Jan. 30, 1968 J. R. CHAMBERLIN, JR 3,366,844

REVERSIBLE CONNECTOR ARRANGEMENT

Filed Oct. 23, 1965 5 Sheets-Sheet 1

FIG. 1.

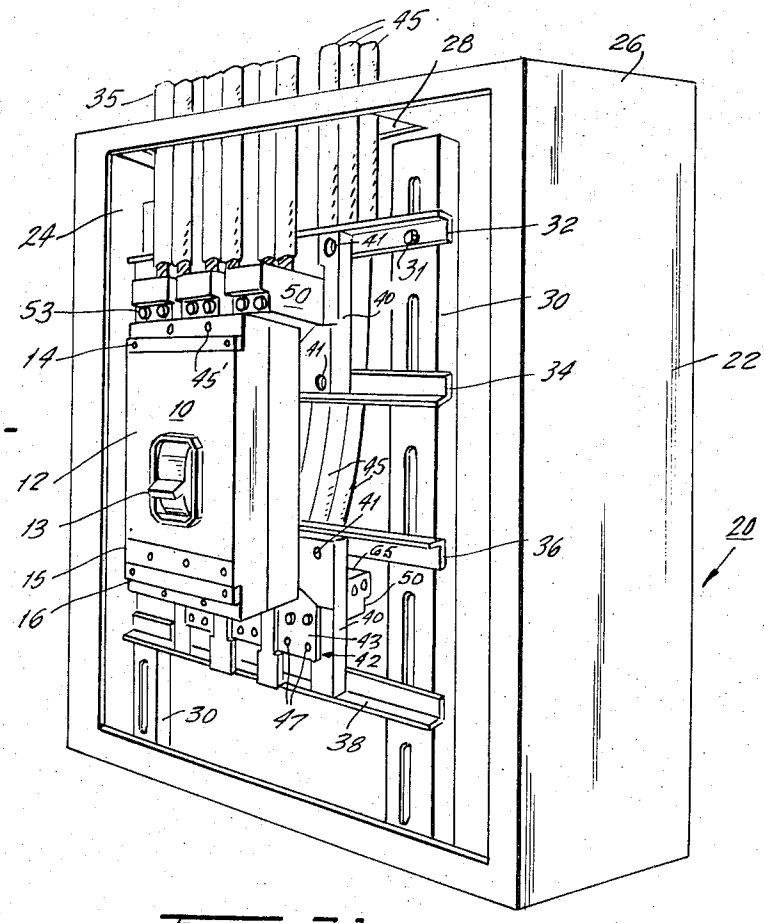


FIG. 11.

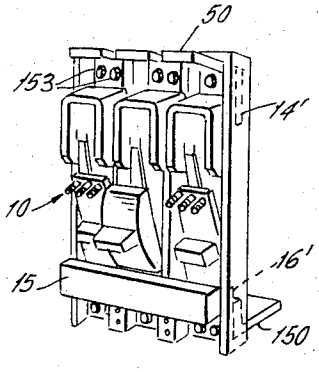
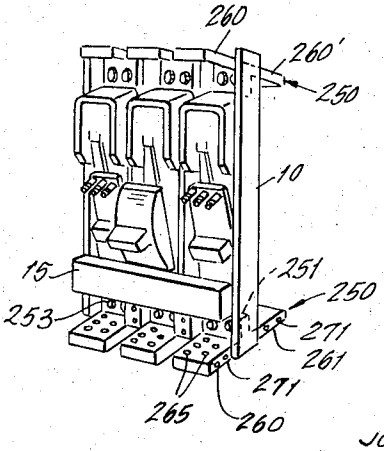


FIG. 21.



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Jan. 30, 1968 J. R. CHAMBERLIN, JR 3,366,844

REVERSIBLE CONNECTOR ARRANGEMENT

Filed Oct. 23, 1965 5 Sheets-Sheet 3

FIG. 5.

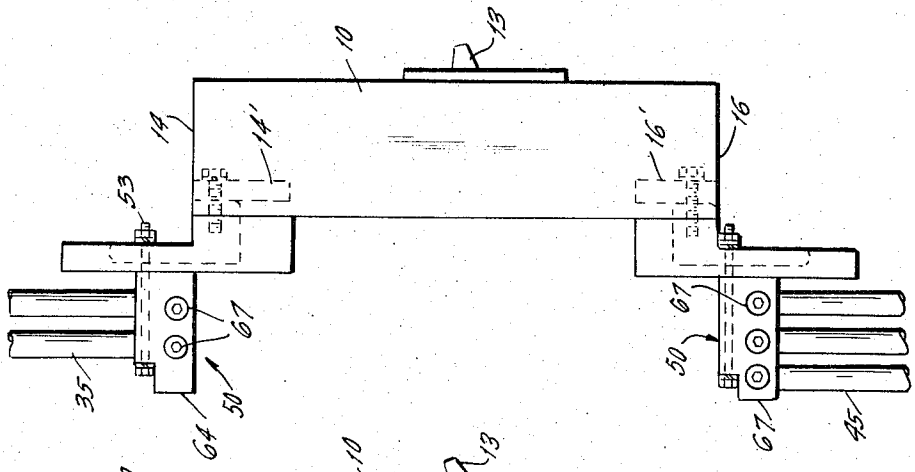


FIG. 4.

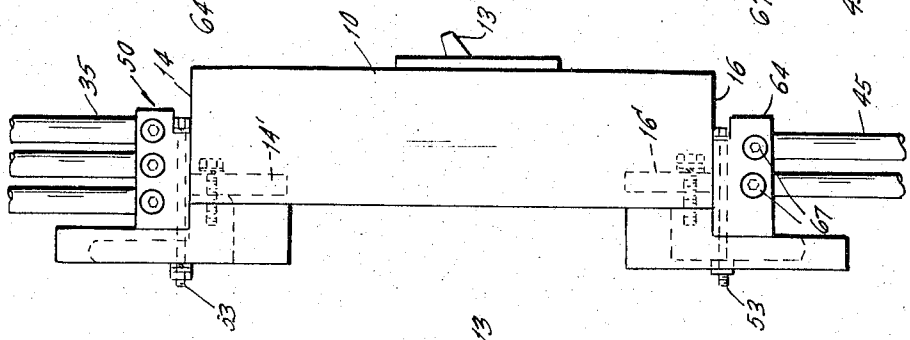


FIG. 3.

