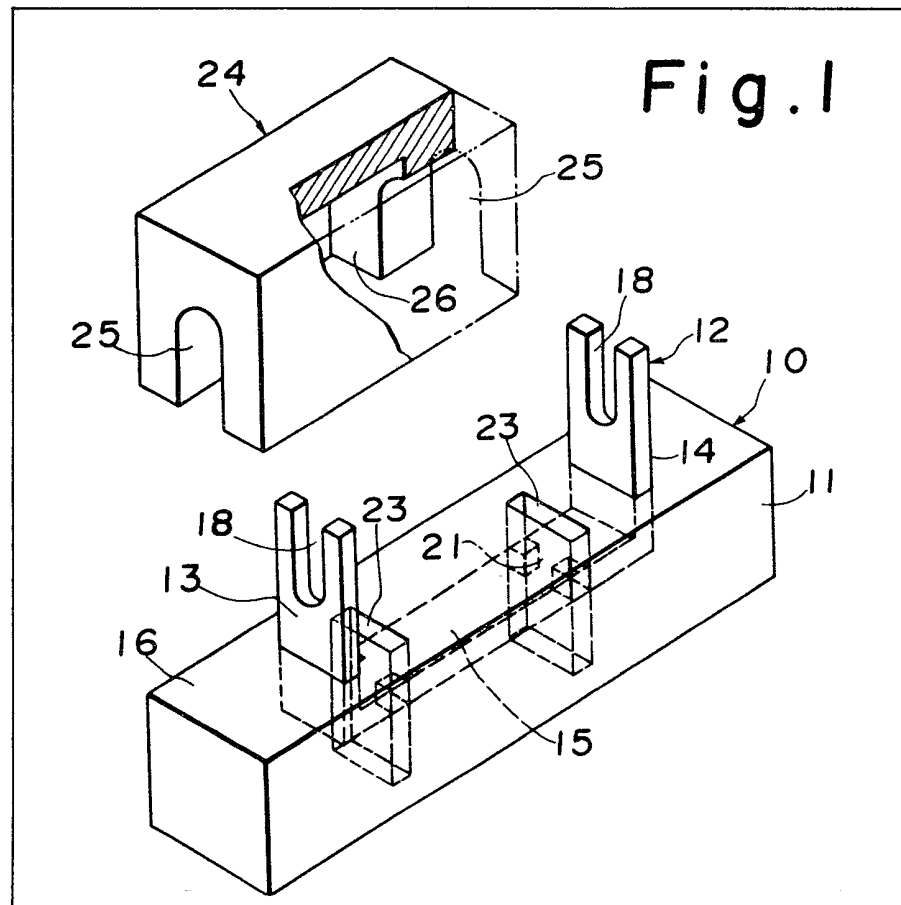


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(54) Electrical connector

(57) An electrical connector 10 for wires of a multi-conductor cable includes a base member 11 and an electrical contact 12 of generally U-shaped configuration defined by a pair of parallel spaced arms 13, 14 and a connective portion 15 interconnecting the arms at their lower ends. The contact 12 is embedded in the base member 11 with the upper portions of the arms extending outwardly from the upper surface 16 of the base member 11. The upper portion of each arm has a slot 18 extending along the length

thereof and opening to the upper edge thereof to provide a bifurcated end. The base member 11 has an aperture 23 formed therein and extending generally perpendicular to the connective portion 15. That portion of the connective portion 15 disposed in the aperture 23 serves as an engaging section. A wire of the cable is adapted to be received in the slot 18 to make electrical contact with the contact 12. The engaging section of a mating connector 10 is adapted to be snugly fitted in the contact slot 18 of the connector 10 to establish electrical contact between the two connectors.



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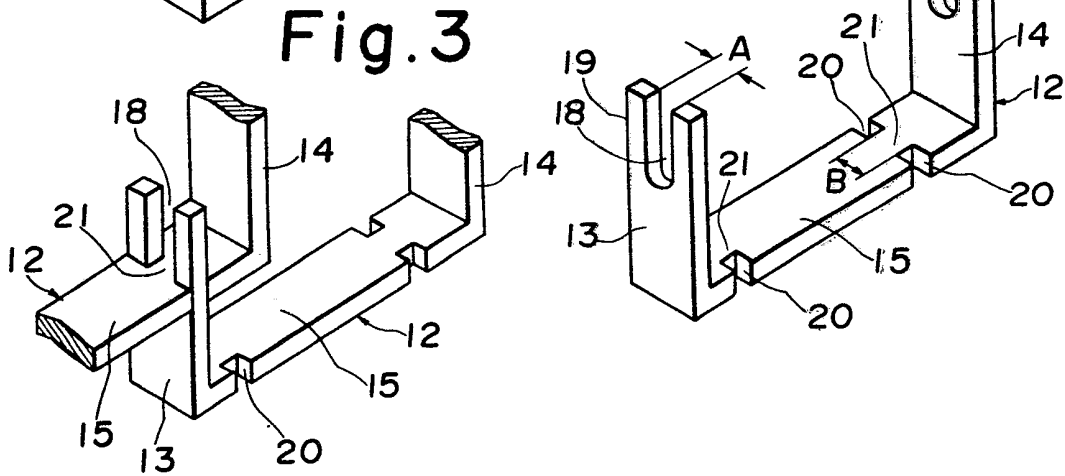
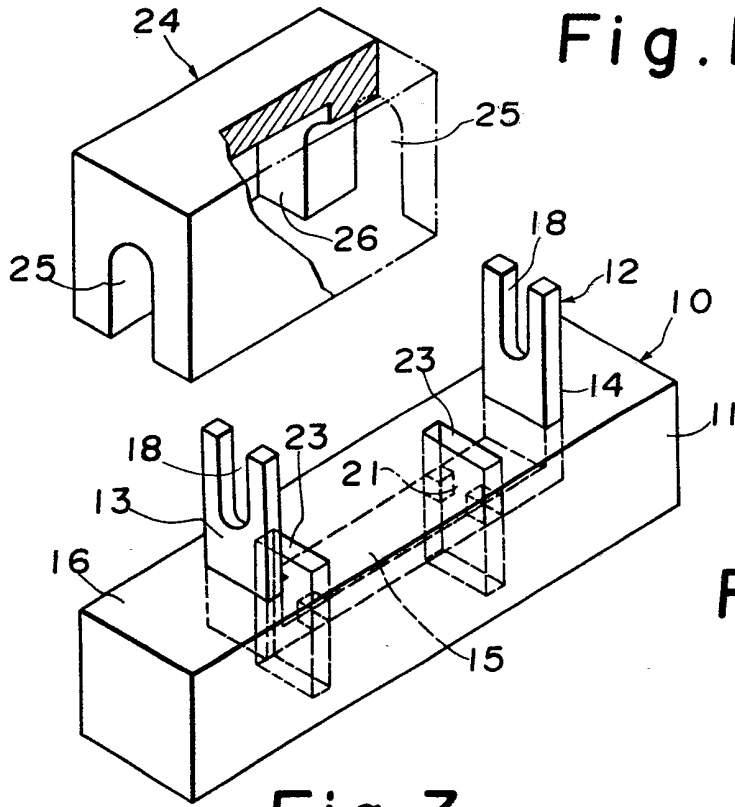


