

[54] **GANG CONNECTOR AND PATCHING CABLE ASSEMBLY AND METHOD OF USING SAME**

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[22] Filed: **Feb. 26, 1971**

[21] Appl. No.: **175,281**

[52] U.S. Cl. **339/29, 179/99, 339/150 B, 339/255 R**

[51] Int. Cl. **H01r 13/54**

[58] Field of Search **179/175, 98; 324/51, 324/73; 339/29, 28, 18, 252, 278, 255, 91, 150, 108, 151, 45, 198, 75**

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[57] **ABSTRACT**

A gang connector and patching cable assembly and method for maintaining uninterrupted communication service between components of a central telephone office facility while certain permanent components therein are being serviced or replaced. The patching cable serves to bridge components and conductors undergoing repair, consolidation or replacement and includes flexible patching cabling equipped with detachably coupled gang connectors having provision for simultaneously connecting each end of a multiplicity of the patching cable conductors to individual terminals of remotely located terminal boards thereby providing temporary bypass connections in parallel with conductors of the permanent central station equipment while the latter are undergoing servicing. The gang connectors have various unique features including independently movable contactors provided with sets of sharp pointed pins fused to their outer ends.

4 Claims, 8 Drawing Figures

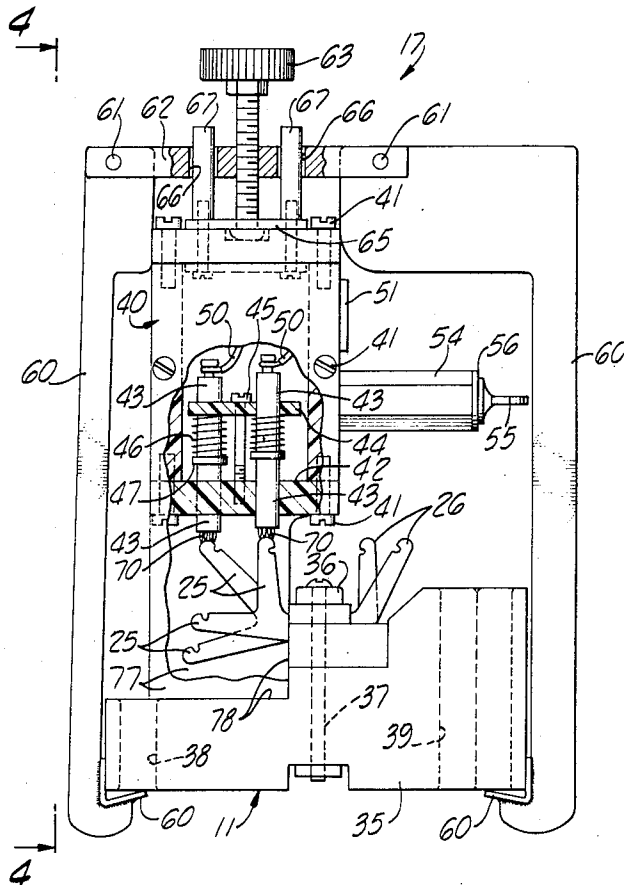
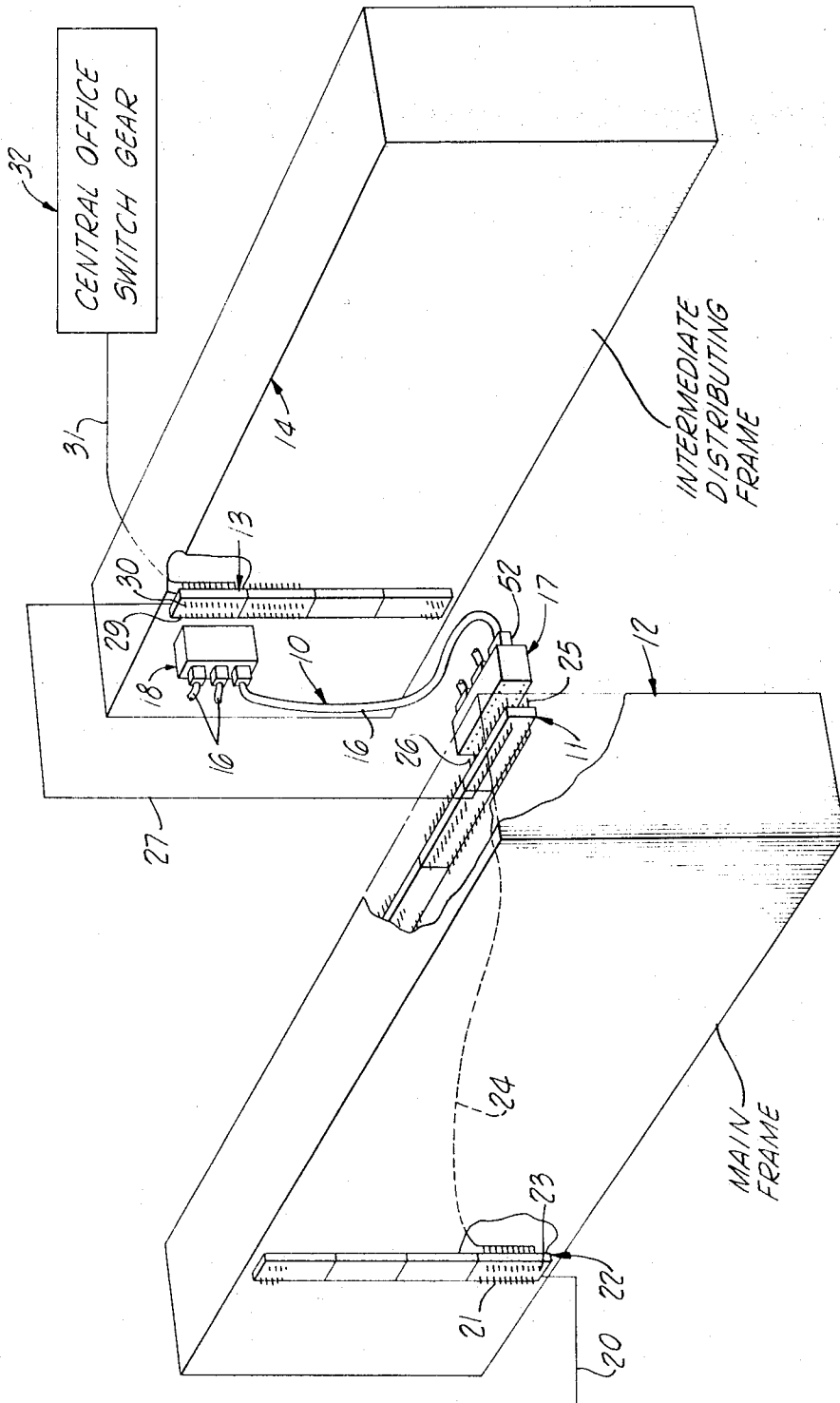


