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(54) **Electrical connector with a terminal having a slotted wire receiving portion and wire strain relief means.**

(57) The condenser comprises an insulating housing (4) defining cavities (18) in which are electrical terminals (20) having slotted plate portions (26) for receiving wires (22) and wire strain relief ears (52, 54) for crimping about the insulation of the wires (22).

So that the terminals (20) can be wired in situ in the housing (4), by means of a wire insertion tool (72) and an ear crimping tool (70), each cavity (18) has an open side (17) for receiving the tools (70 and 72) and towards which side (17) the slotted plate portions (26) and the ears (52 and 54) upstand from a floor (66, 68) of the cavity (18). The ears (52, 54) are offset longitudinally of the terminal (20).

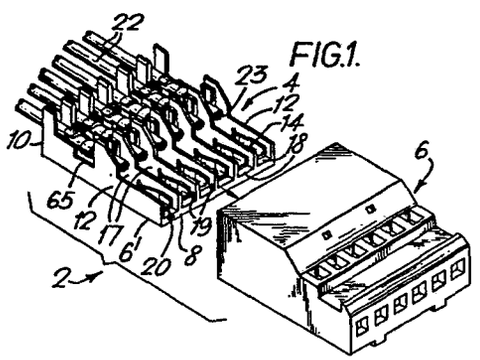

FIG.1.

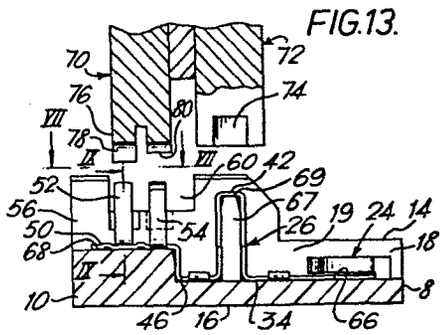

FIG.13.

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TITLE MODIFIED
see front page

Electrical Connector.

This invention relates to an electrical connector comprising an elongate electrical terminal and an insulating housing defining a cavity receiving the terminal and extending between a mating face and a wire receiving face of the housing, the terminal comprising a contact portion proximate to the mating face, for mating with a further terminal, a wire strain relief portion proximate to the wire receiving face and a wire receiving portion intermediate the contact portion and the strain relief portion, the strain relief portion comprising a web having ears on opposite sides thereof for crimping about the insulation of an insulated wire, and the wire receiving portion comprising a plate having a slot adapted to receive a wire inserted into the slot in a direction transverse to the longitudinal axis of the wire.

An electrical terminal as described above for use in an electrical connector is disclosed in GB-A-1,483,981.

The present invention is directed to the problem of providing an electrical connector having such terminals but which is so constructed that the terminal can be wired, preferably by means of an automatic cable or harness making machine, when the terminal is in situ in the connector housing, and in which the strain relief afforded for the wire is greatly improved.

According to the present invention therefore,

an electrical connector as defined in the first paragraph of this specification is characterised in that the web and the plate rest on a floor of the cavity and the cavity has an open side opposite to the floor, the ears being offset from one another longitudinally of the terminal and being upstanding therefrom towards the open side and the slot opening into an edge of the plate remote from the floor, the ears and the wire receiving portion being so positioned relative to one another and relative to the housing that the ears can be crimped about a single insulated wire and such wire simultaneously inserted into the slot, by means of tooling inserted through the open side of the cavity.

For a better understanding of the invention an embodiment thereof will now be described by way of example with reference to the accompanying drawings in which:-

Figure 1 is a perspective view of a multi-way electrical connector assembly comprising an electrical connector having a housing containing electrical terminals, wire receiving portions of which have been crimped to wires, and a shroud which is shown as being exploded from the connector;

Figure 2 is an enlarged perspective view of one of the terminals in an unwired condition;

Figure 3 is a similar view to that of Figure 2 but showing the terminal in a wire condition;

Figure 4 is an enlarged side view showing wire receiving and strain relief portions of the terminal, with a portion of a wire in alignment therewith;

Figure 5 is a similar view to that of Figure 4 but showing the wire receiving and strain relief

portions connected to the wire;

Figure 6 is a perspective view of the connector showing wires in alignment with the wire receiving and strain relief portions of the terminals;

Figure 7 is an enlarged view of the housing taken on the lines VII - VII of Figure 13;

Figure 8 is an enlarged view taken on the lines VIII - VIII of Figure 7, also showing part of a tool for crimping the strain relief portions of the terminals to the wires;

Figure 9 is an enlarged cross-sectional view taken on the lines IX - IX of Figure 13, of the strain relief portion of one of the terminals and showing a wire therein prior to such portion being crimped to the wire;

Figures 10 and 11 are similar views to that of Figure 9 but illustrating successive stages in the crimping of the strain relief portion to the wire, Figure 11 being taken on the lines XI - XI of Figure 14;

Figure 12 is an enlarged, inverted, fragmentary perspective view of the crimping tool;

Figure 13 is a sectional side view of the connector in association with the crimping tool and a wire insertion tool, which tools are shown in fragmentary form prior to being depressed to wire the terminals of the connector;

Figure 14 is a similar view to that of Figure 13, but taken after a wire has been inserted between the tools and the connector and the tools have been depressed; and

Figure 15 is an enlarged, fragmentary, perspective view of an end portion of the housing.