Fig. 4

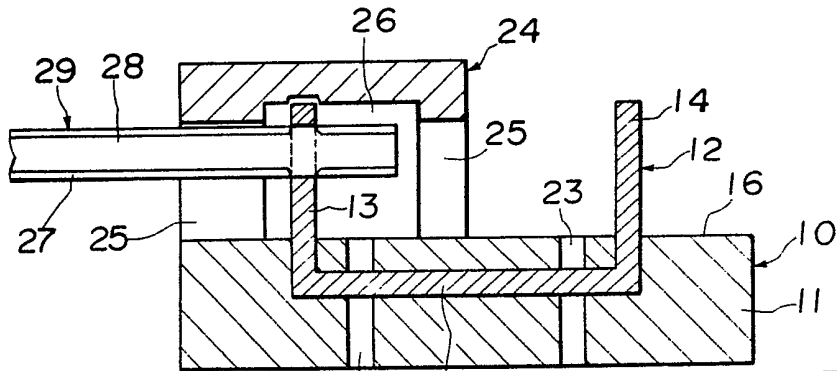


Fig. 5

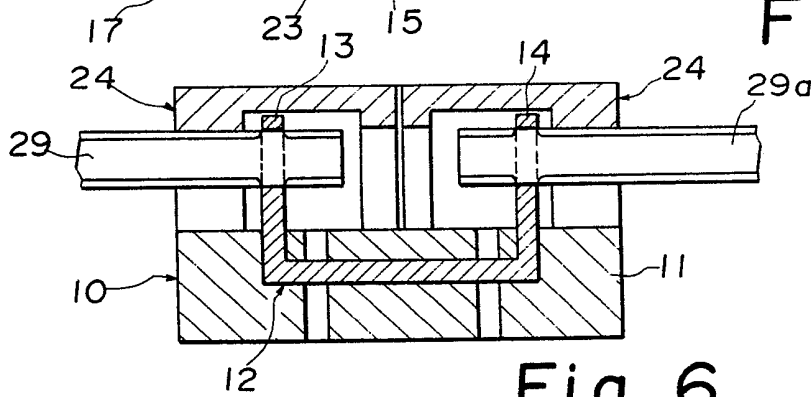


Fig. 6

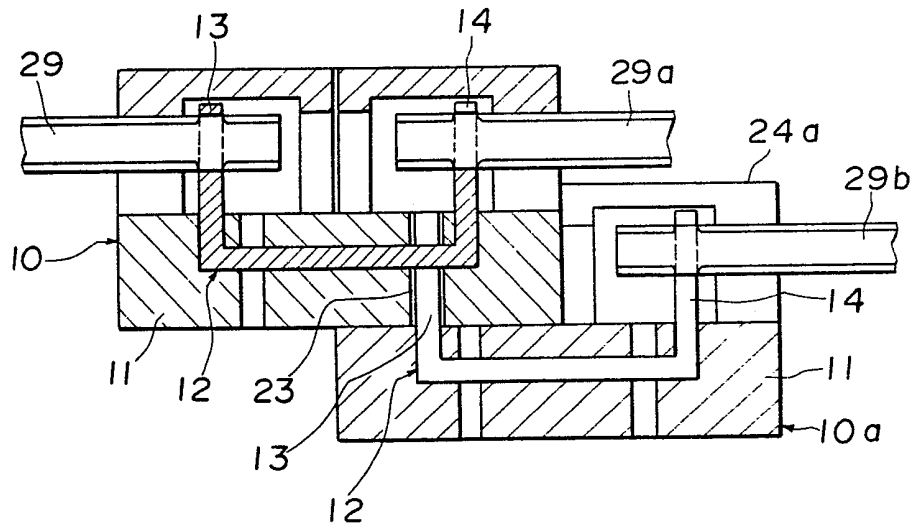


Fig. 7

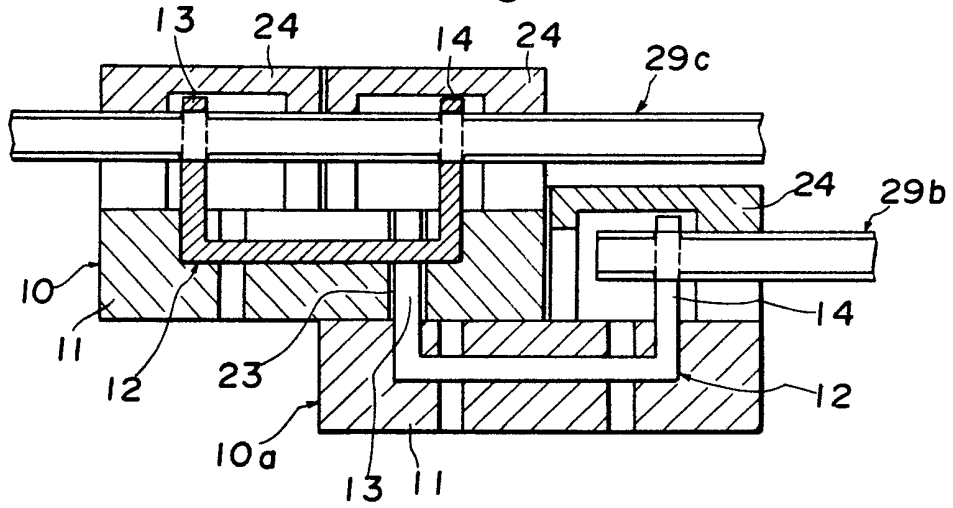


Fig. 8

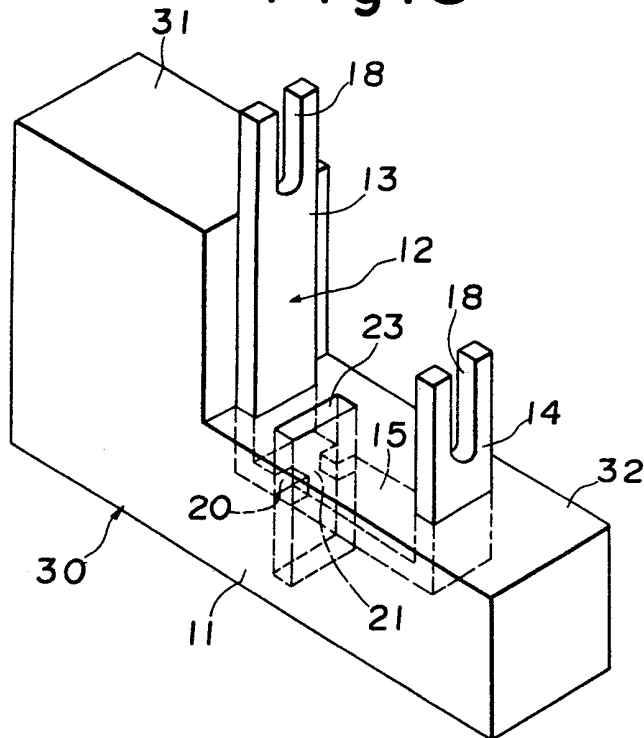


Fig. 8A

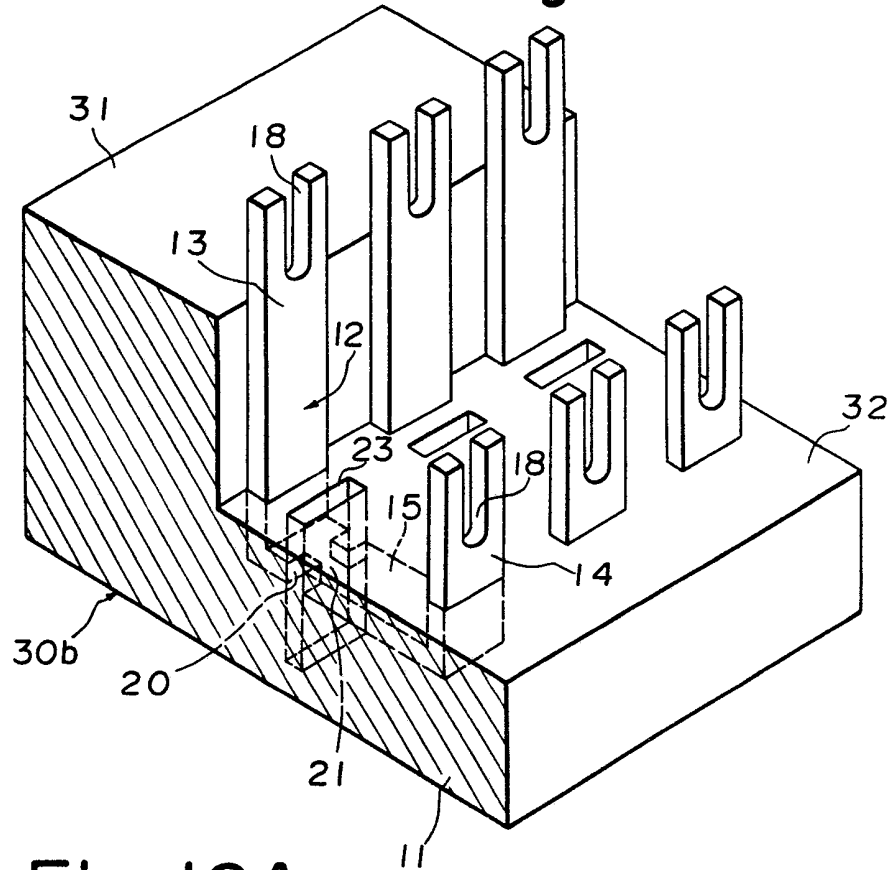


Fig. 12A

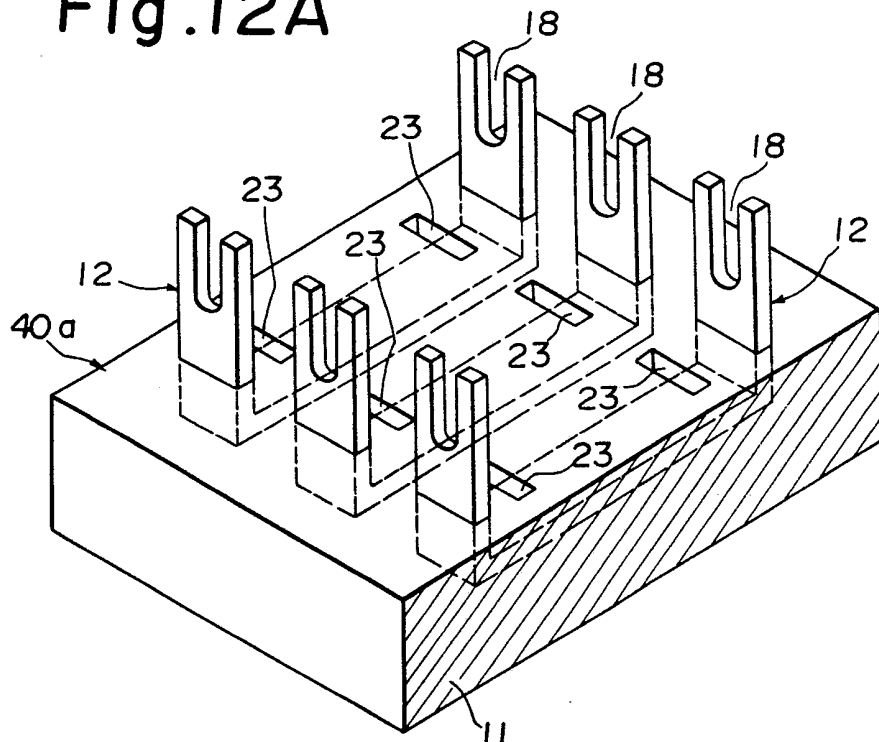


Fig. 9

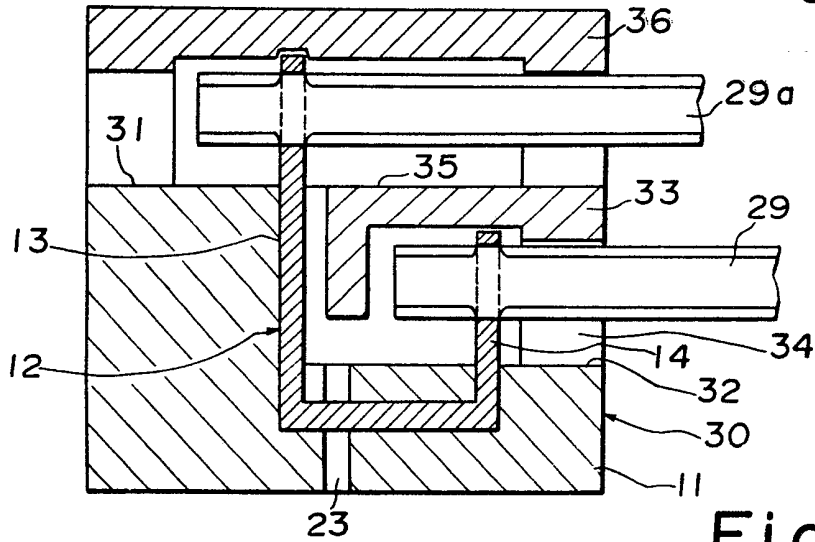


Fig. 10

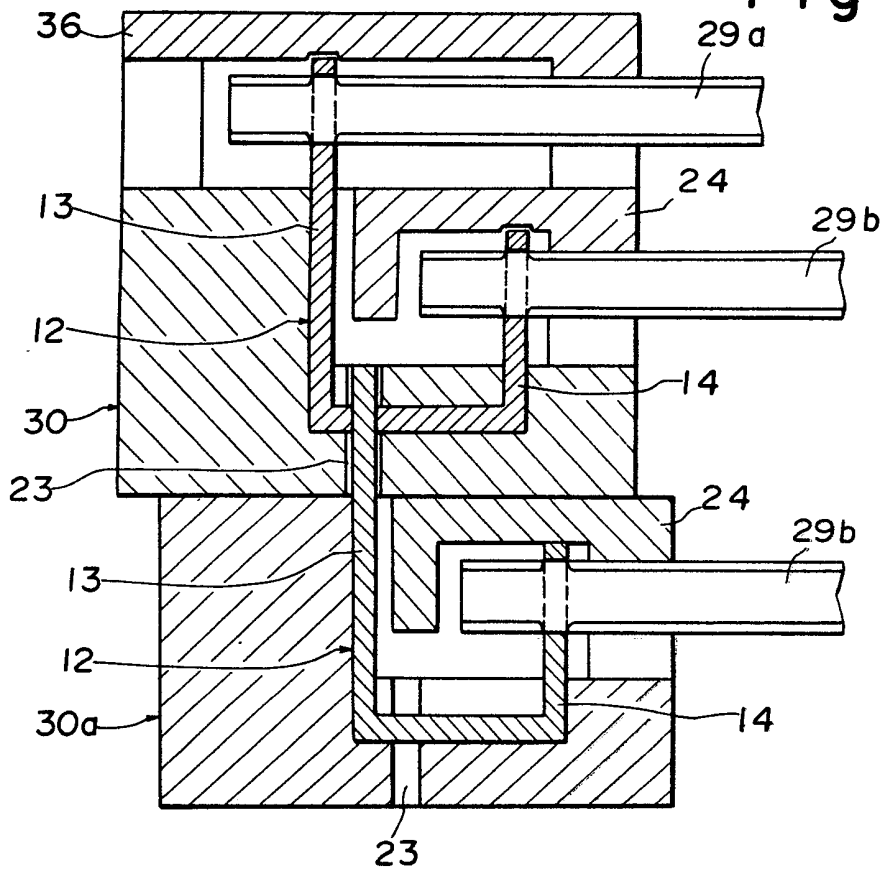


Fig. 11

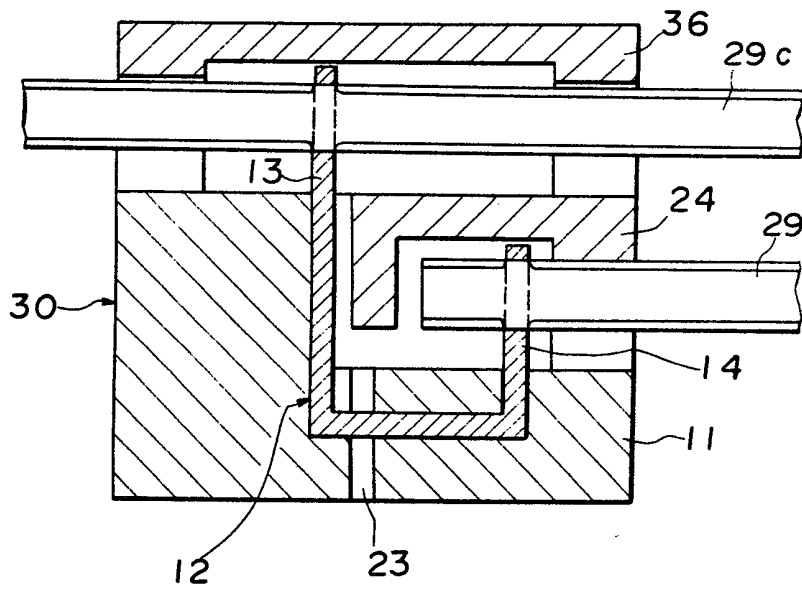


Fig. 12

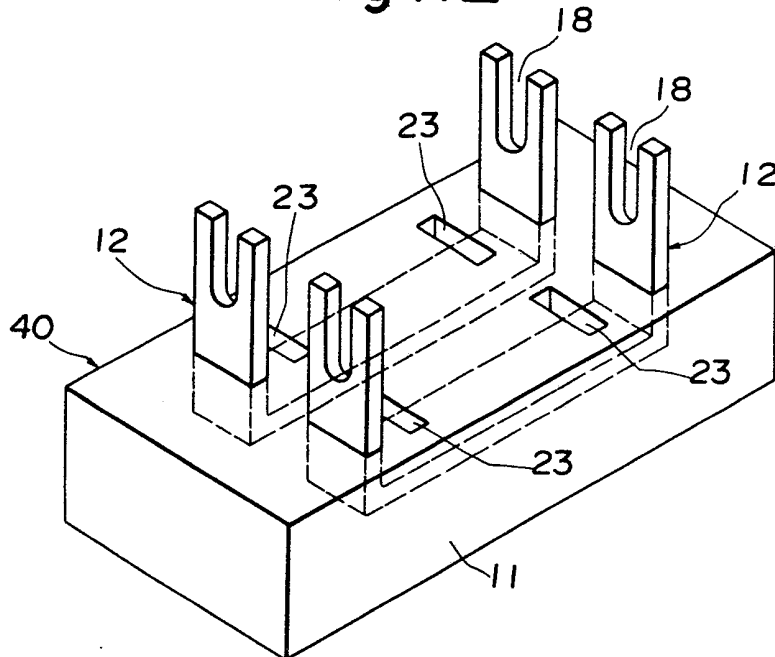


Fig.13

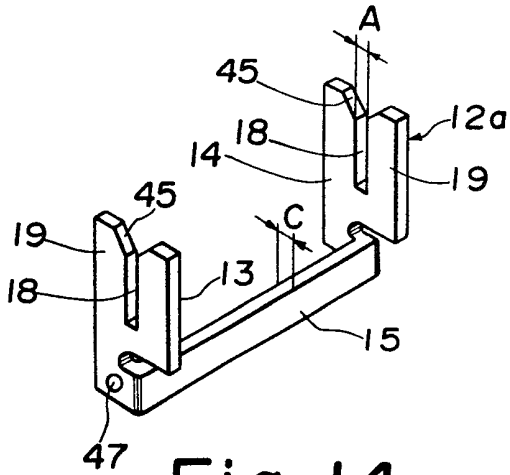


Fig.15

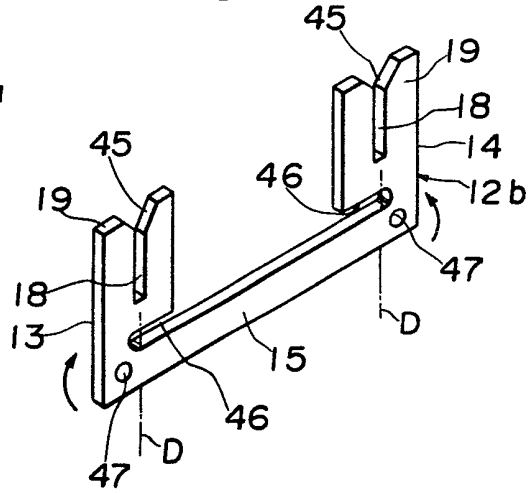


Fig.14

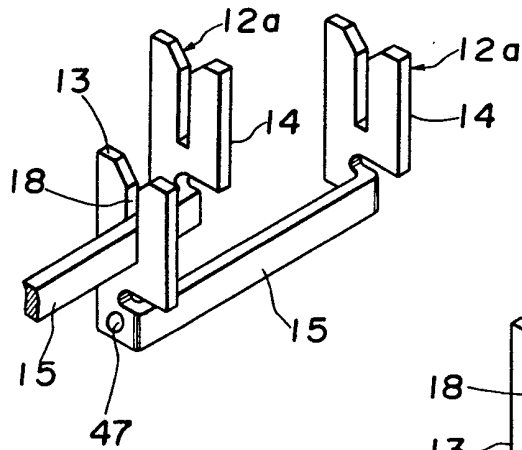
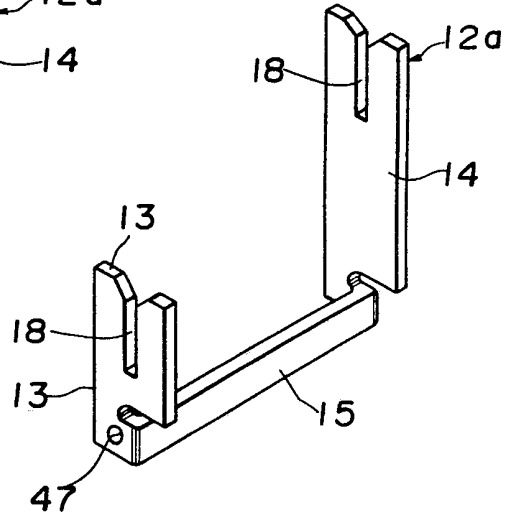


Fig.16





## SPECIFICATION

**Electrical connector**

5 This invention relates to an electrical connector for wires of a multiconductor communication cable.

A communication or telephone cable comprises a plurality of wires. The installation of a telephone cable line requires the connection of individual wires of a first cable to individual wires of a second cable. The connection between the corresponding wire ends is conventionally made by twist splicing or by the use of suitable connecting elements. This wire connecting operation requires much labor and time.

