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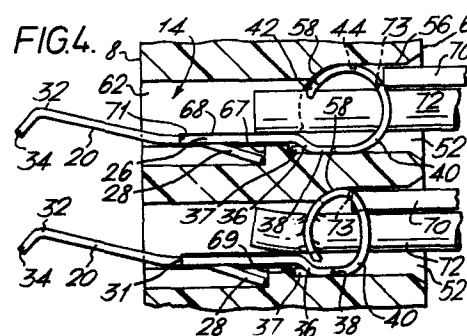
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(54) **Slotted plate electrical connector.**

(57) The invention relates to an electrical connector into slotted plate terminals of which, wires can be inserted axially so that the housing of the connector need not be designed to allow lateral insertion of the wires into the terminals. As shown in Figure 4 (upper part) an electrical terminal in a cavity (14) in an insulating housing has a loop shaped wire receiving part (40) having a wire receiving slot (44) formed in its free end portion (42). A wire (72) can be inserted through a wire receiving opening, bounded by an edge (73), in the wire receiving part (40) to extend across the mouth of the wire receiving slot (44). As shown in the lower part of Figure 4 a tool (70) can be driven against the edge (73) to deform the wire receiving part (40), guided by an arcuate surface (58) of the housing, to force the electrically conductive core of the wire (72) into the slot (44).



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Slotted plate electrical connector.

This invention relates in general to the art of making electrical line connections and relates in particular to an electrical connector of the slotted plate type.

We have described for example in our United States Patent Specification No. 3,760,335 an electrical connector comprising an insulating housing having a cavity receiving an electrical terminal provided with a loop shaped wire connecting portion having a wire receiving slot therein having a mouth into which an electrical wire is insertable in a direction transversely of the longitudinal axis of the wire to make electrical connection between the wire and the terminal.

In such known slotted plate connectors, the wire is inserted into the slot of the terminal by moving the wire laterally of its axis and into the slot. The housing must therefore be provided with an opening through which the wire can be moved laterally into the slot of the terminal, and through which it projects when the connection has been made. This requirement necessarily limits the manufacturer's freedom of design of the housing, as well as limiting the number and arrangement of the cavities where the connector is of the multi-terminal kind, since lateral access for a wire to be connected to each terminal must always be provided. In fact it has not hitherto been found practicable to use slotted plate terminals in electrical connectors having several rows of terminals or in multi-terminal circular cross-section connectors, in

view of the wire access problem outlined above.

The broad concept from which the invention proceeds is that in order to avoid the above disadvantages, the terminal should be such that the
5 wire can be axially inserted thereinto, the terminal being subsequently deformable within the housing, e.g. by means of a simple tool, to cause the wire to be received in the wire receiving slot of the terminal.

According to one aspect of the invention, an
10 electrical connector as defined in the second paragraph of this specification is characterised in that the wire receiving slot is formed, in a free end portion of the wire connecting portion which has a wire receiving opening through which the wire can be inserted in the
15 direction of its longitudinal axis to extend across the mouth of the wire receiving slot, the wire connecting portion being deformable inwardly of the cavity to move the free end portion past the wire so that the wire is received in the wire receiving slot.

20 According to a further aspect of the invention, an electrical connector comprising an insulating housing having a mating face and a wire receiving face, a terminal receiving cavity extending through the housing from the mating face to the wire receiving face,
25 a stamped and formed electrical terminal in the cavity, the terminal having a wire connecting portion which is proximate to the wire receiving face, a mating portion which is proximate to the mating face, and a transition portion between the wire connecting portion and the
30 mating portion, the wire connecting portion comprising a reversely formed sheet metal strip having a wire receiving slot and which is adjacent to the wire receiving face and has a free end, is characterised in that the slot extends inwardly from the free end, and
35 a wire receiving opening is provided in an arcuate

surface of the wire connecting portion at a location opposite to the free end, the cavity having a pocket portion adjoining the wire receiving face in which portion the wire receiving portion is disposed, the
5 pocket portion having an arcuate surface which substantially conforms to the arcuate surface of the wire connecting portion whereby, upon the insertion of a wire into the pocket portion through the wire receiving opening and past the free end, and upon curling over the
10 wire receiving portion, the free end moves past the wire and the slot receives the wire whereby edge portions of the slot establish electrical contact with the wire.

