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[54] **ELECTRONIC CONNECTOR DEVICES**
6 Claims, 11 Drawing Figs.

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317/101 CW, 339/278 M
 [51] Int. Cl. **H01r 13/62**
 [50] Field of Search **339/151,**
278; 29/573, 203 P, 624, 626, 627; 317/101

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ABSTRACT: An electric connector system for equipment involving many connecting wires uses a transfer connector on the equipment to be installed in an equipment rack. The transfer connector supports a number of contact pins by means of removable comblike plates with slots at right angles to one another to support an array of pins. These can be entered into a similar array of sockets in a connector block fixed to the rack and to which the permanent wiring is attached. The pins of the connector are pushed into the sockets in one operation and then the comb plates are detached and are available for reuse.

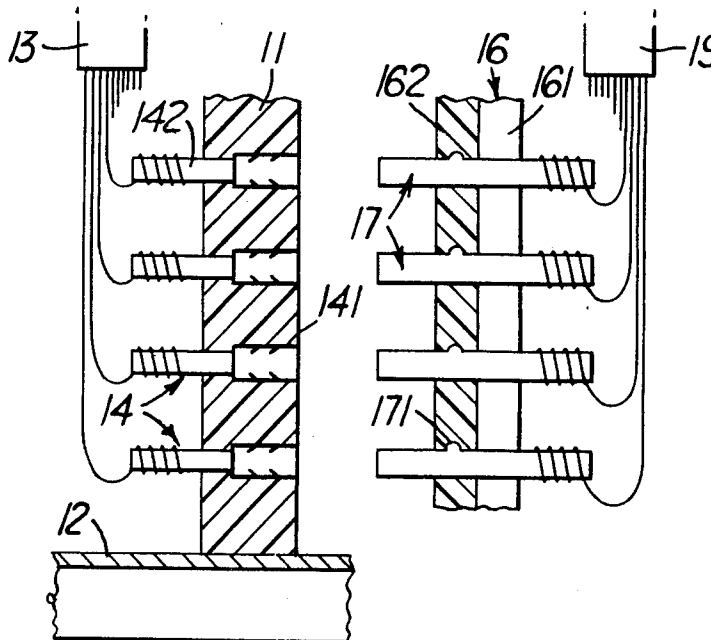


Fig. 1.

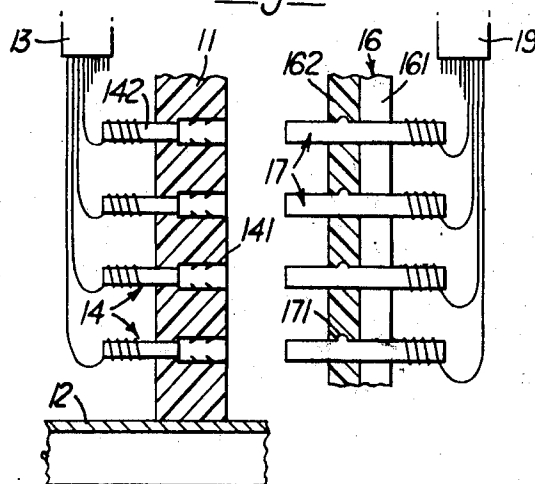
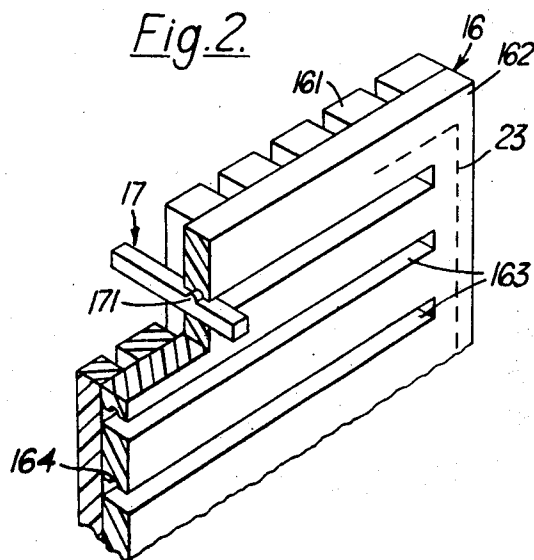


Fig. 2.