10 Such a wire connecting operation is also required when it is desired to install an additional electrical equipment in the telephone cable line.

It is an object of the present invention to provide a miniaturized electrical connector for wires of a multiconductor communication cable by which wire connection can be made in various forms with utmost ease.

According to the present invention, there is provided an electrical connector which comprises a base member of electrical insulating material having upper and lower parallel flat surfaces, said base member having an aperture formed therein and opening to the lower surface thereof, said aperture extending in a direction generally perpendicular to the upper and lower surfaces of said base member; and an electrical contact of generally U-shaped configuration defined by a pair of parallel spaced arms and a connective portion interconnecting said arms at their lower ends, said contact being embedded in said base member with the upper portions of said arms extending outwardly from the upper surface of said base member, said connective portion being disposed in generally parallel relation to the upper and lower surfaces of said base member, said connective portion having an engaging section, the upper portion of each arm having a slot extending along the length thereof and opening to the upper edge thereof so as to provide a bifurcated end portion, the width of said slot being slightly less than that of said engaging section, the upper portion of said arm being complementary in shape to said aperture, and said engaging section being disposed in said aperture.

The invention will now be more particularly described with reference to the drawings wherein like reference numerals denote corresponding parts in several views:

Fig. 1 is a perspective view of an electrical connector provided in accordance with the invention;

55 Fig. 2 is a perspective view of an electrical contact employed in the connector;

Fig. 3 is a fragmentary perspective view of two contacts, showing the manner of connection therebetween;

60 Fig. 4 is a cross-sectional view of the connector, showing a wire connected to the contact;

Fig. 5 is a view similar to Fig. 4 but showing a modified form of wire connection;

65 Fig. 6 is a cross-sectional view of a pair of assembled connectors showing wires connected to the

contacts;

Fig. 7 is a view similar to Fig. 6 but showing a modified form of wire connection;