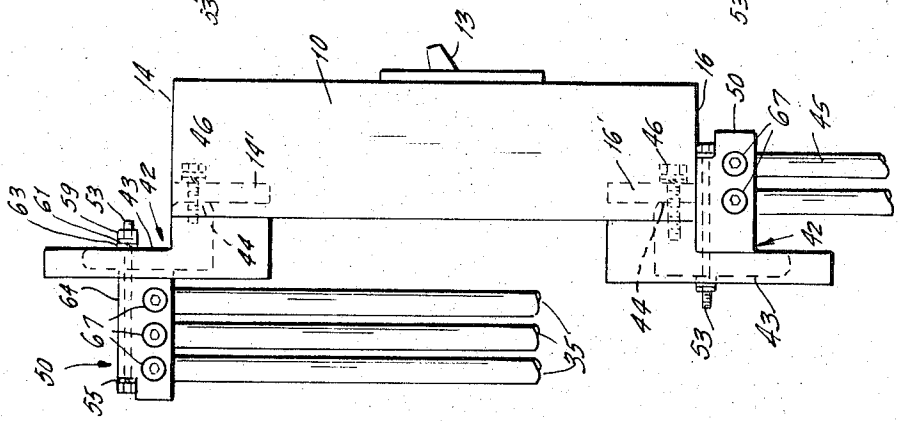
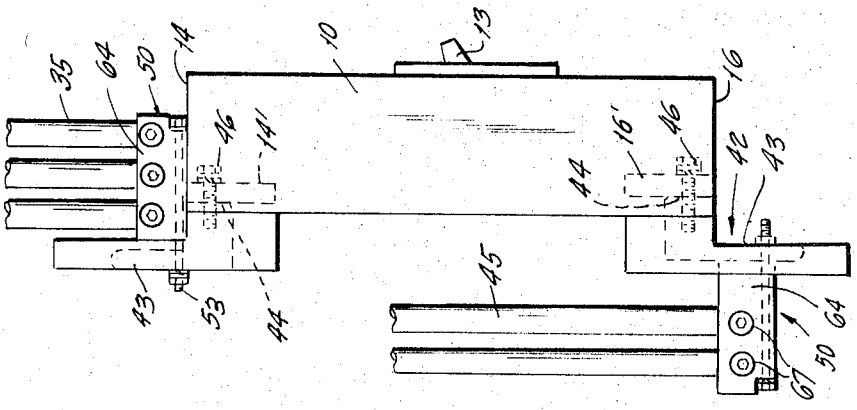


FIG. 2.



Jan. 30, 1968 J. R. CHAMBERLIN, JR 3,366,844

REVERSIBLE CONNECTOR ARRANGEMENT

Filed Oct. 23, 1965 5 Sheets-Sheet 3

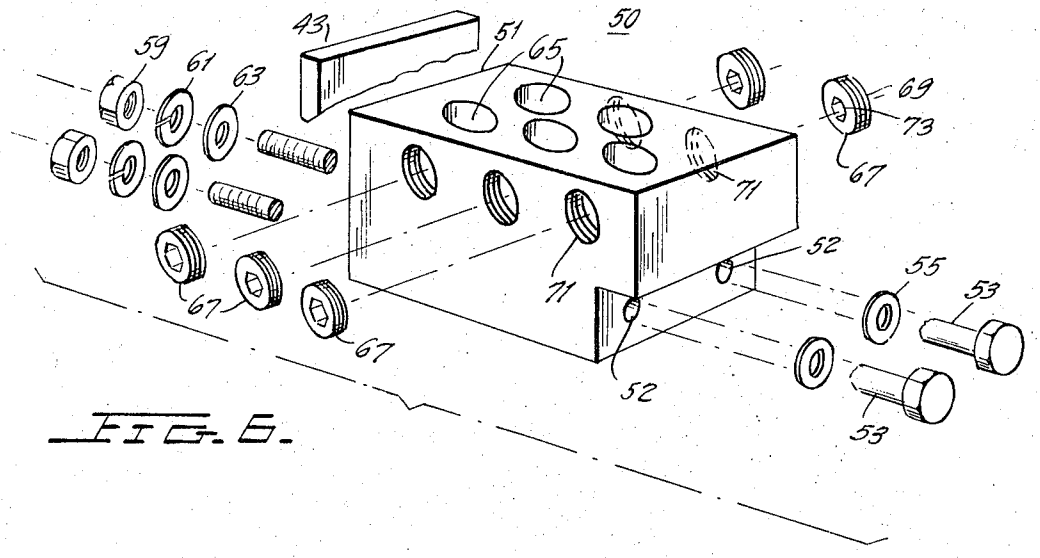


FIG. 6.

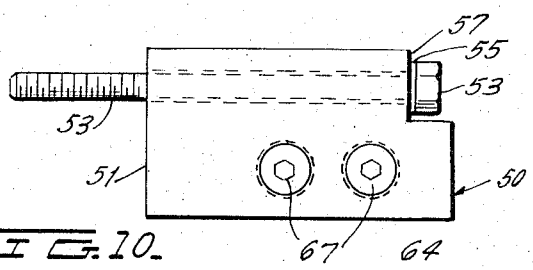


FIG. 10.

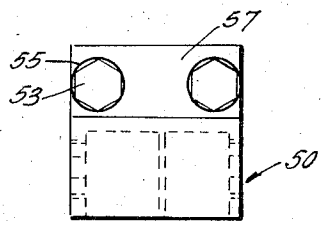


FIG. 9.

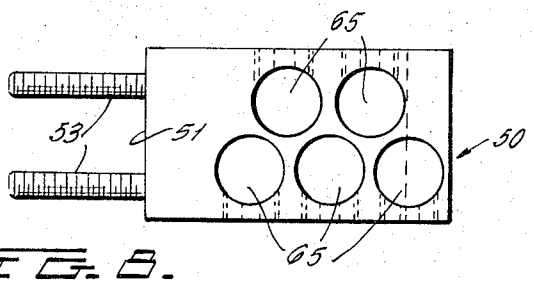


FIG. 8.

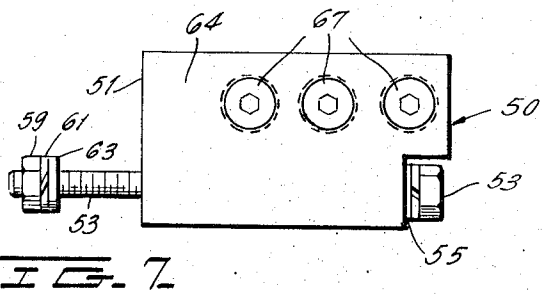


FIG. 7.

