Aug. 10, 1965 E. W. FORNEY, JR 3,200,364

ELECTRICAL CONNECTOR ASSEMBLY FOR INSULATED TAPE CABLE

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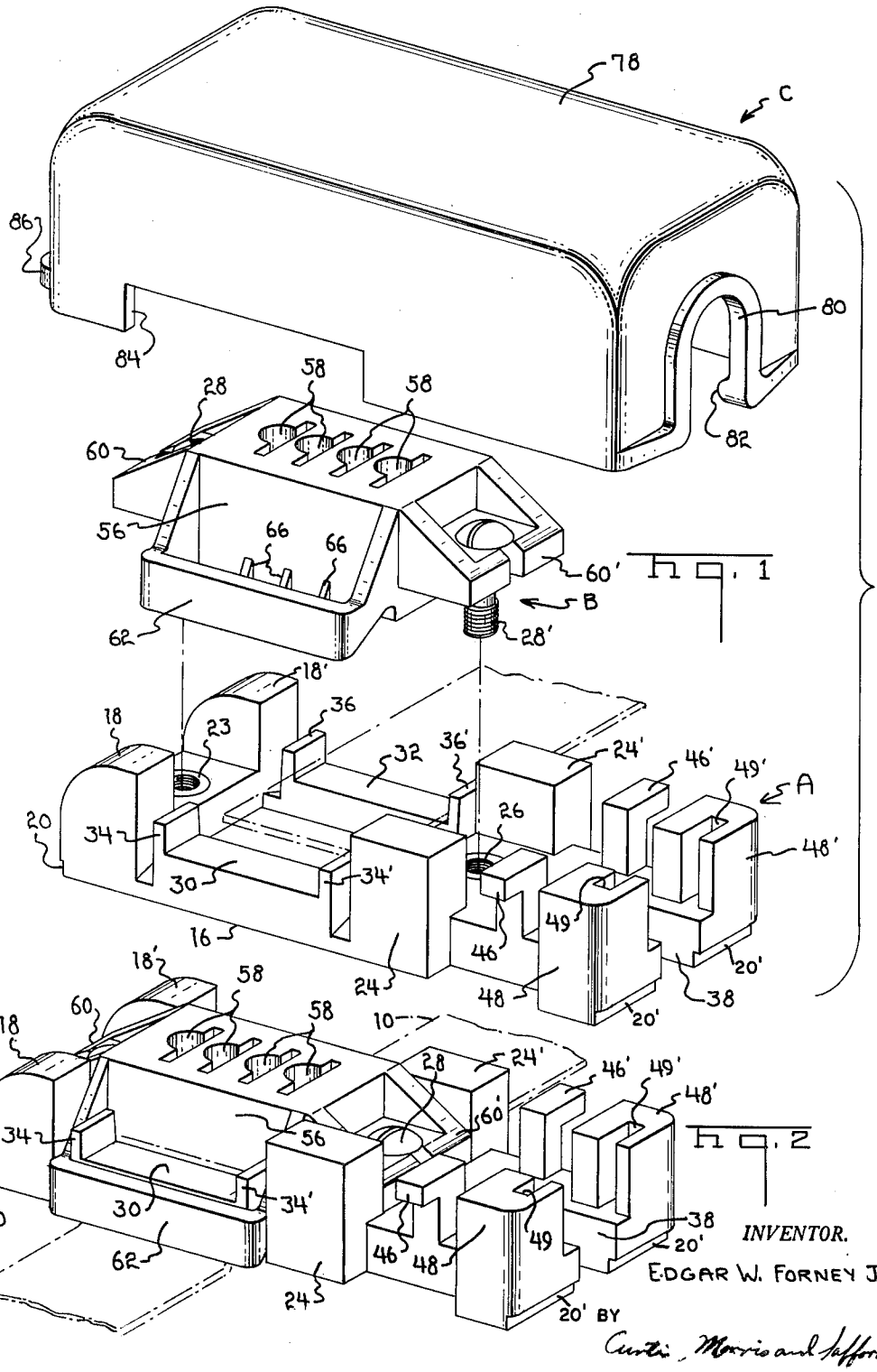