70 Fig. 8 is a perspective view of a modified electrical connector;

Fig. 8A is a fragmentary perspective view of a multi-contact connector;

Fig. 9 is a cross-sectional view of the connector of Fig. 8, showing wires connected to the contact;

75 Fig. 10 is a cross-sectional view of a pair of assembled connectors of Fig. 8;

Fig. 11 is a view similar to Fig. 9 but showing a modified form of wire connection;

80 Fig. 12 is a perspective view of another modified electrical connector;

Fig. 12A is a fragmentary perspective view of a multicontact connector; and

Fig. 13 to 16 are perspective views of a modified electrical contact.

85 Fig. 1 shows an electrical connector 10 which comprises an elongated base member or body 11 of square cross-section, and a generally U-shaped electrical contact 12, the base member 11 being molded from electrical insulating material. As best shown in Fig. 2, the U-shaped contact 12 is defined by a pair of parallel spaced arms 13, 14 of the same length and a connective portion 15 interconnecting the arms at their lower ends. The contact 12 is embedded in the base member 11 with the upper portions of the arms 13, 14 extending outwardly from the upper surface 16 of the base member 11. The connective portion 15 is disposed in generally parallel relation to the upper and lower flat surfaces 16 and 17 of the base member 11.

100 The upper portion of each of the contact arms 13, 14 has a slot 18 extending along the length thereof and opening to the upper edge thereof so as to provide a bifurcated end portion 19, the slot 18 extending centrally of width of each arm. The contact 12 is arranged relative to the base member 11 in such a manner that the two arms 13, 14 are spaced equidistantly from the center of the base member 11. As best shown in Fig. 2, the connective portion 15 has a pair of aligned notches 20, 20 formed through the lateral edges thereof to provide a neck section or engaging section 21 therebetween, the notches 20, 20 being provided adjacent to the arm 14. Also, another pair of aligned notches 20, 20 are formed in the connective portion 15 to provide another neck section or engaging section 21 adjacent to the other arm 13.

The base member 11 has a pair of spaced apertures 23, 23 formed therethrough and extending in a direction generally perpendicular to the connective portion 15 of the contact 12. The pair of apertures 23, 23 are disposed in alignment with the pair of engaging sections 21, 21, respectively. The upper portion of each arm 13, 14 is complementary in shape to the aperture 21.