Some slotted or wedge type terminals into which an electrical conductor can be inserted axially
15 are disclosed in United States Patent Specification Nos. 2,583,530; 2,725,544; 3,012,219; 3,351,889; 3,688,243; 3,744,007; 3,916,149 and 3,979,615, but not one of these specifications either discloses or suggests a solution to the problem with which the present
20 invention is concerned.

For a better understanding of the invention reference will now be made by way of example to the accompanying drawings, in which:-

25 Figure 1 is a perspective, partially exploded, view of an electrical connector comprising an insulating housing containing electrical terminals;

Figure 2 is a sectional view of the housing taken on the lines II - II of Figure 3;

30 Figure 3 is a view taken on the lines III - III of Figure 2;

Figure 4 is an enlarged fragmentary sectional view of the connector, illustrating the use of a tool for connecting wires to the terminals;

35 Figure 5 is a plan view of the leading end

portion of a progression strip illustrating a partially formed, and a fully formed, terminal for the connector; and

5 Figures 6 and 7 are small scale perspective views illustrating respective modifications of the housing.

As shown in Figures 1 to 3, an electrical connector 2 comprises a rectangular insulating housing 4 having a wire receiving end face 6, a mating end face 8, and lateral faces 10 and 12. A pair of superposed cavities 14 for receiving electrical terminals 16 extend through the housing 4 from the face 6 to the face 8.

15 The terminals 16 are manufactured by stamping and forming, as a continuous metal progression strip 18 (Figure 5) with adjacent terminals of the strip connected by slugs 50 of the strip material. Figure 5 shows the fully formed end terminal of the strip and the next adjacent terminal which has only partially
20 been produced and is in the form of a flat stamped out blank 16'. Each terminal 16 has a contact spring portion 20 at its forward or mating end, an intermediate portion 22, and a wire receiving portion 24 at its rearward end. The intermediate portion 22 comprises
25 a rectangular plate 26 from which extends a locking tongue 28 for retaining the terminal 16 in the housing 4. The contact portion 20 is in the form of a contact spring extending obliquely from the plate 26 and being bent at 32 to provide a downwardly (as seen in Figures
30 1 and 4) bent tip portion 34. The portion 20 is slightly narrower than the plate 26 to provide leftwardly (as seen in Figures 1, 4 and 5) directed shoulders 31. The contact spring portion 20 is intended to establish contact, for example, with an electrical
35 post (not shown) or a similar contact member.

The wire receiving portion 24 comprises a short flat base 38 which is connected to the plate 26 by an offset 36 from which a stop 37 has been struck. From the side of the base 38 remote from the offset 36, an arcuate part 40 of the wire receiving portion 24 extends over the base 38 with its concave surface facing the base 38. It will be apparent from Figure 5 that the part 40 has been produced by curling the flat stamped out blank 16' through an angle of substantially 260° , the radius of curvature of the part 40 being such that its free end portion 42 is disposed above, and in alignment with, the offset 36. By virtue of an opening 46' stamped in the blank 16', the length of the part 40 which is to overlies the offset 36 and base 38 is connected to the offset 36 only by a pair of straps 48' of the blank spanned by a rectilinear edge 73 at the rightward (as seen in Figure 5) of the opening 46'. When the part 40 has been curled over, a wire receiving opening 46 bounded laterally by arcuate straps 48 and spanned above the base 38 by the edge 73 is thus provided in the part 40. The free end portion 42 of the part 40 has a wire receiving slot 44 extending inwardly thereof, the width of the slot 44 being such that upon an insulated wire 72 being relatively moved into the slot 44, the insulation of the wire is displaced and the edges of the slot establish secure electrical contact with the electrically conductive core of the wire 72.

