

[54] **TAP SHOE ASSEMBLY FOR USE WITH WIRE TERMINAL STRIPS**

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

[21] Appl. No.: **175,270**

[52] U.S. Cl. .... **200/51.04**, 179/175.1, 200/5 A

[51] Int. Cl. .... **H01r 33/30**

[58] Field of Search ... 200/51 R, 51.03, 51.04, 51.05,  
200/51.06, 51.07, 5 A; 179/175.1 R, 179.1  
PC

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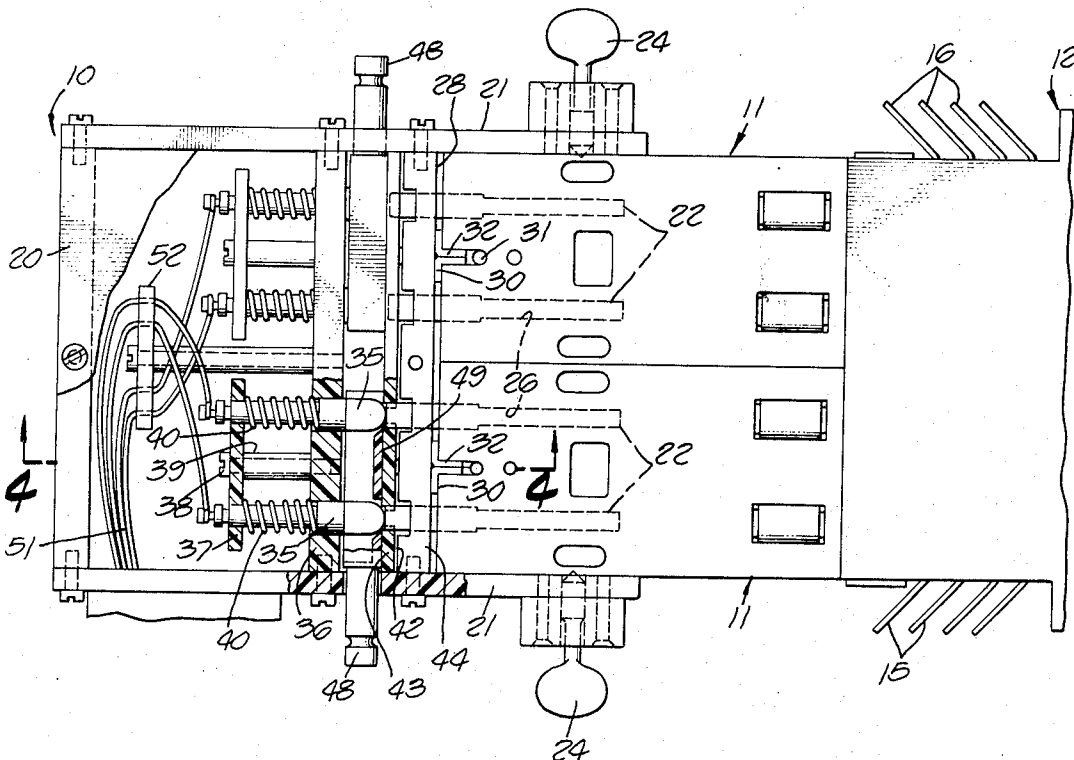
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[57]

**ABSTRACT**

A gang connector for temporary use in making simultaneous connection to a multiplicity of pairs of conductors permanently soldered to the separate terminals of a terminal strip. The connector includes simple, positive means housed therein for making or breaking contact between any selected pair of conductors and terminals carried by the connector and readily connectable to cabling equipped with separable coupling means mateable with these terminals. The connector is specially designed with conductor prongs insertable into the test probe wells of individual line protectors customarily present on wire terminal strips. Guard strips extend along either side of these conductor prongs and include adjustable means for clamping the connector assembled to the terminal strip via its line protectors.

