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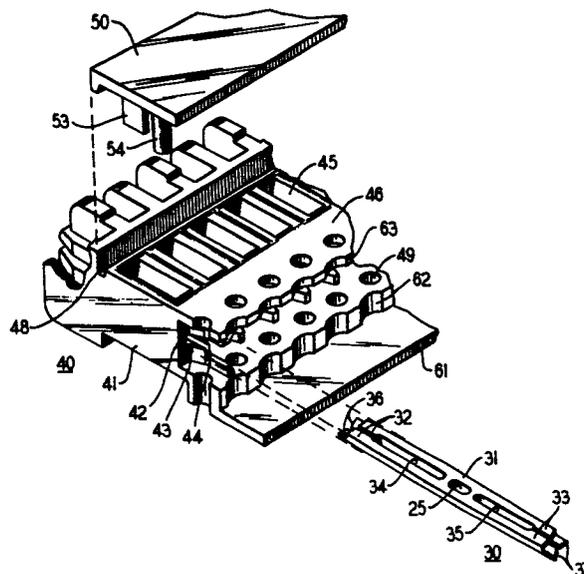
⑸ Designated Contracting States: **BE DE FR GB NL SE**

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⑸ **Connecting block for interconnecting wires and with two matable connector parts and slotted beam contacts.**

⑷ Connecting block for electrically interconnecting first conductors with associated second conductors, in which a first connector part of insulative material has individual receiving and indexing means for the first conductors and in which a second connector part for mating with the first connector has a body member of insulative material and a plurality of slotted beam contacts.

The specification discloses as second connector part a one-piece body member (41) and contactholding means (50). The slotted beam contacts can be assembled easily in cavities (42) in the body member (41) which being in one piece has no join therein to rupture. The holding means (50) has projections (53, 54) which extend through apertures (45) in the wall of the body member (41) to engage in a slot (34) and an aperture (25) in the slotted beam contact, so retaining the contact in the cavity (42). The connecting block may, for example, be used to provide interconnection fields in telephone systems.



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(R.N. Berglund 2-4)

Apparatus for interconnecting Conductors

This invention relates to devices for making electrical cross-connections between two sets of
5 conductors and, in particular, to apparatus for inter-
connecting first conductors with associated second
conductors, the apparatus comprising a first connector
of insulative material, provided with individual
receiving and indexing means for the first conductors,
10 and a second connector for mating with the first
connector, comprising a body member of insulative
material and a plurality of slotted beam contacts.

In the prior art, wire connecting blocks of the
type including an indexing strip and a connecting block
15 are known wherein the connecting block carries a plurality
of slotted beam contacts, such as disclosed in U.S. Patent
No. 3,611,264. The indexing strip has a plurality of
uniform height, spaced-apart teeth along its length.
These teeth aid in indexing a first set of conductors.
20 A corresponding plurality of uniform height, spaced-
apart teeth carried by the connecting block serve to
index a second set of conductors to be cross-connected
through the slotted beam contacts to the first set of
conductors.

25 A number of improvements to this basic connecting
block are disclosed in U.S. Patent No. 3,798,587. In order
to facilitate mass assembly of the contacts in the
28 connecting block, this improved connecting block is a

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two-piece structure, the parts of which are secured together following insertion of the slotted beam contacts. While this connecting block arrangement has proved to be satisfactory in some applications, it was found that when
5 the connecting block is placed over the indexing strip in cold temperatures, certain stresses are applied to the bond between the two connector parts. These stresses often rupture the bond causing failure of the entire unit.

In the claimed apparatus, the body member in
10 which the contacts are held can be manufactured as one piece, so avoiding rupture of a bond between paths thereof. On the other hand, assembly of the slotted beam contacts in the connector is facilitated by the use of the contact holding means which enables the contacts to be inserted
15 easily in the body member and then secured by the contact holding means.

In other applications, such as outdoor environments, moisture collects across the exposed conductor ends. This moisture oftentimes results in short circuits between
20 some of the conductors. In an attempt to alleviate this problem, an insulative, greaselike compound is placed in the cavity of the connector disclosed in the said U.S. Patent No. 3,798,587. While this greaselike compound aids in the reduction of electrical short circuits, unfortunately, it
25 further increases the mechanical stresses applied to the joint between the two connector parts as the connector is brought into engagement with the indexing strip.