As shown in Figure 1, an electrical connector assembly comprises an electrical connector

having an insulating housing 4 of thermoplastics material, e.g. nylon, and an insulating shroud 6 dimensioned to receive the connector.

The housing 4 has a mating face 8 and a wire receiving face 10, between which extend opposite end walls 12, barrier edge walls 14 of barriers 19, and a base 16. The barriers 19 extend between a plurality of juxtaposed, channel shaped cavities 18 each receiving a terminal 20, arranged to be electrically connected to a wire 22 as explained below. As best seen in Figure 2 each terminal 20 which has been stamped and formed, for example from brass, has a contact portion 24 at its forward end, a wire receiving portion 26 intermediate its ends and a crimpable strain relief portion 28 at its rearward end. The contact portion 24 which is in the form of a receptacle for a post or pin (not shown) has a flat web 30 from opposite longitudinal edges of which elongate contact springs 32 converge rearwardly.

The portion 24 is connected to the portion 26 by a flat neck 34 from which extend, obliquely with respect to the plane of the neck 34, flanges 36, the portions 26 and 28 being connected by a flat neck 46 from which similarly extend similar flanges 47.

The wire receiving portion 26 comprises a pair of parallel spaced flat plates 38 and 40 connected at their upper (as seen in Figure 2) ends by spaced straps 42, and each having a wire receiving slot 44 opening between the straps 42. The minimum width of at least one of the slots 44 is less than the diameter of the electrically conductive core 23 of each of the wires 22, so that the edges of that slot 44 will penetrate the insulation of the wire 22 when it has been inserted into the

slot laterally of the longitudinal axis of the wire 22, so as to establish electrical contact with the core 23 of the wire. The other slot 44 may be of greater width than the diameter of a core 23 so that the walls of that slot serve only to grip the insulation of the wire 22.

The strain relief portion 28 comprises an elongate web 50 having transverse corrugations 56 and a cranked portion 48 parallel to the plates 38 and 40 and being connected to the neck 46. The web 50 is positioned at a level between the straps 42 and the web 46, the webs 34 and 36 being positioned at the same level, as one another, as shown in Figures 4 and 5.

First and second crimping ears 52 and 54, respectively, extend from the lateral edges of the web 50, between the corrugations 56 and in offset relationship to one another longitudinally of the webs 50. The ear 52 is proximate to the rearward end of the web 50, the ear 54 being proximate to the portion 48.

As best seen in Figures 13 to 15, each cavity 18 is defined by opposed side walls 56 and 58 of the barriers 19, and floors 66 and 68 of the base 16, which are disposed at different levels, the cavity 18 having an open side 17, opposite to the floors 66 and 68, bounded by the adjacent walls 14. The barriers 19 have rectangular notches 60 therein proximate to the face 10 of the housing 4, from the bottoms of which extend recesses 62 and 64, the recesses 64 being further from the face 10 than the recesses 62. The recesses 62 and 64 provide clearance for the root portions of the ears 52 and 54, respectively, of the terminals 20 as best seen in Figure 7. As shown in Figure

15, the walls 12 have notches 65 which are adjacent to, and are deeper than, the notches 60 of the walls 12. As shown in Figure 7 the notches 65 receive the ears 54. The walls 12 are of substantially half the thickness of the barriers 19 in order to permit a plurality of the connectors to be stacked against each other while maintaining the spacing between adjacent terminals, from one connector of the stack to the next.

Each side wall 56 and 58 is provided with a projection 67 upstanding from the floor 68 and positioned forwardly of the notches 60. Shoulders 69 of the projections 67 support the straps 42 of the terminals 20 as best seen in Figures 13 and 14.

The floors 66 which are at a lower (as seen in Figures 13 and 14) level than the floors 66, extend inwardly from the face 8 and serve to support the contact portions 24 and the webs 34 and 46 of the terminals 20, the floors 68, which extend inwardly from the face 10, serving to support the webs 50 of the terminals 20; as best seen in Figure 13.

The individual wires 22 are connected to the terminals 20 by means of tooling (best seen in Figures 13 and 14) comprising a crimping tool 70 and an insertion tool 72, which are mounted on a common insertion ram (not shown) arranged to be driven in vertical reciprocating movement. The tool 72 comprises a plurality of juxtaposed spaced insertion punches 74 (one shown) each dimensioned to enter between the straps 42 of a terminal 20 and push a wire 22 into the slots 44 of the terminal.

The tool 70 (as best seen in Figure 12) has a working end 76 across which extend a row of

first crimping dies 78 and a row of second crimping dies 80 parallel to, and spaced from, the row of dies 78. Each die 78 has an arcuate surface 82 for engaging the ear 52 of a terminal 20, and an extension 84 on one side of the surface 82, for crimping the ear 52 about a wire 22, as illustrated in Figures 10 and 11. Cut-outs 86 are provided between the dies 78 to enable them to move into the individual cavities 18 of the housing 4 when the tool 70 has been depressed to the position of Figure 11. Each die 80 has an arcuate concave surface 88 on one side of which is an extension 90, for crimping the ear 54 of a terminal 20 about a wire 22, cut-outs 92 being provided between the dies 80 to allow them to enter respective cavities 18 in the Figure 11 position of the tool 70.

