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United States Patent [19]

Lemke et al.

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[45] **Reissued Date of Patent: May 13, 1997**

[54] **PLUG TERMINATOR HAVING A GROUNDING MEMBER**

[75] Inventors: **Timothy A. Lemke**, Carlisle; **Richard A. Elco**, Mechanicsburg; **Timothy W. Houtz**, Etters, all of Pa.

[73] Assignee: **Berg Technology, Inc.**, Reno, Nev.

[21] Appl. No.: **352,380**

[22] Filed: **Dec. 8, 1994**

Related U.S. Patent Documents

Reissue of:

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Issued: **Dec. 8, 1992**
Appl. No.: **774,991**
Filed: **Oct. 11, 1991**

U.S. Applications:

[60] Division of Ser. No. 609,941, Nov. 7, 1990, Pat. No. 5,057,028, which is a continuation-in-part of Ser. No. 460, 856, Mar. 8, 1990, abandoned, filed as PCT/US89/02082 May 12, 1989, which is a continuation-in-part of Ser. No. 285,533, Dec. 16, 1988, abandoned, which is a continuation-in-part of Ser. No. 193,611, May 13, 1988, Pat. No. 4,824, 383, which is a continuation-in-part of Ser. No. 91,002, Sep. 2, 1987, abandoned, which is a continuation-in-part of Ser. No. 932,921, Nov. 18, 1986, abandoned.

[51] **Int. Cl.**[6] **H01R 13/652**

[52] **U.S. Cl.** **439/101**; 439/108; 439/607

[58] **Field of Search** 439/92, 95, 101, 439/108, 79, 607–609, 636, 637, 686, 695, 701

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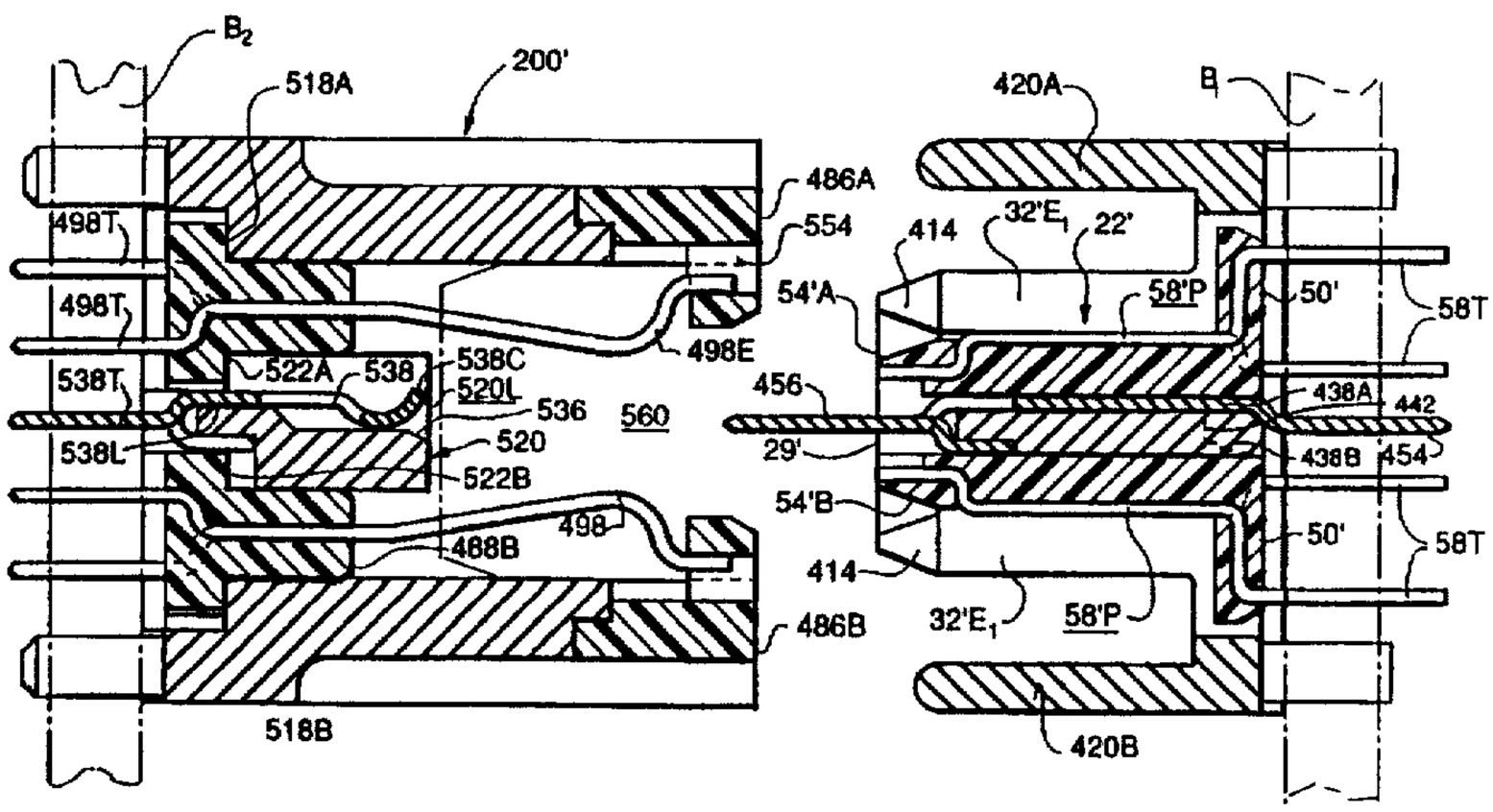
Primary Examiner—Gary F. Paumen
Attorney, Agent, or Firm—Woodcock Washburn Kurtz Mackiewicz & Norris

