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EUROPEAN PATENT APPLICATION

②① Application number: 83306740.8

⑤① Int. Cl.³: **H 01 R 23/02**

H 01 R 23/66, H 01 R 13/658

②② Date of filing: 04.11.83

③⑩ Priority: 17.11.82 US 442472
26.09.83 US 536017

④③ Date of publication of application:
27.06.84 Bulletin 84/26

⑥④ Designated Contracting States:
BE DE FR GB IT NL SE

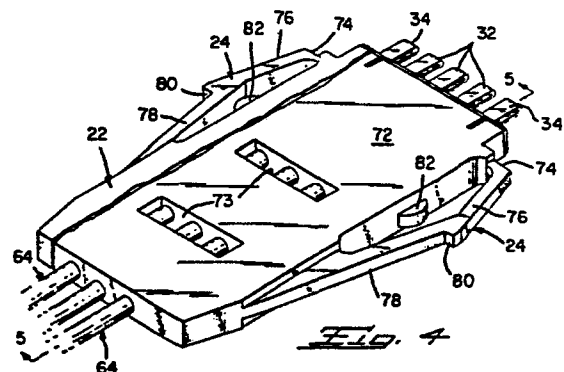
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⑤④ **Electrical plug connector.**

⑤⑦ An electrical plug connector comprises a slab-like dielectric contact-carrying member (36, 36A, 36B) having signal contact members (44, 44A, 102) secured to one side of the contact-carrying member (36, 36A, 36B) at spaced intervals therealong. A ground contact member (54, 54A, 120) is secured to the other side of the contact-carrying member (36, 36A, 36B) with contact sections (32, 34, 104, 122) of the signal contact members (44, 44A, 102) and the ground contact member (54, 54A, 120) extending from a front end of the contact-carrying member (36, 36A, 36B). Conductor-connecting sections (50, 60, 90, 92, 110, 128) of the signal and ground contact members extend along the contact-carrying member (36, 36A, 36B). Signal conductors (62) and ground conductors (66) of electrical cables (64) are electrically connected respectively to the conductor-connecting sections (50, 60, 90, 92, 110, 128) of the signal contact members (44, 44A, 102) and the ground contact member (54, 54A, 120). A dielectric housing member (72, 142) is secured onto the contact-carrying member (36, 36A, 36B) and part of the electrical cables (64) so that the contact members (44, 44A, 102, 54, 54A, 120) from their contact sections (32, 34, 104, 122) to their conductor-connecting sections (50, 60, 90, 92, 110, 128) are covered.



"ELECTRICAL PLUG CONNECTOR"

1 This invention relates to electrical connectors
and more particularly to an electrical plug connector
in which electrical conductors of electrical cables are
terminated to contact members and the terminations are
5 sealingly secured in a housing that supports the cables
and is latchably mounted in a polarized position in a
connector-receiving member.

Electrical connectors for transmission cables terminate
the conductors of such cables. The connectors are gener-
10 ally detachably connected to other electrical connectors
for transmitting electrical signals from a transmission
source to a receiving member or vice versa.

The connectors must be constructed to minimize losses
or irregularities in the signals being transmitted from
15 the transmission source to the receiving member. The
construction of the connectors must also be concerned
with electrical performance characteristics so that they
are not affected by wear and handling that results when
equipment is moved and detachable connection and
20 reconnection with other connectors take place.

It is an object to provide an improved connector
in these respects.

According to the invention an electrical plug
connector of the type comprising an electrical
25 contact assembly including a slab-like dielectric contact-
carrying member on which signal and ground contact members
are mounted at opposite sides, electrical cables having
signal and ground conductors electrically connected
respectively to conductor-connecting sections of the
30 signal and ground contact members, and a dielectric housing

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1 member on the electrical contact assembly, is character-
ized in that mid sections of the signal contact members
and a planar section of the ground contact member are
secured to the contact-carrying member and signal and ground
5 contact sections extend outwardly from a front
surface of the contact-carrying member; said housing
member is secured onto the contact assembly and sections
of the electrical cables thereby spacing, supporting
and providing strain relief for the cables the signal
10 and ground contact sections extending outwardly from
the front end of the housing member.

According to another aspect of the present invention,
the housing member has polarizing latching members that
latch the plug connector in a polarized position in a
15 connector-receiving member.

Figure 1 is a perspective and exploded view of an
electrical connection system in which the invention is
typically used, .

Figure 2 is a perspective and exploded view showing
20 the parts of an electrical contact assembly of a connector,

Figure 3 is a perspective view of Figure 2 in an
assembled form,

Figure 4 is a perspective view of the plug connector
in a completed form,

25 Figure 5 is a cross-sectional view along line 5-5
of Figure 4,

Figure 6 is a top plan view with parts broken away
of the plug connector,

Figure 7 is a front elevational view of the plug
30 connector,

Figures 8 and 9 show parts of the connector and
connector-receiving member illustrating the latching

1 arrangement,

Figure 10 is a view similar to Figure 2 showing the parts of an alternative embodiment of the electrical contact assembly,

5 Figure 11 is a perspective view of Figure 10 in an assembled form,

Figure 12 is a cross-sectional view along line 12-12 of Figure 11 with a housing secured on the contact assembly,

10 Figure 13 is a view similar to Figures 2 and 10 showing the parts of a further embodiment of the electrical connector assembly,

Figures 14 and 15 are perspective views of Figure 13 in an assembled form,

15 Figure 16 is a perspective view of the plug connector of Figures 13-15 in a completed form.

As shown in Figure 1, a multilayer circuit board 10 has areas 12 in which matrices of electrical receptacle contacts 14 are disposed. Connector-receiving members 20 16 are secured in position on board 10 via bolts 18. Spaced projections 20 are located along the inside surfaces of the tops and bottoms of members 16, forming channels in which slab-like electrical plug connectors 22 are latchably secured by flexible latch members 24 engaging 25 surfaces 26 in openings 28 of members 16 as shown in Figures 8 and 9. This enables front sections of connectors 22 to be positioned through front openings 30 in members 16 so that tab contact sections 32 and 34 of connectors 22 can be electrically connected with respective receptacle 30 contacts 14 in areas 12.

1 Figures 2 through 9 illustrate electrical plug
connector 22 in greater detail. A slab-like contact-
carrying member 36, moulded from a suitable dielectric
material has a series of three spaced recesses 38 located
5 in one surface thereof. A pair of spaced circular
projections 42 extends outwardly from the other surface
of member 36.

 Signal contact members 44 are stamped and formed
from suitable sheet metal stock and they include contact
10 sections 32, central sections 46 having oblong holes
48 therein, and conductor-connecting or ferrule sections
50. Each of contact sections 32 is folded back to provide
a double layer of metal, the layers of which are maintained
in spaced relationship with one another by an inwardly-
15 directed projection 52 formed in one layer. Central
section 46 is planar and is disposed in a respective
recess 38 of contact-carrying member 36 with oblong
projection 40 extending through oblong hole 48. When
signal contact members 44 are secured in position in
20 recesses 38 of contact-carrying member 36 via the outer
ends of oblong projections 40 being enlarged by the applic-
ation of pressure or heat, contact sections 32 extend
outwardly from the front end of member 36 along the longi-
tudinal axis thereof while conductor-connecting sections
25 50 extend outwardly from the back end of member 36 along
the same plane containing recesses 38. Sections of the
contact member 44 between the contact section 32 and

1 the central sections 46 are bent to position the contact
sections 32 generally in a medial plane of the slab-
like member 36.