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Fig. 3.

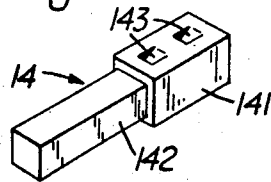


Fig. 4.

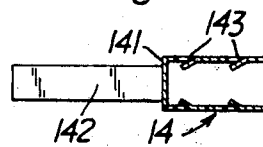


Fig. 7.

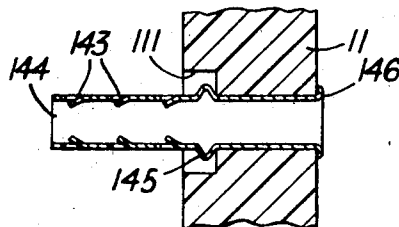


Fig. 8.

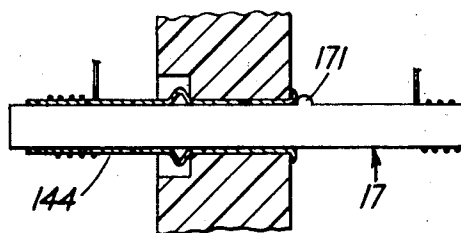
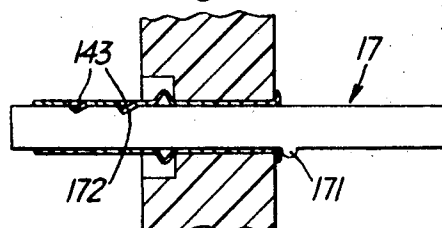
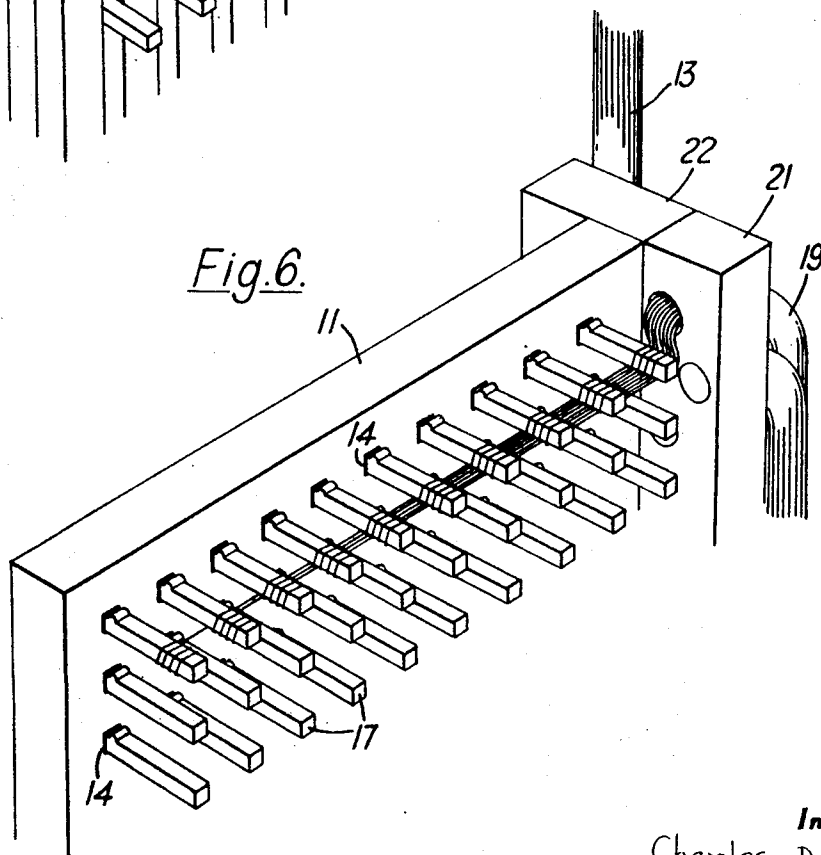
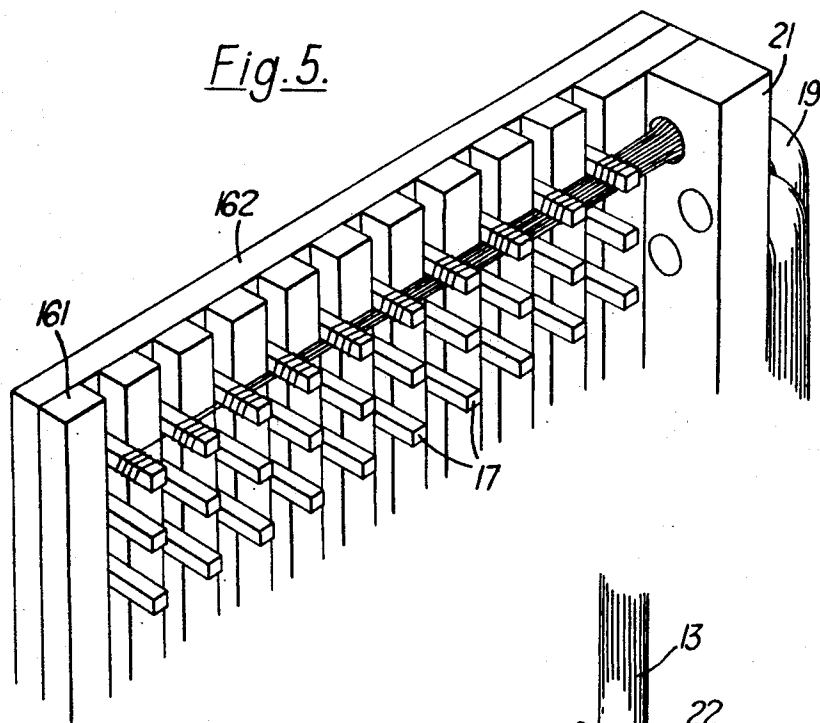