Fig. 1

Fig. 2

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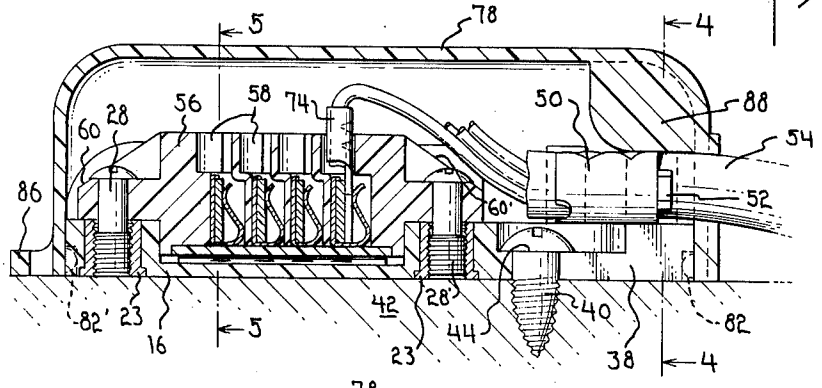
Fig. 3



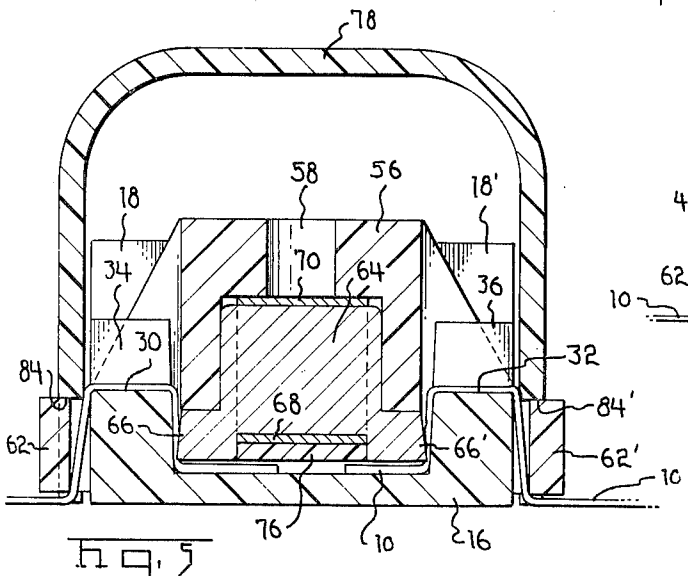


Fig. 5

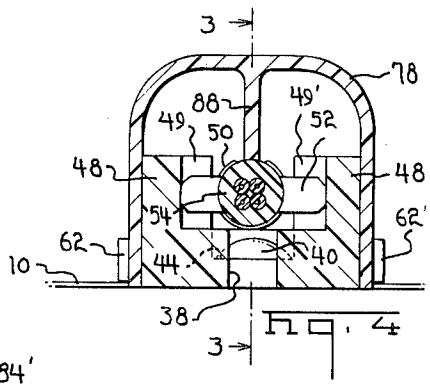


Fig. 4

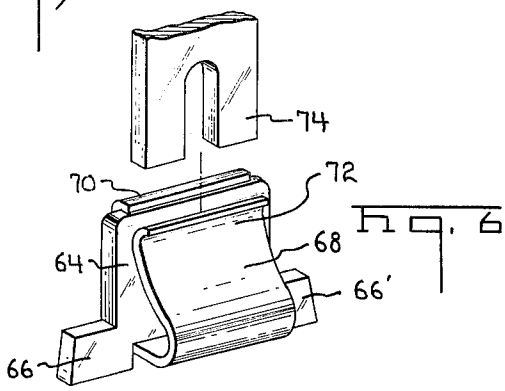


Fig. 6

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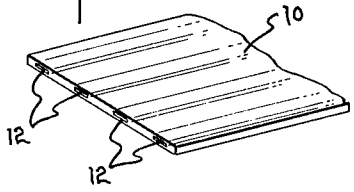
Fig. 7