5 A ground contact member 54 has an elongated planar
section 56 along which are disposed holes 58 for engage-
ment with circular projections 42 when planar section
56 is disposed against the bottom surface of contact-
carrying member 36 whereafter the outer ends of projections
42 are enlarged by the application of pressure or heat
10 thereby securing ground contact member 54 onto member
36. Adjacent the outer contact sections of the series
of signal contact sections 32, a pair of ground contact
sections 34 extend outwardly from ground contact member
54, at one side, generally in the same manner as contact
15 sections 32 and they have the same double layer configuration
as contact sections 32 so that ground contact sections
34 and are displaced from section 56 to lie coplanar
with contact sections 32. Four conductor-connecting
sections 60 extend outwardly from planar section 56 at
20 the other side of the ground contact member 54 and are
spaced apart to extend outwardly from the back end of
member 36 in alternating spaced relationship with respect
to the section 50.

As can be discerned, when signal contact members
25 44 and ground contact member 54 are secured in position
on contact-carrying member 36, an electrical contact
assembly is formed with contact sections 32 and 34 disposed
generally in a medial plane at the front end of contact-
carrying member 36. Ground contact sections 34 are disposed
30 adjacent the outer contact sections of the series of

1 three signal contact sections 32. The arrangement of
signal contact sections and ground contact sections can
be in any manner as desired with ground contact sections
34 on each side of one or more signal contact sections
5 32 to make certain that optimum isolation of the signal
information being processed along signal contact sections
32 is obtained.

Conductor-connecting sections 50 and 60 are laterally
spaced with respect to one another in alternating manner
10 as shown in Figure 3 and each conductor-connecting section
50 is centrally spaced with respect to conductor-connecting
sections 60 on each side thereof as shown in Figures
3 and 6.

Contact-carrying member 36 spaces the signal contact
15 members 44 relative to each other and relative to ground
contact member 54.

Signal conductors 62 of three-lead coaxial cables
64 are disposed in the respective conductor-connecting
sections 50 of signal contact members 44 while ground
20 or drain conductors 66 of each of cables 64 are disposed
in respective conductor-connecting sections 60 immediately
below and to each side of conductor-connecting sections
50. Each cable 64 has a conductive coated plastic outer
conductor surrounding the insulative sheath 68 covering
25 signal conductors 62 which is electrically connected
with a pair of drain conductors 66 thereby forming the
three-lead coaxial cable 64 which also includes outer
dielectric jacket 70. Signal conductors 62 and drain
conductors 66 are secured in conductor-connecting sections
30 50 and 60 in accordance with conventional crimping practices

1 thereby terminating signal conductors 62 in respective
conductor-connecting sections 50 of signal contact members
44 and drain conductors 66 in respective conductor-
connecting sections 60 of ground contact member 54. As
5 seen in Figure 3 the conductor-connecting sections 60
are in a modified figure eight configuration to position
drain conductors 66 from adjacent cables therein. If
desired, signal conductors 62 and drain conductors 66
can be electrically connected to conductor-connecting
10 sections 50 and 60 respectively by the use of a laser
to laser-weld the conductors to the conductor-connecting
sections.

After conductors 62 and 66 of cables 64 have been
terminated to respective contact members 44 and 54,
15 the terminated assembly is positioned in a mould which
includes cable-positioning members so that dielectric
housing 72 of suitable dielectric material may be moulded
onto contact-carrying member 36 including the parts of
the signal and ground contacts secured thereto and the
20 terminations of cables 64 to conductor-connecting sections
50 and 60. Openings 73 are formed in housing 72 due
to the cable-positioning members. Housing 72 also covers
the inner parts of contact sections 32 and 34 as shown
in Figure 5, and also covers sections of cables 64 to
25 space and support them and provide strain relief therefor.
Housing 72 also environmentally seals the terminations,
stabilizes the contact sections and supports them.

The dielectric constant of the material of contact-
carrying member 36 and housing 72 is suitably substantially
30 the same as that of the cables to maintain the integrity

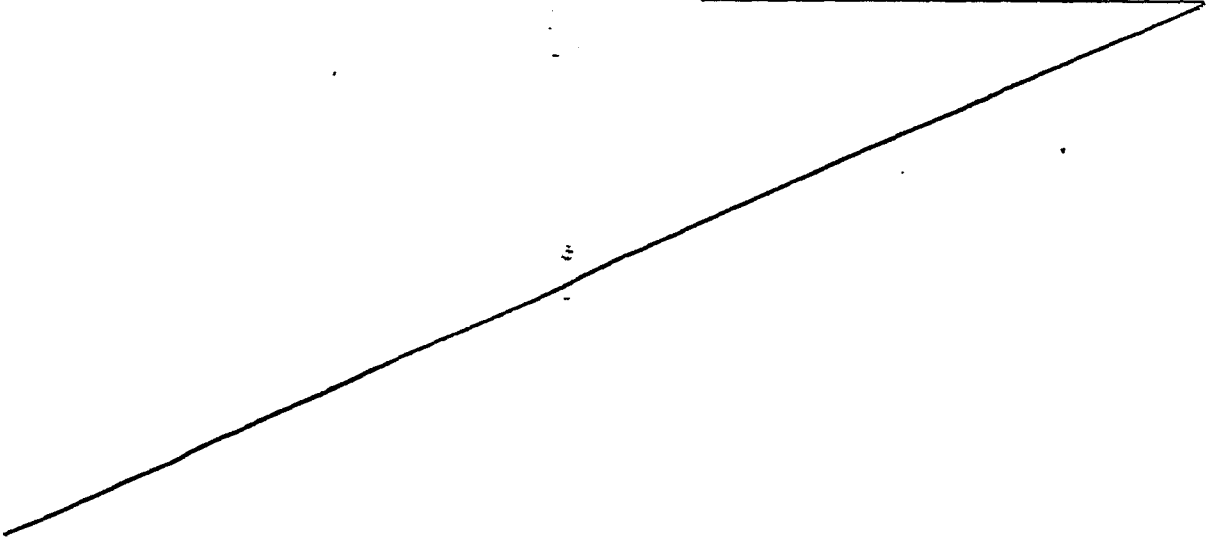
1 of the signals being transmitted along the cables and
the contact members.

Flexible latch members 24 are integrally formed
during the moulding of the housing 72 and each latch
5 member includes a forward stop surface 74 which engages
against an inside surface of connector-receiving member
16 as seen in Figure 9. Each of flexible latch members
24 includes a front leg 76 and a rear leg 78 converging out-
wardly to a rear facing latch surface 80. The legs are
10 flexed inwardly when plug 22 is inserted within connector-
receiving member 16 between spaced projections 20. When
stop surfaces 74 of latch members 24 engage the inside
front surfaces of connector-receiving member 16, latch
members 24 flex outwardly with front legs 76 extending
15 into openings 28 to engage latching surfaces 80 with
surfaces 26 thereby latchably securing plug connector
22 in position in connector-receiving member 16 as shown
in Figure 9.

Arcuate projections 82 are located on housing 72
20 behind legs 76 and 78 to prevent latch members 24 from
being overstressed when plug connectors 22 are moved
into connector-receiving member 16. As shown in Figure
7, the latch member 24 at the left side is thicker than
the latch member 24 on the right side and spaced project-
25 ions 20 are accordingly spaced along connector-receiving
member 16 thereby defining a polarizing arrangement to
polarize the insertion of plug connectors 22 within
connector-receiving member 16 to make certain that contact
sections 32 and 34 are properly electrically connected
30 with respective electrical receptacle contacts 14.

1 Whereas three-lead coaxial cables 64 have been disclosed
as being terminated to the conductor-connecting sections
of signal contact members 44 and ground contact member
54 of the connector assembly, a three-lead transmission
5 cable can also be used wherein a signal conductor is
isolated from drain conductors on each side thereof.
The typical assembly utilizing the present invention
is for ends of cables 64 or transmission cables to be
terminated to electrical plug connectors 22 for transmitting
10 electrical signals with high reliability and uniformity
from a transmission source to a receiving member.