A preferred embodiment of the invention has a L-shaped skirt integral with and projecting away from the
30 second connector for encasing the end of the first conductors.

One way of carrying out the invention will now be described, by way of example, with reference to the attached drawings which illustrate one specific
35 embodiment and in which:

FIG. 1 is a side view of a first connector;
FIG. 2 is an end view of the first connector;
38 FIG. 3 is a top view of the first connector;

FIG. 4 is an exploded partial perspective view of the second connector;

FIG. 5 is a partial perspective view of a comb-like slotted beam contact retainer;

5 FIG. 6 is a side view of the second connector;

FIG. 7 is an end view of the second connector;

FIG. 8 is a top view of the second connector;

FIG. 9 is a composite end view of the first and second connectors aligned for mating connection with one
10 another and further illustrating encasement of the exposed wire ends of the first set of conductors.

A first mating connector, hereinafter denoted as indexing strip 11 and shown in FIGS. 1 through 3, includes a longitudinally extending body member 12.
15 Integral with body member 12 and extending generally perpendicular to an axis thereof are a plurality of spaced-apart teeth 13. Teeth 13 alternate in height to facilitate indexing of a first set of conductors 14 shown in FIG. 9. To further facilitate wire indexing, teeth 13, as shown in
20 FIG. 1, have tapered tip regions 15 on adjacent sidewalls 16. These tapered tip regions 15 form generally funnel-shaped wire entry ways for directing conductors 14 into wire retaining slots 17 formed by spaced-apart teeth 13.

Adjacent sidewalls 16 of spaced-apart teeth 13
25 have integral therewith a pair of opposed depressions 18 for capturing and holding an indexed conductor 14 between the teeth in a wire retaining slot 17. Opposed depressions 18 are located at an intermediate point along the height of teeth 13 above wire retaining slot 17.

30 Extending along a length of body member 12 are outwardly projecting edges 20 and 21, as shown in FIG. 2. Edges 20 and 21 are at different elevations along body member 12 with edge 20 being at a lower elevation than edge 21 when viewed from tapered tip regions 15 of spaced-
35 apart teeth 13. This difference in elevation of edges 20 and 21 enables only one way engagement of indexing strip 11 with a second mating connector 40, as shown in FIG. 9.
38 Edge 21 has a width nearly twice the width of edge 20.

This difference in width facilitates cutoff of first conductors 14 by a tool (not shown).

Also shown in FIG. 2 is a generally funnel-shaped channel 22 which is integral with sidewall 16 of spaced apart teeth 13. A similar channel 22 is integral with an opposed sidewall 16 of teeth 13. These funnel-shaped channels 22 have widths of greater extent at tip regions 15 of teeth 13 to facilitate directing slotted beam contacts 30, carried by second mating connector 40 and shown in FIG. 4, into engagement with indexed conductors 14, as shown in FIG. 9.

Indexing strip 11 is affixed to a support carrier (not shown), similar to that illustrated as element 36 in FIG. 2 of U.S. Patent No. 3,798,587, by cylindrical posts 23. Posts 23 are inserted into apertures in the support carrier and heated to produce an expanded head similar to that of a rivet.

In order to securely couple indexing strip 11 to second mating connector 40, a plurality of truncated cylindrical projections 24 are integrally provided on outer walls of spaced-apart teeth 13. Projections 24, as shown in FIGS. 2 and 3, have a greater thickness near an edge opposite tip regions 15 of spaced-apart teeth 13. This coupling arrangement will be considered in further detail following the description of second mating connector 40.

Once conductors 14 are indexed, cross-connections among these conductors and conductors 39 of a second set, as shown in FIG. 9, are effected through a plurality of slotted beam contacts 30, shown in FIG. 4. Each of contacts 30 includes a central portion 31 which has first and second pairs of oppositely directed cantilever beams 32 and 33 extending therefrom. Each of the beams in the pairs of beams 32 and 33 are spaced apart from one another by elongated generally rectangular apertures 34 and 35, respectively. Apertures 34 and 35 extend from central portion 31 to a point near a pair of oppositely directed insulation-penetrating edges 36 and 37, respectively, at the ends of beams 32 and 33. It should be noted that beams

33 are of shorter length than beams 32 to increase the force provided by edges 37 during engagement with conductor insulation. Also included in central portion 31 is a generally over-shaped aperture 25 used in mounting contact 5 30 in mating connector 40.