**17 Claims, 5 Drawing Figures**



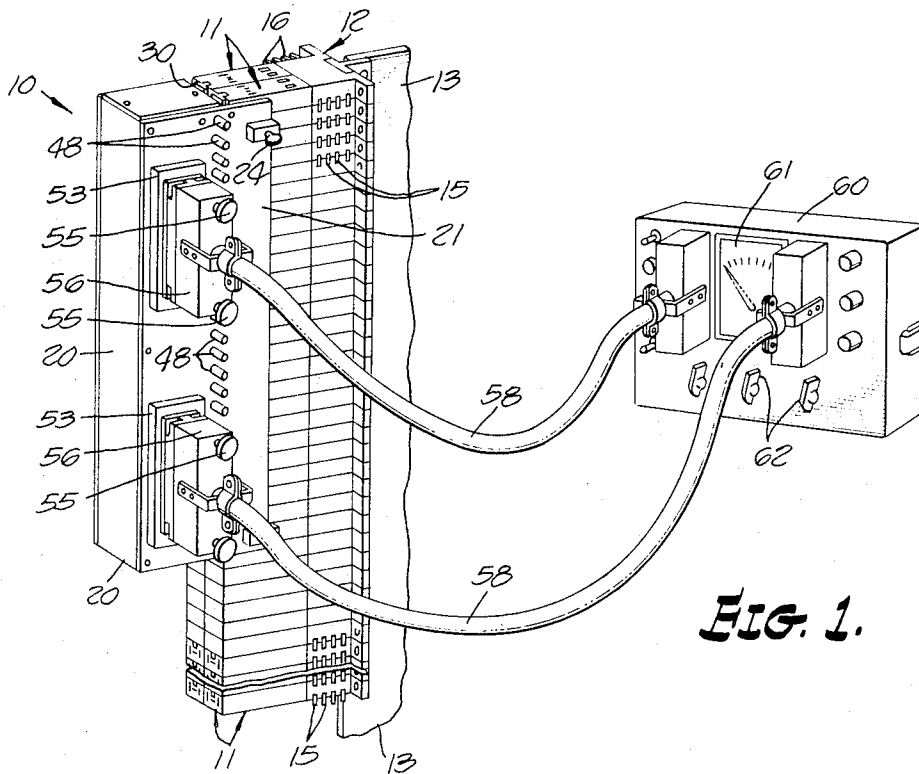


FIG. 1.

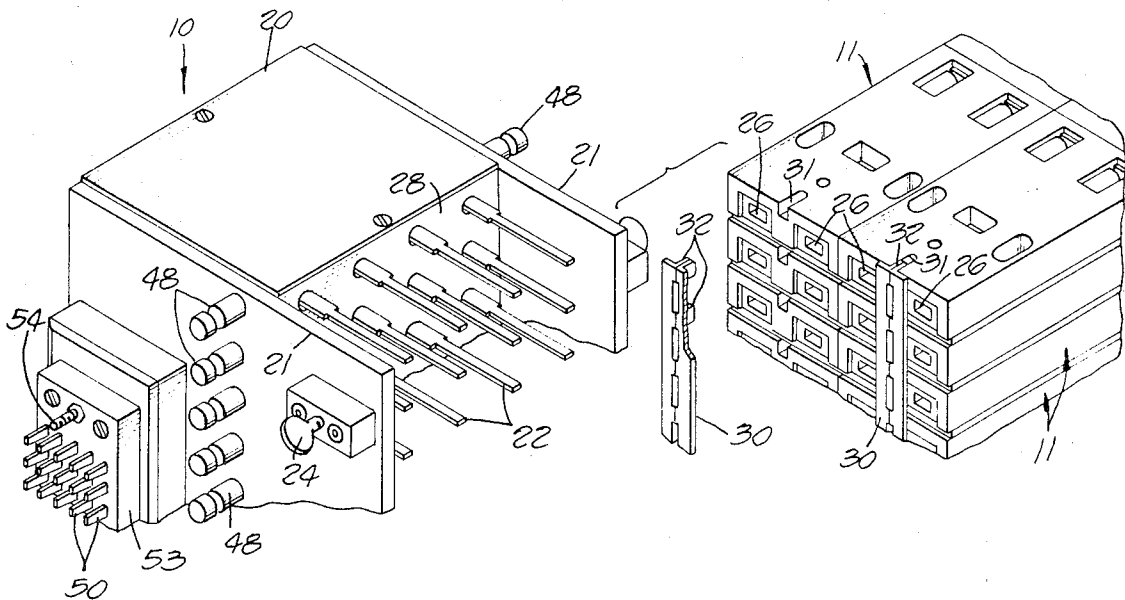


FIG. 2.