Fig. 9.



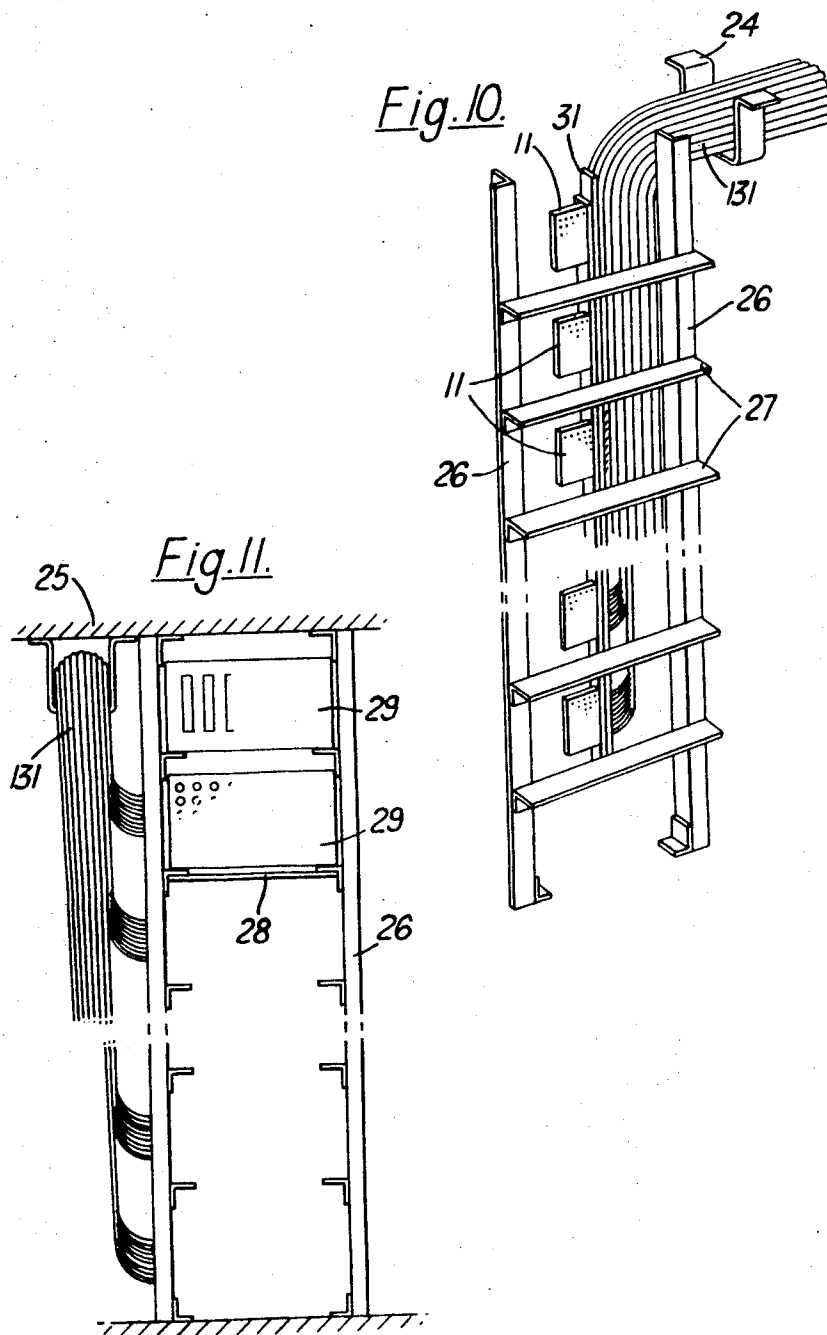
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ELECTRONIC CONNECTOR DEVICES