125 The contact 12 is of a one piece or unitary construction and comprises an elongated rectangular plate of electrical conductive metal which is bent into the U-shaped configuration, the elongated plate having a uniform thickness throughout the entire length thereof. The dimension of each notch 20 in the direc-

tion of the length of the connective portion 15 is slightly greater than the thickness of the elongated plate. The width A of the slot 18 is slightly less than the width B of the engaging section 21.

5 A rectangular cover or cap member 24 of electrical insulating material is of a generally channel-shaped cross-section as best shown in Fig. 1. The length of the cover member 24 is substantially half of that of the base member 11, and they have the same width.

10 The cover member 24 has a pair of openings 25, 25 formed at its opposite ends and a cavity 26 lying therebetween, the width of each opening 25 being less than the width of the cavity 26.

As shown in Fig. 3, the engaging section 21 of the contact 12 can be snugly fitted in the slot 18 of a mating contact 12 so that electrical connection between the two contacts is established.

The width A of the slot 18 is slightly less than the diameter of a conductor 28 of a wire 29 of a multiconductor cable (Fig. 4). Therefore, when the insulated wire 29 is forced into the slot 18, the insulation 27 of the wire 29 is torn so that the conductor 28 makes electrical contact with the contact 12 as shown in Fig. 4. Then, the cover member 24 is attached onto the base member 11 to enclose the upper portion of the contact arm 13, the wire 29 passing through the left-hand opening 25 (Fig. 7).

Various forms of wire connection through the connector or connectors 10 will now be described.

30 (a) *Linear connection*

As shown in Fig. 5, this linear connection is made using one connector 10. A wire 29 is connected to the arm 13 of the contact 12 while a wire 29a is connected to the arm 14. A pair of cover members 24, 24 are attached to the base member 11.

(b) *Branch connection*

As shown in Fig. 6, this branch connection is made using two connectors 10, 10a. Wires 29, 29a are connected to the contact arms 13, 14 of the connector 10 in the manner as shown in Fig. 5. A wire 29b is connected to the contact arm 14 of the connector 10a. The upper portion of the contact arm 13 of the connector 10 is received in the aperture 23 of the connector 10 with the engaging section 21 of the connector 10 being snugly fitted in the slot 18 of the connector 10a. An additional cover member 24a is attached to the connector 10a.

(c) *Hot line connection*

This hot line connection shown in Fig. 7 differs from the branch connection shown in Fig. 6 only in that the wires 29, 29a is replaced by a through wire 29c.

(d) *Switching connection*

In the connection arrangement shown in Fig. 5, when it is desired to change the connection between the wires 29 and 29a to the connection between the wire 29 and another wire, the connection arrangement shown in Fig. 6 is first provided. Then, the wire 29a is cut to maintain only the connection between the wires 29 and 29b so that the switching operation is suitably carried out without interrupting the supply of electrical current through a transmission cable line.

(e) *Circuit checking*

65 A contact bar of a suitable tester is inserted into

the aperture 23 for engagement with the engaging section 21 of the contact 12 to check the circuit. Thus, the engaging section 21 serves as a test point for the circuit.

70 (f) *Preassembly of connectors to a multiconductor cable*

Connectors 10, 10a can be connected to wire ends of a multiconductor cable at the factory to provide a transmission cable, much labor and time can be saved at the work site when installing a transmission cable line.

Fig. 8 shows a modified connector 30 which differs from the connector 10 of Fig. 1 mainly in that a base member 11 is of a recumbent L-shape and that one contact arm 13 is substantially longer than the other arm 14. Further, a connective portion 15 has only one engaging section 21 defined by a pair of aligned notches 20, 20. The base member also has only one aperture 23 disposed in alignment with the engaging section 21. The upper surface of the base member 11 is stepped to provide a raised portion 31 and a depressed portion 32. The upper portions of both arms 13, 14 extend outwardly from the depressed portion 32, and the arm 13 extends further beyond the raised portion 31.

Fig. 8A shows a modular multi-contact connector 30b which is similar in construction to the connector 30 of Fig. 8 except that it has a plurality of juxtaposed contacts 12.

Fig. 9 shows a branch connection arrangement using one connector 30, in which wires 29, 29a are received respectively in the contact slots 18, 18 of the arms 14, 13 as described above for the connector 10. A cover member 33 of generally channel-shaped cross-section is placed on the depressed surface portion 32 to enclose the contact arm 14, the cover member 33 having one end opening 34 through which the wire 29 passes. The upper surface 35 of the cover member 33 lies flush with the raised surface portion 31 of the base member 11. An additional cover member 36 of generally channel-shaped cross-section, which is equal in length to the base member 11, is placed on the coplanar surface, provided jointly by the raised surface portion 31 and the upper surface 35 of the cover member 33, to enclose the contact arm 13.

Fig. 10 shows another branch connection arrangement using two connectors 30, 30a, in which the connector 30a is additionally connected to the branch connection shown in Fig. 9. The engaging section 21 of the connector 30 is snugly received in the slot 18 of the contact arm 13 of the connector 30a to establish electrical contact between the two contacts 12, 12, as described above for the connection arrangements using the connector 10 of Fig. 1. A wire 29b is connected to the contact arm 14 of the connector 30a.

Fig. 11 shows a hot line connection arrangement which differs from the connection arrangement of Fig. 9 only in that the wire 29a is replaced by a through wire 29c extending through the cover member 36.

Fig. 12 shows a further modified connector 40 which is of the multi-contact type. A pair of contacts 12, 12 are embedded in a base member 11 in juxtaposed

osed relation. As shown in Fig. 12, The multi-contact connector 40 is similar in construction to the connector 10 of Fig. 1 except that the base member 11 has a greater width and that another pair of apertures 23, 23 are provided in the base member 11. With this multi-contact connector 40, a pair of wire connections can be made. It will be appreciated that there can be provided a modular multi-contact connector 40a having, for example, ten or twenty juxtaposed contacts 12 as shown in Fig. 12A.