FIG. 1.



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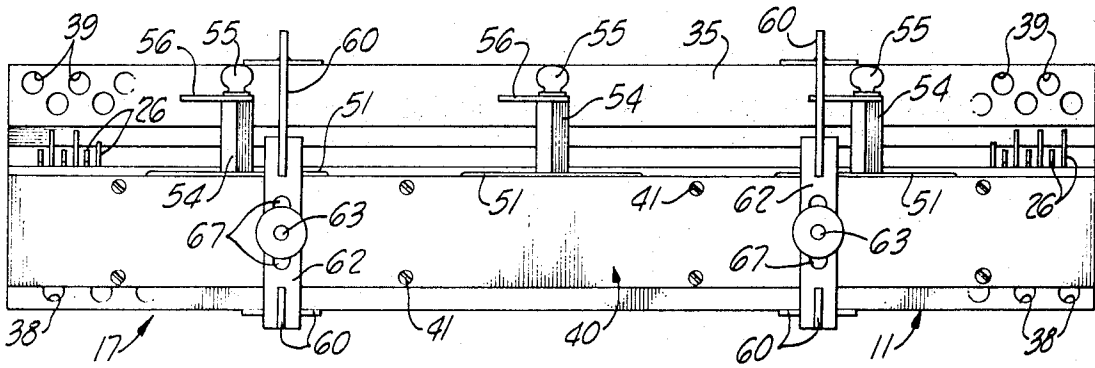


FIG. 2.