The present invention relates to electric connector devices for electrical equipment for the purpose of connecting an item of electrical equipment to an installation incorporating such equipment.

In the comparatively complex types of electrical and electronic equipment where a very large number of connections have to be made, for example in telephone exchange systems, it is usual for the equipment, often supplied by an outside contractor, to be provided with a connector block embodying an array of connector pins to which wires forming part of the permanent installation are attached by soldering or by winding the bared ends of the wires around the connector pins.

This arrangement is not altogether convenient in practice since the installation of the wiring cannot be completed until the equipment is available so that the various connections can be made.

The present invention is directed to an electrical connector system for connecting electrical equipment to an installation embodying a large number of connecting wires, in which the limitations of the previously used arrangements are reduced and a facility is provided for making the required large number of connections. More specifically the invention is directed to avoiding the need for directly connecting large numbers of wires individually to the equipment being installed.

The present invention embraces the provision of improved means forming part of the permanent installation and a temporary connector system associated with the equipment and adapted to be brought into mating engagement with the connector system of the installation.

The present invention is based on the provision of a transfer connector associated with a piece of equipment and bearing the connections to be made to that equipment and which is adapted to be brought into mating engagement with a connector assembly forming part of the permanent installation to provide simultaneously the required number of connections between the permanent installation and the equipment, after which the transfer connector is removed and is available for further use.

The invention thus provides a large number of mating elements, which may be pins and sockets, an array consisting of one type of element forming part of the permanent installation being engageable with a like array of the other type of element forming part of the equipment to be connected to the permanent installation.

More specifically a connecting system incorporating the features of the present invention includes a connector or terminal block forming part of the permanent installation and to which the wires of the permanent installation are attached by engagement with projecting elements arranged in a suitable closely spaced array to enable the required number of connecting elements to be disposed in a relatively small compass and in which the other ends of said elements are adapted for mating engagement with elements associated with the transfer connector and with connections to the equipment itself. That mating element which is in the form of a socket may consist of a tubular element of square or rectangular section projecting outwardly of the connector block or of the transfer connector and the wires to be connected thereto may be wound around the projecting part of said tubular element which is partly housed in the connector block or in the transfer connector as the case may be. Alternatively the socket element may comprise a socket portion embedded in the connector block and an outwardly projecting pinlike portion around which the connector wire is wound to form a permanent joint.