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Jan. 30, 1968 J. R. CHAMBERLIN, JR 3,366,844

REVERSIBLE CONNECTOR ARRANGEMENT

Filed Oct. 23, 1965 5 Sheets-Sheet 4

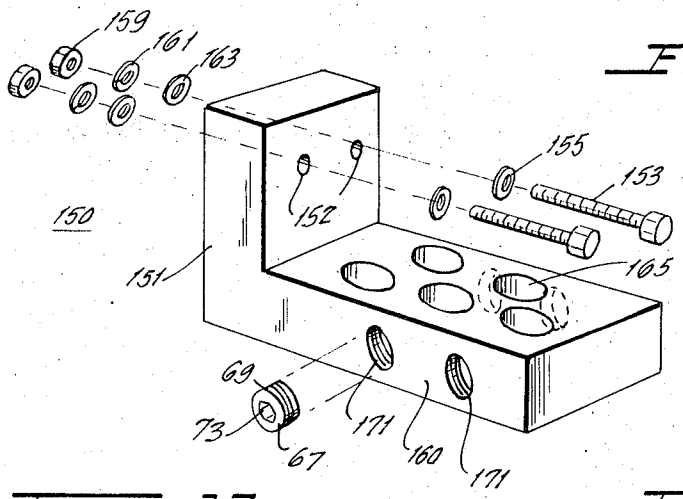


FIG. 12.

FIG. 13

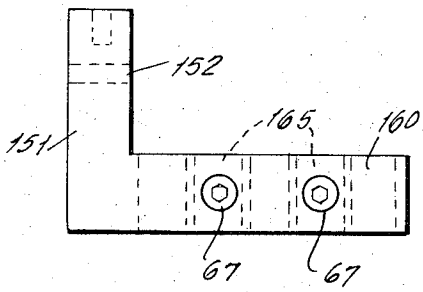
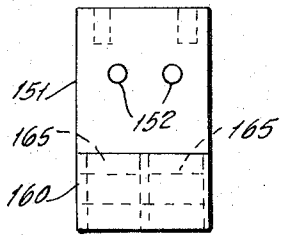


FIG. 15.



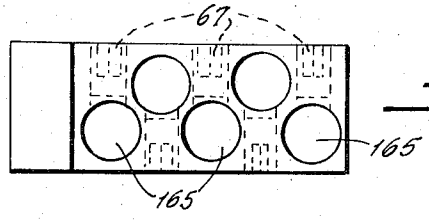
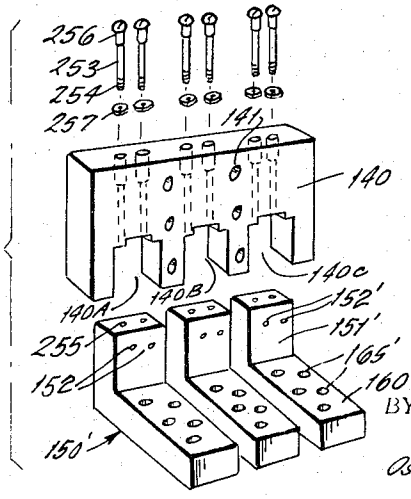


FIG. 14.

FIG. 20.



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Jan. 30, 1968 J. R. CHAMBERLIN, JR 3,366,844

REVERSIBLE CONNECTOR ARRANGEMENT

Filed Oct. 23, 1965 5 Sheets-Sheet 5

FIG. 19.

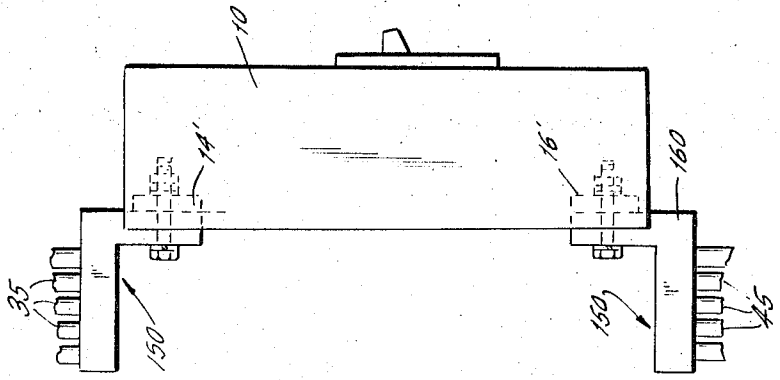


FIG. 18.

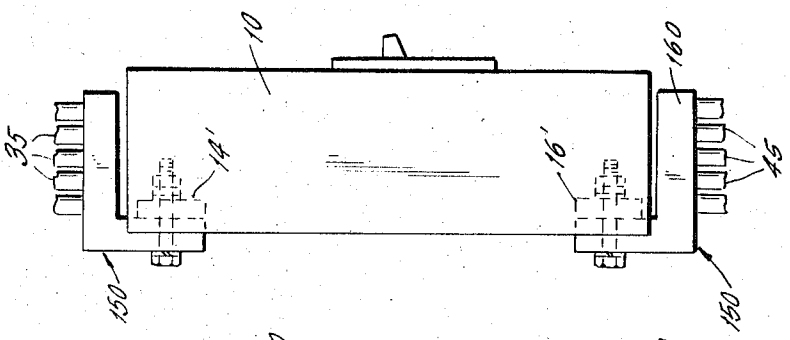


FIG. 17.

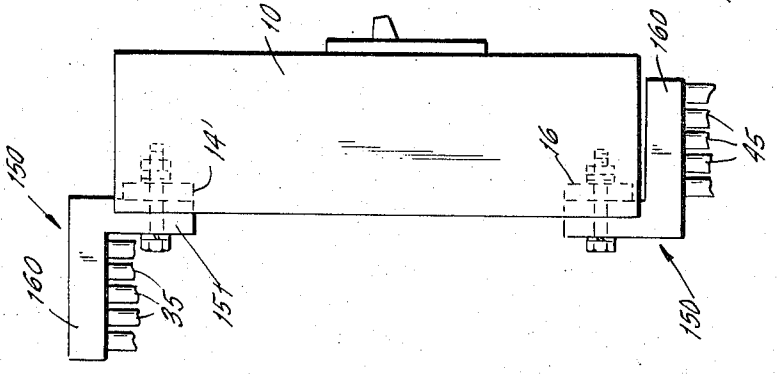
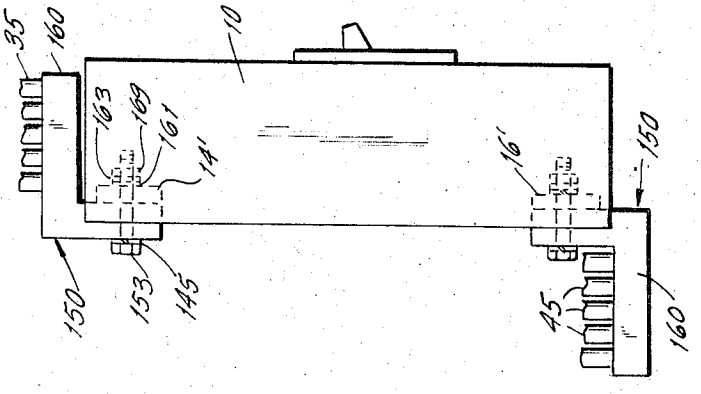


FIG. 16.