Figures 10 through 12 illustrate an alternative embodiment
of the electrical contact assembly wherein contact-
carrying member 36A includes a conductor-positioning
15 section 84 along which are channels 86 and 88. Channels
86 are centrally aligned with recesses 38A in which signal
contact members 44A are secured via oblong projections
40A so that signal conductors 62 of cables 64 are positioned
in channels 86 and in engagement with respective conductor-
20 connecting sections 90 of signal contact members 44A
which are engaged with conductor-positioning section
84. Ground conductors 66 of cables 64 are positioned
along channels 88 on each side of



1 a respective channel 86 and in engagement with a conductor-connecting
section 92 of ground contact member 54A secured onto contact-carrying
member 36A via projections 42A with section 92 engaged with section 84.
Conductors 62 and 66 are welded respectively to conductor-connecting
5 sections 90 of contact members 44A and conductor-connecting section 92 of
contact member 54A, preferably by laser-welding techniques. Housing 92A
is molded onto the terminated contact assembly.

Figures 13-16 illustrate a further embodiment of the electrical contact
assembly wherein contact-carrying member 36B includes
10 conductor-positioning section 94 along which channels 96 are located in one
side and channels 98 are located in the other side. Channels 96 are in
communication with recesses 100 and both of channels 96 and 98 include
beveled surfaces to guide signal conductors 62 and ground conductors 66
of cables 64 respectively along channels 96 and 98.

15 Signal contact members 102 are stamped and formed from pre-rolled or
pre-milled metal stock with contact sections 104 being thicker than bent
sections 106 which are thicker than central or mid sections 108 and ferrule
sections 110. Mid sections 108, part of bent sections 106, and ferrule
sections 110 of signal contact members 102 are disposed in respective
20 recesses 100 with oblong projections 112 in recesses 100 extending through
oblong holes 114 of mid sections 108 and ferrule sections being disposed
between aligning projections 116 at the inner ends of recesses 100.
Aligning projections 116 align ferrule sections 110 in recesses 100 so that
slots 118 in ferrule sections 110 are in alignment with respective channels
25 96, slots 118 having a width slightly less than the diameter of signal
conductors 62 so that they can be force-fitted thereinto. After signal
contact members 102 are positioned in recesses 100, projections 112 are
mechanically or thermally deformed thereby securing contact members 102
in position with contact sections 104 extending outwardly from and being
30 centrally aligned along the front surface of contact-carrying member 36B.

Ground contact member 120 is stamped and formed from pre-rolled or
pre-milled metal stock with contact sections 122 being thicker than bent
sections 124 which are thicker than central section 126 which has a
folded-over section 128 in which slots 130 are located. Slots 130 are in
35 communication with respective openings 132 in bight section 134 which neck

1 down as they merge with slots 130. The width of slots
130 is slightly smaller than the diameter of conductors
66 so that they can be force-fitted thereinto.

5 Planar section 126 has holes 136 through which circular
projections 138 on contact-carrying member 36B extend
when ground contact member 120 is mounted thereon.
Projections 138 are mechanically or thermally deformed
thereby securing contact member 120 on member 36B with
contact sections 122 extending outwardly from and being
10 centrally aligned along the front surface of member 36B
so that contact sections 104 and 122 are in alignment.
Planar section 126 also has openings 140 therein which
are designed in size and location to tailor the impedance
of the assembly to approximate the characteristic impedance
15 of the cable.

After contact members 102 and 120 have been secured
to member 36B, conductors 62 and 66 of cables 64 are
guided by channels 96 and 98 so as to be positioned along
slots 118 and 130 of respective contact members 102 and
20 120. These conductors are then force-fitted into slots
118 and 130 whereafter they are laser welded in position
in accordance with conventional welding practices thereby
forming the electrical contact assembly as shown in Figures
14 and 15.

25 Dielectric housing 142 as shown in Figure 16 is moulded
onto the contact assembly in the same manner as that
of housing 72 and housing 142 has a single opening 144
to minimize engagement with cables 64 to prevent distortion
thereto. Integral flexible latch members 146 of different
30 widths extend outwardly from the sides of housing 142

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- 1 and arcuate projections 148, 150 are located on housing
142 and latch members 146 to prevent overstressing of
latch members 146. Housing 142 otherwise functions the
same as housing 72 and the dielectric constant of the
5 material of member 36B and housing 142 is substantially
the same as that of cables 64 to maintain the integrity
of the signals being transmitted along the cables and
the plug member.