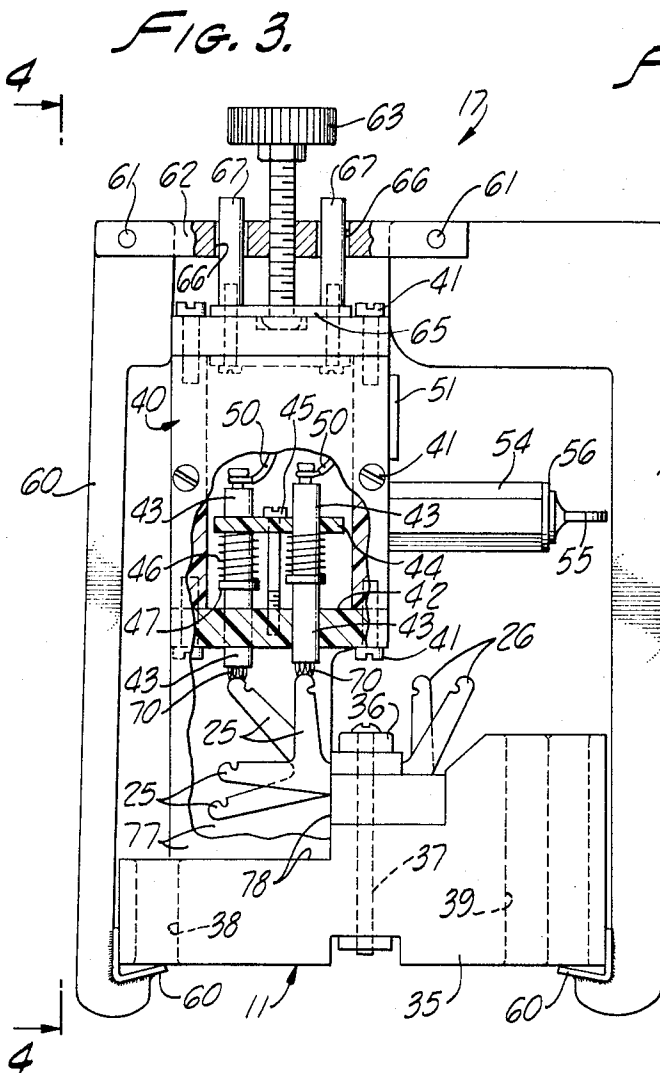


FIG. 3.

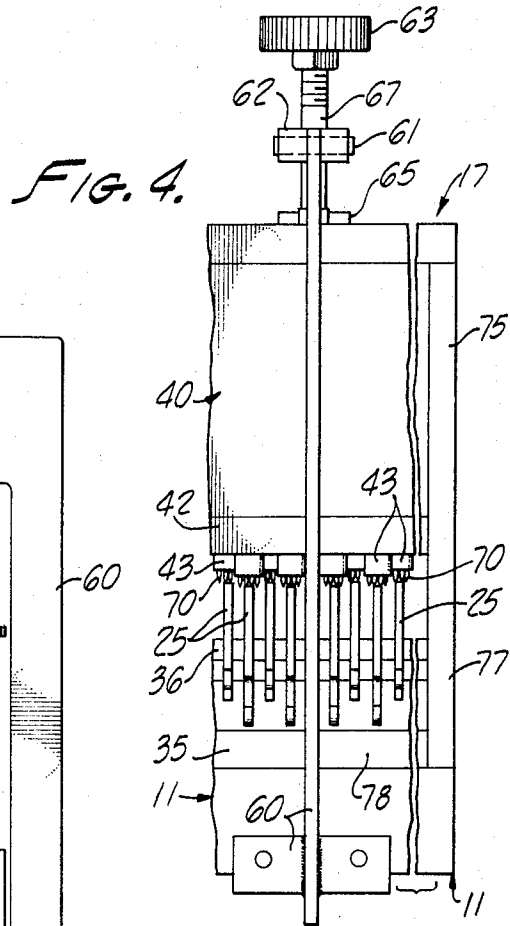


FIG. 4.

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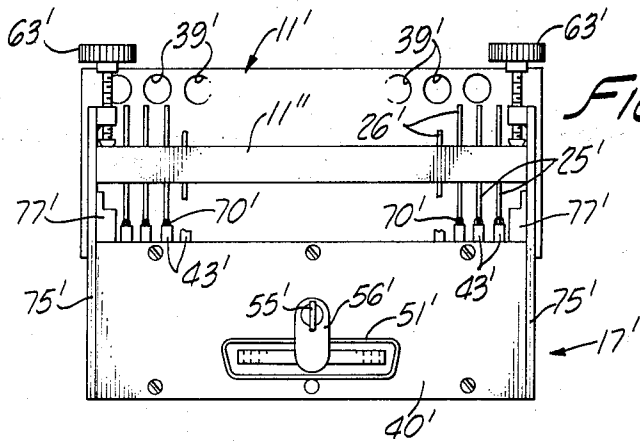


FIG. 5.