In order to connect the wires 22 to the individual terminals 20, the wires 22 are aligned with the terminals (Figure 4) and are laid between the ears 52 and 54 of the terminals 20 (Figure 10), and the tooling 70, 72 is depressed so as to enter the cavities 18 through their open sides 17, to cause the punches 74 to insert the wires into the slots 44 of the terminals, and the dies 78 and 80 simultaneously to crimp the ears 52 and 54 of the terminals 20 onto the wires 22 (Figures 10 and 11). The ears 52 and 54 are initially engaged by the extensions 84 and 90, respectively, of the crimping dies so as to be curled inwardly (Figure 10). The arcuate surfaces 82 and 88 then drive the ears downwardly to their positions of Figure 11, so that the wire 22 is clamped against the corrugations 56 on the web 50 of the terminal 20. The provision of the cut-outs 86 and 92 of the tool 70 and of the notches 60 of the housing 4, enables the

crimping dies to penetrate into the cavities 18, to perform the crimping operations.

Any tensile force applied to a wire 22 is transmitted to the terminal through its crimped strain relief ears 52 and 54 so that the electrical connection between the wire 22 and the wire receiving portion 26 of the terminal is unaffected by the application of the tensile force.

The tooling 70, 72 is preferably incorporated in a cable making machine, according to US-A-4,136,440, or a harness making tooling according to US-A-3,859,724. In any event, it is highly desirable to insert the wires 22 into the slots 44 and to crimp the terminals 20 onto the wires 22 in one stroke of the tools 70 and 72.

The terminals 20 are loaded into the cavities 18 of the housing 4 by aligning a terminal with each cavity 18 and moving the terminal thereinto laterally of its longitudinal axis, and through the open side 17 of the cavity. The width of each cavity 18 is such that the flanges 36 and 47 of the terminal 20 in the cavity bear against the side walls of the cavity to retain the terminal therein. The straps 42 of each terminal 20 are supported during the insertion of a wire 22 into the slots 44 of the terminal, by adjacent shoulders 69 of the housing 4, so that the plates 38 and 40 of the terminal are not subjected to compressive stress.

Claims:

1. An electrical connector comprising an elongate electrical terminal (20) and an insulating housing (4) defining a cavity (18) receiving the terminal (20) and extending between a mating face (8) and a wire receiving face (10) of the housing (4), the terminal (20) comprising a contact portion (24) proximate to the mating face (8), for mating with a further terminal, a wire strain relief portion (28) proximate to the wire receiving face (10) and a wire receiving portion (26) intermediate the contact portion (24) and the strain relief portion (28), the strain relief portion (28) comprising a web (50) having ears (52 and 54) on opposite sides thereof for crimping about the insulation of an insulated wire (22), and the wire receiving portion (26) comprising a plate (40) having a slot (44) adapted to receive a wire (22) inserted into the slot (44) in a direction transverse to the longitudinal axis of the wire (22); characterised in that the web (50) and the plate (40) rest on a floor (66, 68) of the cavity (18) and the cavity (18) has an open side (17) opposite to the floor (66, 68), the ears (52 and 54) being offset from one another longitudinally of the terminal (20) and being upstanding therefrom towards the open side (17) and the slot (44) opening into an edge of the plate (40) remote from the floor (66, 68), the ears (52 and 54) and the wire receiving portion (26) being so positioned relative to one another and relative to the housing (4) that the ears (52 and 54) can be crimped about a single insulated wire (22) and such wire simultaneously inserted into the slot (44), by means of tooling (70, 72) inserted through the open side (17) of the cavity

(18).

2. A connector according to Claim 1, characterised in that the floor (66, 68) has a first portion (68) supporting the web (50) and a second portion (66) supporting the wire receiving portion (26), the second portion (66) of the floor being offset from the first portion (68) thereof in a direction away from the open side (17) of the cavity (18).

3. A connector according to Claim 1 or 2, characterised in that the cavity (18) has side walls (19) extending longitudinally of the terminal (20), each side wall (19) having a recess (60) for accommodating the tooling (70, 72).

4. A connector according to Claim 1, 2 or 3, characterised in that the wire receiving portion (26) comprises a pair of plates (40) each having a slot (44), the edges of the plates (40) remote from the floor (66, 68) being connected by straps (42), the straps (42) being supported on shoulders (69) provided on projections (67) upstanding from the floor (66, 68).

5. A connector according to any one of the preceding claims, characterised in that the wire receiving portion (26) of the terminal (20) is connected to the strain relief portion (28) thereof by means of a flat web (46), from each opposite free edge of which projects a flange (47), obliquely with respect to the plane of the flat web (46), each flange (47) engaging a side wall (19) of the cavity (18) to retain the terminal (20) therein.