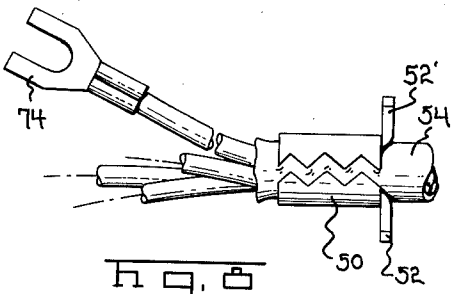


Fig. 8

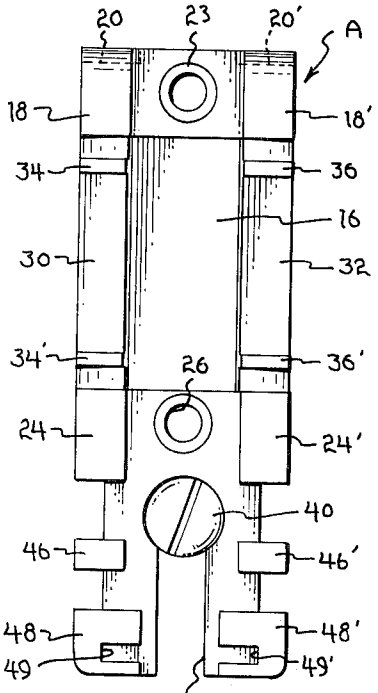


Fig. 9

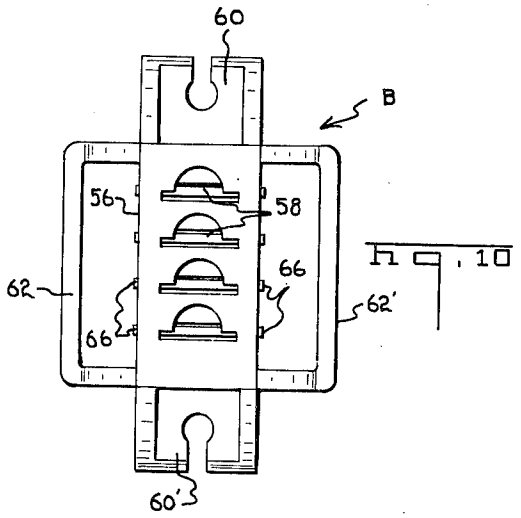


Fig. 10

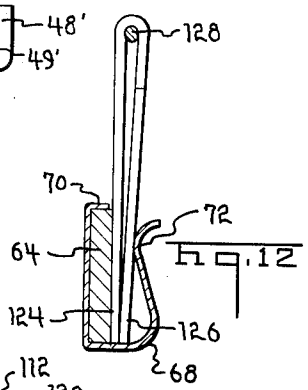


Fig. 12

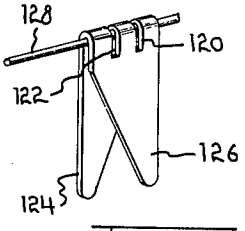


Fig. 11

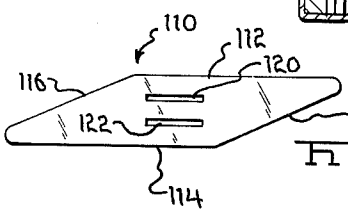


Fig. 13

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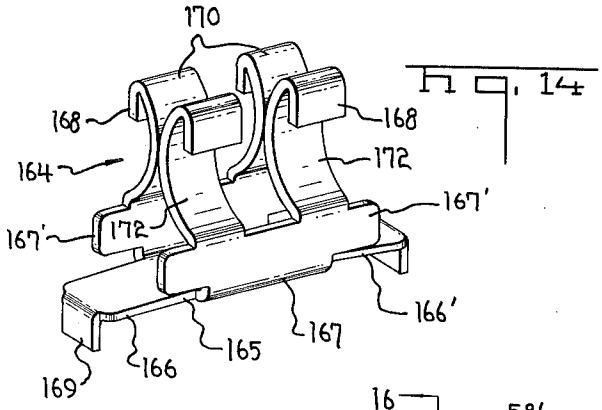