The second mating connector 40, shown in FIG. 4, comprises a body member 41 which has a plurality of elongate generally rectangular cavities 42 therein for slidably engaging slotted beam contacts 30. Extending 10 partially along planar inner sidewalls 43 of cavities 42 are channel cavities 44. A corresponding plurality of spaced-apart apertures 45 are included in an outer sidewall 46 of body member 41. Spaced-apart apertures 45 are aligned in one-to-one correspondence with rectangular cavities 42 and 15 channel cavities 44.

Once slotted beam contacts 30 are inserted into rectangular cavities 42 and aligned such that aperture 25 is beneath a corresponding aperture 26, shown in FIG. 6, anchoring member 50 is brought into engagement with body 20 member 41. Anchoring member 50, shown in FIG. 5 is comprised of a generally flat rectangular member 51. Integral with member 51 and extending outwardly therefrom are a plurality of spaced-apart generally triangular pro- 25 jections 52. Extending from tops of triangular projections 52 are projections 53 and 54. Interposed between pro- jections 53 and 54 is a notch 55 the width of which is approximately equal to a width of central portion 31 between apertures 25 and 34 of contact 30. The projections 52, 53, 54 extend through the apertures 45 in the wall 46 30 of respective cavities 42, to hold the contacts in the cavities.

Triangular projections 52, in conjunction with projections 53 and 54 and the depth of notch 55, limit the extent of engagement of slotted beam contact 30 with 35 rectangular member 51. It should be noted that projection 53 extends through slot 34 in the contact into channel cavities 44 and projection 54 extends through aperture 25 38 in the contact into aperture 26. This mounting

arrangement for slotted beam contacts 30 couples insertion forces produced during engagement of second mating connector 40 with indexing strip 11 into projections 53 and 54. Consequently, the insertion forces tend toward the shearing of projections 53 and 54 rather than the splitting of body member 41.

To ensure proper alignment of anchoring member 50 with body member 41, the former includes a projecting lip 56 along a lengthwise edge 57. Outer sidewall 46 has a mating groove 48 extending along its length. This lip and groove arrangement provides a polarized mating of anchoring member 50 with body member 41. The two members 50 and 41 are secured to one another, for example, by ultrasonic welding.

As shown most clearly in FIGS. 7 and 9, body member 41 has integral therewith and extending outwardly away therefrom a generally L-shaped skirt 61. A plurality of scallops 62, as shown in FIG. 4, along the base leg of the "L" and along opposite edge 63, engage conductors 14, as shown in FIG. 9, and hold them in place between indexing strip 11 and mating connector 40. Skirt 61 encases exposed ends 19 of first conductors 14 to electrically isolate them from one another. Not only does the insulative material of which both indexing strip 11 and mating connector 40 are made provide electrical isolation, but skirt 61 in conjunction with sealing compound (not shown) shields exposed ends 19 to prevent any accumulation of moisture which could cause electrical short circuits.

After first conductors 14 are individually received and indexed in indexing strip 11 and conductor ends 19 are trimmed to the proper length, mating connector 40 with the plurality of slotted beam contacts 30 therein is brought into engagement with indexing strip 11. Mating connector 40 is coupled securely to indexing strip 11 by projections 24 which engage a corresponding plurality of circular apertures 49 in sidewall 46 and skirt 61. Circular apertures 49 are aligned in correspondence with truncated cylindrical projections 24 so that apertures 49 surround

projections 24 with the greater thickness inhibiting separation of mating connector 40 from indexing strip 11 once the two are mated.

5 It should be noted that mating connector 40 holds the slotted beam contacts 30 in a spatial relationship so that an individual contact 30 is engageable with an individual conductor 14. Opposite ends of contacts 30 are now available for engagement with second conductors 39, as shown in FIG. 9.

10 To facilitate alignment and indexing of second conductors 39, mating connector 40, as shown in FIGS. 6 through 8, has a plurality of spaced-apart, alternating height teeth 65 integral with body member 41. Teeth 65 have a configuration somewhat similar to that of teeth 13
15 on indexing strip 11 insofar as teeth 65 have tapered tip regions 66 forming funnel-shaped wire entry ways 67. Near the bottom of wire retaining slots 68 formed by adjacent sidewalls 69 of teeth 65 there are oppositely directed interference projections 71. Projections 71 have a thick-
20 ness of greater extent at a central point therein which is removed from taper tip regions 66. Projections 71 facilitate capture and inhibit conductors 39 from separating from mating connector 40 after being seated in contacts 30.

