# United States Patent [19]

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[11] **3,750,086**

[45] **July 31, 1973**


[54] **RAPID CONNECTOR**


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[22] Filed: **Jan. 3, 1972**

[21] Appl. No.: **214,645**

[52] **U.S. Cl.** .................... **339/75 M**

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

[58] **Field of Search** .................... 339/74, 75, 176, 339/274



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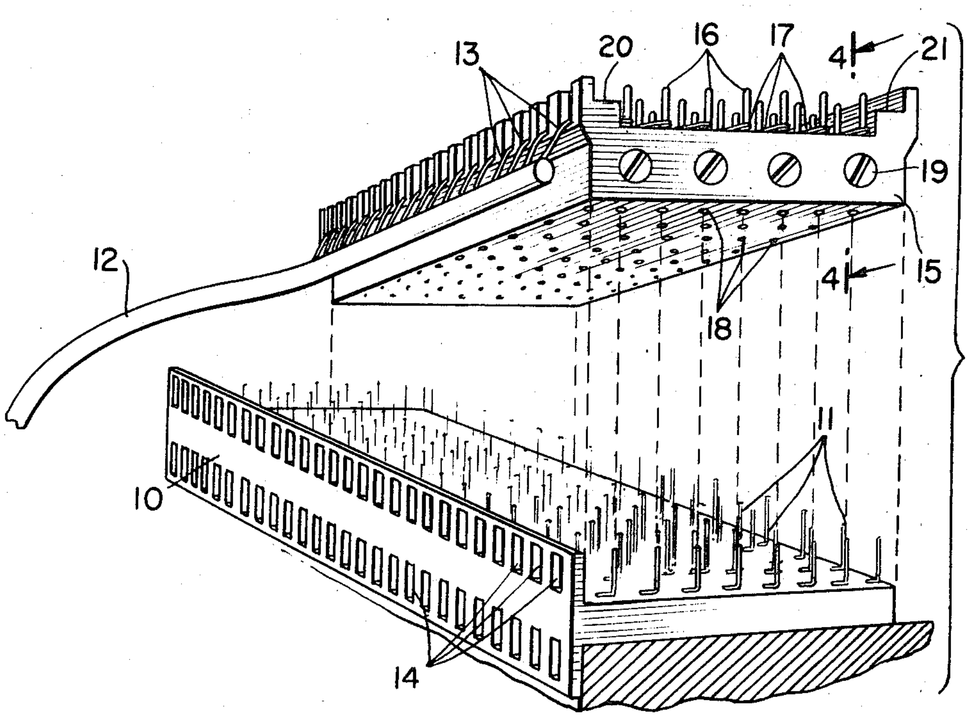
[57] **ABSTRACT**


A rapid connector is utilized to effect electrical connections between individual wire ends from a multi-conductor cable to terminal pins on a terminal block such as might be located in a central telephone office. The connector comprises an insulative body having a plurality of wire receiving pins on one side to which the wire ends of the multi-conductor cable are connected at the factory or during the manufacture of the body. The other side of the body includes a plurality of terminal pin receiving openings. The cable pins extend into the body and terminate in spring fingers adjacent to the terminal pin receiving openings and cam means are provided for camming the spring fingers simultaneously into electrical contact with the terminal pins after the terminal pins have been received in the terminal pin receiving openings. Those openings are free of obstructions when the cam means are in unlocked position so that a large number of pins from the board can simultaneously be received in the pin openings with a minimum of friction.