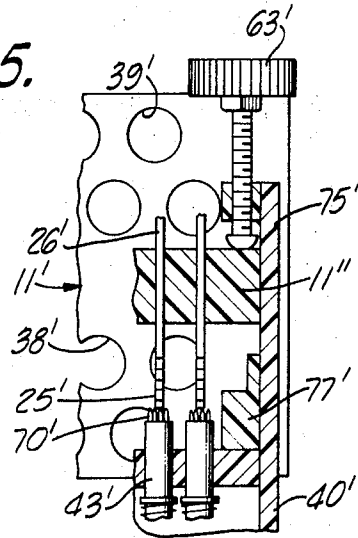


FIG. 7.

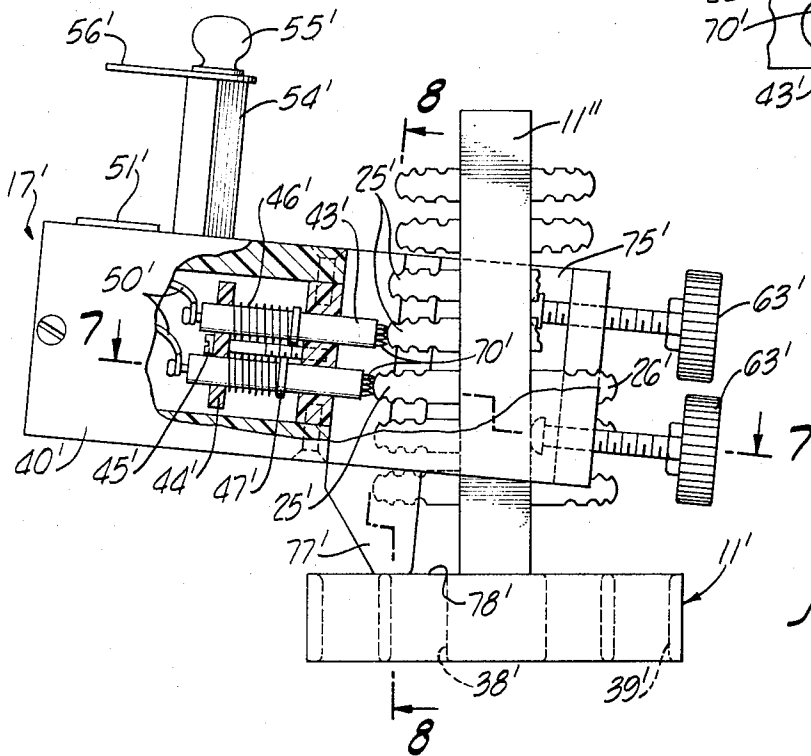


FIG. 6.

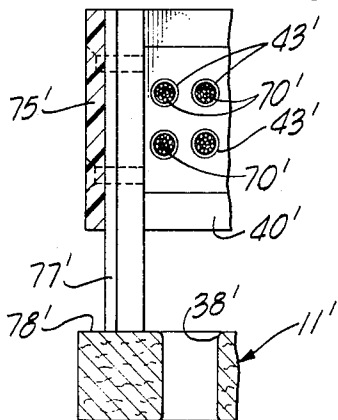


FIG. 8.

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GANG CONNECTOR AND PATCHING CABLE ASSEMBLY AND METHOD OF USING SAME

This invention relates to patching cable assemblies and more particularly to unique equipment of this character and to a mode of utilizing the same to provide by-pass communication channels in parallel with certain normally permanent conductive paths thereby permitting the latter to be serviced or replaced without interrupting phone service.

Serious problems arise in telephone central station facilities whenever it becomes necessary to replace, consolidate, or service certain of the equipment interconnecting the main service cables of the system and their connections to switching gear within the central station. Typically, the equipment with which the present invention is concerned is that portion interconnecting the main frame and the intermediate distributing frames. This portion of the equipment includes the large numbers of terminal boards extending in horizontal rows on the horizontal side of the main frame and the mass of wires connecting these terminal boards to similar terminal boards arranged in vertical rows on the intermediate distributing frame, and often designated IDF. For example, expansion of a phone system may necessitate the installation of more compact and highly concentrated terminal boards along with new connections extending between the horizontal side of the main frame and the IDF. Thousands of wires and terminal boards of more modern design must be replaced or rearranged and substituted for prior antiquated equipment. This is an extremely laborious time-consuming task requiring the services of many expert technicians and is accompanied by intolerable interruptions in telephone service to subscribers and requires most complex checking and testing before completing the operation.