United States Patent Office

3,366,844

Patented Jan. 30, 1968

3,366,844

REVERSIBLE CONNECTOR ARRANGEMENT

John R. Chamberlin, Jr., Bryn Mawr, Pa., assignor to I-T-E Circuit Breaker Company, Philadelphia, Pa., a corporation of Pennsylvania

Filed Oct. 23, 1965, Ser. No. 503,320
15 Claims. (Cl. 317—99)

ABSTRACT OF THE DISCLOSURE

An arrangement for electrically connecting the longitudinally displaced terminals of an electrical switching device (such as a circuit breaker) to the externally remote circuitry, which provides substantially straight line paths for the connecting cables, and thereby avoids the need to loop the cables. An intermediary connecting means is utilized which may be selectively orientated to accommodate a variety of cable routes.

My invention relates to improvements in the manner in which external circuit connections are made to the longitudinally spaced terminals of an electrical switching device, and more particularly to the utilization of a novel connector, intermediate the line and load terminals of a circuit breaker device and the external connections thereto, such that conductor runs may be made from either end of the mounting enclosure without the need for conductor looping.

The installation of electrical switching devices, as for example circuit breakers of the multi-phase variety, is conventionally made to a support structure which rigidly mounts the circuit breaker and provides access for reception of the line and load connections thereto. Such circuit breaker units generally include line and load terminals at their opposed housing ends, which when mounted to the support structure will be located at opposite ends thereof (e.g., the upper and lower ends respectively of the supporting enclosure). These terminals must, in turn, be connected to the external circuitry, typically by wires or cables. Because of various factors relating to the convenient routing of such cables, it is oftentimes necessary to bring in both the line and load conductors from same end of the enclosure. For example, considering an arrangement where a circuit breaker unit is vertically oriented, such that its line terminals are at the upper end of the enclosure, and its load terminals are at the lower end of the enclosure, a situation may be typically encountered where all the external conductor cables must be brought in from the upper end of the enclosure. While this would permit convenient interconnection to the adjacently located circuit breaker line terminals, the interconnection of the load cables to the circuit breaker load terminals has oftentimes required looping or bending of the cable about the circuit breaker unit.

In the larger frame size breakers, as for example of the type shown and discussed in copending U.S. patent application entitled "Circuit Breaker Contact Mounting," Ser. No. 430,549, filed Feb. 5, 1965, now Patent No. 3,268,703, in the name of Carl E. Gryctko and assigned to the assignee of the instant invention, it is oftentimes necessary to provide a plurality of conductor cables, each

of an appreciable thickness and rigidity, at each of the circuit breaker terminal connections. The bending of such cables is rather cumbersome and space-consuming, thereby complicating the installation of the circuit breaker to its external circuitry, and requiring a larger enclosure volume than would otherwise be necessary.

My invention avoids this problem by the introduction of a novel intermediary connecting means between the circuit breaker terminals and the external conductors. Such intermediary connecting means is constructed such that the external circuit conductor means for both the line and load terminals of the circuit breaker may enter at one end of the enclosure and be directly routed to their individual terminal locations along a continuously straight path.

More specifically, such intermediary connecting means include integrally formed first and second portions. The first portion abuts its respective circuit breaker terminal and is secured thereto. The second portion transversely extends to a region whereat it may conveniently receive the external circuit conductor. As for example, considering the above discussed arrangement wherein both the line and load conductors are brought in from the upper side of the enclosure, the connecting means at the upper or line terminal side will have their second portions transversely extend in a forward direction to generally overlie the volume defined by the circuit breaker housing. The connecting means at the opposed load end of the circuit breaker will have their second portions rearwardly extending, beyond the volume defined by the circuit breaker housing and immediately adjacent thereto. Thus, the external cables to the load end may be directly routed behind the circuit breaker housing, thereby avoiding the need to loop them about the load end of the circuit breaker, as had been previously required.

The versatility of my invention similarly permits the individual connecting means at the line and load ends to be reserved so as to conveniently permit the entry of all the conductor cables from the lower or load end of the enclosure unit. More specifically, the connecting means at the circuit breaker load end will now be orientated to forwardly extend over the circuit breaker load end, such that their external conductor cables are routed thereto while overlying the volume defined by the circuit breaker housing. Alternatively, the connecting means at the opposed line end of the circuit breaker are now orientated such that their second portions extend rearwardly, free from the circuit breaker housing, such that the external cables may be directly routed along a straight line path behind the circuit breaker unit.

Advantageously, my invention provides still further versatility in the manner in which the cables may be routed to the respective circuit breaker terminals, under those conditions where they are brought in at their respective ends of the enclosure. That is, the connecting means may be orientated such that the cables connect to either a forward or rear region of the circuit breaker housing, thereby minimizing the need for deviating from a straight line path between the point of cable entry and the point where the cable is attached to its respective circuit breaker terminal connecting means.

In accordance with one form of my invention, the circuit breaker unit is mounted to line and load end support assemblies of the type which is the subject of copending

U.S. patent application entitled Circuit Breaker Mounting Arrangement Including a Base Support Member for Bolt Connecting the Circuit Breaker Terminals to an External Circuit, Ser. No. 503,185, filed Oct. 23, 1965, in the name of John C. Brumfield and assigned to the assignee of the instant invention. The support structure of that invention includes a mounting block assembly, having an insulative base support member separated into adjacent compartments, corresponding to the number and inter-pole spacing of the circuit breaker for which it is intended to be used. Each of the adjacent compartments contains an electrically conductive strap, having a portion of suitable configuration to mate with the individual pole terminal of the circuit breaker device, and another portion of suitable configuration to receive the novel intermediary connecting means of the instant invention. These connecting means may either be mounted to the forward or the rear surface of the electrically conductive strap, such that their transversely extending cable receiving portions are positioned forward or rearward of the circuit breaker housing, in proper cooperative relationship with the external routing of such cable conductors.

In accordance with another form of my invention, the intermediary connecting means may be directly mounted to the circuit breaker terminals. Such connecting means may be of an L-shaped configuration, with the arm of the L abutting the circuit breaker terminal and the leg of the L orientated to rearwardly or forwardly extend, according to the particular installation requirements. In a modification of this embodiment, the need to reorientate the conductor depending upon the manner in which the connections are to be made to the external cables, may be avoided by forming the connecting means of a generally T-shaped configuration, with the arms of the T transversely extending in respective forward and rearward directions, so as to permit reception of the cables at either of these locations.

It is therefore a principal object of my invention to provide an improved means for connecting external circuit conductors to longitudinally separated terminals of an electrical switching device.

Another object of my invention is to provide a connecting means which may be approximately positioned to accommodate straight line runs of connecting cable between a point of entry at either end of the circuit breaker supporting structure and the opposed line and load terminal means.

A further object of my invention resides in the provision of a novel connecting means which permits a plurality of interconnection arrangements between external circuit conductors and the opposed line and load ends of a circuit breaker device, without the need to loop cables within the enclosure support.