25 Electrical isolation is provided among exposed ends of conductors 39 by extended lateral projections 72 on teeth 65 as shown in FIG. 8. These extended projections 72 increase the electrical path length between adjacent exposed conductor ends. On outer edges of alternate ones of projections 72 are projecting lips 73 for facilitating
30 engagement of a test cord (not shown) with mating connector 40.

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CLAIMS

1. Apparatus for electrically interconnecting first conductors with associated second conductors, the apparatus comprising a first connector of insulative material, provided with individual receiving and indexing means for the first conductors, and a second connector for mating with the first connector, comprising a body member of insulative material and a plurality of slotted beam contacts, characterised in that the second connector includes contact holding means (52-54) which project into the body member (41) through wall (46) thereof and which coact with the contacts (30) so as to hold the contacts (30) in the body member (41).

2. Apparatus for electrically interconnecting first conductors (14) with associated second conductors (39), the apparatus comprising first and second unitary mating connectors (11 and 40) of insulative material, the first connector provided with individual receiving and indexing means (13) for the first conductors, and further comprising a plurality of slotted beam contacts (30), characterised by a contact holding member (50) which forms a sidewall portion and which is integrated with the second connector (40) when the apparatus is assembled, and that the contact holding member is provided with projections (52-54) which penetrate an adjacent outer sidewall (46) of the second connector as well as the beam contacts (30) so as to hold the assembled contacts firmly in place.

3. The apparatus in accordance with claim 2, wherein capturing and holding means are provided integral with adjacent sidewalls of spaced-apart teeth (13) of the first connector and comprise first and second opposed depressions (18) in adjacent sidewalls of the teeth, the opposed depressions located at an intermediate point along the height of the teeth above wire retaining slots (17).

4. The apparatus in accordance with claim 2 or 3, wherein directing means (22) are included in the first connector (11), integral with opposed sidewalls (16) of each of the spaced-apart teeth (13), for directing a

plurality of slotted beam contacts (30) held by the second connector (40) into engagement with the indexed first conductors (14).

5 5. The apparatus in accordance with claim 4 wherein the directing means comprise generally funnel-shaped channels (22) on adjacent sidewalls of the spaced-apart teeth, the channels having a width of greater extent at the tips of the teeth.

10 6. The apparatus in accordance with one or more of claims 2-5, wherein each of the slotted beam contacts includes: a central portion having a generally oval-shaped aperture (25) therein; first and second pairs of oppositely directed cantilever beams (33), wherein the first pair of beams (33) is shorter in length than the second pair of
15 beams (32).

 7. The apparatus in accordance with any of claims 2-6, wherein the second connector (40) is provided with holding means comprising a body member (41) having a plurality of elongated generally rectangular cavities (42)
20 therein for slidably engaging slotted beam contacts (30); channel cavities (44) extending partially along planar inner sidewalls (43) of cavities (42); and an outer sidewall (46) extending along a length of the body member, said outer sidewall having a plurality of spaced-apart
25 apertures (45) therein aligned in one-to-one correspondence with said plurality of rectangular cavities (42) and the channel cavities (44).

 8. The apparatus in accordance with claim 7, the contact holding member (50) is engageable with the
30 aligned plurality of apertures (45), one of the elongated generally rectangular apertures (34, 35) in each of the slotted beam contacts (30), the generally oval-shaped aperture (25) in the contacts, and the channel cavities (44).

35 9. The apparatus in accordance with claim 8, wherein the contact holding member (50) comprises: a generally flat rectangular member (51); a plurality of
38 spaced-apart generally triangular projections (52) integral

with said rectangular member; and a plurality of projections (53, 54) integral with tops of the triangular projections 52, the triangular projections limiting the extent of engagement of the slotted beam contacts with the
5 rectangular member (51).

10. The apparatus in accordance with claim 9, wherein each of the projections (53, 54) has a notch (55) therein the width of which is approximately equal to a width of a central portion (31) between the generally oval-
10 shaped aperture (25) and one of the generally rectangular apertures (34,35) in one of the slotted beam contacts (30).

11. The apparatus in accordance with claims 9 or 10, wherein the contact holding member (50) includes a projecting lip (56) along an edge (57) of said
15 rectangular member (51).