6. A connector according to any one of the preceding claims, characterised in that the wire receiving portion (26) of the terminal is

connected to the contact portion (24) thereof by means of a flat web from each opposite free edge of which projects a flange (36), obliquely with respect to the plane of such web, each flange engaging a side wall (19) of the cavity (18) to retain the terminal therein.

7. A connector according to any one of the preceding claims, characterised in that the web (50) of the strain relief portion (28), which is elongate, is provided with a series of transverse corrugations (56) which project from such web (50) between the ears (52 and 54), which are offset from one another longitudinally of the web (50).

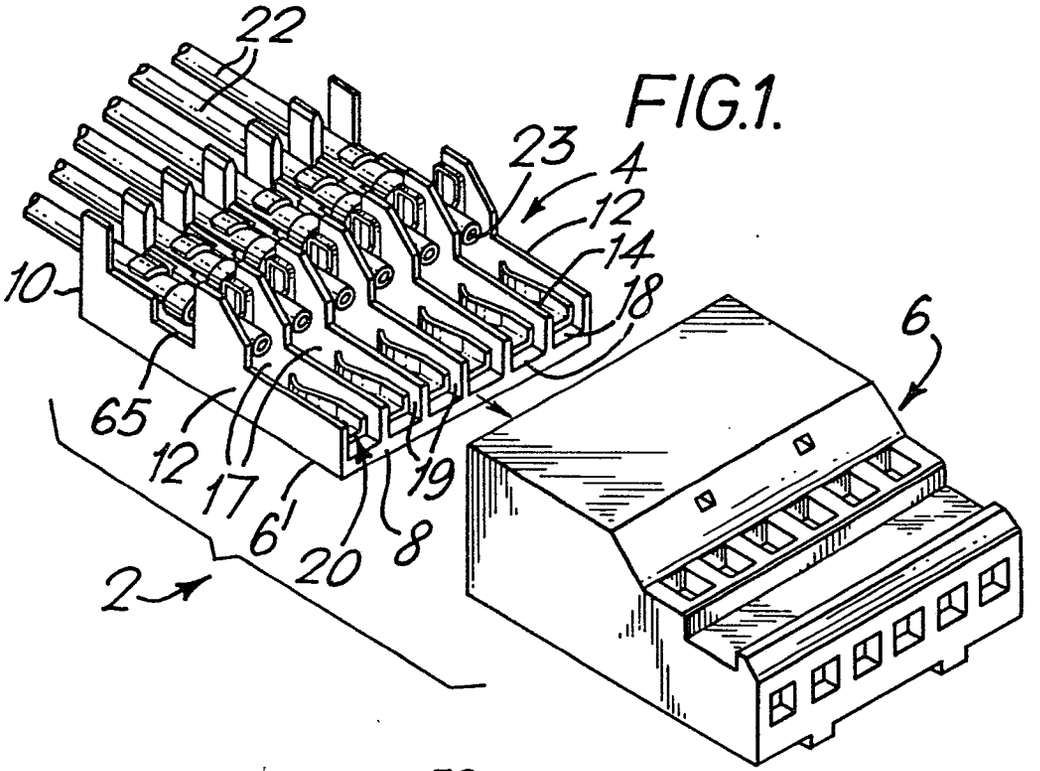


FIG.1.

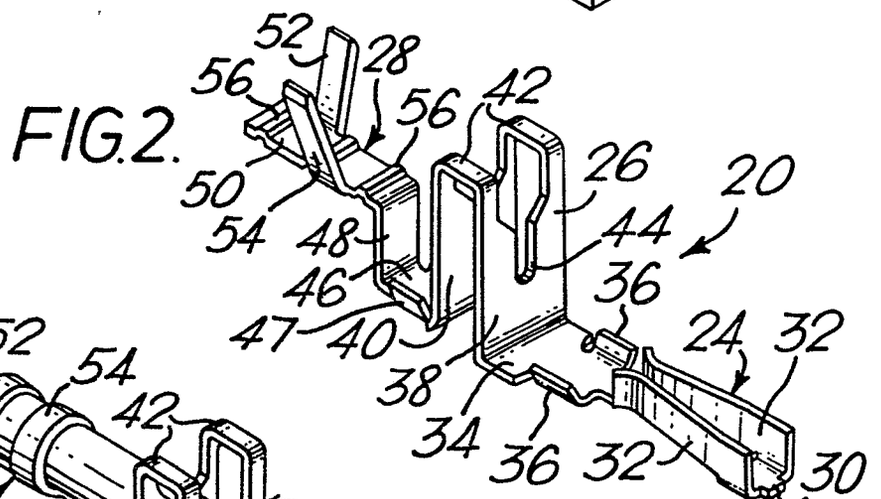


FIG.2.