Fig. 14

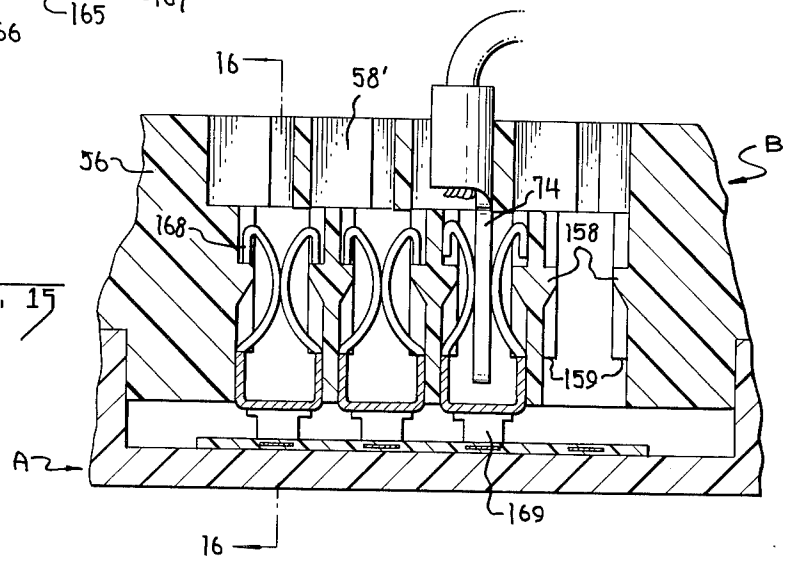

Fig. 15

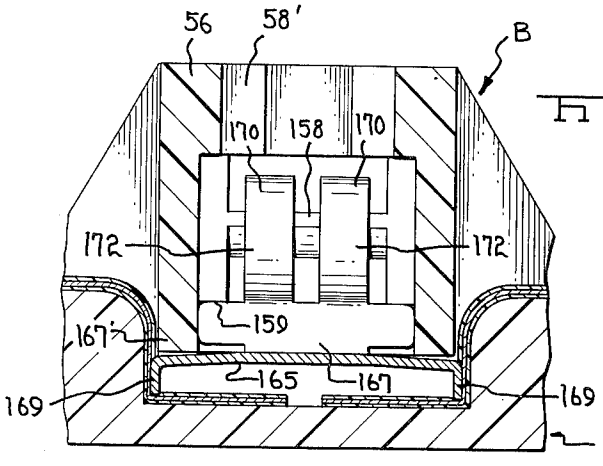

Fig. 16

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3,200,364

ELECTRICAL CONNECTOR ASSEMBLY FOR INSULATED TAPE CABLE

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Filed Sept. 4, 1963, Ser. No. 306,523
7 Claims. (Cl. 339—99)

This is a continuation-in-part of my earlier filed application S.N. 223,097, filed September 12, 1962, now abandoned of the same title.

A current trend in the design of electrical circuitry is the use of the so-called "tape cable," comprising a flat strip of insulation having a plurality of parallel conductors embedded therein. This cable is lightweight and saves space in circuit design. Additionally, it can be coated with an adhesive and easily secured to the sidewall of a panel or wherever it is used.

One of the disadvantages of using such cable is the difficulty in joining it to conventional electrical conductors which may be secured to the components in the circuit. It is an object of this invention to provide a device which can be used to join tape cable to conventional conductors. It is also an object of this invention to provide such a device without pre-stripping the insulation on the tape cable.

It is a further object of this invention to provide a device for securing conductors to tape cable, whereby a plurality of such conductors may be secured to any one of the conductors in the cable, and also be easily disconnected whenever necessary.

It is another object of this invention to provide a device which may be used either intermediate the ends, or at the ends of a tape cable to tap current from the cable. This device may also be used to joint the ends of two tape cables in conductive relationship.

It is also an object of this invention to provide a clip-type connector which may be secured to a conductor for joining the conductor to a tape cable. The connector is easily secured to the conductor without the use of any special tools, and may be inserted into a receptacle which will hold it in tight engagement with the conductor.

Other objects and attainments of the present invention will become apparent to those skilled in the art upon a reading of the following detailed description when taken in conjunction with the drawings in which there is shown and described illustrative embodiments of the invention; it is to be understood, however, that these embodiments are not intended to be exhaustive nor limiting of the invention but are given for purposes of illustration in order that others skilled in the art may fully understand the invention and the principles thereof and the manner of applying it in practical use so that they may modify it in various forms, each as may be best suited to the conditions of a particular use.