**7 Claims, 5 Drawing Figures**



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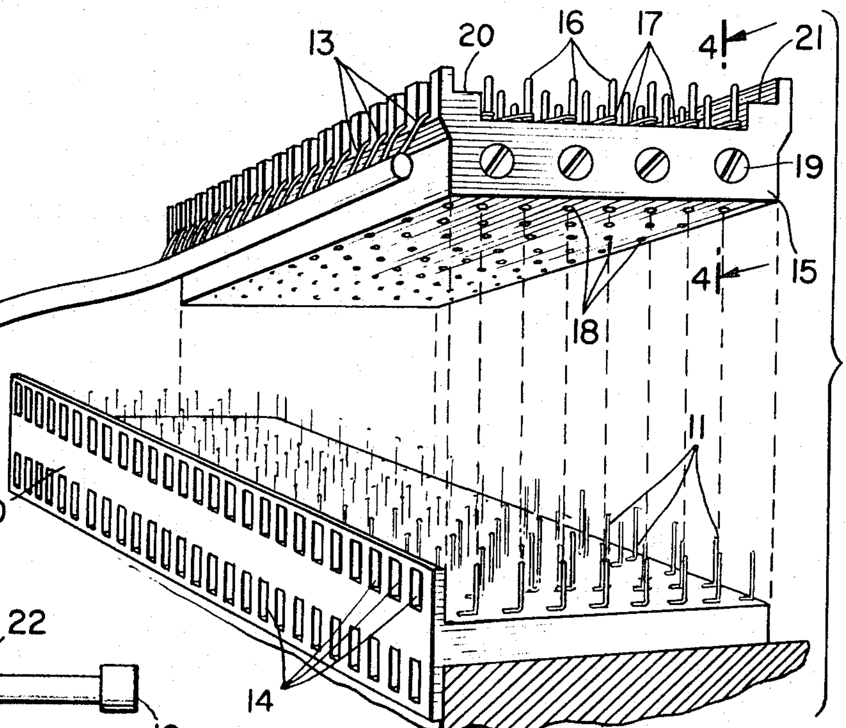


FIG. 1.

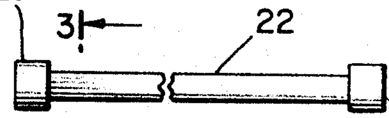


FIG. 2.

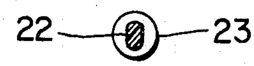


FIG. 3.

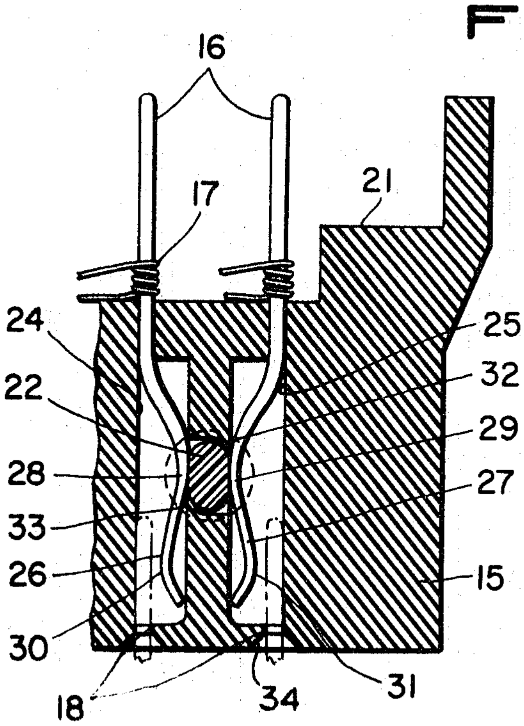


FIG. 4.

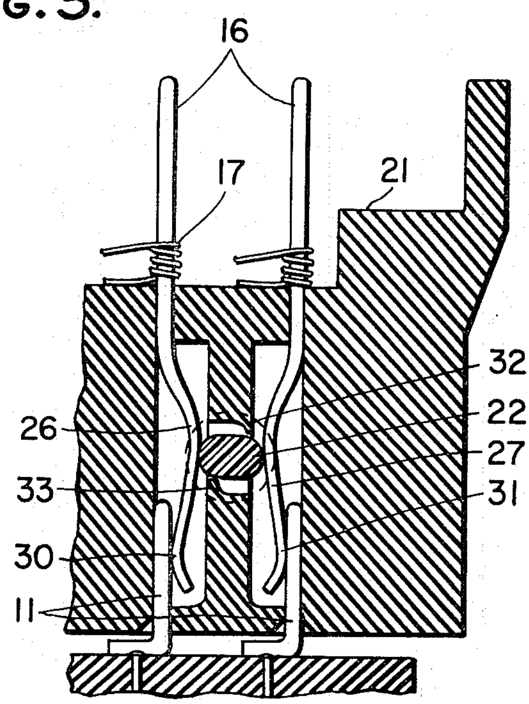


FIG. 5.