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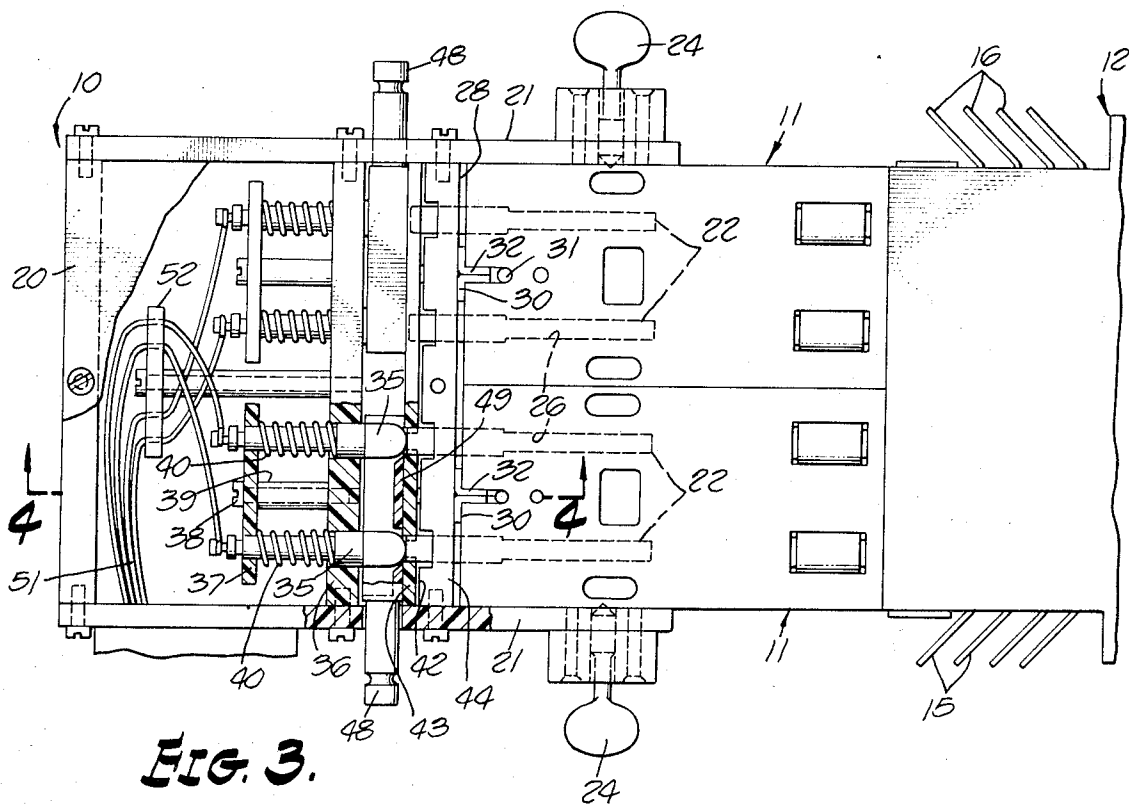


FIG. 3.

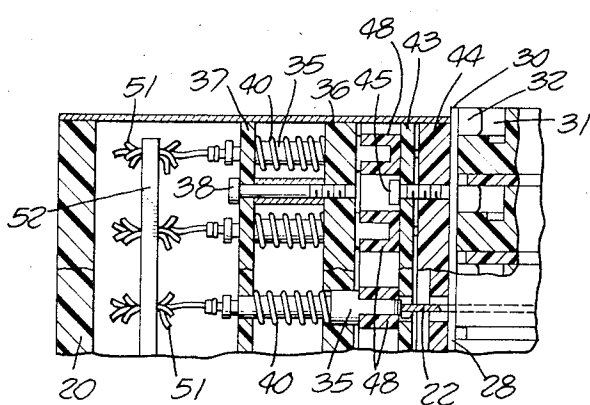


FIG. 4.