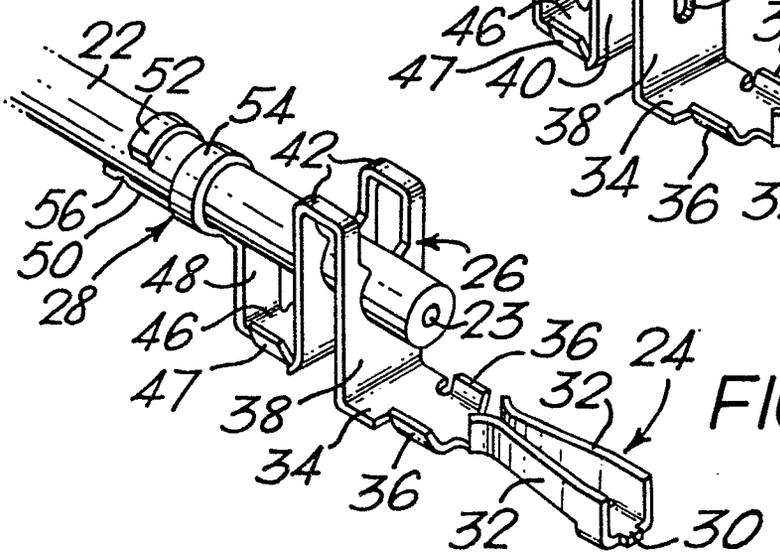


FIG.3.

FIG.4.

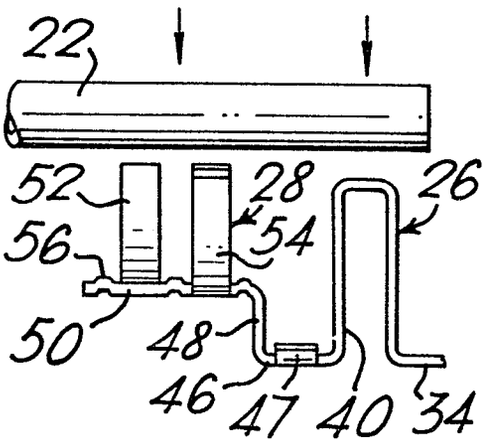


FIG.5.

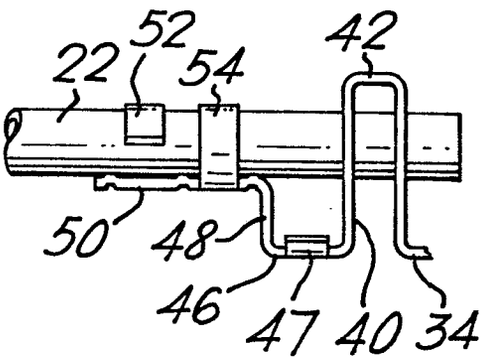
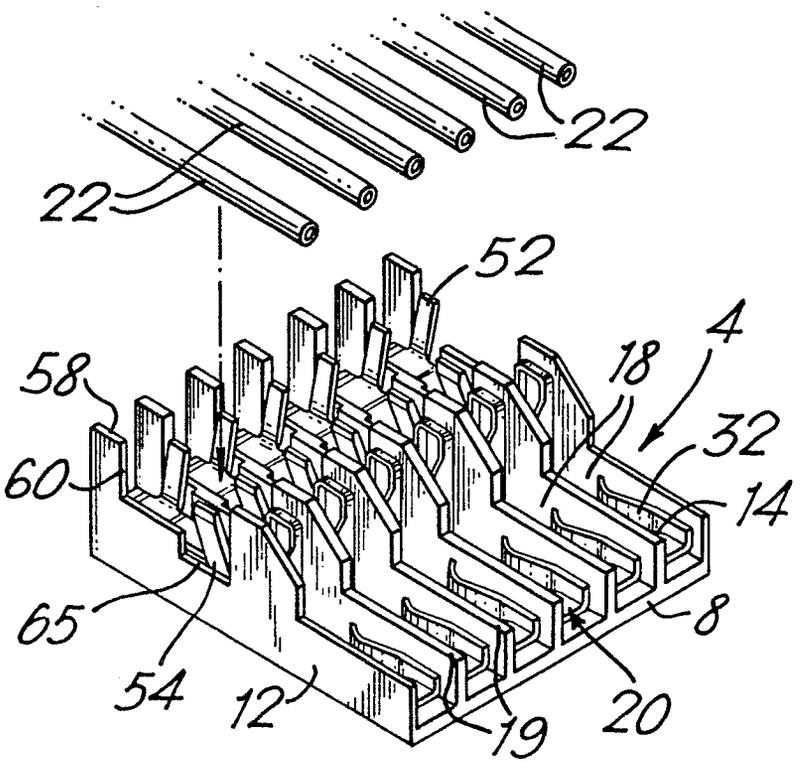
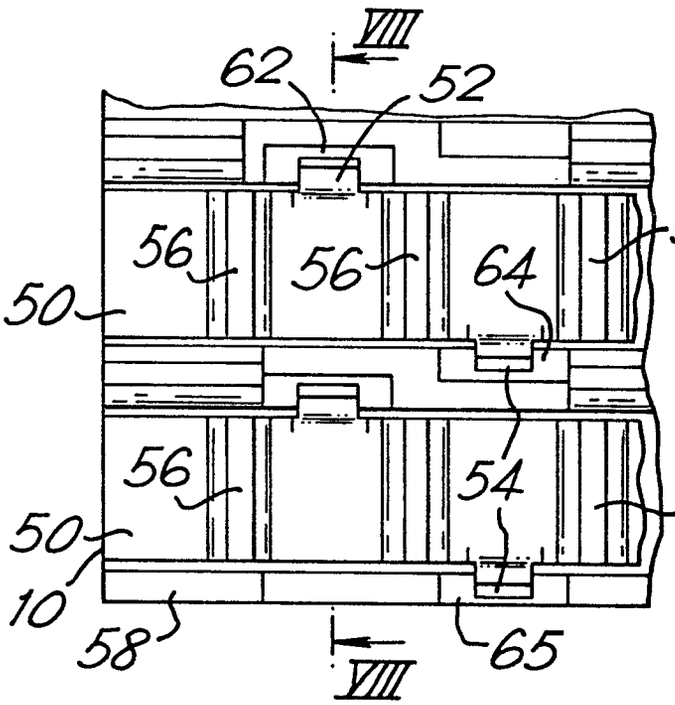