The transfer connector embodies support means adapted to support a number of connector pins in an array having an arrangement of the pins identical with the arrangement of the sockets in the connector block, said pins extending on both sides of the support and being arranged on one side to receive the wires leading to the equipment and on the other side being adapted to enter and mate with the sockets in the connector

block. Obviously the location of the pins and sockets can be reversed, that is to say, the connector block forming part of the permanent equipment may have projecting pins adapted to mate with sockets associated with the transfer connector.

The transfer connector itself may comprise two superimposed supports provided with a row of parallel slots extending inwardly from one edge to provide a comblike support and the slots in the two members may extend at right angles so that when they are superimposed the contact pin elements (or the sockets), in the alternative arrangement are supported in a fixed array which is coincident with the array of the sockets (of pins) provided on the connector block.

With an arrangement of this kind all the wires of the permanent installation may be fitted to the projecting pins on the connector block in the usual way, for example by winding the wire around the pins or by soldering or crimping, and these operations can proceed independently of the availability of the equipment to be connected to the wiring harness.

The equipment is supplied with a transfer connector already fitted and connected or wired to the equipment, connections being made to the pins on one side of the support combs while the pins on the other side are placed ready for immediate mating with the sockets of the connector block. Thus on arrival of the equipment the connector pins of the transfer connector may be offered to the sockets in the connector block and then mated by suitable pressure exerting means. Thereafter the two comblike members forming the transfer connector may be removed leaving the equipment reliably connected to the installation, the parts of the transfer connector apart from the pins being then available for further reuse.

The features of the present invention are illustrated by way of example on the accompanying drawings in which:

FIG. 1 is an explanatory view in section showing a transfer connector and a connector block and illustrating the features of the present invention,

FIG. 2 is a detail view in perspective showing the main features of the transfer connector,

FIGS. 3 and 4 are detail views showing the socket elements mounted in the connector block,

FIG. 5 is a perspective view showing the transfer connector and a fanning strip for the wiring leading to the equipment to be installed,

FIG. 6 is a view showing the connector block of the permanent installation with its associated fanning strip assembly with the fanning strip associated with the equipment, the main parts of the transfer connector having been removed leaving the equipment connected to the installation,

FIG. 7 is a detail showing an alternative type of connector block,

FIG. 8 is a view corresponding to FIG. 7 after the respective connector pin has been inserted into the socket,

FIG. 9 is a detail view showing a construction of pins and sockets in which a positive lock effect is obtained between the pin and socket,

FIG. 10 is a view illustrating diagrammatically the racking and coupling of the permanent installation with the associated connector blocks, and

FIG. 11 illustrates the racking with installed equipment.

In the example shown in FIG. 1 of the drawings the invention includes a connector block 11 mounted on a rack or carrier 12 of any suitable type forming part of the permanent installation and wiring loom or harness typically indicated at 13, a number of the wires being shown connected to socket elements of the connector block 11. These parts pertain to the permanent installation, and it will be understood that although only a limited number of sockets are shown in the connector block 11 the latter will in fact comprise an array having in many cases a very large number of connections to the wiring loom or harness indicated at 13. It will be appreciated that the numerous connections may be made to the connector block 11 independently of the arrival of, for example, telephone exchange equipment intended to be mounted on the rack indicated typically at 12 and to be connected to the wiring in-

stallation represented by the harness 13. These operations can be performed prior to the arrival of the equipment which can then be quickly connected in position in the manner hereinafter described.

In the arrangement shown on FIG. 1 of the drawings the connector block 11 is provided with a large number of connector elements 14 embedded in an insulating carrier suitably fixed to or mounted on the rack 12. Each element 14 embodies a socket portion 141 embedded in the insulating material and a pin portion 142 extending rearwardly thereof for connection to the wires from the harness 13. Preferably the pin portion 142 is of oblong rectangular section and the sockets 141 also embody an oblong rectangular bore. An oblong arrangement of the pinportion 143 is preferred as it permits satisfactory connections to be made by winding the bared end of the wires around the pins without any substantial danger of inadvertent slackening with long continued use. If desired however the joints may be made by soldering operations.