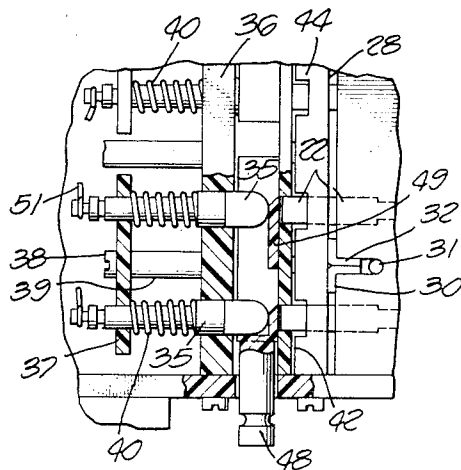


FIG. 5.

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## TAP SHOE ASSEMBLY FOR USE WITH WIRE TERMINAL STRIPS

This invention relates to separable electrical connectors for a multiplicity of conductors, and more particularly to a unique gang connector designed for simultaneous assembly to and disassembly from terminal strips of the type commonly used in telephone central offices and the like.

Terminal strips are used in vast numbers to interconnect cross-country communication cables to central office equipment and to other cross-country cables. There is frequent need for gaining access to individual ones of these conductors and pairs of conductors for many purposes including servicing and testing as well as for transferring certain lines to other equipment as well as for locating and tracing particular lines. It has been common practice heretofore for service personnel to employ hand held test probes which are manipulated over the contacts of terminal strips to perform the above mentioned operations. This is an extremely laborious and time consuming operating requiring at least one man to manipulate the probes and other personnel to make entries on records, to manipulate equipment in other parts of the facility and to observe test equipment and to make entries in log books and the like. At other times it is desired to maintain the lines in service while transferring conductors from one terminal strip to another either at the same or a different location.

The foregoing and the like operations well known to operating and maintenance personnel of communication equipment are greatly simplified by the present invention utilizing a gang connector having a multiplicity of prongs and each specially arranged for insertion into a particular test probe well of the line protectors customarily present on and forming part of conventional terminal strips. These test probe wells open through the outer end of the line protectors into which the long probes of the invention tap shoe are readily insertable. To avoid the possibility of unintentional disassembly, the connector is preferably provided with clamping means to lock it in its installed position while conducting a service operation. Operatively associated with the connector are individual line connectors and disconnectors for each pair of wires attached to the terminal strip. An operating plug for each pair of these contacts is shiftable crosswise of the shoe prongs and in a manner to make or break electrical contact between these prongs and conductor terminals carried by the connector and mateable with the coupling plug of a service cable leading to a test bench or to another part of the facility. The operator can place any selected number of pairs of the lines in circuit with the test cable and can change these connections by the simple expedient of pushing or pulling any selected control button on the gang connector. As soon as the particular operation is completed the service cable is quickly disconnectable by releasing the clamping means for the connector and withdrawing it from the test probe wells of the line connectors.

Accordingly it is a primary object of the present invention to provide an improved and unique gang connector for telescopic assembly over a terminal strip and including individual pairs of conductors which are selectively insertable into and disconnectable from circuit with conductors permanently connected to the terminal strip.

Another object of the invention is the provision of a multiple conductor gang connector having contact prongs insertable into the test probe wells of the line protectors of a multiple conductor terminal strip and usable in performing various service operations thereon while retaining the circuits served in operation.

Another object of the invention is the provision of an improved gang connector for use with the terminal strips of a central office main frame and embodying therein manually operable switching means for connecting and disconnecting the terminal strip conductors in circuit with the connector.

Another object of the invention is the provision of a gang connector the prongs of which are arranged for insertion into the test probe well of the line conductors of a terminal strip and including means for clamping the connector assembled to these line protectors.

Another object of the invention is the provision of simple, easily operated extension cable means equipped with a gang connector at one end thereof quickly connectable to and disconnectable from multiple connectors of any selected terminal strip of a communication system central office.

