination of claim 1, including a cover member mounted to the rail members having an operating arm secured to the actuating member and linkage members; movement of the cover member acting to independently operate the linkages to drive the second panel in the vertical and horizontal directions.

3. The combination of claim 2, wherein the second linkage includes a slotted bearing portion conforming with a radius about a cover member mounting pin of a length such that movement of the second linkage upon rotation of the cover member occurs either before or after the first linkage has completed its travel in driving said second panel in the vertical direction.

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