In the drawings:

FIGURE 1 is an exploded, perspective view of a tape cable connector embodying the principles of this invention;

FIGURE 2 is a view similar to FIGURE 1, showing the clamping means inserted into the base member to bind a tape cable therein;

FIGURE 3 is a sectional view taken through plane 3—3 of FIGURE 4, illustrating the assembled device with a conductor and a tape cable secured therein;

FIGURE 4 is a sectional view taken along plane 4—4 of FIGURE 3;

FIGURE 5 is a sectional view taken along plane 5—5 of FIGURE 3;

FIGURE 6 is a perspective view of the conductor-receiving receptacle;

FIGURE 7 is a perspective view of a length of tape cable;

FIGURE 8 is a perspective view of a bundle of wires having connectors secured thereto and strain-relief means;

FIGURE 9 is a top plan view of the base member shown in FIGURE 1;

FIGURE 10 is a top plan view of the insert illustrated in FIGURE 1;

FIGURE 11 is a perspective view of a clip-type connector applied to a conductor, which may be secured in conjunction with the insert of FIGURE 10;

FIGURE 12 is a side view of the clip of FIGURE 11 as secured to the receptacle;

FIGURE 13 comprises a blanked-out strip of metal useful in forming the clip of FIGURES 11 and 12;

FIGURE 14 is a perspective view of an embodiment of the conductor-receiving receptacle;

FIGURE 15 is a part sectional vertical view of the receptacle of FIGURE 14 mounted in the insert which in turn is mounted in the base member; and

FIGURE 16 is a sectional view taken along plane 16—16 of FIGURE 15.

As shown in FIGURE 1, the connector assembly comprises three basic parts: the base member "A"; the insert or clamping means "B"; and the cover means "C." Preferably, the device is made of any suitable plastic which may be readily molded into the desired shape and is sufficiently strong to resist the usual wear and tear in usage.

A typical length of insulated tape cable, as shown in FIGURE 7 is comprised of one or more layers of insulating plastic 10. A plurality of flat copper conductors 12 are embedded therein. These conductors are normally parallel to each other and run the length of the cable. Additionally, an adhesive backing may be provided on one side of the tape cable to permit it to be secured to a wall, chassis, etc. While the invention is most useful when it is applied to tape cable, it may be used with any electrical conductor.

As shown in FIGURES 1 and 2, the base member "A" comprises a planar bottom wall 16 which is generally rectangular. A set of posts 18, 18' extend upwardly from one end of the bottom wall 16. Each of these posts has an undercut 20 (only one shown in FIGURE 1) at the juncture of the post and the wall. The space between the posts 18, 18' contains an aperture with a threaded insert 23 for receiving a retaining screw 28. A second set of posts 24, 24' also extends from the planar wall 16. The second set of posts is spaced from the first set and parallel thereto. An aperture with a threaded insert 26 is located in the space between the posts 24, 24', and is also adapted to receive a retaining screw 28'.

The portion of the base member defined by the posts 18, 18' and the posts 24, 24' is adapted to accommodate the tape cable 10, as well as the clamping means "B" which retains the tape cable therein. As seen in FIGURES 2 and 3, the tape cable 10 extends through the assembly between the posts and at right angles to the longitudinal axis of the device. The cable is raised slightly at the sides of the block by risers 30 and 32.

The riser 30 extends between the post 18 and the post 24. The riser 32 is slightly tapered on its inner surface and is similarly located between posts 18' and 24'. A slot is located between each riser and each of the posts. Guide members 34 and 34' on each end of the riser 30 are spaced from each other a distance slightly greater than the width of the tape cable. The guides insure alignment of the tape cable disposed between the projections. A similar set of guides 36, 36' are provided on the riser 32 to align the cable with respect to the riser 32.

The conductor-receiving end of the base member "A" is slotted at 38 (FIGURES 1 and 4) to receive a threaded screw 40 (FIGURE 3) to secure the device to a wall or chassis 42. The slot 38 is slightly undercut (FIGURE 4) to form a shoulder 44 to seat the head of the screw 40.

Making the slot longitudinal permits adjustment of the device on the wall to facilitate alignment with the tape cable.

Also extending from the base member "A," in the vicinity of the longitudinal slot **38**, is a pair of strain-relief posts **46**, **46'**. As shown in FIGURES 1 and 2, these posts are generally L-shaped (upside down) with the foot of the L directed away from the slot **38**. These posts are useful in conjunction with conductors which are not provided with a strain-relief means. Such conductors may be wrapped around these posts prior to making a connection so that any strain on the conductor will be taken up by the posts rather than by the connection. Undercut portions **20'** (similar to undercut portions **20**) are located at the base of each post.