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 perspective view of one preferred embodiment of the invention gang connector assembled to a typical terminal strip with flexible service cables extending therefrom to test equipment for checking the operating conditions of conductors terminating on the terminal strip;

FIG. 2 is a fragmentary exploded view on an enlarged scale of one end portion of the connector showing its operative relationship to the line protectors of a typical terminal strip;

FIG. 3 is a top plan view of the terminal strip shown in FIG. 1 with portions of the gang connector broken away to show interior constructional details;

FIG. 4 is a fragmentary view taken along line 4-4 on FIG. 3; and

FIG. 5 is a fragmentary view of the manually operable switch for a pair of line conductors and showing the movable contacts inside the gang connector in open position.

Referring initially more particularly to FIG. 1, there is shown a gang connector, designated generally 10, clamped to the outer end of two rows of generally rectangular line protectors 11 forming part of a 100 wire terminal strip 12. As is well known by persons familiar with telephone equipment in central offices, such terminal strips are mounted end to end on a main frame 13 of the central office. The thousands of pairs of telephone wires entering the central office terminate on individual terminal lugs (FIG. 3) of terminal strips 12. Usually these terminal lugs 15 are located along one side of the terminal strip and are connected through line protectors 11 to other terminal lugs 16 along the other side and to the outer ends of which other conductors are soldered extending to various units of the central office equipment.

Tap shoe 10 comprises a generally rectangular main housing 20 the opposite lateral sides 21 of which pro-

ject beyond the prong-equipped face of the gang connector in the manner best shown in FIG. 2 for a distance somewhat in excess of the length of prongs 22. The outer edges of these extensions 21 are equipped with threaded thumb screws 24 for use in clamping the connector to the sides of line protectors 11 after the connector has been installed thereover.

It will be understood that there is a separate line protector 11 for each pair of lines served by a terminal strip 12 and that the outer exposed end of each is provided with a pair of test probe wells 26 (FIG. 2) into which it has been heretofore customary to insert a test probe to make contact with one or the other of the lines served by that protector. One well of each pair is connected to the central office equipment via terminal lug 16 and the other test probe well is connected to a terminal lug 15 in circuit with an outgoing conductor. Prongs 22 projecting outwardly from the inner face of 28 of the gang connector are sized and spaced for telescopic insertion in a respective one of the test probe wells 26. Typically, the shoe shown can serve 50 pairs of conductors, or half of those normally connected to a single strip 12.

In order to assure that the prongs 22 are accurately aligned with all 50 of the test probe wells 26, it is preferable to first install the spacer strips 30,30 (FIG. 2) astride the outer ends of the two rows of line protectors 11,11. Referring to the showing of the line protectors in FIG. 2, it will be noted that one rim edge of each protector has a shallow notch 31. Each of strips 30 comprises a T-shaped strip of metal or rigid plastic having its T-stem portion notched to provide lugs 32 sized to have a snug frictional fit in a respective one of the notches 31. Accordingly, these spacer strips 30 are readily pressed into their installed position in the manner illustrated in FIG. 2 and cooperate to hold the line protectors accurately aligned and uniformly spaced relative to one another with their wells 26 properly positioned to receive the connector prongs 22.

Referring now to FIGS. 3-5 there will be described the internal components of the gang connector with particular reference to the means for connecting or disconnecting each pair of probes 22 with the associated wells 26. For this purpose the connector includes an independently reciprocable contactor 35 for each of the prongs 36. Thus, as is shown in FIG. 3, each contact 35 is reciprocal axially of itself in aligned openings of an insulating support comprising a partition 36 and a strip 37 which are held assembled to one another by cap screws 38 and a separator spool 39. A light compression spring surrounds the shank of contactor 35 with one end bearing against strip 37 and the other end bearing against a shoulder of the contactor to urge the rounded end of the contactor into engagement with the inner end of one of the prongs 22.

Prongs 22 are T-shaped at their inner or rearward ends with T-head 42 held trapped immovably between two non-conductive plates 43,44. These plates have aligned openings through which the inner end of the prong is accessible for electrical contact with one of contactors 35. It will be understood that the T-heads of adjacent prongs are spaced from one another so that there is no possibility of electrical contact therebetween. However, the innermost end of each

probe is in position to be contacted by the movable contact 35 and to be held there by spring 40 if the control button for contactors 35 is in its open position. The two insulator plates 43,44 holding the heads of the T-shaped prongs captively assembled are held assembled by cap screws 45 at spaced intervals therealong (FIG. 4).