Each of the cavities 14 comprises an enlarged pocket portion 52 extending inwardly from the wire receiving face 6 and a smaller, generally rectangular, portion 62 extending inwardly from the mating face 8 and communicating with the portion 52 intermediate the ends of the cavity 14. The portion 52 has (as best seen in Figure 3) parallel sidewalls 54, a top wall 56, and a floor 60. The top wall 56 merges at its inner end

with an arcuate wall portion 58 bridging spaced arcuate wall portions 59, at the intersection between the portions 52 and 62 of the cavity 14. A lip 66 provided at the inner end of the floor 60 presents oppositely
5 directed shoulders 67 and 69 which co-operate with the locking tongue 28 and the stop 37 of the terminal to prevent movement of the terminal in either direction after insertion into the cavity 14, as will be apparent from Figure 4. Grooves 68 in the sidewalls of the
10 portion 62 of the cavity 14 receive the lateral edges of the plate 26 of the terminal, the shoulders 31 of the terminal abutting the forward ends 71 of the grooves 68 as shown in Figure 4. The part of the contact spring portion 20 adjoining the plate 26 of
15 each terminal is supported by shoulders 63 in portion 62 of the cavity 14.

It will be apparent that the terminals can be inserted into the cavities 14 by properly orienting the terminals relative thereto and moving the terminals
20 through the cavities from the wire receiving face 6 towards the mating face 8, the terminals being located and retained in the cavity 14 by virtue of the co-operation between the tongue 28 and shoulder 67 and between the stop 37 and the shoulder 69. A groove 64
25 in the floor 60 of the portion 62 of each cavity 14 permits an extraction tool (not shown) to be used to depress the tongue 28 to release the terminal so that it can be removed from the housing 4.

As shown in Figure 4, the wire receiving portions of the terminals fit snugly in the portions 52
30 of the cavities 14 with the free end portions 42 abutting the arcuate wall portions 58 of the cavities 14.

When a wire 72 is to be connected to one of the terminals 16 in the housing 4, an end of the wire
35 72 is aligned with the wire receiving opening 46 of

the terminal and is then inserted through the opening 46 until the wire end extends beyond the free end portion 42 of the terminal into the cavity portion 62 as shown in the upper part of Figure 4. A tool blade
5 in the form of a simple rectangular cross-section tongue, is then forced against the edge 73 of opening 46 of the terminal to deform the part 40 of the terminal as shown in the lower part of Figure 4, so that the free end portion 42, guided by the arcuate surfaces 58 and
10 59, moves along an arcuate path which intersects the longitudinal axis of the inserted wire 72. During such movement, the portion 42 moves past the electrically conductive core (not shown) of the wire 72 which remains substantially stationary by abutment against the plate
15 26, the edges of the slot penetrating the insulation of the wire so that the core is received in the slot 44 to establish permanent electrical contact between the core and the walls of the slot 44. Although the wire remains substantially stationary, the relative movement
20 of the free end portion 42 with respect to the wire is substantially the same as if the wire were moved laterally of its axis and into the wire receiving slot 44. The wire is supported by the plate 26 in spaced relation to the base 38, by virtue of the provision
25 of the offset 36 thus allowing full penetration of the insulation of the wire by the free end portion 42.

The electrical connection between the terminal and the wire core is achieved by the progressive curling over of the part 40 of the terminal, by
30 engagement of the parts of the free end portion 42 bounding the slot 44, with the arcuate wall portions 59, accompanied by a partial flattening of the part 40 as shown in the lower part of Figure 4, so that the final shape of the wire receiving portion 24 of the
35 terminal is substantially that of an oval on a flat

base (see the lower part of Figure 4). The precise shape of the wire receiving portion of the terminal after it has been deformed in this way will depend upon several factors including the spring characteristics and thickness of the metal stock from which the terminal was made and the manner in which the deforming force is applied to the part 40 of the terminal. However, some further curling of the part 40 must take place if the free end portion 42 thereof is to be moved through the insulation of the wire 72. Other flattening or compressing techniques might be used to achieve movement of the free end portion 42 through the insulation of the wire in response to the application to the edge 73 of a force in a direction parallel to the longitudinal axis of the wire.