When it is desired to use the device with a set of bundled wires, a pair of strain-relief members **48** and **48'** at the outer extremities of slot **38** may be employed. These members are generally U-shaped and face each other to form a channel **49**, **49'**. A ferrule **50** (FIGURE 8) with a pair of ears **52**, **52'** emanating therefrom may be secured around the bundle of wires **54** and deform thereon. The ferrule **50** may then be inserted between the members **48** and **48'** with the ears **52**, **52'** extending into the slot **49**, **49'** formed by the alignment of these members. Any tensile strain on the bundle will be resisted by the ears **52**, **52'** on the ferrule **50**, rather than by the connectors.

Directing attention to the clamping member "B," it is also comprised of plastic, preferably of the same material as the rest of the device. This clamping member comprises a central block **56** and a plurality of parallel, slotted apertures **58** disposed therein. These apertures contain receptacle members of the type illustrated in FIGURE 6. Each end of the block has a flange **60**, **60'** with an opening therein to receive the screws **28** and **28'** respectively. The side portions of the blocks have clamp members **62** and **62'** (FIGURES 1 and 2) extending therefrom. The clamp members **62**, **62'** are secured to the side of the block **56** and designed to fit over the risers **30**, **32**.

In assembly, the block **56** is inserted onto the base member "A" with the bottom section of the block disposed between the risers **30** and **32**. The clamp member **62** surrounds the riser **30** and tightly engages it. Similarly, the clamp member **62'** surrounds the riser **32**. In this position, the screw **28** passes through the opening in the flange **60** at one end of the block **56**, and is threaded into the threaded member **23** in the base member to secure the clamping member into the base member "A." The screw **28'** passes through the opening in the flange **60'** and threads into the opening **26** in the base member "A" so that the block **56** is tightly secured to the base member.

The receptacle means as shown in FIGURE 6 comprises a plate member **64** having lateral extensions **66** and **66'**. The lateral extensions have sharp corners that are adapted to scrape the insulation from the tape when the connection is made. Surrounding the plate **64** is a spring clip **68** having one edge **70** which secures it to the plate **64**. The opposite edge **72** of the clip **68** resiliently engages one side of the plate **64**. This permits an electrical connector having a blade **74** to be inserted between the resilient spring **72** and the plate **64** so that it can be readily engaged or disengaged.

As shown in FIGURES 1 and 3, a receptacle may be inserted into each of the slots **58** and retained therein (e.g., by an insulating strip **76** bonded to the bottom of the block **56**, as shown in FIGURES 3 and 5). The extensions **66** and **66'** protrude slightly from the sides of the block **56** (note FIGURES 1 and 5).

The cover member "C" comprises a housing **78** (FIGURE 1) which may be snapped onto the assembly. One end of the housing has a U-shaped, reinforced opening **80** to permit ingress of the conductors. The inner surface of the cover has an inwardly-extending lip **82** which

snaps into the undercut portion **20'** at one end of the base member "A." The cover is hooked onto the undercuts **20'** and then cammed down over the posts **18**, **18'** at the other end until it snaps into undercuts **20**. Slots **84** and **84'** on the sides of the cover member "C" permit entry of the tape cable (note FIGURES 1 and 5), and provides clearance for clamp members **62** and **62'**.

A slotted bar **86** is attached to the cover on the outer surface at one end thereof. This may be used in disengaging the cover from the base member by prying the bar outwardly to release the lip **82'** from the undercut portion **20**.

A longitudinally-extending fin **88** extends from the inner surface of the cover **78** (FIGURES 3 and 4) adjacent the U-shaped opening **80**. This fin **88** bears upon the top of the bundle of wires inserted therein to secure them on the base member "A."

Operation

When it is desired to attach the device to tape cable **10** on a wall **42**, the base member "A" is secured to the wall by a screw **40** fitted through the aperture **38** in the base member "A." The tape cable **10** enters the assembly over the riser **30**, and is trimmed so that its end is positioned in the well between the risers **30** and **32**. An additional cable may be introduced in like manner over the riser **32** (FIGURES 1 and 5). (A single length of tape cable may be fed through the device in the same manner.) The clamping member "B" is fitted onto the base member "A" by inserting the block **56** between the risers **30** and **32**. The clamping members **62**, **62'** surround the risers **30** and **32** respectively, to tightly engage the tape cable **10** between the block and the inside surface of the risers.