12. Apparatus in accordance with claim 11, wherein the outer sidewall (46) of the second mating connector (40) includes a groove (48) therein engaging the projecting lip and providing mating of the contact
20 holding member with the second mating connector (40).

13. The apparatus in accordance with any of claims 2-12, wherein a shielding means (61) forms an integral part of the second connector (40) and encases exposed ends (19) of the first conductors (14) and
25 comprises: a generally L-shaped skirt (61) projecting away from the second connector (40).

14. The apparatus in accordance with claim 13, wherein the integral skirt (61) is scalloped along the base of the L-shape, the scallops (62) engaging the first
30 conductors (14) and holding them in place between the first and second connectors (11, 40).

15. The apparatus in accordance with any of claims 4-14, wherein coupling members (24) are provided integral with each of the spaced-apart teeth (13) securely
35 coupling the second connector to the first connector.

16. The apparatus in accordance with claim 15, wherein the coupling members (24) comprise a plurality
38 of truncated cylindrical projections (24) each projection

having a greater thickness near its edge opposite a tip of said spaced-apart teeth; and that the second mating connector (40) comprises a plurality of generally circular apertures (49) aligned in correspondence with the truncated
5 cylindrical projections (24), said apertures surrounding the projections and the greater thickness inhibiting separation of the first and second connectors after the connectors are mated.

17. The apparatus in accordance with any of claims
10 2-16 wherein the first connector includes: a longitudinally extending body member (12); first and second projecting side edges (20,21) extending along a length of the body member, the first and second side edges being at different elevations along the body member such that the first side
15 edge is at a higher elevation than the second side edge to enable one way engagement of the first and second connectors.

18. The apparatus in accordance with claim 16, wherein the first side edge (21) has a width nearly twice the width of the second side edge (20) to facilitate
20 cutoff of the first conductors (14).

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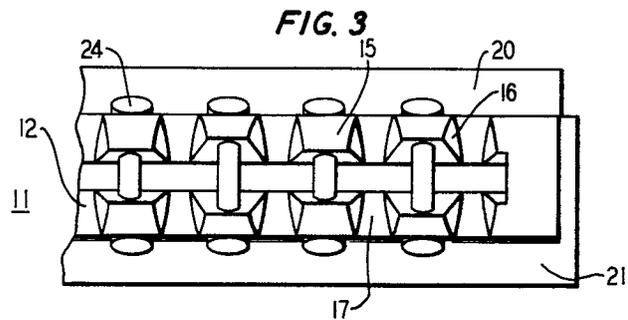
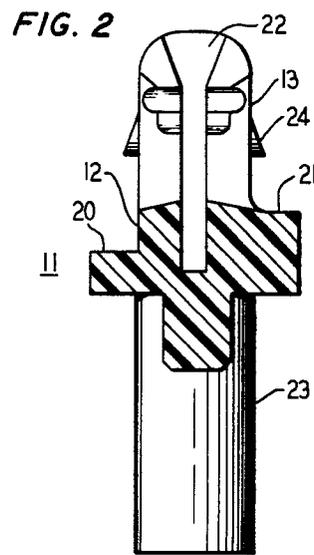
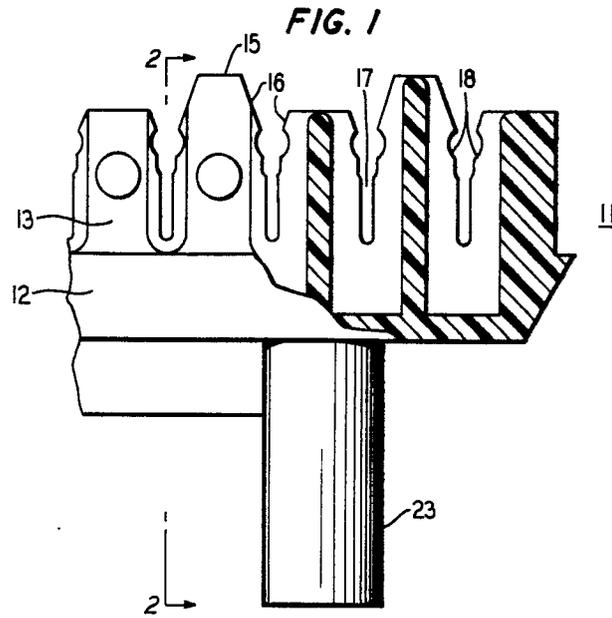