FIG.6.

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VIII

FIG.7.

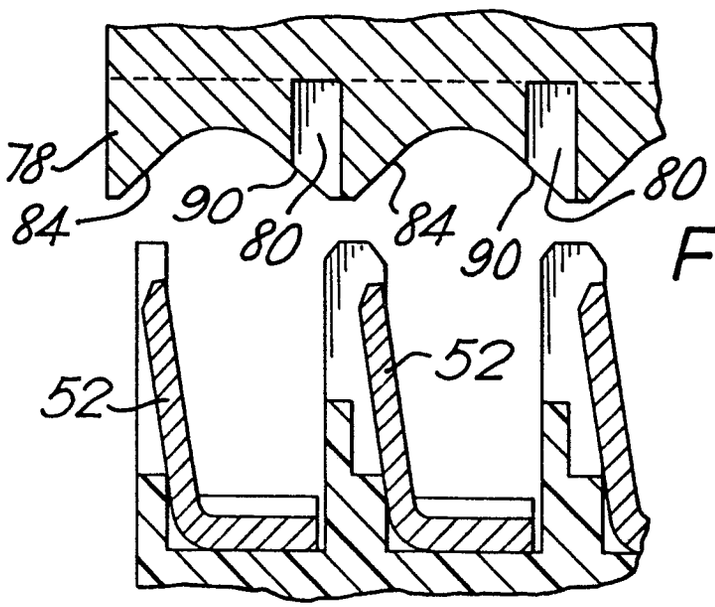
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FIG.8.

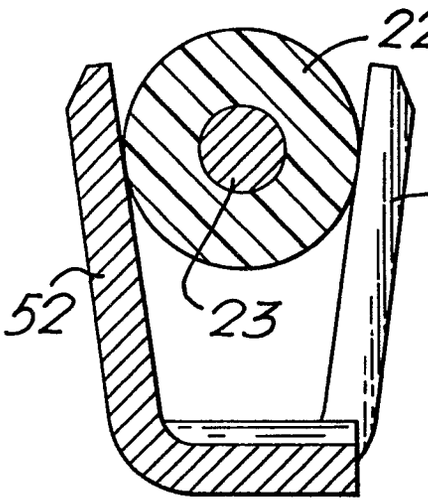

FIG.9.

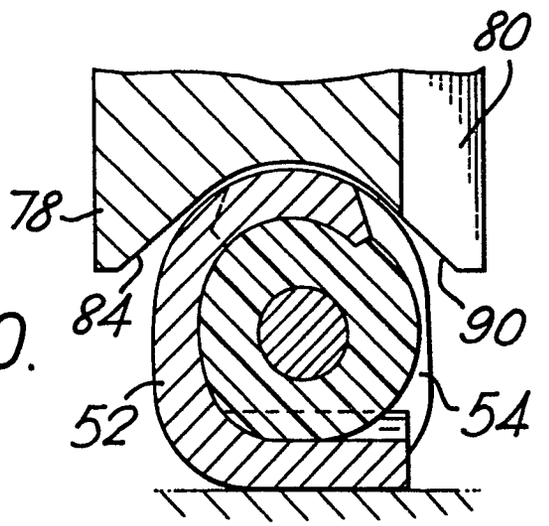

FIG.10.

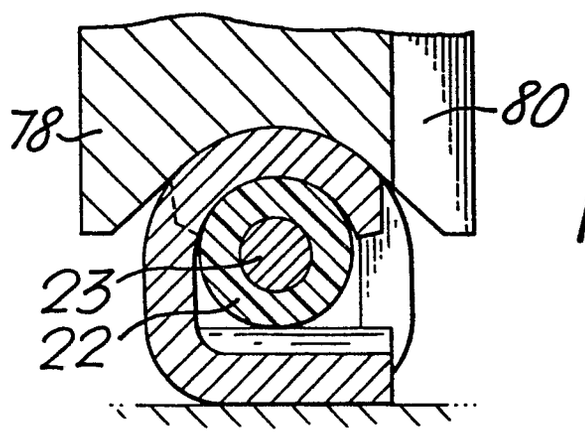

FIG.11.