An additional object of my invention resides in the combination of an electrical switching device, its support structure and an individual connecting means at the respective switching device terminals located at the opposed end thereof, characterized in that the external circuit conductors may enter at the same end of the support structure and be directly routed to their designated connecting means along continuously straight paths.

Still another object of my invention is to provide such a combination, wherein the connecting means includes a first portion in abutting relationship with its respective switching device terminal means and a second portion positionable to transversely extend either rearward or forward from the circuit breaker terminal location.

Still a further object of my invention is to provide such a combination wherein the individual connecting means are directly connected to the circuit breaker terminals.

Still an additional object of my invention is to permit the novel connecting means to be used in conjunction with a mounting block assembly, which is both mechanically and electrically connected to the circuit breaker unit independent of the external circuit connections thereto.

These as well as other objects of my invention will become readily apparent upon a consideration of the following description and drawings in which:

FIG. 1 is a perspective view showing a three phase circuit breaker unit mounted within its individual enclosure and circuit connected in accordance with one form of my invention.

FIGS. 2–5 are side views showing the various ways which the connecting means of the instant invention may be orientated to accommodate the particular cable routing requirements. In FIG. 2 (as in FIG. 1) all the cables are brought in from the upper end of the enclosure, in FIG. 3 all the cables enter from the lower end of the enclosure; in FIG. 4 the cables are brought in from respective upper and lower ends of the enclosure, along the front surface thereof; and in FIG. 5 the cables are also brought from their respective upper and lower ends of the enclosure, but along the rear surface thereof.

FIG. 6 is an exploded view of the form of my invention shown in conjunction with FIGS. 1–5 above.

FIGS. 7, 8, 9 and 10 are front, top, end and rear views of the connecting means shown in FIG. 6.

FIG. 11 is a perspective view, showing another form of my invention, directly mounted to the circuit breaker terminals.

FIG. 12 is an exploded perspective view of the connecting means utilized in FIG. 11.

FIGS. 13, 14 and 15 are side, top and end views respectively, of the connector means shown in FIG. 12.

FIGS. 16–19 show the connecting means of FIGS. 13–15 in the various orientations corresponding to previous FIGS. 2–5.

FIG. 20 is still another arrangement in accordance with my invention, showing a connecting means similar to that of FIGS. 12–15 above, used in conjunction with circuit breaker mounting block assembly.

FIG. 21 is another modification of my invention, in which the connecting means need not be re-orientated to accommodate the various cable alternatives.

Referring initially to FIG. 1, the circuit breaker unit **10** to which the external connections are to be made, in accordance with the inventive concept of my invention, is illustratively shown as a three pole device, of the general type which is the subject of U.S. patent application Ser. No. 430,549, to which reference is made for a more complete description of its operation. It should be understood, however, that this circuit breaker device is merely shown for illustrative purposes. The novel connecting arrangement of the instant invention may be practiced in conjunction with numerous other types of electrical switching apparatus, including longitudinally spaced terminals which had previously required the looping of cables under certain installation conditions.

Circuit breaker unit **10** includes a housing **12** and a manual operating handle **13** for moving the circuit breaker contacts between their ON and OFF positions, as well as a trip unit assembly, generally shown as **15**, for initiating interruption of the circuit breaker contacts in the conventional manner, when subjected to a predetermined fault condition. The individual pole line terminals **14'** are located at one end of the housing, generally shown as **14**, with the individual pole load terminals **16'** being located at the longitudinally spaced opposed end of the housing **12** generally shown as **16**. Circuit breaker **10** is mounted within enclosure **20**, such that it is vertically orientated with its line side **14** at the upward region of the enclosure and its load side **16** at the bottom region of the enclosure.

Circuit breaker **10** is of the larger frame size variety of commercially available molded case circuit breaker units, and may typically be designed to carry 1600 amperes steady-state, at 600 volts, with an interruption capacity upwards of 75,000 volts. As such, the external circuit conductors to the terminals thereof, generally shown by cables **35** and **45**, are of an appreciable thickness, and

preferably comprise a plurality of individual cables at each of the terminal connections. The weight of circuit breaker **10** will be quite substantial, with the particular frame size shown being in the order of 50 pounds. Hence, a firm rigid and mechanically secure mounting arrangement is required for maintaining the circuit breaker in its desired location. This may take the form of bolt means directly securing the breaker to the enclosure. However, the particular arrangement shown in FIG. 1 utilizes individual mounting block assemblies **40**, which is the subject of copending U.S. patent application entitled Circuit Breaker Mounting Arrangement Including a Base Support Member for Bolt Connecting the Circuit Breaker Terminals to an External Circuit, Ser. No. 503,185. The upper mounting block assembly **40** is secured to transverse angle members **32**, **34** as by appropriate bolt means (not shown) extending into recessed openings **41** thereof. Similarly, the lower mounting block assembly is secured to transverse angle members **36**, **38** by similar bolt means extending into its recessed openings **41**. Transverse angle members **32**, **34**, **36**, **38** are appropriately secured to longitudinal bracing members **30**, as by bolt means **31**, with bracing members **30** being secured, as by welding, to the side walls **22**, **24** of the enclosure **20**.

The mounting block assemblies **40** include individual phase conducting members **42**, to which the individual circuit breaker terminals **14'** or **16'** are mechanically and electrically secured at **44**, as by bolt means **46** (see FIGS. 2–5), with additional bolt means (not shown) extending through housing aperture **45'** and into threaded recess of the mounting block for further securably mounting the breaker **10** to the respective mounting block assemblies **40** located at the line and load ends **14**, **16** thereof. The individual phase connecting means **42** include an external circuit connecting portion **43**, to which the novel intermediary connecting means **50** of the instant invention is secured. However, my invention may also be practiced with connecting means **50** suitably contoured for direct mounting to the circuit breaker terminals **14**, **16'**, without the need for the mounting assemblies **40**. However, such mounting assemblies **40** provide the additional advantage of permitting mounting independence between the connection to the circuit breaker terminals **14'**, **16'** and the cables **35**, **45**, as is fully discussed in aforementioned copending application Ser. No. 503,185.

Referring further to FIGS. 6–10, intermediary connecting means **50** includes a lowermost surface **51**, which abuts against external circuit connecting portion **43** of the individual terminal strap means **42**. A pair of openings **52** extend through the length of one portion of the connecting means **50**, emerging at surface **51**, and having a spacing corresponding to the lateral spacing between opening **47** of the terminal strap means portion **43**. Opening **52** receives a bolt means **53**, which extends therethrough and into openings **47** for securably mounting the connecting means **50** to terminal strap **42**, with the additional provision of a flat washer **55** located intermediate the head of bolt **53** and the uppermost surface **57** at one end of opening **52**. The forward end of bolt means **53** extends through terminal strap means opening **47**, and is tightened at the other side of the strap means by nut means **59**, lock washer **61** and flat washer **63**.