The metal stock from which the terminal strip is manufactured must be selected with some care if the curling of the wire receiving portion of the terminal as shown in Figure 4 is to be achieved. In general, a spring hard material should be chosen since a spring material will tend to curl upon application of the force against the edge 73, and is also required to ensure the permanence of the electrical connection between the wire core and the walls of the slot 44 in the free end portion 42. A suitable spring material, for example, is a spring hard phosphor bronze or a suitable brass composition. The force required to bring about the curling operation can also be controlled to some extent by appropriately choosing the dimensions of the opening 46' in the blank shown in Figure 5. Reducing the width of the straps 48' will result in a reduction in the force required to bring about the curling operation.

Under some circumstances, the part 40 of the terminal may spring back slightly after the tool blade 70 has been removed from the cavity 14. Such

spring back will not however disturb the electrical connection between the terminal and the wire since the spring back will occur at locations remote from the free end portion 42, for example at the base 38.

5 A salient advantage of the invention is that the wire is moved axially into the terminal rather than laterally of its axis into the terminal, the force which causes the terminal to be connected to the wire being applied in a direction parallel to the axis of the wire.
10 The cavities containing the terminals need not therefore be accessible from a side surface of the housing. By virtue of this feature, electrical connectors having several rows of terminals and circular cross-section multi-cavity electrical connectors, as shown in Figures
15 6 and 7 respectively, can be provided with slotted plate terminals, without access to the slots thereof being inhibited.

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Claims:

1. An electrical connector comprising an insulating housing having a cavity receiving an electrical terminal provided with a loop shaped wire connecting portion having a wire receiving slot therein
5 having a mouth into which an electrical wire is insertable in a direction transversely of the longitudinal axis of the wire to make electrical connection between the wire and the terminal; characterised in that the
10 wire receiving slot (44) is formed, in a free end portion (42) of the wire connecting portion which has a wire receiving opening (46) through which the wire (72) can be inserted in the direction of its longitudinal axis to extend across the mouth of the wire receiving
15 slot (44), the wire connecting portion (24) being deformable inwardly of the cavity to move the free end portion (42) past the wire (72) so that the wire (72) is received in the wire receiving slot (44).

2. A connector according to Claim 1,
20 characterised in that the wire connecting portion (24) has an arcuate portion (40) comprising the free end portion (42), such free end portion (42) being guidable towards the wire (72) by an arcuate wall surface (58, 59) of the cavity (14), the curvature of which wall
25 surface (58, 59) corresponds to that of the arcuate portion (40) of the wire connecting portion (24).

3. A connector according to Claim 2,
characterised in that the arcuate wall surface (58, 59) is such that the radius of curvature of the arcuate
30 portion (40) is reduced as the free end portion (42) is moved towards the wire (72).

4. A connector according to Claim 2 or 3,
characterised in that the parts of the free end portion (42) bounding the slot (44) are guidable by individual
35 arcuate wall portions (59) of the cavity (14).

5. A connector according to any one of the preceding claims, characterised in that the wire receiving opening (46) is so dimensioned and oriented that a tool (70) inserted into the cavity (14) is engageable with an edge of the wire receiving opening (46) when the wire (72) has been passed through such opening (46), to deform the wire connecting portion (24).

6. A connector according to any one of Claims 2 to 5, characterised in that the wire connecting portion (24) comprises a flat base (38) from an edge of which the arcuate portion (40) of the wire connecting portion (24) extends so as to overhang the base (38) with the concave inner surface of such arcuate portion (40) facing the base (38) and the free end of the free end portion (42) also facing the base (38), the base (38) being connected to a wire end supporting plate (26) of the terminal by an offset (36) so that when the wire (72) has been inserted through the wire receiving opening (46) with its end supported on the wire end supporting plate (26) of the terminal, the wire (72) is spaced from the base (38).

7. A connector according to Claim 6, characterised in that the base (38) has a stop (37) projecting inwardly of the cavity (14) and towards one face (69) of a lip (66) projecting from a wall of the cavity (14), a locking tongue (28) of the terminal projecting towards an opposite face (67) of the lip (66), so that the terminal is located in the cavity (14).