Screws **28** and **28'** are inserted into the threaded openings **22** and **26**, thus securing the insert member "B" to the base member "A." As the insert "B" is forced toward the base "A," the tapered, inner surfaces of risers **30** and **32** force the tape cable into close proximity to the outwardly-extending portions **66**, **66'** of the connector plates **64**, causing insulation to be scraped from the surface of the tape cable to expose the conductors **12**. The connector plates **64** and the conductors **12** make electrical contact.

A bundle of wires **54** having blade-type terminals **74** on the end of each wire may be inserted into the base member "A" so that the ferrule **50** on the bundle is disposed between the posts **48**, **48'** and the projections **46**, **46'**. The ears **52**, **52'** on the ferrule **50** fit into the slots **49**, **49'** to anchor the bundle of wires in proper position and provide a strain-relief. The blades **74** of the terminals may be fitted into the appropriate slots **58** to make connection with the copper conductor **12** of the tape cable via receptacle **64**. An arcuate section in the slot accommodates the ferrule portion of the terminal. The cover "C" is snapped in place with the lips **82**, **82'** on the inner surfaces of the cover fitting into the undercut portions **20** and **20'**. The fin **88** bears upon the ferrule **50** to properly retain it in place.

An embodiment of a clip-type connector **110**, adapted to be used in the assembly, may be blanked-out from a strip of sheet metal in the manner shown in FIGURE 13. This clip is generally a parallelogram, having opposed parallel sides **112**, **114**, and **116**, **118**. Sides **112** and **114** form an acute angle and sides **116** and **118** form an identical acute angle.

A pair of rectangular openings **120** and **122** are formed centrally of the clip along the central line thereof. These openings are parallel to the sides **112** and **114** and are equi-distantly spaced therefrom.

After the connector is formed out of sheet metal, it is folded over along the center line to form two pointed edge portions **124** and **126**. Portions **124** and **126** can be separated slightly with the fingers so that a conductor **128** (FIGURE 11) may be inserted into the clip along its

folded-over portion adjacent the openings 120 and 122. With the conductor 128 in place, the pointed edge portions 124 and 126 are inserted into a receptacle 58. The receptacle holds the sides of the clip together and thereby tightly secures the conductor therein.

An embodiment of the receptacle means 164 is shown in FIGURES 14–16. This receptacle means is adapted to be used in place of the receptacle means shown in FIGURE 6 and may be blanked out from a strip of sheet metal similar to that used to form clip 68. After the receptacle means 164 has been blanked out, it comprises a member 165 having lateral extensions 166, 166' and electrical connector receiving means which include arcuate shaped legs 170, 172 resiliently in engagement with each other. As shown, legs 170, 172 contain two sections but each leg can be a solid piece of material if desired. A blade 74 of an electrical connector can be inserted between resilient legs 170, 172 as shown in FIGURE 15 so that it can be readily engaged or disengaged.

Each leg is connected to member 165 by a piece 167. Abutting members 167' extend outwardly from each side of pieces 167. Each leg also contains a downwardly directed part 168. Each extension 166, 166' has a downwardly directed section 169 which has a sharp corner that is adapted to scrape and penetrate the insulation of the tape to make connection with a corresponding conductor thereof.

Turning now to FIGURE 15, the receptacle means 164 are shown mounted into each of the slots 58' of block 56. Each slot 58' has on the interior thereof flanges 158 directed toward the axis of the slot which define a plane upper surface and an inclined lower surface. Spaced from the bottom of each slot on each end of each side surface, there are abutting surfaces 159.

As each receptacle means 164 is pushed into a corresponding slot 58' from the bottom, parts 168 of the legs engage the inclined surfaces of flanges 158. Upon additional pressure being applied to the receptacle means, parts 168 pass beyond the inclined surfaces and the bottom edges of parts 168 rest on the plane upper surfaces of the flanges 158. This serves to lock the receptacle means in its corresponding slot. Also abutting members 167' engage against corresponding abutting surfaces 159 which act as stop means to limit the inward movement of the receptacle means within the slot when the block 56 is inserted into the base member A to bring the sections 169 into electrical engagement with the conductor of the cable.

The outer ends of abutting members 167' as shown in FIGURE 16 engage the ends of the apertures in order to limit the lateral movement of the receptacle means.

As can be seen when observing the receptacle means in FIGURE 15 without a blade 74 therein, the parts 168 do not engage the side walls of the slot. The reason for this is to enable a special tool to be inserted within the slot in order to press legs 170, 172 toward each other until parts 168 are free of the upper plane surfaces of the flanges 158 so that the receptacle means can be removed from its slot.