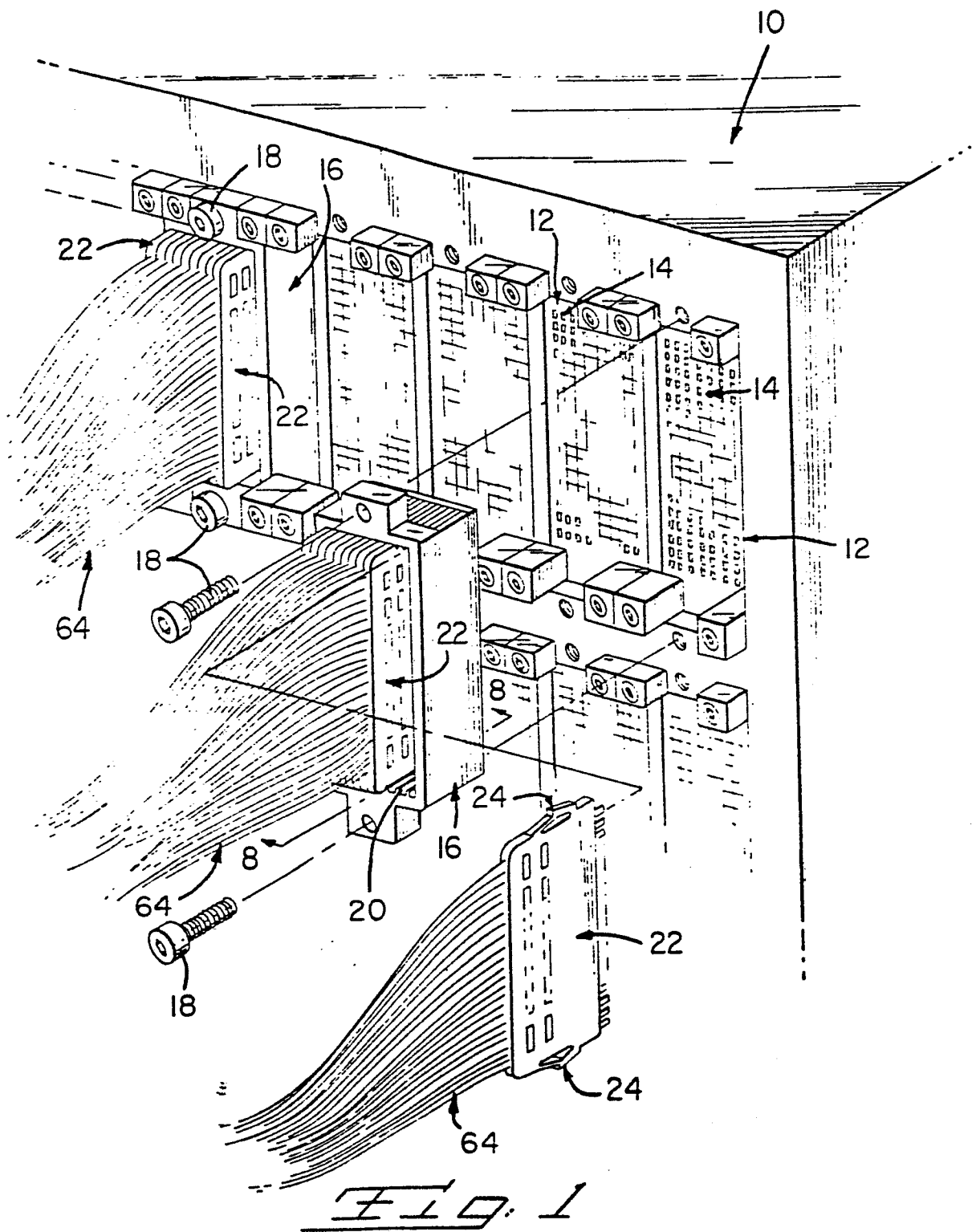
CLAIMS

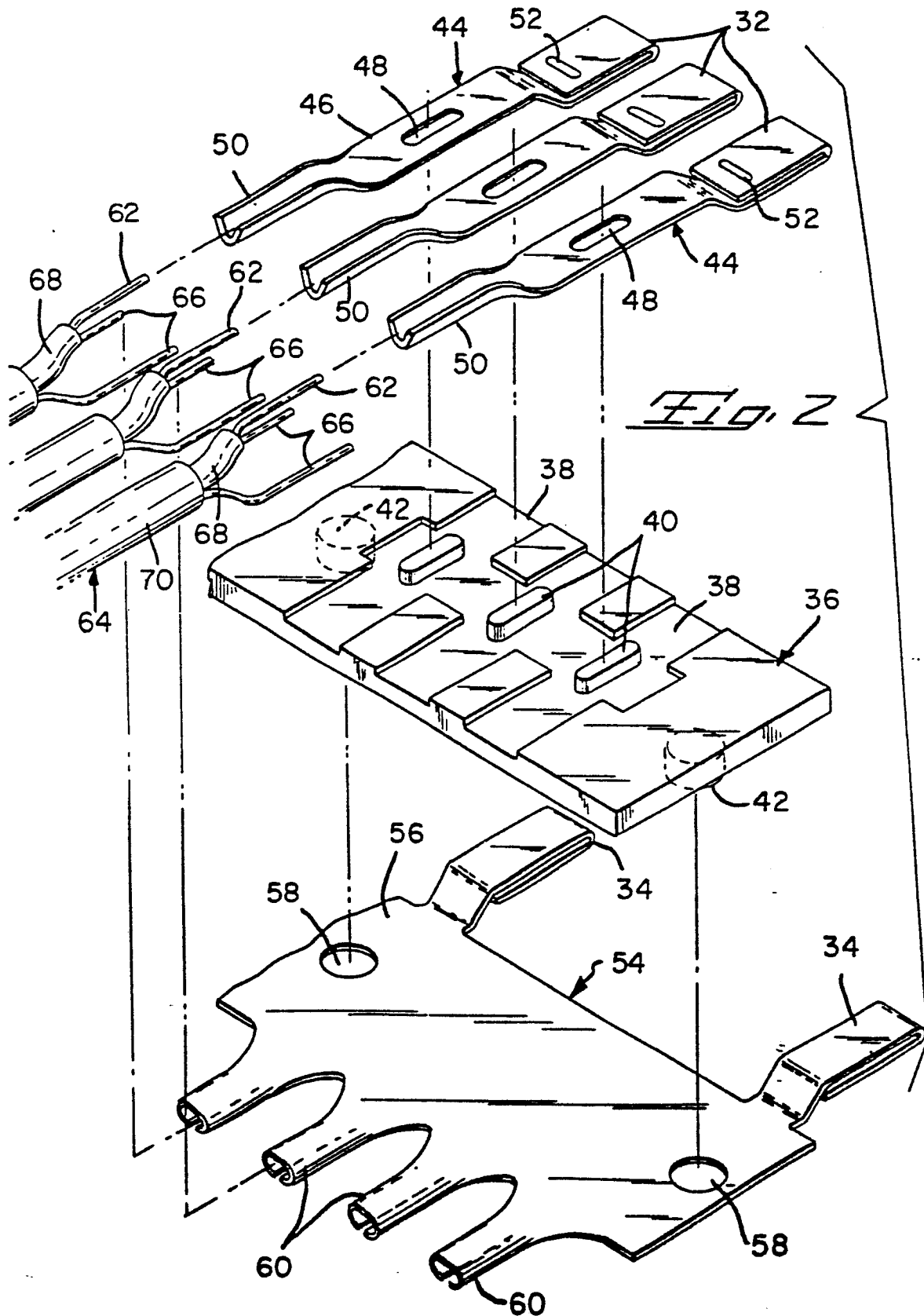
- 1 1. An electrical plug connector of the type comprising
an electrical contact assembly including a slab-like
dielectric contact-carrying member (36, 36A, 36B) on which
signal (44, 44A, 102) and ground (54, 54A, 120) contact
5 members are mounted at opposite sides, electrical cables
(64) having signal (62) and ground (66) conductors electric-
ally connected respectively to conductor-connecting sections
(50, 60, 90, 92, 110, 128) of the signal (44, 44A, 102)
and ground (54, 54A, 120) contact members, and a dielectric
10 housing member (72, 142) on the electrical contact assembly,
characterized in that mid sections (46, 108) of the signal
contact members (44, 44A, 102) and a planar section (56,
92, 126) of the ground contact member (54, 54A, 120)
are secured to the contact-carrying member (36, 36A,
15 36B) and signal (32, 104) and ground (34, 122) contact
sections extend outwardly from a front surface of the
contact-carrying member (36, 36A, 36B); said housing
member (72, 142) is secured onto the contact assembly
and sections of the electrical cables (64) thereby spacing,
20 supporting and providing strain relief for the cables
(64) the signal (32, 104) and ground (34, 122) contact
sections extending outwardly from the front end of the
housing member (72, 142).
2. An electrical plug connector as set forth in claim
25 1, characterised in that said signal contact sections
(32, 104) and said ground contact sections (34, 122)
are arranged in generally coplanar fashion.
3. An electrical plug connector as set forth in claim
1, characterized in that said conductor-connecting sections
30 (50, 60) are ferrule members which extend outwardly from

- 1 a rear end of said contact-carrying member (36) and in
which the signal conductors (62) and ground conductors
(66) are crimped and welded.
4. An electrical plug connector as set forth in claim
5 1, characterized in that said conductor-connecting sections
(90, 92) are planar sections disposed adjacent a conductor-
positioning section (84) of said contact-carrying member
(36A) which has channels (86, 88) along which the signal
conductors (62) and ground conductors (66) extend and
10 are welded to said conductor-connecting sections (90,
92).
5. An electrical plug connector as set forth in claim
1, characterized in that said conductor-connecting sections
(110) of said signal contact members (102) are ferrule
15 members (110) having slots (118) therealong and said
conductor-connecting section (128) of said ground contact
member (120) is a planar member (128) having slots (130),
said ferrule members (110) and said planar member (128)
disposed adjacent a conductor-positioning section (94)
20 of said contact-carrying member (36B) which has channels
(96, 98) along which the signal conductors (62) and ground
conductors (66) extend and which are positioned into
said slots (118, 130) and welded to said ferrule members
(110) and said planar member (128).
- 25 6. An electrical plug connector as set forth in claim
1, characterized in that said contact-carrying member
(36, 36A, 36B) has oblong projections (40, 40A, 112)
extending through oblong holes (48, 114) of the mid sections
(46, 108) of the signal contact members (44, 44A, 102),
30 circular projections (42, 42A, 138) of the contact-carrying