8. An electrical connector comprising; an insulating housing having a mating face and a wire receiving face, a terminal receiving cavity extending through the housing from the mating face to the wire receiving face, a stamped and formed electrical terminal in the cavity, the terminal having a wire connecting portion which is proximate to the wire receiving face,

a mating portion which is proximate to the mating face, and a transition portion between the wire connecting portion and the mating portion, the wire connecting portion comprising a reversely formed sheet metal strip having a wire receiving slot and which is adjacent to the wire receiving face and has a free end, characterised in that the slot (44) extends inwardly from the free end (42) and a wire receiving opening (46) is provided in an arcuate surface of the wire connecting portion (24) at a location opposite to the free end (42), the cavity having a pocket portion (52) adjoining the wire receiving face (6) in which portion (52) the wire receiving portion (24) is disposed, the pocket portion (52) having an arcuate surface (59) which substantially conforms to the arcuate surface of the wire connecting portion (24) whereby, upon the insertion of a wire (72) into the pocket portion (52) through the wire receiving opening (46) and past the free end (42), and upon curling over the wire receiving portion (24), the free end (42) moves past the wire (72) and the slot (44) receives the wire (72) whereby edge portions of the slot (44) establish electrical contact with the wire (72).

9. A pre-loaded electrical connector of the type comprising an insulating housing having a wire receiving face and having a contact receiving cavity extending into the wire receiving face, an electrical contact terminal in the cavity, the terminal having a wire connecting portion which is proximate to the wire receiving face, the wire connecting portion being of the class having a wire receiving slot for establishing electrical contact with the wire, characterised in that the wire connecting portion (24) is a reversely formed strip (24) and has a wire receiving opening (46) therein which is adjacent to the wire receiving face (61), the strip (24) having a free end (42) which is generally opposite to the wire

receiving opening (46) and is located inwardly of the
cavity (14) from the opening, the free end (42) being
spaced from an intermediate portion of the terminal (16),
a wire receiving slot (44) extending inwardly from the
5 free end (44) through portions of the strip (24), the
wire connecting portion (24) being deformable inwardly
of the cavity (14) with accompanying movement of the
free end (44) past a wire (72) which has been inserted
through the opening (46) whereby the wire (72) is
10 received in the wire receiving slot (44).