FIG.12.

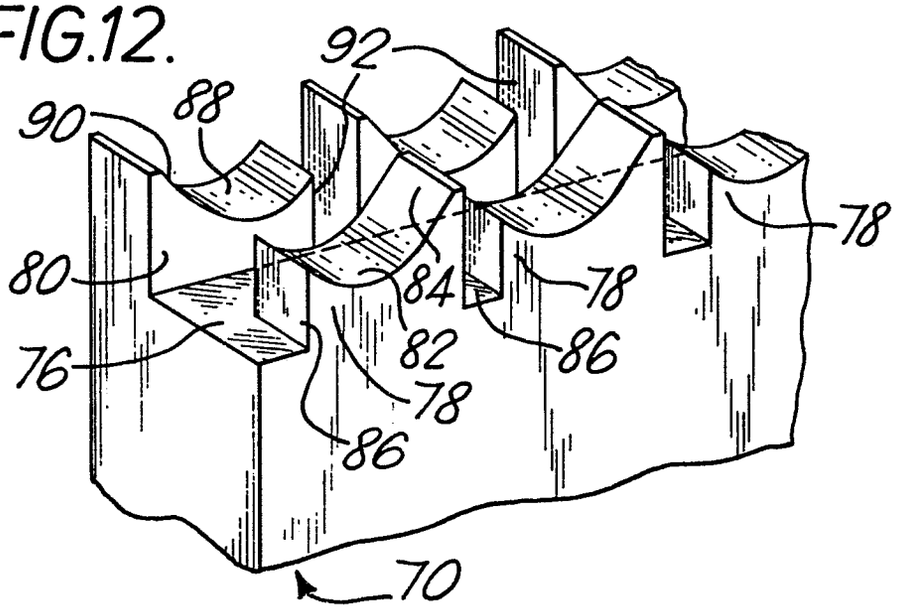
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FIG.15.

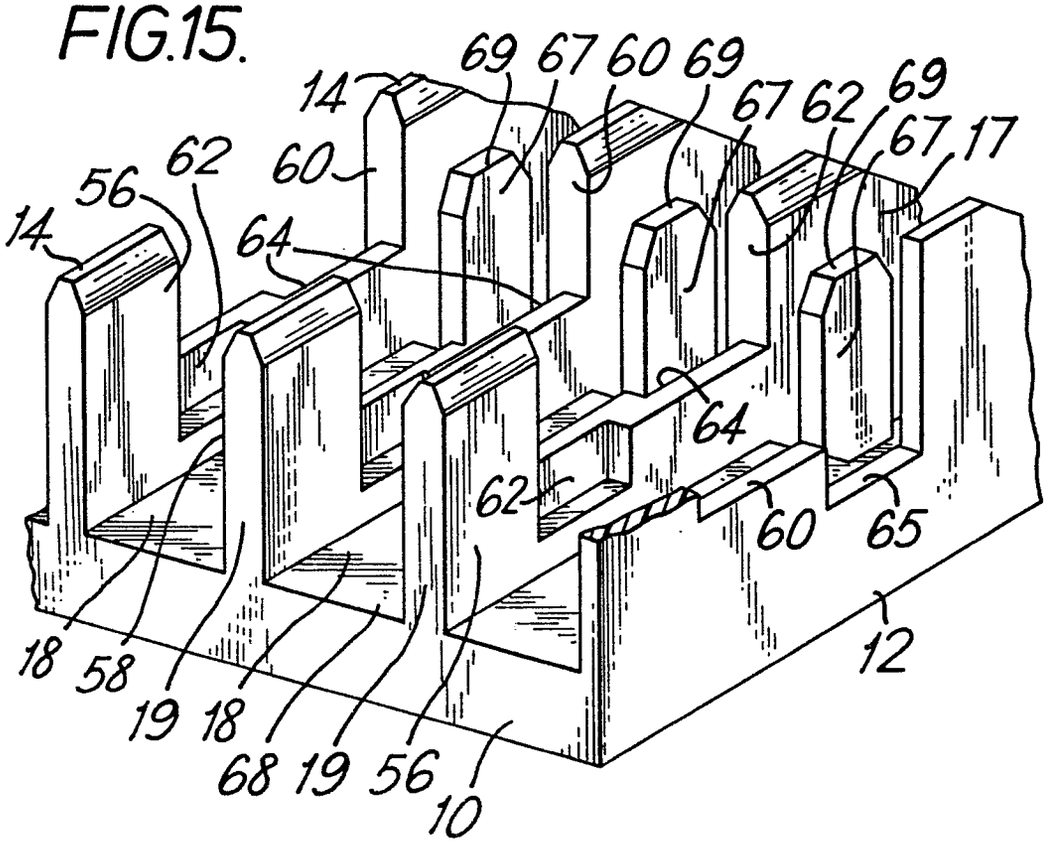
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FIG.13.