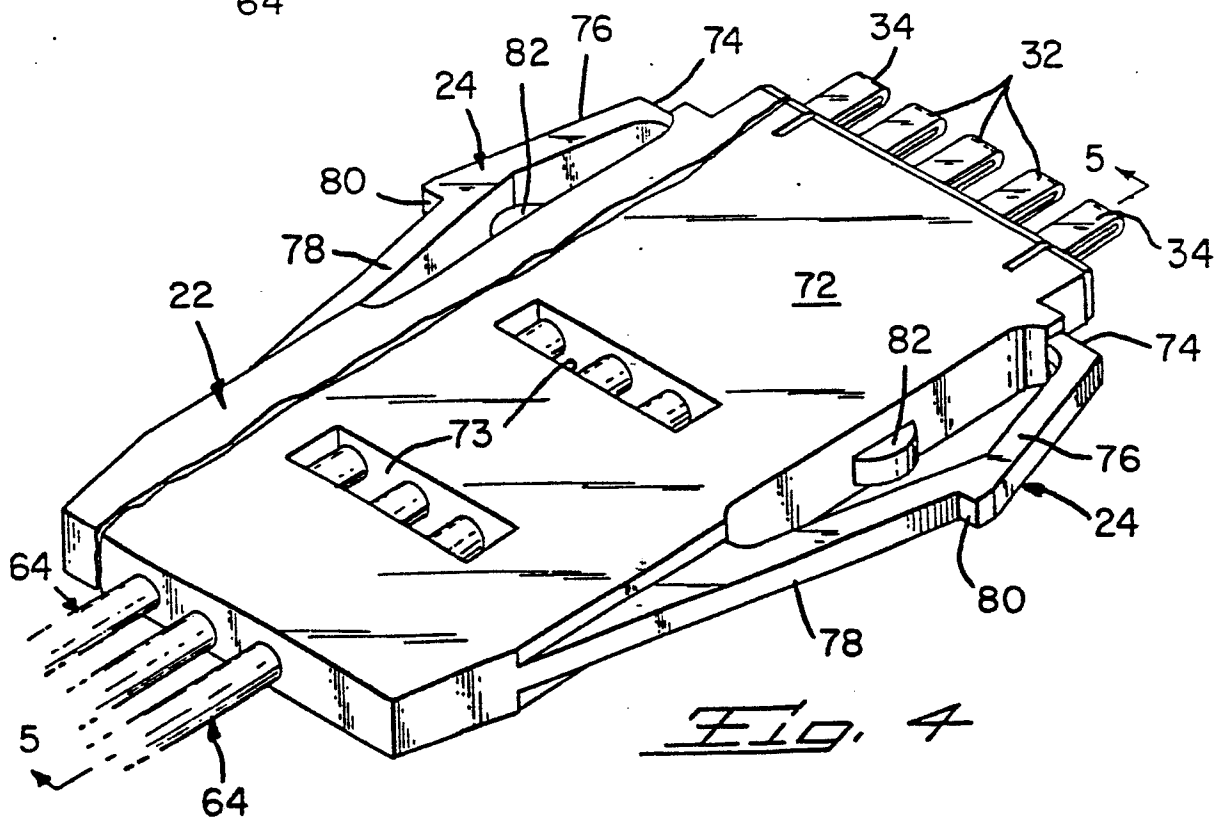
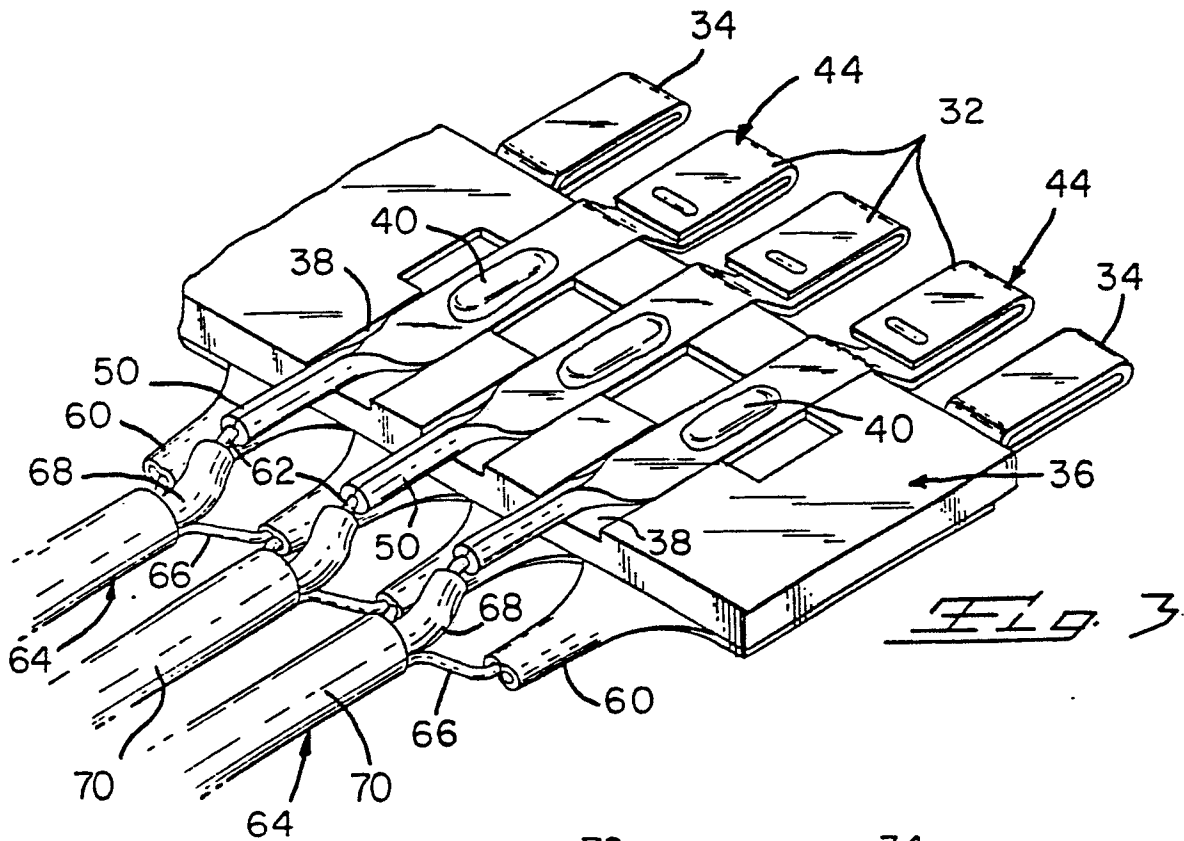
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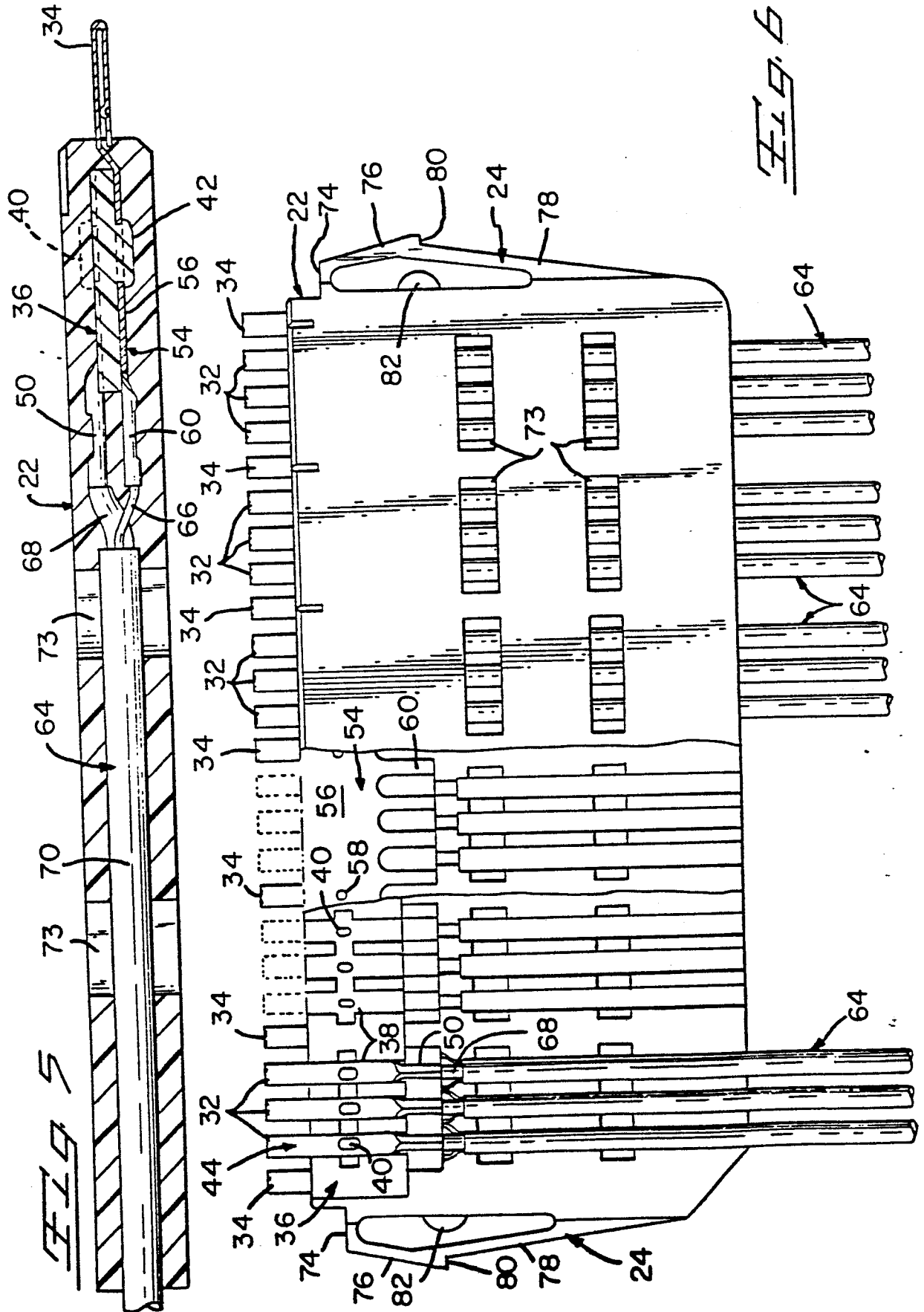
- 1 member (36, 36A, 36B) extend through holes (58, 126) of
the planar section (56, 92, 126) of the ground contact
member (54, 54A, 120), outer ends of the oblong projections
(40, 40A, 112) and the circular projections (42, 42A,
5 138) are distorted thereby securing the signal contact
members (44, 44A, 102), and the ground contact members
(54, 54A, 120) to the contact-carrying member (36, 36A,
36B).
7. An electrical plug connector as set forth in claim
10 1, characterized in that said signal contact sections
(32) and said ground contact sections (34) are formed
by bent back metal layers.
8. An electrical plug connector as set forth in claim
1, characterized in that said signal contact sections
15 (104) and said ground contact sections (122) are solid
stock.
9. An electrical plug connector as set forth in claim
1, characterized in that the housing member (72, 142)
has flexible latch members (24, 146).
- 20 10. An electrical plug connector as set forth in claim
9, characterized in that the latch members (24, 146)
are of different widths.