Control buttons are arranged in a row along either side of the gang connector and have limited reciprocal movement transversely of the connector to control the closed or open position of a related pair of the movable contactors 35. Referring first to FIG. 3, it will be observed that the upper one of buttons 48 is shown in elevation, whereas the lower one of the buttons 48 is shown in cross section to illustrate the internal construction. Thus, the inner end of each of the control buttons is channel shaped in cross section and its bottom or web portion has a pair of openings opposite the rounded end of a pair of an associated pair of contactors 35,35. The portion of contactors 35 extending into these channels are flattened and have a loose sliding fit with the sidewalls of the channels. This prevents the contactors from rotating.

When the control buttons are pulled outwardly to the full line position shown in FIG. 3, a related pair of contactors 35 project through the openings in the web portion of the control button and are held by springs 40 in firm electrical contact with the inner T-head of the associated probes 22. However, if a control button is pushed inwardly, the cammed edge of the openings in the control buttons cooperate with the rounded ends of the contactors 35 to shift the contactors to the left as viewed in FIG. 3 to the open position thereof illustrated in FIG. 5. Accordingly, it will be understood that the web portion 49 of the control buttons then overlies the inner T-head of prongs 22. It follows that button 48 then holds its pair of contacts 35 out of electrical circuit with the associated pair of prongs 22.

It will thus be clear from the foregoing that each of buttons 48 controls a separate pair of contactors 35 and that the circuit between these contactors and prongs 22 is broken when the buttons are pushed into the position shown in FIG. 5, and that the circuit is held closed by springs 40 when the buttons are pulled out to the position shown in FIG. 3.

Each of contactors 35 is connected in circuit with a separate male coupler terminal 50 (FIG. 2) by an insulated conductor 51. These conductors have one end soldered to the tip end of contactor 35 and pass through a support strip 52 interiorly of the gang connector housing. The male coupler terminals 51 are anchored in a support block 53 mounted along the exterior side of the connector housing in the manner best shown in FIGS. 1 and 2. Mounting base 53 is provided at either end with a threaded stud 54 (FIG. 2) to which the thumb screws 55 may be coupled to hold the female coupler fitting 56 in assembled position. This coupler fits over each of the terminal lugs 50 and connects these by separate conductors passing through cable 58 to some other equipment in the central station such as the verifier test equipment 60 shown in FIG. 1.

Verifier 60 is of any suitable type having a meter 61 which can be used to provide readings when any selected one of the lines served by a terminal under test is connected in circuit with the meter. Control knobs

62 are manipulated to regulate the current or voltage imposed on the line under test, the operator of the instrument panel noting the line being tested by observing the position of control buttons 48 on the side of gang connector 10.

As is shown in FIG. 1, gang connector 10 is connected to the 50 pairs of incoming and outgoing lines connected to the upper half of terminal strip 12. The other 50 pairs of lines serviced by the lower half of the terminal strip can be tested by securing a separate connector thereto or by transferring gang connector 10 to the line protectors 11 for the lower half of this strip.

According to another use of gang connector 10, it may be desirable to replace terminal strip 12 with another strip of the same or a different design and yet maintain the lines in service while the substitution is taking place. In this case the invention connector is employed to interconnect the new terminal strip with the old while individual pairs of conductors are being transferred from the old strip to the new. During this operation the old terminal strip is detached from its support on main frame 13 and the new strip is mounted either in its place or in its new location on the main frame and interconnected to the connector and service cable auxiliaries shown in FIG. 1 and described above.

While the particular gang connector for use with wire terminal strips 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 embodiments of the invention and that no limitations are intended to the detail of construction or design herein shown other than as defined in the appended claims.

We claim:

1. That improvement in a gang connector for use with a terminal board of the type having line protectors each equipped with test probe wells each connected to a line conductor and opening through the outer ends of the line protector, said gang connector comprising: an elongated hollow main body having a multiplicity of conductive probes projecting therefrom and adapted for telescopic insertion into respective ones of said probe wells to complete a conductive path to a respective line conductor, a separate conductive terminal for each of said line conductors carried by said main body, and means including manually operable switch means carried by said main body for connecting each pair of line conductors to a corresponding pair of said conductive terminals at the user's option.