## RAPID CONNECTOR

This invention relates to a rapid connector and more particularly to a connector for connecting individual wire ends from a multi-conductor cable to terminal block pins in a central telephone switching office.

## BACKGROUND OF THE INVENTION

In running cable and connecting individual conductors carried by the cable to terminal block pins such as in a telephone switching office, the practice heretofore has been to wind each wire end of the cable after stripping the insulation about an individual pin on a terminal block. This operation at the site of the central telephone office is extremely time consuming and very costly to the telephone company in that a large labor pool of electricians must be kept on hand for extended periods of time. More particularly, since the connection of the individual cable wires to the pins themselves involves several hours, other work is often delayed pending completion of connection of one multi-conductor cable to a terminal block.

In many instances, there are upwards of two hundred individual terminal pins to which the ends of a multi-conductor cable must be connected. In those instances where the number of pins is considerably smaller, it is feasible to employ a plug which may be pre-connected to the end of the the cable and provided with a series of openings which will receive the pins simultaneously to make the connection. However, where a very large number of pins are involved, any such types of plugs heretofore proposed have been impractical largely because of the tremendous amount of friction involved in attempting to insert simultaneously a large number of pins in openings in the plug. Moreover, problems are involved in assuring a foolproof connection for each individual wire to a pin. When a plug body of conventional type is utilized, any slight variatiions in the fixed spacings between the openings for receiving the terminal pins or any variations within the tolerances of the positioning of the terminal pins themselves might result in an impairment of the integrity of some of the pin connections to contacts within the body.

## BRIEF DESCRIPTION OF THE PRESENT INVENTION

With the foregoing in mind, the present invention contemplates a novel plug body construction to provide a rapid connector which will enable a very large number of individual wire ends to be simultaneously connected to terminal block pins and yet in which friction problems heretofore encountered with multi-pin plugs and possible failure of certain of the connections are wholly avoided. Moreover, the provision of the rapid connector of the present invention enables the cable wire ends to be wired to the rapid connector or plug body itself at the factory so that when cable is connected at a telephone central office site, it is only necessary for the worker to connect a plug to the terminal block rather than take the long time involved in effecting individual wire connections. As a consequence, the large labor pool and time involved in running and connecting cable in telephone switching offices can be drastically reduced with a consequent savings to the telephone company.

More particularly, the rapid connector itself comprises an insulative body having a plurality of wire receiving cable pins on one side pre-connected to the wire ends of a multi-conductor cable, and terminal pin receiving openings on the other side, the cable pins extending into the body and terminating in spring fingers adjacent to the terminal pin receiving openings, respectively. The body includes a cam means for camming the spring fingers simultaneously into electrical contact with the terminal pins after the terminal pins have been received in the terminal pin receiving openings. Thus at the time of insertion of the pins in the openings, the openings themselves offer no obstructions to receiving the pins. However, after the pins have been received, operation of the cam means effects the desired electrical connection. As a result, friction is minimized during the insertion of the pins in the plug. Not only is a rapid and efficient connection assured, but the construction of the unique camming means in co-operation with the spring fingers assures that each and every individual connection will provide an electrical contact which is not subject to failure or opening even though there may be slight variations in the actual physical spacing of the terminal block pins and openings in the rapid connector body.