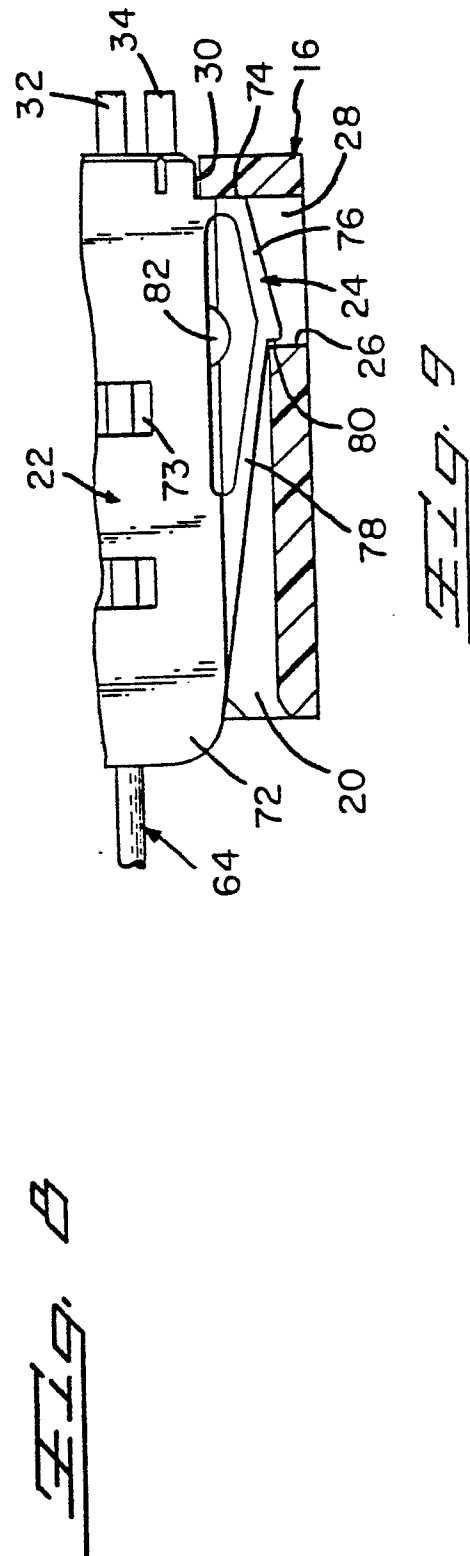
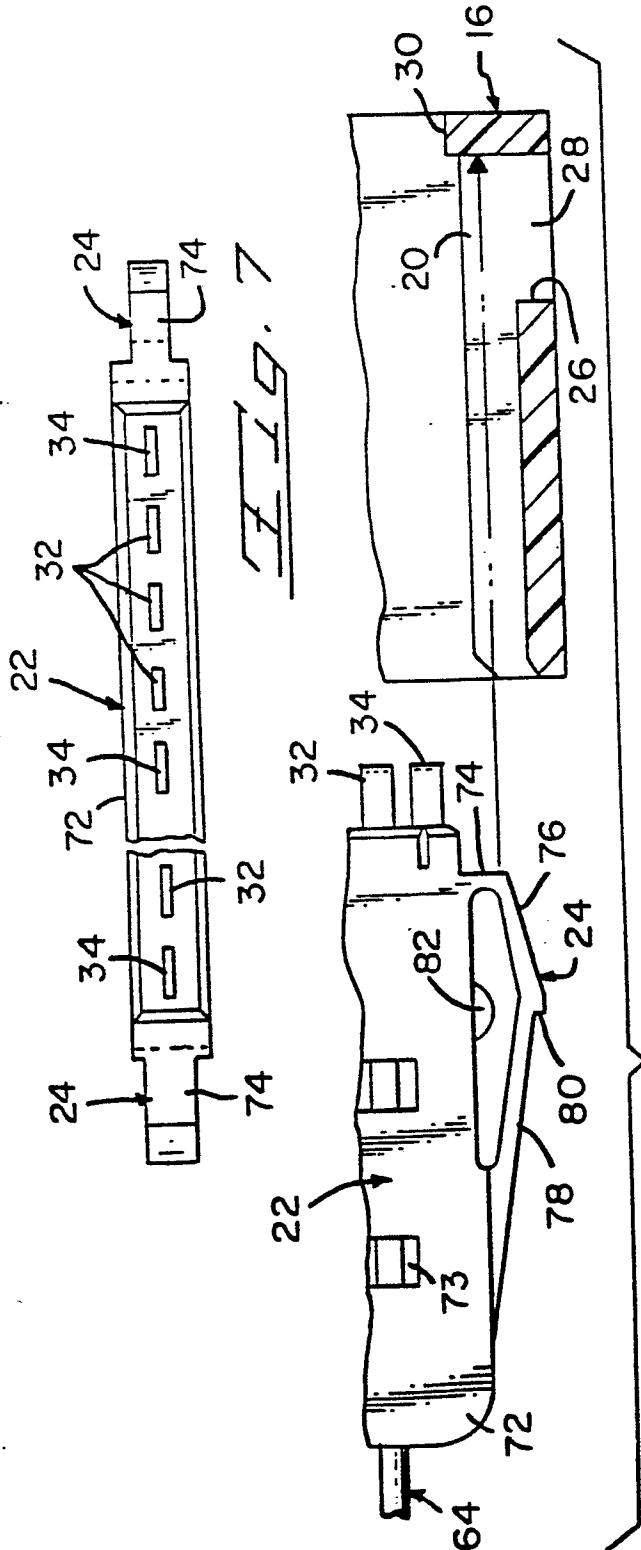