By the present invention there is provided a far simpler, faster and highly reliable technique of servicing and converting from old to new components substantially without any or negligible interruption in phone service. This is accomplished by the invention gang connector patching assemblies provided in as many sets as necessary for a particular operation. Each set comprises one or more flexible patching cables of the requisite length to bridge the distance between the two frames. The opposite ends of these cables are connected by separable couplings to tap shoe units each having the requisite number of independent contactors to make simultaneous connection to the terminals of a particular terminal board of the type in use in that central office. These gang connectors include simple, easily operated clamping means for holding all contactors of that connector assembly in firm and simultaneous contact with all terminals of the particular terminal board. When the gang connector assemblies at the opposite ends of the cables have been clamped in place there is provided a separate conductive patching path in parallel with each conductor of the existing system. It is now possible to disconnect the old wires from the terminal boards at either end of the patching facility while maintaining service over the conductors of the patching cable. Likewise the former terminal boards may be disconnected from their respective frames and moved sufficiently to permit new terminal boards to be installed following which individual pairs of wires are shifted from the old terminal board to the correspond-

ing terminals of the new board without any interruption in service.

Each gang connector assembly or unit comprises an elongated, hollow main body reciprocally supporting a multiplicity of spring biased contactors each equipped with a plurality of sharp pointed needles on its outer end. Each contactor is connected internally of the shoe body to a pin of a female connector coupling to which a connector of the patching cable coupling is mateable. The housing includes clamping jaws controlled by a common thumb nut to lock the jaws in position over the opposite lateral edges of a terminal board with each contactor in pressure contact with one of the wire terminals. Locator struts carried by the connector body abut surfaces of the terminal board and support the connector assembly with its contactors accurately aligned with respective ones of the wire terminals. The gang connector at the other end of the patching cable may be of the same or different construction depending upon the type of terminal board in use in the central station equipment.

Accordingly, it is a primary object of the present invention to provide a unique patching cable assembly and method usable in telephone central office facilities to maintain uninterrupted telephone service while certain components of the equipment are being replaced, serviced or repaired.

Another object of the invention is the provision of a novel patching cable set having specially constructed gang connector assemblies at its opposite ends equipped with means for quickly securing the same in place over a respective phone system terminal boards thereby quickly and reliably establishing an alternate group of communication connections between two terminal boards remotely spaced from one another.

Another object of the invention is the provision of simple easily-operated patching cable equipment for quickly establishing a new series of connections between the rear of a telephone main frame and a related terminal board on the intermediate distributing frame in the same station.

Another object of the invention is the provision of a gang connector assembly specially designed for ease of attachment to and detachment from a terminal board and having provision for connecting its independent contactors to other equipment via a flexible patching cable.

Another object of the invention is the provision of a multiple conductor connector assembly having independent contactors each having a plurality of sharply pointed contact pins fused to its outer end.

Another object of the invention is the provision of a gang connector assembly having a multiplicity of independent contactors each spring biased to an extended position and provided with means for adjusting the spring tension on a plurality of the contactors simultaneously.

Another object of the invention is the provision of a gang connector assembly for attachment to a multiple contact terminal board and including locator strut means cooperating with means on the terminal board to assure accurate positioning of the assembly as it is clamped in place on the terminal board.

These and other more specific objects will appear upon reading the following specification and claims and upon considering in connection therewith the attached drawing to which they relate.

Referring now to the drawing in which a preferred embodiment of the invention is illustrated:

FIG. 1 is a diagrammatic view showing the patching gang connector assembly positioned for assembly between a terminal board on the horizontal side of a main frame and a second terminal board on an intermediate distributing frame;

FIG. 2 is a top plan view of one preferred embodiment of the invention gang connector assembly assembled to a typical terminal board;

FIG. 3 is an end view on an enlarged scale taken from the right hand end of FIG. 2 with parts broken away to show details of the construction;

FIG. 4 is a fragmentary side elevational view taken along line 4—4 on FIG. 3;

FIG. 5 is a front elevational view of a second preferred embodiment of the gang connector clamped against the downwardly facing side of another common terminal board construction;

FIG. 6 is an end elevational view on an enlarged scale taken from the right hand end of FIG. 5 with parts broken away to show constructional details;

FIG. 7 is a fragmentary sectional view taken along line 7—7 on FIG. 6; and

FIG. 8 is a fragmentary cross sectional view taken along line 8—8 on FIG. 6.