## BRIEF DESCRIPTION OF THE DRAWINGS

A better understanding of the invention will be had by now referring to the accompany drawings in which:

FIG. 1 is an exploded perspective view of a rapid connector in accord with the present invention preparatory to being connected to a large number of pins on a terminal block such as might be encountered in a central telephone switching office;

FIG. 2 is a side elevational view of one of the cam means utilized in the rapid connector of FIG. 1;

FIG. 3 is a cross-section of the cam means taken in the direction of the arrows 3—3 of FIG. 2;

FIG. 4 is a greatly enlarged fragmentary cross-section of the rapid connector taken in the direction of the arrows 4—4 of FIG. 1 showing the cam member in an unlocked position so that terminal pins may be readily received in the body; and,

FIG. 5 is a view similar to FIG. 4 illustrating the cam means in an operated or locked position wherein electrical connections are effected between the cable wire ends and terminal pins on the terminal block of FIG. 1.

## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG. 1, there is shown a typical terminal block **10** which might be secured in a bay in a central telephone switching office. As shown, this terminal block includes a plurality of exposed terminal pins **11**.

Shown above the terminal block **10** is a multiconductor cable **12** from which exposed individual wire ends **13** may be provided. Prior to the present invention, the exposed wire ends **13** were stripped of insulation and would be individually wrapped about the terminal pins **11** of the terminal block **10** to connect the cable to the block. For this purpose, the side structure of the terminal block includes slots **14** for receiving bundles of wire for connection to the various pins. Since each terminal block may include up to 200 or even more individual terminal block pins, the stripping of individual terminal wires from the multi-conductor cable and the wrapping of these wires about the terminal ends is a very time consuming operation particularly when performed at the site of the central switching office.

In accord with the present invention, rather than wire the individual wire ends to the terminal block pins, directly, there is provided a rapid connector in the form of an insulative body **15** having a plurality of wire receiving cable pins **16** on one side which, in the embodiment disclosed, constitutes the top side of the body **15.** These pins **16** are arranged to be connected directly to the individual wire ends in the multi-conductor cable **12** at a manufacturing site or factory prior to running the cable in a central telephone office. Thus, the facilities at the factory or manufacturing site include automatic winding machinery which can rapidly effect the various individual wire connections to the cable pins **16** of the body **15.** By pre-cutting cable to proper lengths in accord with the specifications of a remote central telephone office, mass production techniques can be utilized at the manufacturing plant to effect this wiring of the individual wire ends to the body **15.** The proper length of cable already connected to the rapid connector body can then be moved to the central office for effecting desired connections to terminal pins on the block **10.** The wrap around connections between the cable ends and the cable pins **16** are indicated at **17** in FIG. **1.**

Still referring to the plug body **15**, it will be noted that another side includes terminal pin receiving openings which, in the embodiment illustrated, are on the bottom side of the body. These pin openings are spaced to receive the terminal pins **11** when the plug body **15** is connected to the terminal block.

As will become clearer as the description proceeds, the cable pins **16** extend into the plug body **15** and terminate in spring fingers adjacent to the terminal pin receiving openings **18.** A cam means in the body member, an end of one of which is shown at **19** is operable to cam the spring fingers into electrical engagement with the terminal pins **11** after the same have been received in the openings **18.**

The body **15** itself may include parallel shoulders **20, 21** adjacent to its cable pins so that another identical plug body can be connected to the cable pins **16** in a "piggyback" arrangement if desired. Thus in instances where two multi-conductor cables include individual wires to be connected to the same terminal pins on a terminal block, such connections can readily be effected by simply adding a further plug to the additional cable and mounting the same on top of the plug body **15.**

Referring now to FIG. **2**, one of the cam means having the exposed end **19** described in FIG. **1** is shown in side elevational view. This structure comprises an elongated insulated member **22** adapted to run through the length of the body in a direction normal to the direction of the cable pins **16** in FIG. **1.** The other end of the cam means is designated **23** and is exposed at the other end of the body **15** of FIG. **1.** Each of the ends **19** and **23** includes screwdriver slots as will be evident from FIG. **1** so that the cam means may be rotated within the body **15.**

Referring to FIG. **3**, it will be noted that the cross-section of the elongated insulated member portion of the cam means is elongated in one direction. The member itself runs between adjacent pairs of rows of the spring fingers associated with the cable pins **16** such that rotation of the cam means about its own axis through 90° rotates the long dimension of the cross-section from a position parallel to the cable pins **16** to a position transverse to the cable pins.