Fig. 13 shows a modified contact 12a for the connector 10. As shown in Fig. 15, the contact 12a comprises a generally U-shaped stamped plate 12b made of electrical conductive metal, the plate 12b having a uniform thickness over the entire area thereof. As shown in Fig. 15, the contact plate 12b has a pair of generally rectangular arms 13, 14 of the same length and a connective portion 15 interconnecting the arms 13, 14 at their lower ends. The upper portion of each arm has a slot 18 extending along the length thereof and opening to the upper edge thereof so as to provide a bifurcated end portion 19, the slot extending centrally of the width of the arm. The upper edge of each arm has a tapered portion 45 opening into the slot 18 to facilitate the insertion of the wire or the connective portion 15 into the slot 18 as described later. The arms 13, 14 have respective cut-away portions 46, 46 adjacent to the connective portion 15, the cut-away portions 46, 46 extending along the length of the connective portion 15 and opening toward each other.

For providing the contact 12a of the final design, the arms 13, 14 are bent for angular movement through 90 degrees about respective lines D, D in the directions indicated by arrows in Fig. 15. In this condition, each slot 18 is disposed generally in registry with the connective portion 15. The width A of the slot 18 is slightly less than the width C of the connective portion 15.

This contact 12a can replace the contact 12 of the connector 10 of Fig. 1. Those portions of the connective portion 15 disposed in alignment with the pair of apertures 23, 23 serve as engaging sections which are adapted to be snugly fitted in the slot 18 of a mating contact 12a to establish electrical contact between the two contacts, as shown in Fig. 14. The base member 11 is formed by a molding operation, and therefore the contact 12a serves as an insert. Projection 47, 47 are formed on the connective portion 15 and act as means for properly holding the insert or contact in a mold.

Fig. 16 shows another modified contact 12a which differs from the contact 12a of Fig. 13 only in that one arm 14 is substantially longer than the other arm 13. This contact 12a can replace the contact 12 of the connector 30 of Fig. 8.

As described above, with the use of the connectors according to the invention, various forms of wire connection can be provided easily and quickly. Also, by virtue of the provision of apertures 23, a circuit checking is easily carried out by inserting a test bar into the aperture for engagement with the engaging section of the connective portion.

While the connectors according to this invention have been specifically shown and described herein,

the invention itself is not to be restricted by the exact showing of the drawings or the description thereof. For example, the aperture 23 may not extend through the base member 11 but must open to the lower surface of the base member 11.

#### CLAIMS

1. An electrical connector for wires of a multiconductor cable which comprises:

(a) a base member of electrical insulating material having upper and lower parallel flat surfaces, said base member having an aperture formed therein and opening to the lower surface thereof, said aperture extending in a direction generally perpendicular to the upper and lower surfaces of said base member; and

(b) an electrical contact of generally U-shaped configuration defined by a pair of parallel spaced arms and a connective portion interconnecting said arms at their lower ends, said contact being embedded in said base member with the upper portions of said arms extending outwardly from the upper surface of said base member, said connective portion being disposed in generally parallel relation to the upper and lower surfaces of said base member, said connective portion having an engaging section, the upper portion of each arm having a slot extending along the length thereof and opening to the upper edge thereof so as to provide a bifurcated end portion, the width of said slot being slightly less than the width of said engaging section, the upper portion of said arm being complementary in shape to said aperture, and said engaging section being disposed in said aperture.

2. An electrical connector according to claim 1, in which said base member has a second aperture formed therein and opening to the lower surface thereof, said second aperture extending in a direction generally perpendicular to the upper and lower surfaces of said base member, said second aperture being identical in size to the first-mentioned aperture, said connective portion having a second engaging section, and said second engaging section being disposed in said second aperture.

3. An electrical connector according to claim 1 or 2, in which said contact comprises an elongated plate of rectangular cross-section formed into a U-shaped configuration, said elongated plate having a uniform thickness throughout the entire length thereof, said connective portion having a pair of aligned notches formed through the lateral edges thereof to provide a neck portion therebetween which serves as said engaging section, the dimension of said notch in the direction of the length of said connective portion being slightly greater than the thickness of said elongated plate, and the width of said slot being slightly less than the width of said neck section.

4. An electrical connector according to claim 3, in which said connective portion has a second neck section identical in shape and size to the first-mentioned neck section, said base member has a second aperture formed therein and opening to the lower surface thereof, said second aperture extending in a direction generally perpendicular to the upper and lower surfaces of said base member, said

second aperture being identical in size to said first-mentioned aperture, and said second neck section being disposed in said second aperture.

5. An electrical connector according to any of claims 1 to 4, in which one of said two arms is longer than the other, the upper surface of said base member being stepped to provide a raised portion and a depressed portion, the upper portion of said arm of greater length extending outwardly from said depressed portion beyond said raised portion while the upper portion of the other arm extending outwardly from said depressed portion.

6. An electrical connector according to any of claims 1 to 5, in which said connective portion has a substantially uniform width throughout the entire length thereof, the width of said slot being slightly less than the width of said connective portion.

7. An electrical connector according to any of claims 1 to 6, further comprising a cover member adapted to be attached to said base member for enclosing one of said arms.

8. An electrical connector according to any of claims 1 to 7, further comprising at least one additional electrical contact identical in shape and size to the first-mentioned contact, the additional contact being embedded in said base member in juxtaposed relation to the first-mentioned contact, said base member having an additional aperture formed therein and opening to the lower surface thereof, said additional aperture being identical in shape and size to the first-mentioned aperture, and the engaging section of said additional contact being disposed in said additional aperture.

9. An electrical connector for wires of a multiconductor cable substantially as hereinbefore described with reference to Figs. 1 to 7, 8, 8A to 11, 12 or 12A of the accompanying drawings.