Longitudinally adjacent the portion of the connecting means **50**, which contains fastening bolts **53**, is a cable receiving portion **64** which includes a plurality of openings **65** for the reception of the external circuit connecting cables, such as **35** or **45**. Tightening inserts **67**, having an external thread **69**, which mates with threaded openings **71** are provided transversely adjacent each of the openings **65**, and communicating therewith. Inserts **69** further include a central hexagonally shaped opening **73** for the reception of a convenient tightening tool, such that the movement thereof into its respective cable receiving openings **65** firmly grasp the side of the received cable so as to maintain a tight reception thereof.

It is thus seen that the circuit connection is as follows: the circuit breaker terminals **14** and **16'** are electrically connected to terminal receiving portion **44** of the individual terminal strap means **42**. The conducting strap integrally includes a further portion **43** for receiving the connecting means **50** of the instant invention. Connecting means **50** in turn is circuit connected intermediate terminal strap portion **43** and the external circuit conductors such as cables **35**, **45**, to complete the circuit to terminals **14'**, **16'**.

FIG. 1 denotes an installation situation where it is desired that both the line cables **35** and load cables **45** enter the enclosure **22** through opening **28** situated at the top surface thereof. The connecting means **50** at the upper or line end of the circuit breaker enclosure are connected to the forward surface of strap portion **43**, such that the cable receiving portion **64** thereof forwardly projects to generally overlie the volume defined by circuit breaker housing **12**. The connecting means **50**, positioned at the opposed load end **16** of the circuit breaker, are mounted to the rear surface of terminal conducting strap portion **43**, such that the cable receiving portion **64** thereof rearwardly projects beyond, and immediately adjacent, the volume defined by the circuit breaker housing **12**. Hence, the cable runs **45** may pass immediately behind the circuit breaker, along a continuously straight path, into the respective cable receiving openings **65** of the individual load terminal connecting means **50**. The cable runs **35** to the line end **14** also translate a straight line path from the point of entry at opening **28** into their respective cable receiving openings **65** of the connecting means **50** located at the line or upper end of the circuit breaker housing **12**. It should be noted at this point that were it not for the utilization of intermediary connecting means **50** at the load end of the circuit breaker **10**, it would have been necessary to loop the cables about the lower end of the circuit breaker. This typical prior art technique has caused installation difficulties, especially where the load values require substantial thickness cables. Also, an increased depth of enclosure had been previously required to accommodate the looped region of the cable.

Reference is now made to FIGS. 2–5, which show the manner in which the reorientation of my novel connecting means **50** provides increased versatility of cable connections.

FIG. 2 corresponds to the situation illustrated in FIG. 1. Namely, both the line and load cables **35**, **45** respectively enter the enclosure from above the circuit breaker **10**. As such, the connecting means **50** at the upper or line end **14** of circuit breaker **10** are connected to terminal connecting strap **42**, such that its transverse cable portion **64** forwardly projects, in a manner generally overlying the volume defined by the circuit breaker housing **12**. Conversely, the connecting means **50** located at the opposed bottom or load end **16** of the circuit breaker **10** is mounted to the rear end of terminal connecting strap **42**, such that it rearwardly projects beyond the volume defined by the circuit breaker housing, so as to provide an unobstructed path behind the circuit breaker unit **10** for the straight line routing of its cable conductors **45**.

FIG. 3 refers to the reverse situation, where both the line and load cables **35**, **45** enter from the bottom or load end **16** of circuit breaker **10**. It will be noted that the location of connecting means **50** have now been reversed, such that the connecting means **50** at the load end, adjacent where the cables enter, now forwardly projects over the volume of the circuit breaker **10**, and the connecting means **50** at the opposed or line end **14** now rearwardly project beyond the circuit breaker volume. An unobstructed region immediately behind the circuit breaker unit is now provided for the straight line routing of line connecting cables **35** from the bottom end of the enclosure to the external cable connection portion **64** of its individual connecting means **50**.

FIGS. 4 and 5 refer to situations wherein the respective line and load cables **35**, **45** enter the housing ends immediately adjacent their respective locations. However, in FIG. 4 it is desirable that the cables be brought in from the front portion of the circuit breaker unit **10** and in FIG. 5 it is desirable that the cable be brought in from the rear portion of the circuit breaker **10**. Hence, in FIG. 4 both of the connecting means **50** at the line and load ends **14**, **16** respectively are mounted to the forward surface of their individual terminal connecting straps **42**, such that their cable receiving portions **64** forwardly project in front of the circuit breaker terminals **14'**, **16'**, In FIG. 5 both the line and load terminal connecting means **50** are positioned against the rear surface of their respective terminal conducting straps **42**, such that their cable receiving portions **64** are located behind the circuit breaker unit. It may be naturally understood that the arrangements of FIGS. 4 and 5 may be intermixed, according to the particular requirements of the enclosure installation, such that with the cable connections entering the enclosure from their respective sides, either one of the line or load terminal connections may be made forward of the circuit breaker **10** and the other may be made to the rear of the circuit breaker **10**.

Reference is now made to FIGS. 11–15 with respect to another form of my invention, utilizing an L-shaped connecting means **150**, which is adapted to be directly mounted to the circuit breaker terminals, as shown in perspective FIG. 11. Connecting means **150** is of a generally L-shaped configuration, having an arm portion **151** and a leg portion **160**. Arm portion **151** includes a pair of openings **152**, having a spacing corresponding to the spacing between the openings of the circuit breaker terminals **14'**, **16'**. Bolt means **153** extends through opening **152** for firmly securing the arm portion **151** against its respective circuit breaker terminal **14'** or **16'**. Flat washer **155** is interposed intermediate the head of bolt **153** and the top surface of arm portion **151**, with flat washer **163**, lock washer **161** interposed between nut member **159** and the respective circuit breaker terminal means **14'** or **16'** respectively.

The leg section **160** of connecting means **150** includes a plurality of cable rceiving openings **165**, which transversely communicate with locking apertures **171**. Locking apertures **171** receive tightening inserts **67**, having an external thread **69** which mates with the internal thread of locking opening **171**. Threaded inserts **67** further include a central hexagonal opening **73**, such that they may be urged by an appropriate tool transversely into their respective cable receiving openings **165**, for hightly maintaining the cable within such opening.