The foregoing operation will be better understood by now referring to FIGS. **4** and **5.** In FIG. **4,** it will be evident that the interior of the body **15** is provided with enlarged cavities **24** and **25** communicating with the terminal pin receiving openings **18.** The cable pins **16** terminate within these cavities in spring fingers **26** and **27.** The position of the cam means **22** is such that it passes through the body between the cavities **24** and **25** and thus between the spring fingers **26** and **27.** Thus, the cable pins **16** associated with the spring fingers **26** and **27** may be considered a pair of rows of pins, the cam means passing between the pairs such that a single elongated cam means will be provided for each pair of rows as shown in FIG. **1.** Accordingly, a single cam means functions to connect the pins in two rows to the corresponding terminals, there being one half as many cam means as rows of pins.

Referring particularly to the spring fingers, it will be noted that the fingers bow inwardly towards the cam member as at **28** and **29** thence extend outwardly over the major portion of their lengths and finally turning inwardly adjacent their tips to define rounded contact surfaces as indicated at **30** and **31.**

In FIG. **4**, the position of the cam means **22** is shown in its unlocked state wherein the long dimension is vertical and generally parallel to the direction of the cable pins **16.** In this position, the biasing of the spring fingers is such that they snugly engage the cam means; that is, they are biased inwardly to leave the major areas of the cavities **24** and **25** free of any obstructions. Thus, there is no impediment to reception of the terminal pins within the openings **18**, these openings having their entrances beveled as at **34.** The positioning of these pins when completely inserted is indicated by the dotted lines.

Referring now to FIG. **5**, the cam means **22** is shown rotated 90° wherein it will be evident that the long dimension of the elongated cross-section configuration has resulted in a camming apart of the spring fingers **26** and **27** so that their contact surfaces **30** and **31** press firmly against the terminal pins **11** from the terminal block **10.**

Actually, it is desirable that the cam means be rotated slightly greater than 90° so that an overcentering action results as a consequence of the reverse bias pressure of the spring fingers against the ends of the cam means. Suitable stops to limit the rotation of the cam means are indicated at **32** and **33.**

The movement of the spring fingers upon operation of the cam means is such that a slight wiping action as well as a normal pressure occurs against the terminal pins by contact surfaces **30** and **31.** This wiping action as well as a sufficient contact or pressure force normal to the pins is necessary to assure a proper electrical connection. Since the spring fingers themselves are relatively long in a vertical direction and are moved transversely, there is substantial latitude to assure that a proper connection is made even though the terminal pins **11** may not be uniformly spaced on the terminal block.

## OPERATION

In operation, and as mentioned heretofore, the rapid connector body **15** is pre-wired to the individual ends of conductors in the multi-conductor cable **12** prior to the cable and plug being shipped to any remote central office wherein connections to terminal blocks are to be made.

Thus, in running and connecting cable in a central office it is only necessary for the workers to plug the plug bodies **15** into the terminal block **10**, there being provided as many plug bodies as necessary for the connections involved. In this respect, any one terminal block in the central office would ordinarily not require more than two plugs or rapid connectors such as **15** placed in end to end relationship to effect desired connections to all of the terminals. A typical plug body making up the rapid connector will accomodate 200 terminal block pins simultaneously.

The various cam means in the rapid connector bodies are positioned in their unlocked positions; that is, with the long dimension of the cross-section in a vertical direction or parallel to the cable pins **16** as depicted in FIG. **4**. The screwdriver slot may be aligned with the long dimension of this cross-section so that in the unlocked position of the cam means, the slots will always be vertical as shown in FIG. **1**. The body **15** can readily be positioned over the terminal board to receive the terminal pins **11**. Since the various openings and internal cavities are free of obstructions, there is very little friction involved when positioning the body **15** on the terminal board as described in conjunction with FIG. **4** notwithstanding the pins enter 200 openings simultaneously. The entrance beveling **34** of the openings assures reception of the pins even though some may be slightly misaligned. After the body has been seated on the terminal board, the operator will simply rotate the various cam means 90° or slightly greater than 90° to provide an overcentering action so that the spring fingers within the body are connected simultaneously to the terminal pins as shown and described in conjunction with FIG. **5**.