The invention is based on the use of a transfer connector indicated generally at 16 which provides a support for a number of double ended connector pins 17 preferably also of oblong rectangular section and detachably connected to the transfer connector 16 in the manner to be described.

The transfer connector 16 embodies two plates 161, 162 of insulating material having a series of slots 163 extending inwardly from one edge in transverse directions in the two respective plates 161, 162 so that the pins 17 can be accommodated in an array determined by the intersection of the slots 163 in the two plates and these slots are so chosen that the arrangement of the pins 17 in the transfer connector 16 corresponds to the array arrangement of the sockets 141 in the connector block 11.

The slots 163 pertaining to the plate 162 are provided with an intermediate groove 164 and the connector pins 17 are provided with corresponding ribs 171. This ensures that each of the pins 17 is fixed in position in the transfer connector 18 so long as the two plates 161, 162 are held together in superimposed position, for example by means of connector screws or other suitable means, not shown.

In the production of the exchange equipment or other apparatus to be connected to the connector block 11 and thereby to the wiring harness 13 of the permanent installation, the wires pertaining to said equipment, indicated by the cable harness 19 to the left-hand ends of the pins 17, are connected to the pins 17, for example by winding the bared ends of the wires around the pins or by soldering at the time of production of the equipment, the pins being supported by the transfer connector 16 and the plates 161, 162 thereof being fixed together in any convenient manner. On delivery of the equipment the transfer connector can be immediately engaged with the connector block 11 for which purpose the right-hand ends of the pins 17 may be offered to the sockets 141 in the connector block and, with the pins all correctly aligned, the pins 17 may be forced into position, if necessary by means of a suitable pressure-exerting member, after which the plates 161, 162 of the transfer connector may be disconnected from one another and removed from the pins by moving them respectively at right angles, and they are then available for further use. The right-hand ends of the pins 17 remain engaged in the sockets 141 to provide a positive and reliable connection from the installation wiring to the equipment.

It will be appreciated that the invention is based on the provision of mating pins and sockets, and it has been assumed in the arrangement described in detail above that the connector block 11 has connector elements 14 moulded therein or arranged to have a press fit therein, the connector elements incorporating socket portion 141 which receive the pins 17 associated with the connected equipment. Obviously the locations of the pins and sockets may be reversed, that is to say, the connector block 11 may be provided with moulded-in connector pins extending on both sides thereof and the transfer connector 16 may be provided with connecting elements hav-

ing socket portions at one end for engagement with the projecting pins on the connector block 11 and pinlike portions at the other end for engagement with the wires coming from the cable harness 19.

5 Either of the mating elements may be provided with means to ensure the maintenance of good electrical connections between the connected wires leading to the cable harnesses 13 and 19. FIGS. 3 and 4 illustrate a preferred form of socket which may be embedded in the connector block 11 in the construction shown in FIG. 1. The socket portion 141 is preferably of rectangular section and is associated with an integral pin portion 142 which projects externally of the block 11, as already explained, whereas the socket portion 141 is embedded in the insulating material. The socket is provided with springy engagement means which ensure a good electrical connection to the mating pins 17. The sidewall of the socket portion 141 may be relatively thin and depressions or dimples may be formed in one or more of the side surfaces to provide the desired resilient engagement with a mating pin 17. As specifically shown in FIGS. 3 and 4 projecting tongues 143 are pierced in at least one sidewall of the socket to provide springy tongue-like portions engageable with the connector pin 17, but it will be understood that any other suitable arrangement providing good electrical connections may be adopted.

25 The elements 14 and the pin elements 17 are preferably formed of brass or phosphor bronze, and may be coated with a thin layer of a precious metal such as gold, silver, cadmium or iridium to minimize oxidation and ensure low electrical resistance at the connections.

Obviously in some cases the connector block 11 may embody such a large number of connector elements 14 that it would be impracticable to force in simultaneously all the mating pins 17 to be engaged therein and in such cases several transfer connectors 16 may be used side-by-side the several connectors being dealt with successively so that at each insertion operation a group consisting of a fraction of the total number of connections to be made is inserted into position, the operations being repeated for the different connectors until all the required connections are made.