Referring initially to FIG. 1, there is shown diagrammatically a representation of the invention patching gang connector assembly, designated generally 10 in readiness to have one end clamped to a terminal board 11 on main frame 12 and its other end clamped to terminal board 13 supported on IDF 14. Each of the patching connector assemblies 10 includes at least one and, in the case of larger capacity connectors, with several flexible cables 16, a first gang connectors 17 and a second gang connector 18.

It will be understood that main frame 12 and intermediate distributing frame 14 are of any well known construction and customarily installed in different parts of a telephone central office. A typical telephone service cable 20 is shown at its entrance to the central office and each of its conductors is soldered to one end 21 of individual terminal strips arranged along one side of terminal boards 22. The terminal strips extend crosswise of the boards with their ends terminating along the opposite lateral edges of the boards. The other ends 23 of these strips are connected to individual wires indicated as a group 24 arranged on shelves of main frame 12 and having their other ends connected to the ends 25 of similar terminal strips on rows of horizontally arranged terminal boards 11 arranged along the rear or so-called horizontal side of the main frame. The other ends 26 of each of the terminal strips lie along the upper lateral edge of boards 11 and each is connected to a separate wire indicated as a group by reference 27. The wires are suitably supported and pass overhead between frames 12 and 14 to rows of terminals 29 of terminal boards 13 on frame 14. The opposite ends 30 of these same terminal strips are in turn connected by individual wires, indicated at 31, extending to the central office switch gear well known to those skilled in the telephone art and indicated diagrammatically at 32.

Switch gear 32 operates in known manner to make connections to a pair of wires of other cabling and connected by cabling, not shown, back to a terminal board on frame 14 and thence through other conductors similar to 27 to a terminal board on the horizontal side of

main frame 12 and thence through conductors 24 to a terminal board on the front of the main frame and thence via overland conductors to a desired subscriber.

The invention patching gang connector assembly 10 is readily connectable between a selected one of terminal boards 11 and 13 to provide a series of parallel connections between each of the terminals 26 on board 11 and terminals 29 on board 13, thereby permitting each of the wires indicated as a group at 27 to be replaced, or, in the alternative, to be transferred to corresponding terminal lugs on a substitute terminal board at either or both ends of these wires.

Referring now to FIGS. 2, 3 and 4 there is shown details of gang connector 17 clamped to terminal board 11. As is well known, terminal board 11 has a main body of non-conductive material 35 to which is suitably clamped closely spaced set of terminal strips by means of the non-conductive clamping strips 36 and bolts 37. The ends 25 of each of these strips is Y-shaped and to at least one arm of each of which is soldered one of the wires 24 extending from ends 23 of the terminal strips of block 22. The other ends 25 of terminal strips on block 11 is soldered to one of the overhead wires 27 leading to terminal blocks 13 on the intermediate distributor frame 14. It will be understood that individual ones of wires 24 enter through separate openings 38 of main body 35 whereas wires 27 pass through similar openings 39 along the other edge of the terminal board.

The terminal shoe assembly 17 at the left hand end of patching assembly 10 has an elongated hollow main body 40 formed of insulation material, the parts being held assembled by screws 41. Bottom wall 42 (FIG. 3) is formed with rows of holes loosely supporting metallic contactors 43. The upper ends of these contactors have a loose sliding fit in an insulation plate 44 held in assembled position by a pair of spaced-apart adjustable screws 45 extending into threaded wells in bottom plate 42. Surrounding the mid portion of each contactor 43 is a compression spring 46 having one end bearing against a flange 47 embracing the contactor and its other end bearing against the underside of plate 44. So long as the connector is not assembled to a terminal board, spring 46 urges the contactors to their fully extended position with the stop collars 47 bearing against the interior surface of the bottom wall 42 of the main housing. As will be recognized, the springs are also effective to hold plate 44 against the heads of screws 45, with the result that the pressure spring can be adjusted by simply rotating screws 45 inwardly or outwardly. Thus, if screws 45 are adjusted outwardly, the springs apply less pressure on the contactors whereas if the screws are tightened, the springs hold the contactors extended with greater force.