Since the ends of each of the cam means are exposed at each end of the rapid connector body **15**, should two bodies be arranged in tandem, it is still possible to operate the cam means of either body from the far ends.

As mentioned, further plugs can be "piggybacked" on top of the plug bodies described if dual connections are to be made to various terminal pins.

In the event any rewiring has to be done, it is a simple matter to remove the various connections to the terminals by simply rotating the cam means back into their vertical unlocked positions and then lifting the plug from the terminal block. Since no electrical contacts are effected during insertion or removal, not only is friction decreased while inserting or removing but in the event the plug is used in applications other than telephone work wherein high voltages may be involved, any arc and the like is avoided.

From the foregoing, it will be evident that the present invention has provided an improved rapid connector wherein problems associated with running and connecting cables heretofore encountered have been overcome.

What is claimed is:

**1.** A rapid connector for effecting electrical connection between individual wire ends from a multiconductor cable to terminal pins on a terminal block, comprising, in combination:

a. an insulative body having a plurality of wire receiving cable pins on one side for connection to the wire ends of said multiconductor cable and terminal pin receiving openings on its other side, said cable pins extending into said body and terminating in spring fingers adjacent to said terminal pin receiving openings;

b. cam means in said body for camming said spring fingers simultaneously into electrical contact with said terminal pins after said terminal pins have been received in said terminal pin receiving openings whereby a plurality of electrical connections between conductors in said multi-conductor cable and said terminal pins can be made rapidly and simultaneously by said rapid connector; and in which

c. said one side includes parallel shoulders running adjacent to said wire receiving cable pins defining a seat for accommodating an additional rapid connector in piggyback fashion, said cable pins being received in the pin receiving openings on the other side of said additional rapid connector.

**2.** A connector according to claim **1**, in which said insulative body includes enlarged internal cavities communicating with said pin receiving openings, said cam means extending between said cavities and said spring fingers terminating respectfully in said cavities and being biased against said cam means to one side of said cavities so that said cavities are cleared of any obstructions when receiving said terminal pins whereby friction when said terminal pins are received in said openings is minimized, operation of said cam means urging said spring fingers laterally towards the opposite sides of the cavities to thereby electrically engage said terminal pins and sandwich them between the spring fingers and opposite sides of the cavities.

**3.** A connector according to claim **2**, in which said insulative body includes 200 pin receiving openings, each of said openings having beveled entrance portions to facilitate initial insertion of the pins therein.

**4.** A connector according to claim **2**, in which said cam means comprises an elongated insulated member running through said body in a direction normal to the direction of the cable pins to pass between adjacent pairs of rows of spring fingers in said cavities, the cross-section of said member being elongated such that rotation of said member about its own axis through 90° rotates the long dimension of said cross-section from a position parallel to the cable pins to a position transverse to the cable pins whereby the ends of the long dimension of cross-section cam the spring fingers against said terminal pins.

**5.** A connector according to claim **4**, in which each of said spring fingers bows inwardly towards said cam member, thence extends outwardly over a major portion of its length then turns inwardly at its tip to define a rounded contact surface facing outwardly to engage a terminal pin, the movement of the spring finger upon operation of said cam means providing a wiping action as well as a normal pressure against the terminal pin by said contact surface.

**6.** A connector according to claim **5**, in which said cam member is rotatable slightly more than 90° so that an over-centering action takes place, the resiliency of said spring fingers holding the cam member in its locked position.

**7.** A connector according to claim **5**, in which said body includes a plurality of rows of cable pins, there being provided cam means between pairs of adjacent rows, the ends of said cam means being exposed at the ends of said body and including screw driver slot means for enabling rotation of the cam means from either end of said body.

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