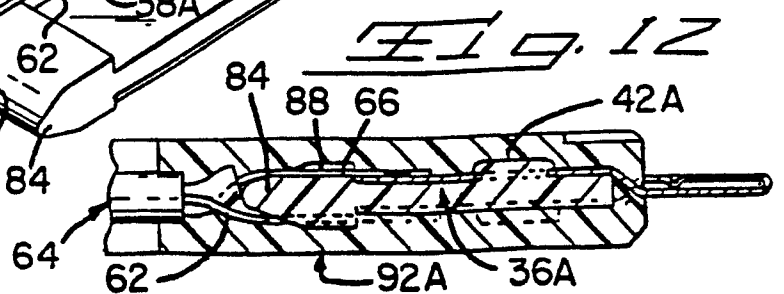
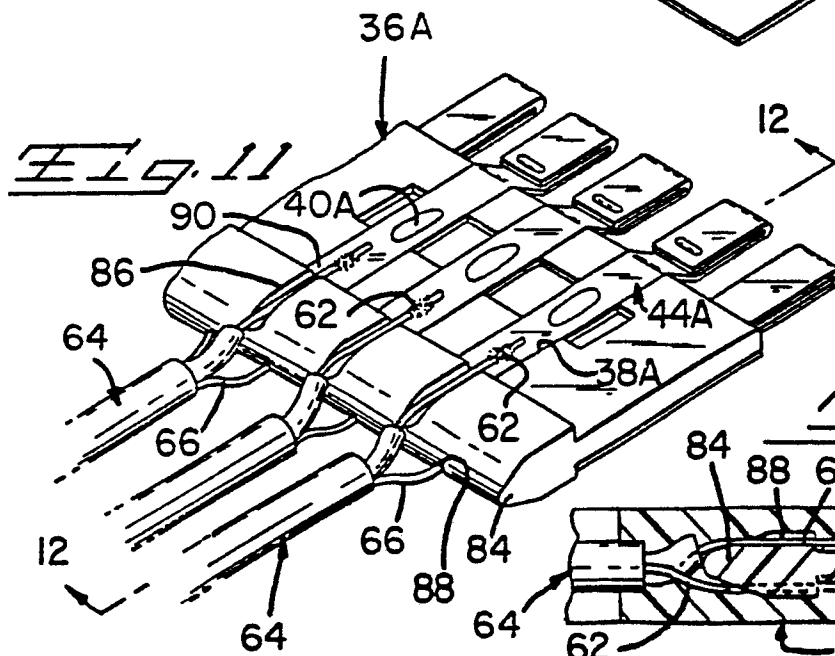
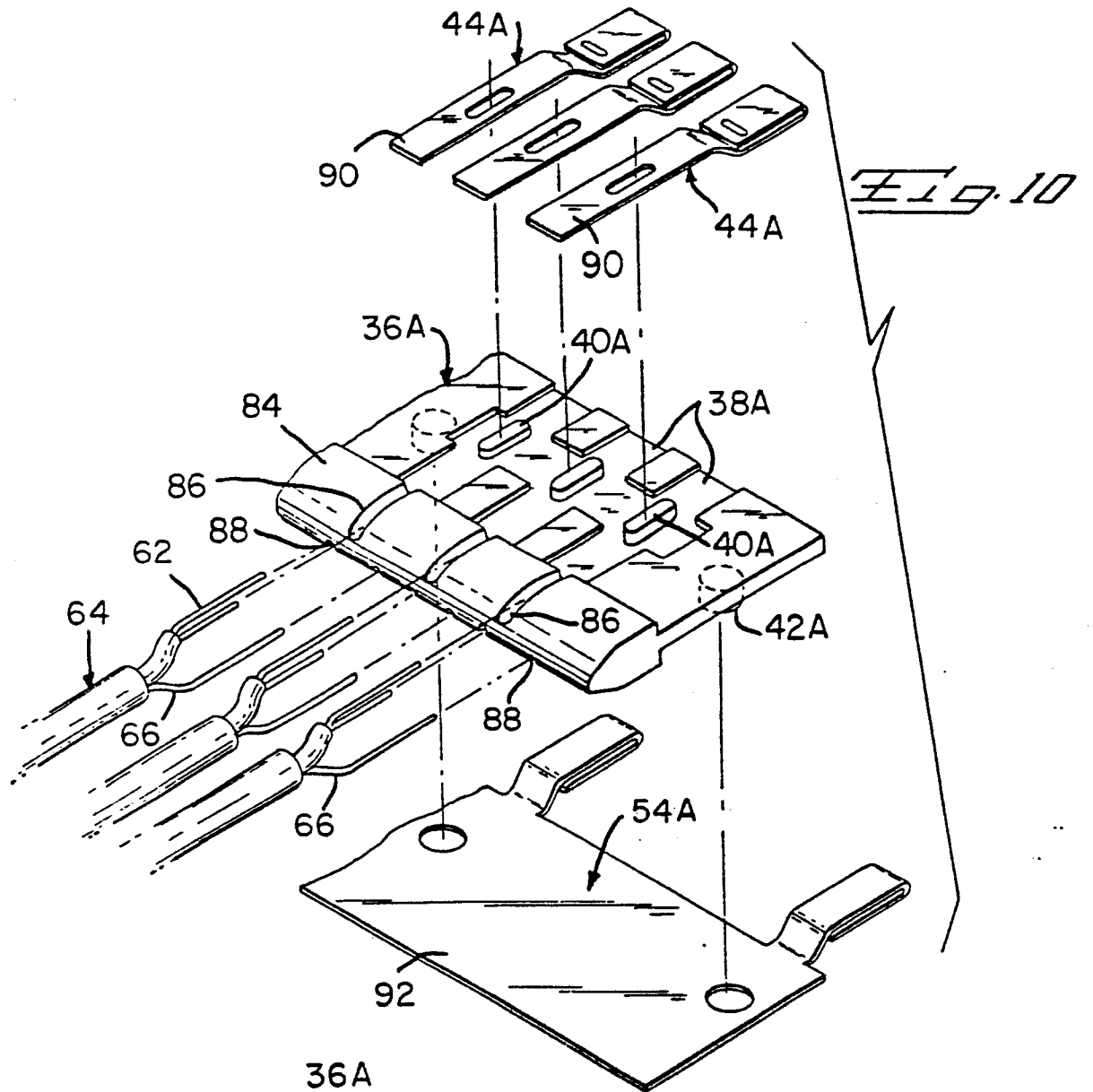
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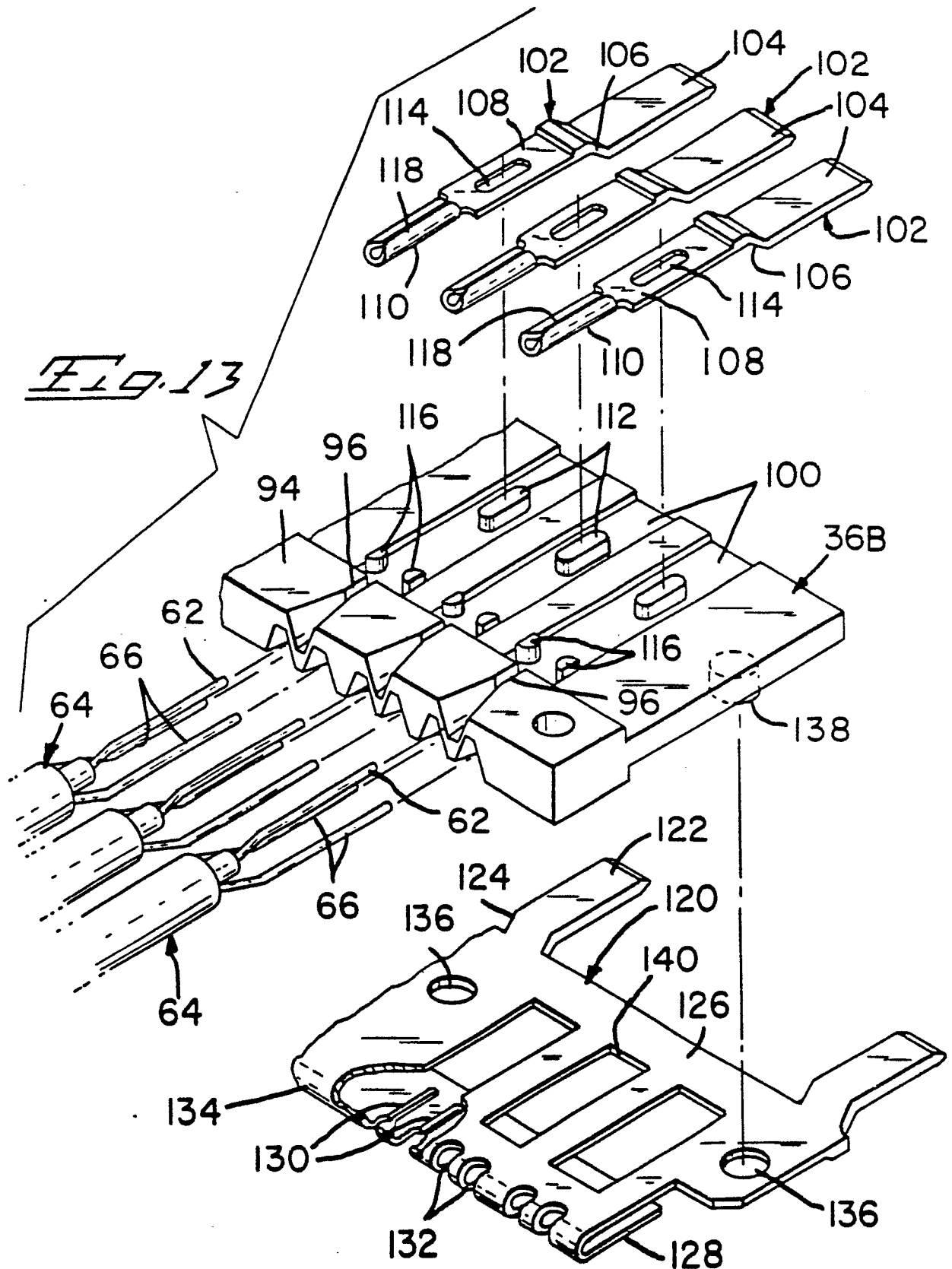