Reference is now specifically made to FIGS. 16–19, which show the various ways in which connecting means **150** may be orientated to accommodate the entry of line connecting cable **35** and load connecting cables **45** from their respective ends of the mounting enclosure. It is to be noted that the orientation shown in these figures corresponds to that shown in FIGS. 2–5 discussed in conjunction with the previous embodiment of my invention. Namely, in FIG. 16, both the line and load cables **35**, **45** respectively are received from above the enclosure. As such the arm portion **151** of L-shaped connecting means **150** is connected to line terminal **14'** such that its leg section **160**, to which the cables **35** are connected forwardly extends to overlie the circuit breaker volume. Conversely, the connecting means **150** at the load side of the circuit breaker is connected to load terminal **16'**, such that its leg section **160** rearwardly extends behind the circuit breaker unit.

In FIG. 17, wherein the line and load cables **35**, **45** respectively enter from the bottom portion of the enclosure, the location of the respective connecting means **151** has been reversed. Namely, the connecting means at the upper or line end of the circuit breaker is connected to its terminal **14'**, such that it rearwardly extends behind the circuit breaker and the connecting means at the load end is connected to its terminal **16'**, such that it forwardly extends to overlie the circuit breaker housing.

In FIGS. 18 and 19, wherein the line and load cables **35**, **45**, enter from their respective ends of the enclosure, the connecting means **150** are first shown orientated such that the cables may conveniently enter from in front of the circuit breaker unit **10**, and in FIG. 19, such that the cables are directed to the rear of circuit breaker **10**.

FIG. 21 shows another form of my invention, corresponding closely to that shown in conjunction with FIG. 11, but wherein the connecting means **250** is of a T-shaped configuration. Connecting means **250** includes a body portion **251**, which is appropriately bolted by **253** to the terminals of circuit breaker unit **10**. The top of the T **260** includes a portion **260'** which transversely extends in a forward direction from the interconnection to its respective body portion **251**, and another portion **261'**, which rearwardly extends from body portion **251**. A plurality of cable receiving openings **265** are located along the top of the T, with there being a similar plurality of communicating tightening apertures **271**, which include insert **67**. Hence, with the connecting means **250** positioned as shown, there will be a cable receiving portion thereof (**260**, **261**) extending both forward and rearward of the circuit breaker terminal means. Hence, the various interconnections shown in FIGS. 16–19 may be accomplished without reorientating the connecting means **250**.

FIG. 20 shows another modified form of my invention, wherein the generally L-shaped connecting means of FIGS. 12–15 is modified and shown as **150'**, such that it is mounted to an intermediate supporting block **140**. Block **140** serves a function similar to that shown by supporting block **40** of FIG. 1. Block **140** is divided into compartments **140**–A, **140**–B and **140**–C, adapted to receive the individual phase connecting means **150'**. These individual phase connecting means **150'** are connected to the insulative support block **140** by elongated bolt members **253**, which have a forward threaded end **254** for threaded engagement with tapped apertures **255** of the connecting member **150'**. A shouldered portion **256** is provided adjacent the head of bolt **253**, to receive a split ring lock washer member **257** for resiliently mounting the individual connecting means **150'** to the insulative support block **140**, in the manner discussed in aforementioned U.S. patent application Ser. No. 503,185. Mounting block **140** is connected to the transverse support angles **32**, **34**, **36**, **38** (as shown in FIG. 1) as by appropriate bolt means (not shown) extending through openings **141** thereof. The terminals **14'**, **16'** of the circuit breaker are respectively connected to openings **152** of the connecting means **150'**. As shown, the connecting means cable connecting portion **160'** will forwardly extend over the body of the circuit breaker unit. However, connecting means **150'** may be reversed and connected to the rear side of the circuit breaker terminal, such that portion **160'** will extend rearward of the circuit breaker, so as to accommodate a cable connection routed in this region in the manner shown in FIGS. 16 and 17 above.

It is therefore seen that my invention provides an improved mounting arrangement for interconnecting external conductors to longitudinally spaced terminals of an electrical switching device (such as a circuit breaker unit) which will permit convenient routing of the cables to the respective terminals along a continuously straight line path.

Although there has been described a preferred embodiment of this novel invention, many variations and modifications will now be apparent to those skilled in the art. Therefore, this invention is to be limited, not by the specific disclosure herein, but only by the appending claims.

The embodiments of the invention in which an exclusive privilege or property is claimed are defined as follows:

1. In combination with an electrical switching device including at least one pair of longitudinally spaced first and second terminal means for connection to externally remote circuitry,

a support structure for rigidly mounting said electrical switching device, with said first and second terminal means accessible for connection to the externally remote circuitry, while said first and second terminal means are located at first and second longitudinally spaced ends of said support structure,

first and second individual connecting means for electrically interconnecting said first and second terminal means to the externally remote circuitry,

each of said connecting means including an external circuit conductor means extending between said support structure and the remotely located external circuitry, and an intermediary connecting means between said external circuit conductor means and said support structure,

said intermediary connecting means including a first portion for electrical connection to said terminal means and a second portion for receiving said external circuit conductor means,

means for positioning said intermediary connecting means in a first position such that the second portions of both said first and second intermediary connecting means are in an unobstructed substantially straight line path to said first end of said support structure, such that the external circuit conductor means for connection to both said first and second intermediary connecting means enter said first end of said support structure and are directly routed to their intermediary connecting means along substantially straight line paths.

2. In combination with an electrical switching device including at least one pair of longitudinally spaced first and second terminal means for connection to externally remote circuitry,

a support structure for rigidly mounting said electrical switching device, with said first and second terminal means accessible for connection to the externally remote circuitry, while said first and second terminal means are located at first and second longitudinally spaced ends of said support structure,

first and second individual connecting means for electrically interconnecting said first and second terminal means to the externally remote circuitry,

each of said connecting means including an external circuit conductor means extending between said support structure and the remotely located external circuitry, and an intermediary connecting means between said external circuit conductor means and said support structure,

said intermediary connecting means including a first portion for electrical connection to said terminal means and a second portion for receiving said external circuit conductor means,

means for positioning said intermediary connecting means in a second position, such that the second portions of both said first and second intermediary connecting means are in an unobstructed substantially straight line path to said second end of said support structure, such that the external circuit conductor means for both said first and second intermediary connecting means enter said second end of said support structure and are directly routed to their intermediary connecting means along substantially straight line paths.

3. In combination with an electrical switching device including at least one pair of longitudinally spaced first and second terminal means for connection to externally remote circuitry,

a support structure for rigidly mounting said electrical switching device, with said first and second terminal means accessible for connection to the externally remote circuitry, while said first and second terminal means are located at first and second longitudinally spaced ends of said support structure,

first and second individual connecting means for electrically interconnecting said first and second terminal means to the externally remote circuitry,

each of said connecting means including an external circuit conductor means extending between said support structure and the remotely located external circuitry, and an intermediary connecting means between said external circuit conductor means and said support structure,

said intermediary connecting means including a first portion for electrical connection to said terminal means and a second portion for receiving said external circuit conductor means,

means for selectively positioning said intermediary connecting means in either a first or second position, said first position characterized as placing the second portions of both said first and second intermediary connecting means in an unobstructed substantially straight line path to said first end of said support structure, and said second position characterized as placing the second portions of both said first and second intermediary connecting means in an unobstructed substantially straight line path to said second end of said support structure, such that in said first position, the external circuit conductor means for connection to both said first and second intermediary connecting means enter said first end of said support structure and are directly routed to their individual intermediary connecting means along continuously straight line paths, and in said second position the external circuit conductor means for connection to both said first and second intermediary connecting means enter said second end of said support structure and are directly routed to their individual intermediary connecting means along substantially straight line paths.