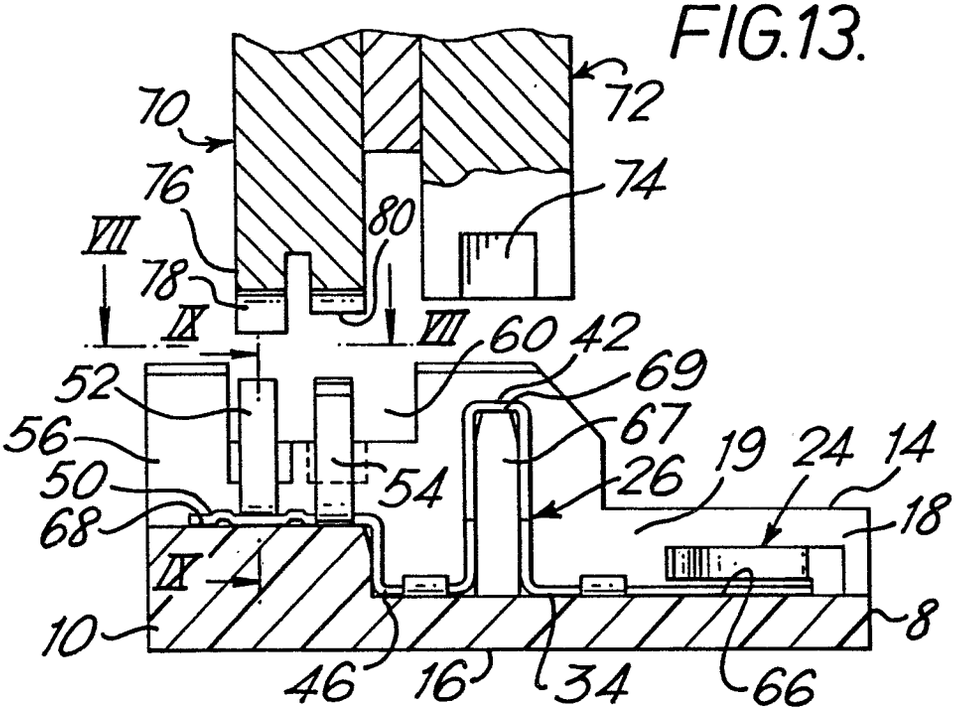
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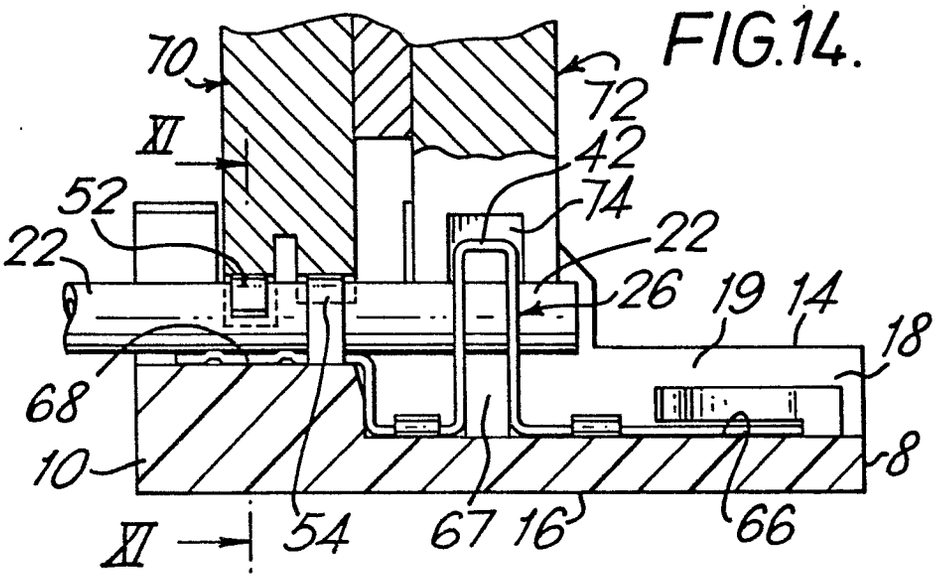
FIG.14.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European Patent Office

EUROPEAN SEARCH REPORT

0057780

Application number
EP 81 30 0547

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim
	US - A - 3 909 935 (AMP) * Column 5, line 6 - column 6, line 23; figures 10-12 *	1,4
	US - A - 3 959 868 (BUNKER RAMO) * Column 4, line 58 - column 7, line 45; figures *	1,3
	GB - A - 2 019 119 (BUNKER RAMO) * Page 2, lines 18-106; figures *	1,2,7
	GB - A - 2 043 368 (METHODE ELECT.) * Page 2, lines 27-84; figures *	1,5
A	US - A - 4 208 083 (TRW) * Abstract; figures *	1
A	US - A - 4 043 034 (AMP) * Figure 2 *	1

CLASSIFICATION OF THE APPLICATION (Int. Cl.³)

H 01 R 4/24
43/00

TECHNICAL FIELDS SEARCHED (Int. Cl.³)

H 01 R 4/24
43/00

CATEGORY OF CITED DOCUMENTS

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

&: member of the same patent family, corresponding document

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	12-10-1981	RAMBOER

EPO Form 1503.1 06.78