The upper ends of each of the contactors 43 are connected by a wire 50 to a separate female socket of a multiple pin electrical cable coupling, the female socket 51 of which opens through the side wall of the main housing as indicated in FIG. 3. Since such cable couplings or disconnects are well known, the constructional details are not shown. However, it will be understood that the male portion 52 (FIG. 1) of these disconnects mates snugly with the female portion 51 and is locked against disassembly by a locking device best shown in FIG. 2. This device comprises a bracket 54 fixed to the main body 40 of the shoe and having a thumbscrew 55 at its outer end which can be tightened against the swinging clamping arm 56 overlying the fe-

male connector half 51. The thumbscrew 55 is loosened and the clamping arm 56 is rotated to the position shown in FIG. 3 thereby permitting the male coupling member 52 to be assembled to half 51. Thereafter, clamping arm 56 is rotated to overlie the outer end of the coupling and held in this position until the thumbscrew 55 has been firmly tightened.

The means for holding connector 17 rigidly clamped to terminal board 11 comprises two sets of clamping jaws 60,60 having the configuration best shown in FIG. 3. The upper ends of the J-shaped clamping jaws are pivotally connected by pins 61 to a common aligning member 62 having its midportion threaded and seating the shank of a thumbscrew 63 having its lower end loosely anchored at 65 to the top side of the connector housing 40. Member 62 is provided with a pair of holes 66 loosely accommodating the upper ends of a pair of pins 67 fixed to the top of the connector housing. Accordingly, thumbscrew 63 is effective to raise and lower member 62 relative to the top side of the connector as pins 67 prevent member 62 from rotating and confine the latter and the attached jaws 60,60 to bodily movement toward and away from the connector until the locator struts 75 are seated firmly in corner 78 of board 11. Jaws 60 fit about the opposite lateral sides of the main body 35 of the terminal block and after they are seated in this position screw 63 is rotated in a direction to force the connector contactors into firm electrical contact with separate ones of the strip ends 25 as the lower ends of locator struts seat in corner 78 of board 11.

These terminal strips are normally maintained in service for many years and become coated with dirt, oxides and other foreign matter. The multitude of tempered sharply pointed pins 70 fused to each of the contactors 43 are found highly effective and important in making certain of a good electrical connection with ends 25 of the terminal strips. The ends of these terminal lugs, being exposed, are frequently deformed in varying degrees. It is therefore difficult to make a good low-loss electrical connection therewith. It will therefore be appreciated that the nest of sharply pointed pins 70 urged into pressure contact with the terminals by springs 46 are highly effective and reliable despite the oftentimes erratic positions of the terminal lugs and the presence of coatings and foreign matter. These pins are compacted into wells at the outer ends of contactors 43 and anchored in place by solder or the like fused metal and, like pins 70, of good conductive material.

As will be observed from FIGS. 3 and 4, the diameter of the groups of pins in each contactor well is very substantially greater than the thickness of the ends of the terminal strips 25. Accordingly, these ends can be bent in either direction by a substantial amount and yet be assured of good electrical contact with one or more of the pins 70.

Referring now to FIGS. 5 to 8 there is shown a second preferred embodiment of the gang connector assembly designed for use with a terminal board 11' of a well known but distinctly different type than that shown in FIGS. 2, 3 and 4. Terminal board 11' has a T-shaped main body with a stem portion 11'' of insulation material extending the length of the T-head portion and having embedded therein the mid portions of several rows of terminal strips having ends 25' projecting from one face of the T-stem and other ends 26' of the same

strips projecting from the other face of the T-stem. As is well known to those familiar with this type of terminal board, the strips increase progressively in length toward the T-head portion of the board and their ends are in alignment with the wire receiving holes 38',39' with the wires for ends 25' entering through rows of holes 38' along one side and the wires attachable to the other ends 26' of the terminal strips entering through rows of holes 39' along the other edge. These terminal strips usually accommodate either 20 or 50 pairs of wires depending upon the length of the particular board, the smaller size being illustrated in FIGS. 5 to 8. It will be understood that the hollow housing 40' of tap shoe 17' and the arrangement of the contactors 43',43' therein is substantially identical with that described above in connection with FIGS. 2 to 4. Accordingly it will be unnecessary to repeat that description here.