The arrangement of the transfer connectors on the equipment to be installed and the connector block associated with the fixed installation are illustrated more fully in FIGS. 5 and 6 in the form in which they would be utilized in practice. In FIG. 5 the wiring harness 19 running to the equipment to be installed is shown, and it will be seen that the wires are led through apertures in a fanning strip 21 each opposite a row of connector pins 17 supported by the comb plates 161, 162. The comb plates 161, 162 are conveniently attached to the fanning strip 21 at the factory where the equipment is produced, and this equipment is delivered with the transfer connector comb plates 161, 162 in position. A similar arrangement is provided for the installation connector block 11 shown in FIG. 6 which illustrates the respective fanning strip 22 through which the wires running from the harness 13 are led for connection to the terminal sockets of the connector block. During transit the comb plates 162 are held together conveniently by securing means extending round the edges, as indicated in dotted lines at 23.

When the equipment is placed in position the pins 17 of the transfer connector are mated with and caused to enter the sockets 14 of the connector block after which the comb plates 161, 162 are removed and all the pins 17 forced home into the respective sockets 14 by a suitable pressure-exerting device. The fanning strips 21, 22 now lie adjacent to one another as shown in FIG. 6 and can be connected by suitable screw means or in any other convenient manner.

FIG. 7 shows an alternative arrangement for the connector block 11, in which instead of using connector sockets 14 having a socket part 141 and a projecting pin part 142 tubular sockets 144 are used which are extended beyond the body of the connector block 11. Each tubular socket 144 is provided at an intermediate point with an outwardly projecting rib or flange 145 which may be accommodated in a recess 111 in the

body of the connector block 11. On the opposite face of the block 11 the end of the socket 144 may be flanged outwardly as indicated at 146 thereby securing the connector socket 144 to the block 11. The part of the socket projecting on the other side of the block 11 is provided with tongues 143 as already described with reference to FIGS. 3 and 4.

It will be understood that the connecting wires for the permanent installation are wound around the outer surface of the socket 144 instead of being wound around the pin part 142 as in FIG. 1, but otherwise the construction remains the same, the socket being of course of square or rectangular section internally and externally. FIG. 8 shows the sockets 144 after the pins 17 have been inserted in position. If desired the projecting end of the socket 144 may be permanently joined to the end of the pin 17 within it, and if desired projecting slightly from it, by soldering, welding or crimping.

FIG. 9 shows an arrangement applicable to all the foregoing constructions in which the tongues 143 are adapted to lock into depressions 172 formed in the pin 17 so as to prevent inadvertent disengagement of the pins and the sockets. In this case the ribs 171 lie on the opposite side of the pins 17 to the depressions 172 so that disengagement of the pins and the sockets can be effected if required by inserting a thin strip of material between the face of the pin bearing the depression 172 and the wall of the socket comprising the tongue 143. This releases the tongues from the depressions and permits the pin to be withdrawn.

The arrangement of a complete installation is shown by way of example on FIGS. 10 and 11 which illustrates the installation troughing 24 for the cabling indicated generally at 131. The troughing may conveniently be supported from above, for example from a ceiling structure 25. Typical racking supports are indicated at 26 provided with supports 27 for shelves 28 adapted to receive the various equipment items indicated at 29.

As shown in FIG. 10 the cabling 131 runs to a vertically disposed series of terminal blocks 11 one being adjacent each shelf 28 and supported for example by a vertical support member 31. The various cables are wired to the connector blocks 11, as already indicated, so that the permanent installation can if necessary be completely wired before the equipment items are received. When the equipment is fitted the transfer connector assembly for each unit is engaged with the respective connector block 11 so that the connector pins 17 engage and are pressed into the sockets 14 before the parts of the transfer connector are removed leaving the equipment connected to the installation as illustrated in FIG. 6.