Another reason for parts 168 not engaging the side walls of the slot is that when the blade 74 is inserted within the receptacle means, the parts 168 are moved into engagement with the side walls thereby decreasing the frictional resistance of the legs of the receptacle means. Such a feature aids in the insertion of connectors; especially if they are subject to being easily bent.

The insert B of FIGURES 15 and 16 is the same as that shown in FIGURES 1–3, 5 and 10 with exception to the receptacle means 164 so that the operation of this embodiment is the same as that of the latter mentioned figures.

As can be discerned, the receptacle means 164 of FIGURES 14–16 is removably secured in clamping means B in order to easily remove it therefrom for cleaning, replacement or other purposes; whereas the receptacle means 64 of FIGURES 1–3 is secured in clamping means B by an insulating strip bonded thereto so that it is not readily removed therefrom.

Changes in construction will occur to those skilled in the art and various apparently different modifications and embodiments may be made without departing from the scope of the invention. The matter set forth in the foregoing description and accompanying drawings is offered by way of illustration only. The actual scope of the invention is intended to be defined in the following claims.

I claim:

1. An electrical connector comprising a base member having a recessed section disposed therein for receiving insulated cable means having conductive means therein, said recessed section having side wall means, said cable means being adapted to be disposed in said recessed section and along said side wall means, clamping means adapted to be secured on said base member to secure said cable means therebetween and including a section for disposition within said recessed section, conductive element means in said clamping means in register with the conductive means in said cable means and including insulation-scraping means extending outwardly from said section of said clamping means, and securing means for securing said clamping means to said base member to secure said cable means thereto with said section of said clamping means disposed in said recessed section, said conductive means extending in the direction of movement of the section into the recessed section and the securing action between said base member and clamping means moving said insulation-scraping means along said cable means disposed against said side wall means to scrape insulation therefrom and make connection with said conductive means.

2. An electrical connector according to claim 1 wherein said conductive element means include additional insulation-scraping means extending outwardly from said section of said clamping means for engagement with an additional cable means disposed in said recessed section and along said side wall means with conductive means of said additional cable means extending in the direction of movement of the section into the recessed section so that the securing action between said base member and clamping means moving also said additional insulation-scraping means along said additional cable means disposed against said side wall means to scrape insulation therefrom and make connection with said conductive means thereof.

3. An electrical connector according to claim 1 wherein a cover means is adapted to be removably snapped onto said base member by means of lip members on one of said base member and said cover means engaging undercut portions on the other of said base member and cover means.

4. An electrical connector according to claim 1 wherein said clamping means has openings therein respectively in communication with said conductive element means for receiving conductive means of a further cable means therein for connection with said conductive element means.

5. An electrical connector according to claim 4 wherein said base member includes double strain-relief means, one of said strain-relief means comprising spaced members having opposing slots therein for receiving ears of a strain member on said further cable means, the other of said strain-relief means comprising post means adjacent said spaced members and around which said conductive means or a strain cord of said further cable means is to be wrapped.

6. An electrical connector according to claim 1 wherein said clamping means has openings therethrough for respective disposition therein of said conductive element means each of said conductive element means including arcuate-shaped legs resiliently engaged within its opening defining a receptacle portion, each of said arcuate-shaped legs having a part engaging a shoulder within the opening thereof to prevent the conductive element means

...n moving in one direction along the opening, and an abutting member extending outwardly from each of said arcuate-shaped legs and engaging an abutting surface in the openings to prevent the conductive element from moving in another direction opposite to said one direction.

7. A clip-type connector comprising a strip of resilient sheet metal in the form of a parallelogram, said strip having elongated openings extending longitudinally thereof and disposed substantially centrally thereof, said strip being folded about a center line with opposing surfaces facing each other, the free ends of the strip being substantially pointed and transversely disposed one with respect to the other, said opposing surfaces being spaced from each other so that a conductor means may be disposed therebetween in an area containing said openings with the openings extending along at least half the circumference of said conductor means, the resiliency of the sheet metal urging the sharp edges of said openings to bite into said conductor means to maintain said conductor means in said area.

References Cited by the Examiner

UNITED STATES PATENTS

2,419,652	4/47	McLarn	339—97
2,909,755	10/59	Jackson et al.	339—17 X
3,024,436	3/62	Kirk	339—17

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