FIG. 4

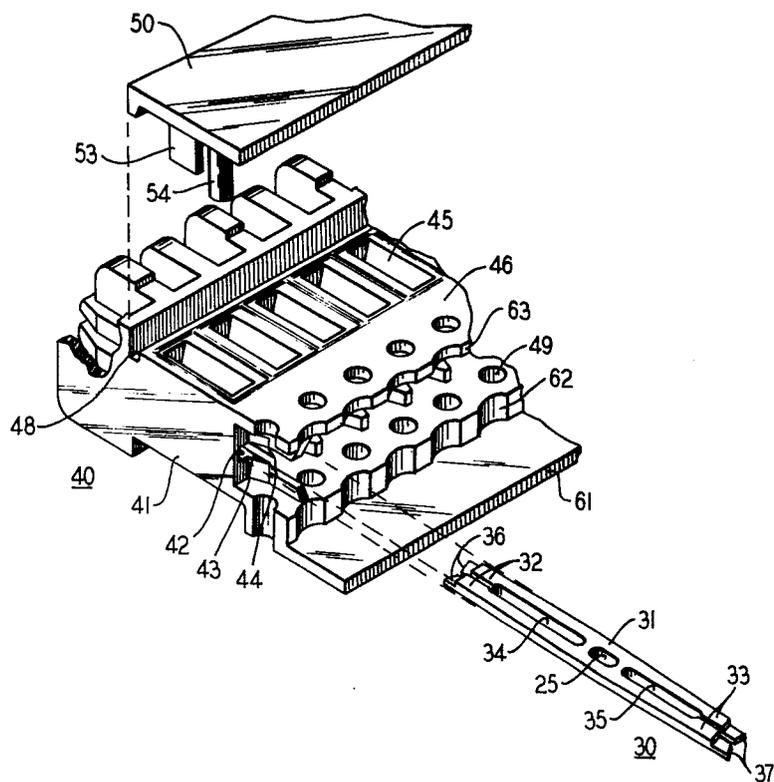


FIG. 5

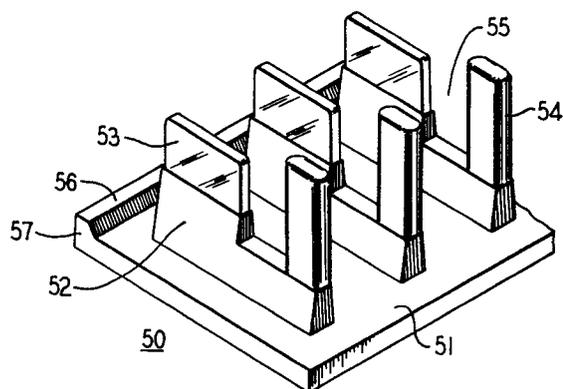


FIG. 6

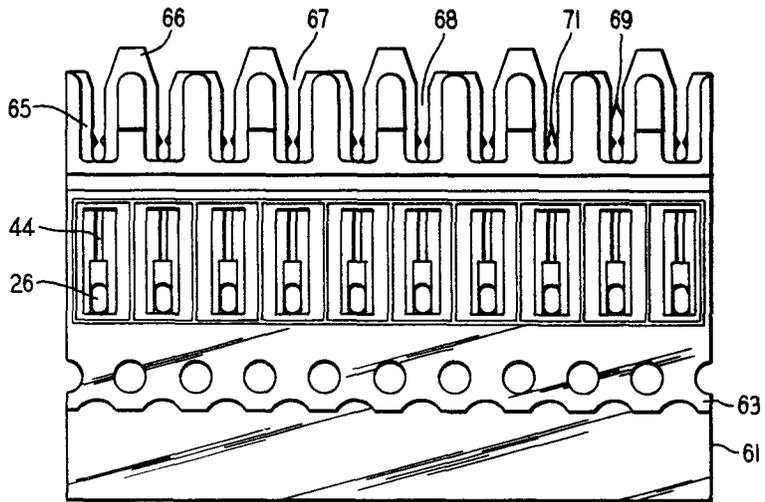


FIG. 7

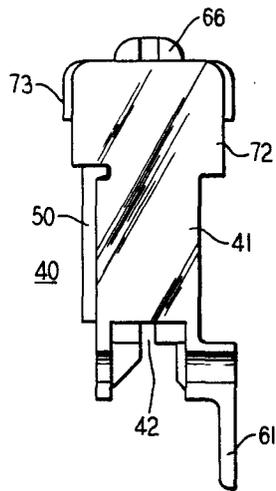


FIG. 8

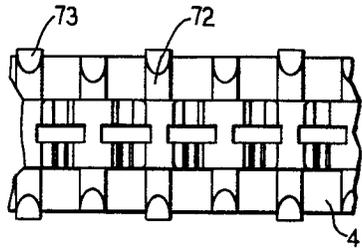
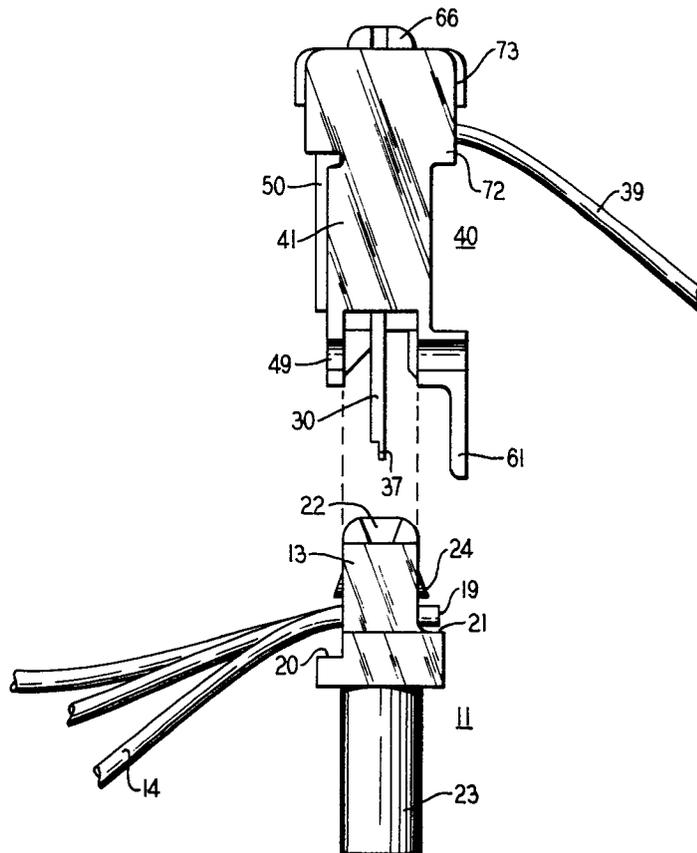


FIG. 9





DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int. Cl. ²)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
	<u>US - A - 3 778 750 (PANDUIT)</u> * Column 6, lines 43-57; column 8, lines 36-58; figures 12-16 *	1,3,8	H 01 R 9/08 H 01 R 9/22
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A	<u>US - A - 3 923 362 (NORTHERN)</u> * Column 3, line 49 - column 4, line 31; figures *	1,14	
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A	<u>FR - A - 2 286 520 (RELIABLE)</u> * Figure 7A *	4,5	
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A	<u>FR - A - 2 289 055 (BUNKER RAMO)</u> * Page 5, lines 18-25; figures *	3	H 01 R 9/08 H 01 R 7/04 H 01 R 43/00 H 01 R 13/42 H 01 R 13/38 H 01 R 9/22 H 01 R 9/16
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D	<u>US - A - 3 611 264 (BELL)</u> * Column 2, lines 46-49; figures *	1,15	
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A	<u>US - A - 3 533 054 (UNITED-CARR)</u> * Column 3, lines 12-17; figures 2-4 *	16	
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A	<u>US - A - 3 858 158 (WESTERN)</u> * Column 4, line 35 - column 5, line 24 *	3,15	
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A	<u>US - A - 3 510 823 (CERVENKA)</u> * Figures *	1	

<p>The present search report has been drawn up for all claims</p>			<p>TECHNICAL FIELDS SEARCHED (Int.Cl.²)</p> <p>CATEGORY OF CITED DOCUMENTS</p> <p>X: particularly relevant A: technological background O: non-written disclosure P: intermediate document T: theory or principle underlying the invention E: conflicting application D: document cited in the application L: citation for other reasons</p> <p>&: member of the same patent family, corresponding document</p>
Place of search	Date of completion of the search	Examiner	
The Hague	16-10-1978	RAMBOER	