I claim:

1. Electrical connector plug means for electrical equipment having a first set of plug connector elements and a second set of plug connector elements positioned in a connector block in an array arranged to mate with corresponding plug elements of the first set upon application of frictional pressure between the first and second said plug elements, comprising transfer connector means including locking structure for temporarily supporting a plurality of said first connector elements in immovable position a two dimensional array comprising multiple rows with a plurality of connector elements positioned to engage in simultaneous frictional engagement in mating electrical connection with said second set of connector elements in said connector block while supported by said transfer connector means to withstand movement caused by the frictional engagement, said transfer connector means being disengageable from said first set of connector elements after the latter have been engaged in electrical contact with said connector elements of said second set in said connector block.

2. Electric connector plug means according to claim 1, comprising superimposed transfer connector members adapted to support a plurality of first connector elements in a regular array adapted for immediate mating with the array of matching connector elements of said connector block and being thereafter removable to leave the first connector elements in operative engagement with the matching connector

elements to provide the connections between an installation and an item of equipment.

3. Electric connector plug means according to claim 2, wherein the first connector elements are supported in regularly spaced order in the form of an array by slots provided in said two superimposed members comprising plates, the slots extending transversely in the two plates and the connector elements being engaged by the two plates at the intersection points of the said slots and in which at least one of the plates is provided with keyway means for receiving and engaging mating structure on the first connector elements to prevent movement of the first elements relatively to the plates in a direction caused by frictional engagement of the plug members when the plates are in the superimposed position.

4. Electric connector devices according to claim 3, wherein the first connector elements consist of connector plug pins extending away from the plates supporting them in both directions, the pins being arranged at one end to be received by the second plug connector elements which comprise sockets adapted to frictionally receive and hold said plug pins in an array arranged in a connector block and means on said plug pin at the other end adapted for attachment to equipment wiring.

5. An electric connector system for electric equipment forming part of an installation, comprising a connector block fixedly associated with the installation and comprising a closely spaced array of first connector elements having pins projecting from the connector block for attachment to the installation wiring, and a transfer connector temporarily associated with equipment to be installed in said installation, said transfer connector embodying removable support means and a plurality of second connector elements supported thereby in an array corresponding to the array of said first contact elements of the connector block and having pinlike portions to which the equipment wiring is connected, the arrangement being such that in fitting the equipment to the installation the two sets of contact elements are brought by said removable support means into electric coupling engagement after which the removable parts are removed leaving the two sets of connector elements in electrical engagement one with the other, with the installation wiring coupled to the elements of the connector block and the equipment wiring connected to the connector elements engaged by the elements of the connector block, said transfer connector comprising two plates of insulating material each plate being of comblike form with through slots extending inwardly from one edge for the major portion of the width of the plate, the slots extending in transverse directions in the two plates when assembled, the slots pertaining to one plate being provided with grooves in one surface of the slot, said grooves being engageable by intermediately positioned lugs on a sidewall of each contact pin supported by said plates at the intersection points of the slots in the two plates, thus supporting the pins in a regular array while preventing axial displacement of the pins relatively to the plates, said plates being temporarily connected while in use as a transfer connector and being disengageable after the contact pins have been engaged in socket elements of a connector block.

6. Electrical connector devices for electrical equipment having a first set of connector elements and a second set of connector elements positioned in a connector block in an array arranged to mate with corresponding elements of the first set, comprising transfer connector means for temporarily supporting a plurality of said first connector elements in a two dimensional array comprising multiple rows with connector elements positioned to engage in mating electrical connection with said second set of connector elements in said connector block, said transfer connector means being disengageable from said first set of connector elements after the latter have been engaged in electrical contact with said connector elements of said second set in said connector block, having element holding means for supporting the connector elements of said first set against movement relative to the transfer connector means when the connector elements of the two sets are

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brought into said mating electrical contact, wherein the transfer connection means comprises two slotted plates superimposed with slots in the different plates normally oriented and wherein the connectors in said first set have a keying

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structure thereon, and one of said slotted plates has key structure therein for receiving the keying structure on said connectors of the first set to comprise said element holding means.

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