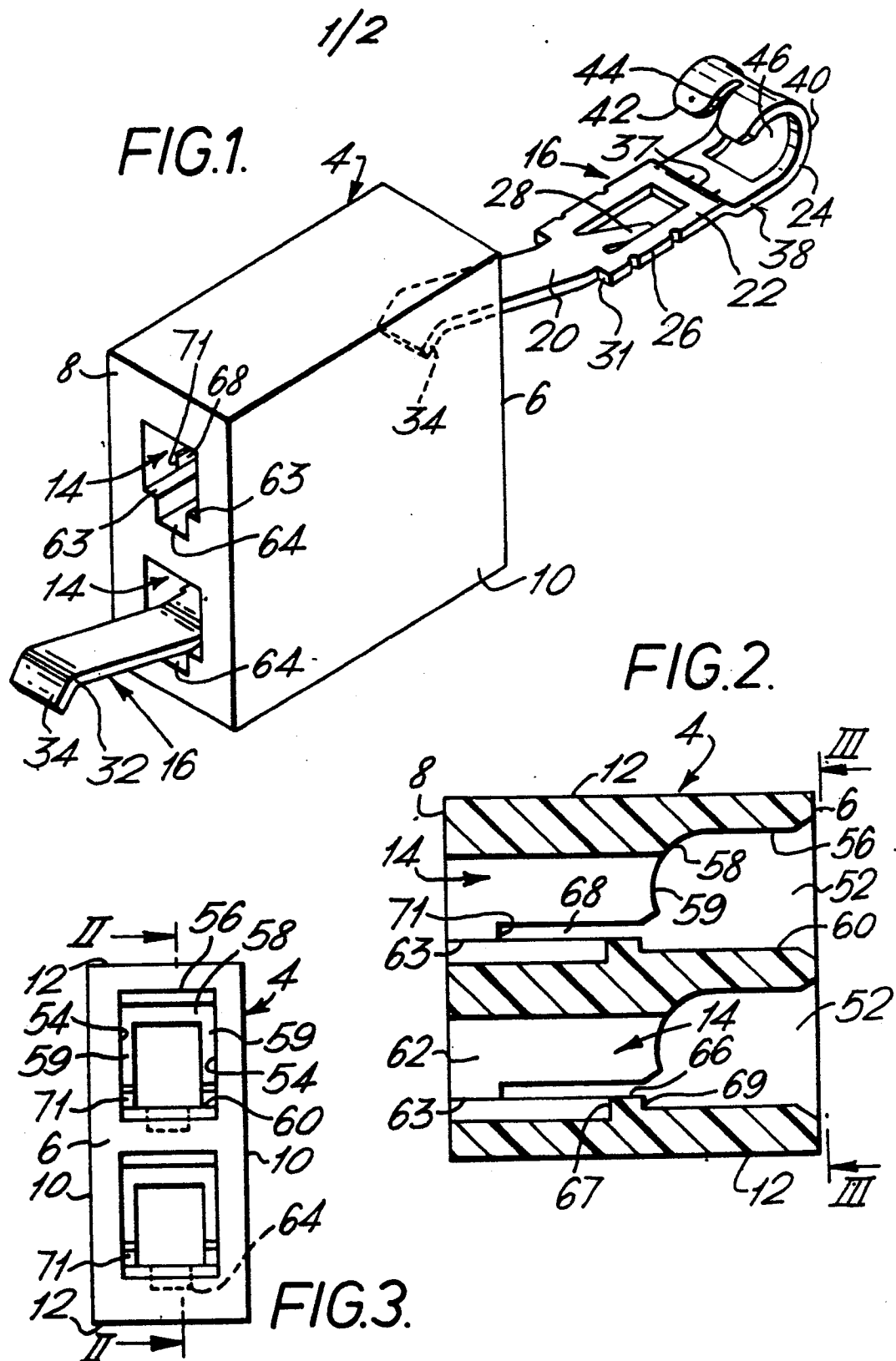
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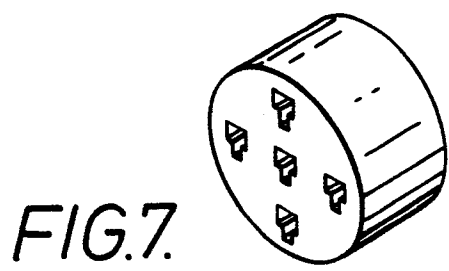
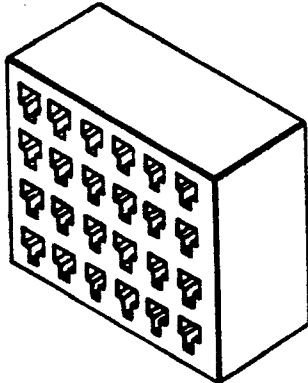
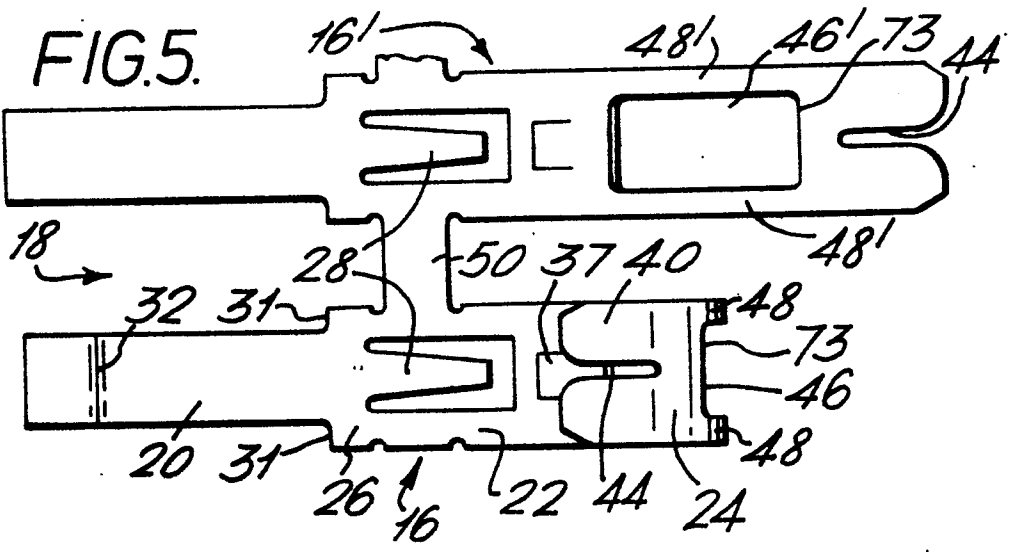
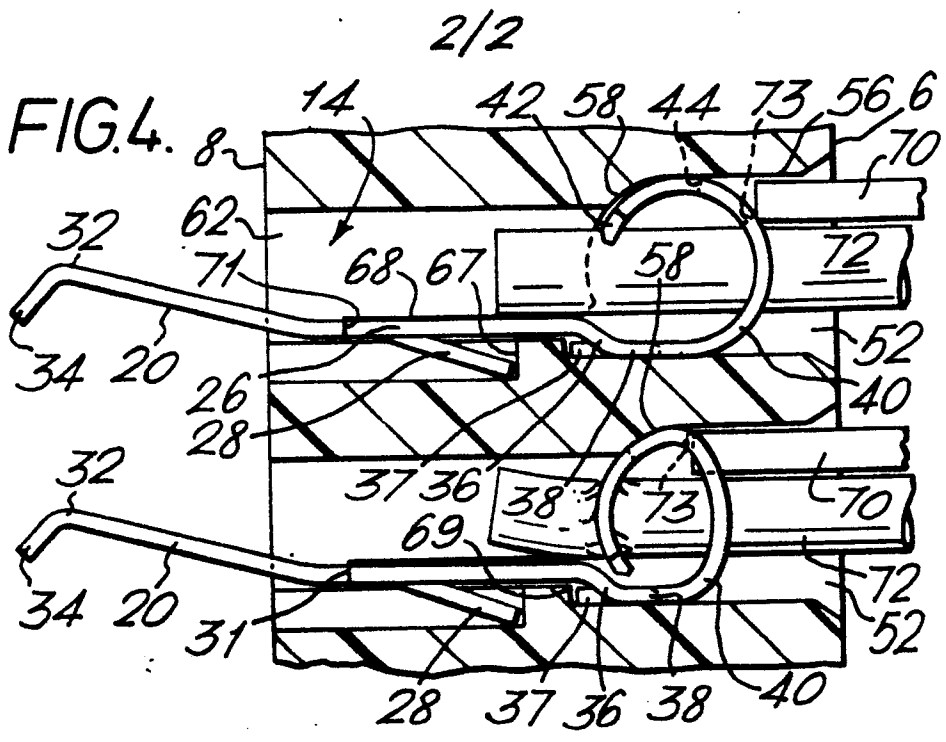
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European Patent
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EUROPEAN SEARCH REPORT

0000624

Application number

EP 78 30 0101

DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int. Cl. 7)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
	<u>FR - A - 2 160 036 (CARELLO)</u> * Page 4, line 10 - page 5, line 14; figures * --	1,7	H 01 R 9/08 H 01 R 13/38
	<u>DE - A - 2 023 170 (KRONE)</u> * Page 3, paragraph 3; figures 1,2 * --	1	
	<u>US - A - 3 916 149 (ELECTRO-THERM)</u> * Column 6, line 12 - column 7, line 37; figures 14-21 * --	1	TECHNICAL FIELDS SEARCHED (Int.Cl. 7) H 01 R 9/08 H 01 R 7/04
	<u>US - A - 3 744 007 (HORAK)</u> * Column 3, line 30 - column 4, line 1; figures * --	1,5	
A	<u>US - A - 3 861 772 (AMP)</u> * Abstract; figures * --	1	
A	<u>US - A - 2 583 530 (HASSELBOHM)</u> * Figures * --	1	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
A	<u>US - A - 4 012 101 (ITT)</u> * Figures * --	1,2,4	
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The present search report has been drawn up for all claims			&: member of the same patent family, corresponding document
Place of search	Date of completion of the search	Examiner	
The Hague	19-10-1978	RAMBOER	