4. In combination with an electrical switching device including at least one pair of longitudinally spaced first and second terminal means for connection to externally remote circuitry,

a support structure for rigidly mounting said electrical switching device with said first and second terminal means accessible for connection to the externally remote circuitry, while said first and second terminal means are located at first and second longitudinally spaced ends of said support structure,

first and second individual connecting means for electrically interconnecting said terminal means to the externally remote circuitry,

each of said connecting means including an external circuit conductor means extending between said support structure and the remotely located external circuitry, and an intermediary connecting means between said external circuit conductor means and said support structure,

said intermediary connecting means including a first portion for electrical connection to said terminal means and a second portion for receiving said external circuit conductor means,

means for selectively positioning said intermediary connecting means, such that the second portions of both said first and second intermediary connecting means are in an unobstructed substantially straight line path to one of the ends of said support structure, such that the external circuit conductor means for both said first and second intermediary connecting means enter at one end of the support structure and are directly routed to their individual, and longitudinally dis-

placed, first and second intermediary connecting means along substantially straight line paths.

5. In combination with an electrical switching device, as set forth in claim 3,

said second portion of the intermediary connecting means extending outward from its respective terminal means in a direction generally transverse to said longitudinal spacing.

6. In combination with an electrical switching device, as set forth in claim 4,

said electrical circuit breaker being mounted in a generally vertical orientation,

said second portion of the intermediary connecting means extending outward from its respective terminal means in a generally horizontal direction.

7. The combination as set forth in claim 6, wherein the intermediary connecting means at the switching device end wherein said external circuit conductor means enter are orientated such that its second portion is laterally offset from the second portion of the intermediary connecting means at the other end of the switching device.

8. In combination with an electrical circuit breaker including at least one pair of longitudinally spaced first and second terminal means for the line and load terminals thereof,

a circuit breaker housing, with said terminals located at one surface thereof,

a support structure for rigidly mounting said electrical circuit breaker in a generally vertical orientation with the housing rear surface abutting said support structure and said terminal means accessible for connection to individual external circuit conductor means,

and said first and terminal means are located at first and second longitudinally spaced line and load ends of said support structure,

intermediary connecting means for eletcrically interconnecting said terminal means to their respective external circuit conductor means,

means for selectively positioning said intermediary connecting means in an obstructed substantially straight line path to one end of said support structure, such that the external circuit conductor means for both said first and second terminal means enter at one end of the support structure and are directly routed to their individual, and longitudinally displaced, first and second terminal conducting means along substantially straight line paths,

said intermediary connecting means including first and second portions, said first portion including first interconnection means for electrical connection to its individual terminal means and said second portion including second interconnection means for electrical connection to its individual external circuit conductor means,

said second portion extending outward from its respective terminal means in a generally horizontal direction,

the intermediary connecting means at the circuit breaker end wherein said external circuit conductor means enter being positioned in a first position,

and the connection means at the other circuit breaker end being positioned in a second position,

said first position characterized as having its second portion forwardly projecting to generally overlie the volume defined by said circuit breaker housing,

said second position characterized as having its second portion rearwardly projecting beyond the volume defined by said circuit breaker housing such that the external circuit connecting means to said last mentioned second portion is routed along an unobstructed substantially straight line path rearward of the circuit breaker housing.

9. In combination with an electrical circuit breaker including at least one pair of longitudinally spaced first and second terminal means for the line and load terminals thereof,

a circuit breaker housing, with said terminals located at the rear surface thereof,

a support structure for rigidly mounting said electrical circuit breaker in a generally vertical orientation with said housing rear surface abutting said support structure and said terminal means accessible for connection to individual external circuit conductor means,

and said first and terminal means are located at first and second longitudinally spaced line and load ends of said support structure,

intermediary connecting means for electrically interconnecting said terminal means to their respective external circuit conductor means,

said intermediary connecting means including first and second portions, said first portion including first interconnection means for electrical connection to its individual terminal means and said second portion including second interconnection means for electrical connection to its individual external circuit conductor means,

said second portion extending outward from its respective terminal means in a direction generally transverse to said longitudinal spacing,

the intermediary connecting means at one of said circuit breaker terminal means having their first portions adjacent their associated circuit breaker terminal means, and their second portions forwardly extending to generally overlie the volume defined by said circuit breaker housing,

the intermediary connecting means at the other of said circuit breaker terminal means having their first portions adjacent their associated circuit breaker terminal means, and their second portions rearwardly extending beyond the volume defined by said circuit breaker housing, such that unobstructed substantially straight line paths are provided for routing the external circuit conductor means from a point of entry at the enclosure end closest to said one circuit breaker terminal means to the second portions of both their respective connecting means.

10. The combination as set forth in claim 4, said intermediary connecting means first portion including first interconnection means for electrical connection to its individual terminal means and said second portion including second interconnection means for electrical connection to its individual external circuit conductor means,

said second portion extending outward from its respective terminal means in a direction generally transverse to said longitudinal spacing,

said intermediary connecting means having a generally L-shaped configuration, with said first and second portions being the arm and leg portions of the L.

11. The combination as set forth in claim 4, said intermediary connector means first portion abutting its respective terminal means, and said second portion transversely extending therefrom.

12. A connector assembly for connecting the space separated line and terminal means of a circuit breaker to externally extending line and load conductor means,

said connector assembly including intermediary connecting means for electrically interconnecting said line and load terminal means to their respective externally extending circuit conductors means, and

means for positioning said intermediary connecting means such that the externally extending circuit conductor means for both said line and load terminal enter at one end of the circuit breaker and are directly routed to their individual, and longitudinally displaced, line and load terminal means along substantially straight line paths.

13. A connector assembly as set forth in claim 12, said intermediary connecting means including first and second portions, said first portion including first interconnection

means for electrical connection to its individual terminal means and said second portion including second interconnection means for electrical connection to its individual external circuit conductor means,

said second portion extending outward from its respective terminal means in a generally transverse direction.

14. A connector assembly as set forth in claim 12, said intermediary connecting means having a generally L-shaped configuration, with said first and second portions being the arm and leg portions of the L.

15. A connector assembly as set forth in claim 13, said intermediary connecting means having a generally L-

shaped configuration, with said first and second portions being the arm and leg portions of the L.

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