A principal difference resides in the clamping means provided to hold the main body of the connector firmly assembled with its contactors 43' in contact with individual ones of ends 25' or ends 26' of the terminal strips. For this purpose the opposite end walls 75,75 (FIG. 5) of the connector housing are extended beyond the ends of contactors 43' and to the extent best shown in FIG. 5 to provide clamping jaws to hold the connector assembly to a terminal board. The adjacent interior surfaces of these projections are so spaced as to have a close sliding fit with the opposite ends of the T-stem portion 11'' of the terminal board. This assures that individual ones of the contactors 43' will be aligned with the ends 25' or 26' of particular terminal strips depending on which face of the board the connector is being clamped to.

Secured to the ends of clamping jaws 75 are clamping screws 63', the screw at one end of the connector being located near the upper corner of one clamping jaw 75 and the screw 63' on the other jaw being located near the opposite end corner of the jaw. This staggered arrangement is advantageous in obtaining more uniform and reliable contact between the pointed contactor pins 70' and the ends of the terminal strips.

Secured to and projecting laterally from one edge of each clamping jaw is a locator strut 77' shaped as best shown in FIG. 6 and having its lower end tailored to seat against surface 78' of the terminal board thereby properly supporting the connector contactors 43' for contact with the ends 25' of the contact strips as the thumbnuts 63' are tightened and with the bottom wall of the shoe lying substantially parallel to a plane passing through the ends of the terminal strips. Thus, in attaching the connector to the terminal board the operator loosens the clamping thumbscrews 63' and then lowers the connector assembly over the T-stem portion 11'' of the terminal board. Once both of the struts 77' are seated against surface 78' the operator holds the connector assembly in this position as he tightens first the thumbscrews 63'. As he does so, the various contactors 43' retract into the body of the connector by varying amounts as springs 46' apply pressure to the pointed pins 70' causing these to cut through any coating or foreign matter on terminal ends 25'. As soon as the thumbscrews are firmly tightened and a check has been made to determine that each of the contactors is making good contact with the associated terminal end, the connector assembly is ready for use. If the patching cable connector has not been installed in coupling fit-

ting 51' this is done and clamping jaw 56' is tightened by means of thumbscrew 55'.

While the particular gang connector and patching cable assembly and method of using same herein shown and disclosed in detail is fully capable of attaining the objects and providing the advantages hereinbefore stated, it is to be understood that it is merely illustrative of the presently preferred embodiment of the invention and that no limitations are intended to the details of construction or design herein shown other than as defined in the appended claims.

I claim:

1. A gang connector assembly clampable immovably along the full length of a phone system terminal board having a multiplicity of pairs of terminal lugs arranged in closely spaced rows from end to end thereof to provide a temporary separate patch connection to each of said lugs, said connector assembly having a main body generally coextensive in length with said terminal board and reciprocally supporting a plurality of separate spring biased contactors each positioned to engage a respective one of the lugs in a plurality of rows thereof extending lengthwise of said terminal board, flexible cabling means including separate wire connections to each of said contactors and extending from said main body to a remote area, a plurality of pairs of manually adjustable jaws pivotably supported along the opposite sides of said main body having inturned free ends engageable with the opposite lateral edges of the terminal board and effective when adjusted to compress the springs of said spring biased contactors and force the same simultaneously into pressure contact with a re-

spective one of said lugs as said main body is moved bodily toward the terminal board, and locator strut means projecting from said main body to one side of said contactors and positioned to engage the terminal body and cooperating therewith and with said clamping jaws to stabilize and hold said connector assembly rigidly and immovably clamped to said terminal board without risk of damage to said terminal lugs or said contactors.

2. A gang connector assembly as defined in claim 1 characterized in that said contactors have a well in the outer end thereof seating a plurality of sharp pointed pins fused into said well.

3. A gang connector assembly as defined in claim 1 characterized in that said locator strut means is located at the opposite ends of said main body.

4. A pair of gang connector assemblies each constructed as defined in claim 1 and connected to the opposite ends of the conductors of a flexible patching cable, said patching cable including a separate conductor having the opposite ends thereof connected to a similarly positioned contactor on a respective one of said gang connector assemblies, and said gang connector assemblies being clampable to a respective phone system terminal board each having a multiplicity of pairs of terminal lugs with a lug of each in pressure contact with a respective spring biased contactor of an associated one of said gang connector assemblies to provide independent electrical connections between the respective lugs of said terminal boards.

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