2. That improvement defined in claim 1 characterized in the provision of means on said main body for releasably clamping said gang connector in place over the outer ends of said line protectors.

3. That improvement defined in claim 1 characterized in the provision of alignment means insertable abreast the exposed outer ends of said line protectors to hold the same properly spaced and positioned for the simultaneous insertion of said conductive probes into said probe wells.

4. That improvement defined in claim 1 characterized in that said main body includes a protective guard flange projecting from either side of said main body and along said conductive probes to protect the same when said gang connector is disassembled from said line protectors.

5. That improvement defined in claim 4 characterized in that said guard flanges closely embrace the remotely spaced lateral edges of said line protectors when assembled thereover and cooperate therewith in positioning said conductive probes in alignment with said probe wells during assembly and disassembly operations.

6. That improvement defined in claim 5 characterized in the provision of means carried by said guard flanges for releasably clamping said gang connector to said line protectors.

7. That improvement defined in claim 1 characterized in that each of said switch means includes an operator therefor accessible from the exterior of said main body and movable between the open and closed position of an associated switch for a pair of line conductors.

8. That improvement defined in claim 7 characterized in that said switch operator means comprises a non-conductive member movable between two positions in one of which an associated pair of said conductive probes are in electrical circuit with a respective one of said conductive terminals and in the other of which positions said non-conductive member holds said pair of probes out of circuit with said terminals.

9. That improvement defined in claim 1 characterized in that said conductive terminals are mounted in upright uniformly spaced parallel rows and form part of a two-part separable electrical cable connector assembly, and an extension electrical cable having a separate wire corresponding to a respective one of said upright terminals and connected to a respective separable conductive contact of said cable connector assembly.

10. A gang connector comprising a main housing, a first set of long conductors arranged parallel to one another and adapted to be telescoped into mating electrical contact with a plurality of other electrical contacts, a second set of conductors movably supported inside said housing and normally spring pressed into firm electrical contact with the inner end of a respective one of said first conductors, and non-conductive means operatively associated with separate pairs of said first and second conductors and movable between first and second positions in the first of which said pairs of first and second conductors are in contact with one another and in the second of which said pairs of conductors are held out of contact.

11. A gang connector as defined in claim 10 characterized in that said non-conductive means is supported for limited lengthwise movement crosswise of said first and second sets of conductors, and cooperating cam means on said non-conductive means and on said second set of conductors operative to move a pair of the latter away from contact with a pair of said first pair of conductors as said non-conductive means is moved in one direction.

12. A gang connector defined in claim 11 characterized in that said non-conductive means is slotted lengthwise thereof and provides a loose sliding fit with a non-circular portion of said second set of conductors to restrain the latter against rotary movement about the longitudinal axes thereof.

13. A gang connector comprising a hollow main housing having first and second non-conductive supports formed with rows of aligned openings

therethrough, a first set of rigid conductors immovably supported by said first support with the outer ends thereof lying parallel to one another and projecting away from both of said first and second supports, a second set of conductors movably supported by said second support and spring biased into contact with the adjacent inner end of a respective one of said first set of conductors, and conductor separator means operatively associated with each pair of said second conductors operable to hold a selected pair thereof positively out of contact with the associated ones of said first set of conductors.

14. A gang connector as defined in claim 13 characterized in that said conductor separator means is reciprocally supported crosswise and between the adjacent ends of said first and second sets of conductors.

15. A gang connector as defined in claim 14 characterized in that said conductor separator means comprises an elongated slider having a stepped passage therethrough accommodating the adjacent end of said

second set of conductors and a step portion of said passages being insertable between the ends of said first and second sets of conductors to hold the same positively out of conducting relation and being movable to a position permitting said conductors to contact one another.

16. A gang connector as defined in claim 15 characterized in that said conductor separator means includes means holding the same captively and slidably assembled between said first and second conductor supports and accessible for operation from the exterior of said main housing.

17. A gang connector as defined in claim 13 characterized in the provision on said main housing of one of the two parts of separable coupling means having a terminal contact for each of said second set of conductors, and flexible conductor means within said main housing interconnecting each of said terminal contacts and a respective one of said second sets of conductors.

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