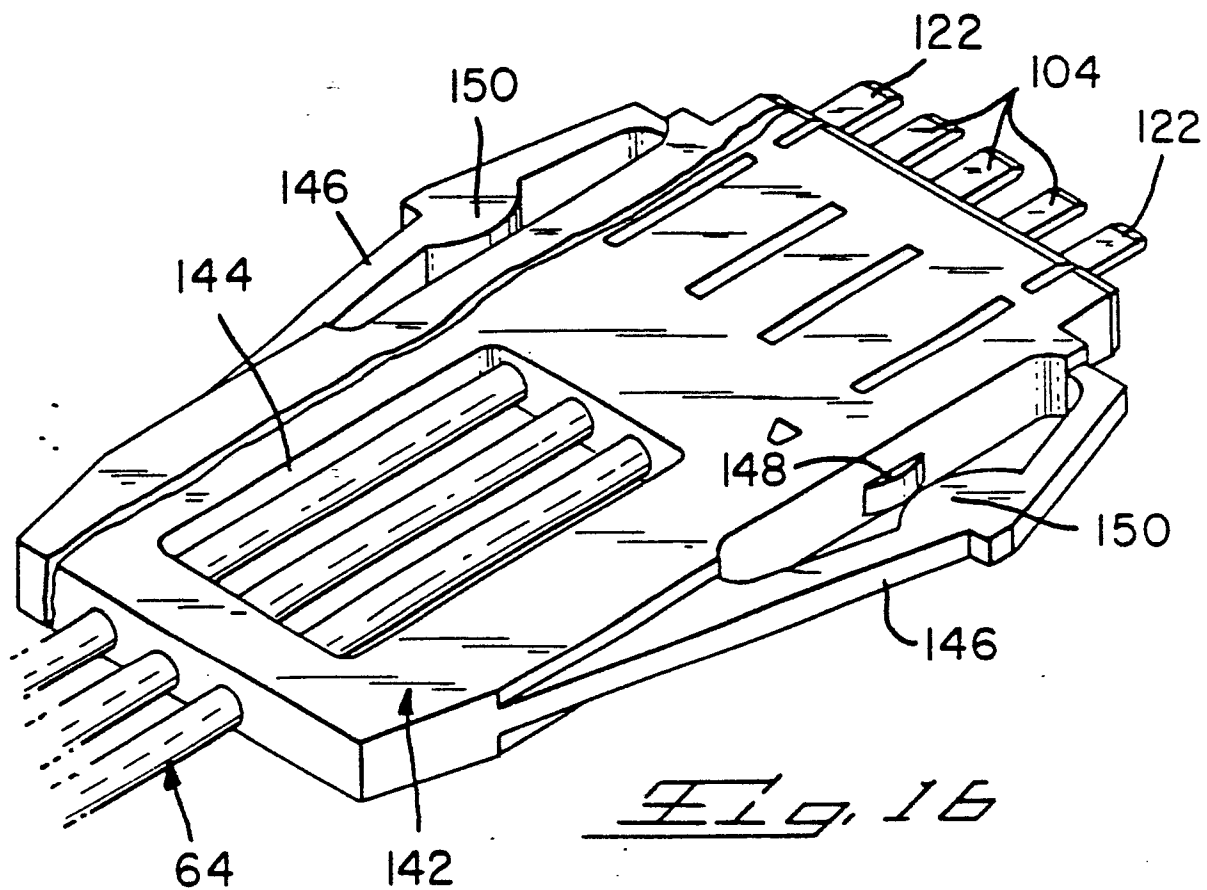
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European Patent
Office

EUROPEAN SEARCH REPORT

0112019

Application number

EP 83 30 6740

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. 3)
A	US-A-3 740 698 (JEROMINEK) * Column 2, line 59 - column 3, line 63; figures 1, 2 *	1,3,4,9	H 01 R 23/02 H 01 R 23/66 H 01 R 13/658
A	GB-A-2 018 054 (CIT-ALCATEL) * Page 1, lines 32-122; figures 1-5 *	1,2,6,9	
A	US-A-3 411 130 (BUSHEY) * Column 2, line 5 - column 3, line 65; figures 1-8 *	1,3	
A	DE-A-1 945 862 (INTERNATIONAL STANDARD ELECTRIC) * Claims 1-6; figures 1-3 *	9	
			TECHNICAL FIELDS SEARCHED (Int. Cl. 3)
			H 01 R 13/627 H 01 R 13/658 H 01 R 23/02 H 01 R 23/66
The present search report has been drawn up for all claims			
Place of search BERLIN		Date of completion of the search 06-02-1984	HAHN G Examiner
CATEGORY OF CITED DOCUMENTS		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document			