[57] **ABSTRACT**

A terminator for multiple electrical conductors has a forwardly projecting ground contact provided on the ground structure thereof. A corresponding receptacle has a die cast frame to which nosepieces are attached. Cantilevered contact elements extend from contact blocks and are received in windows provided in the nosepieces.

24 Claims, 14 Drawing Sheets



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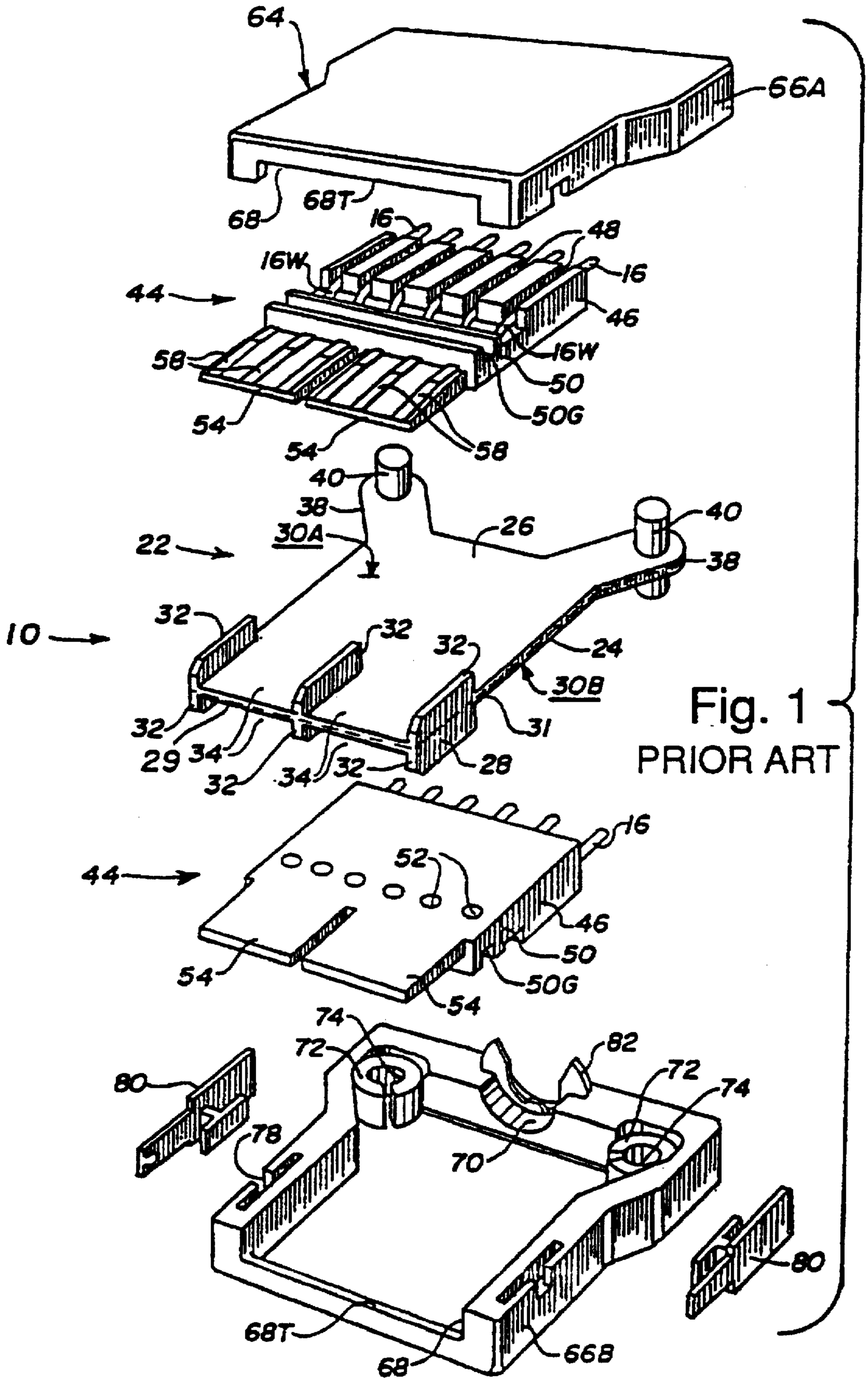
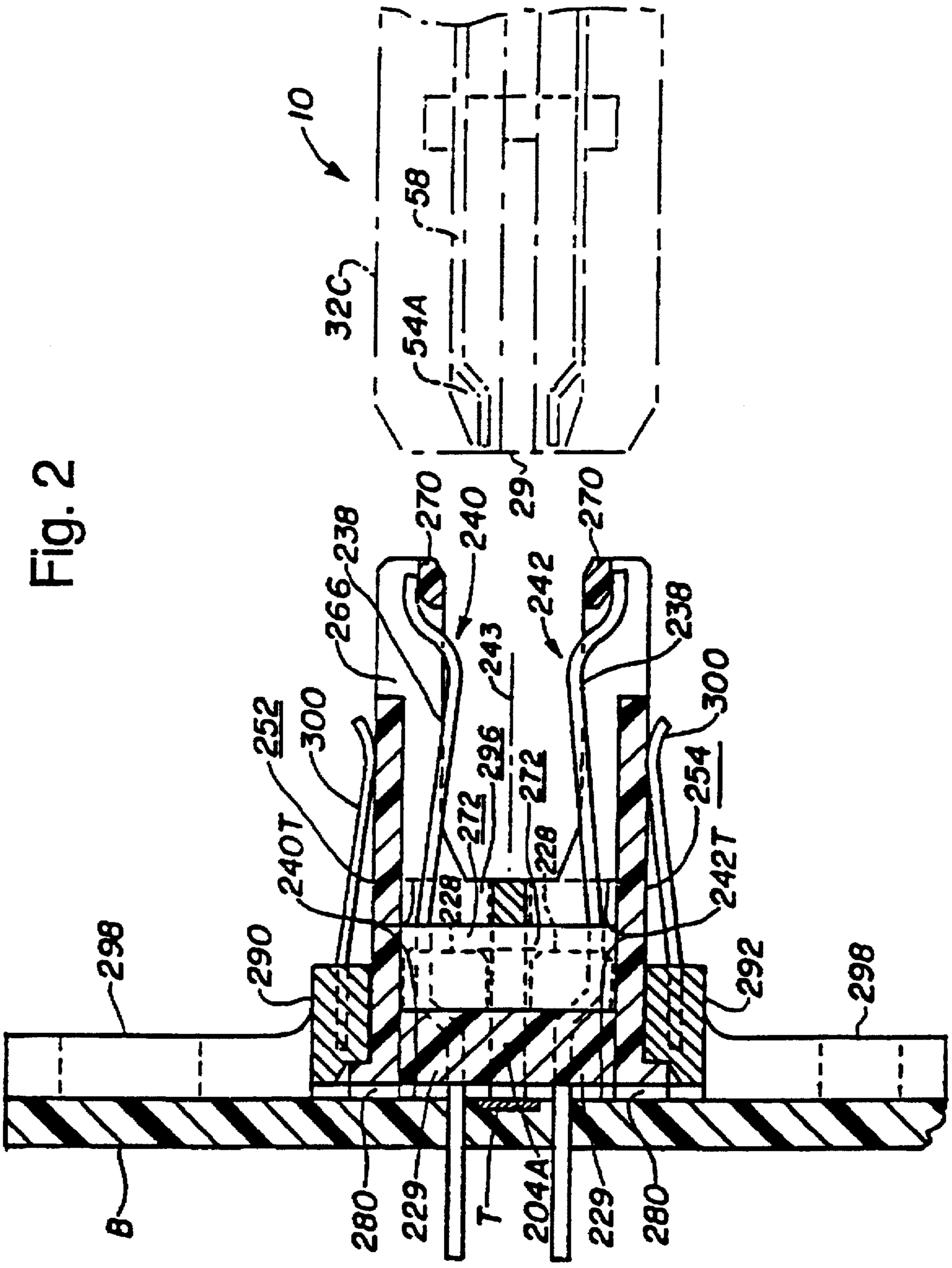


Fig. 1
PRIOR ART

Fig. 2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242T
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290
292
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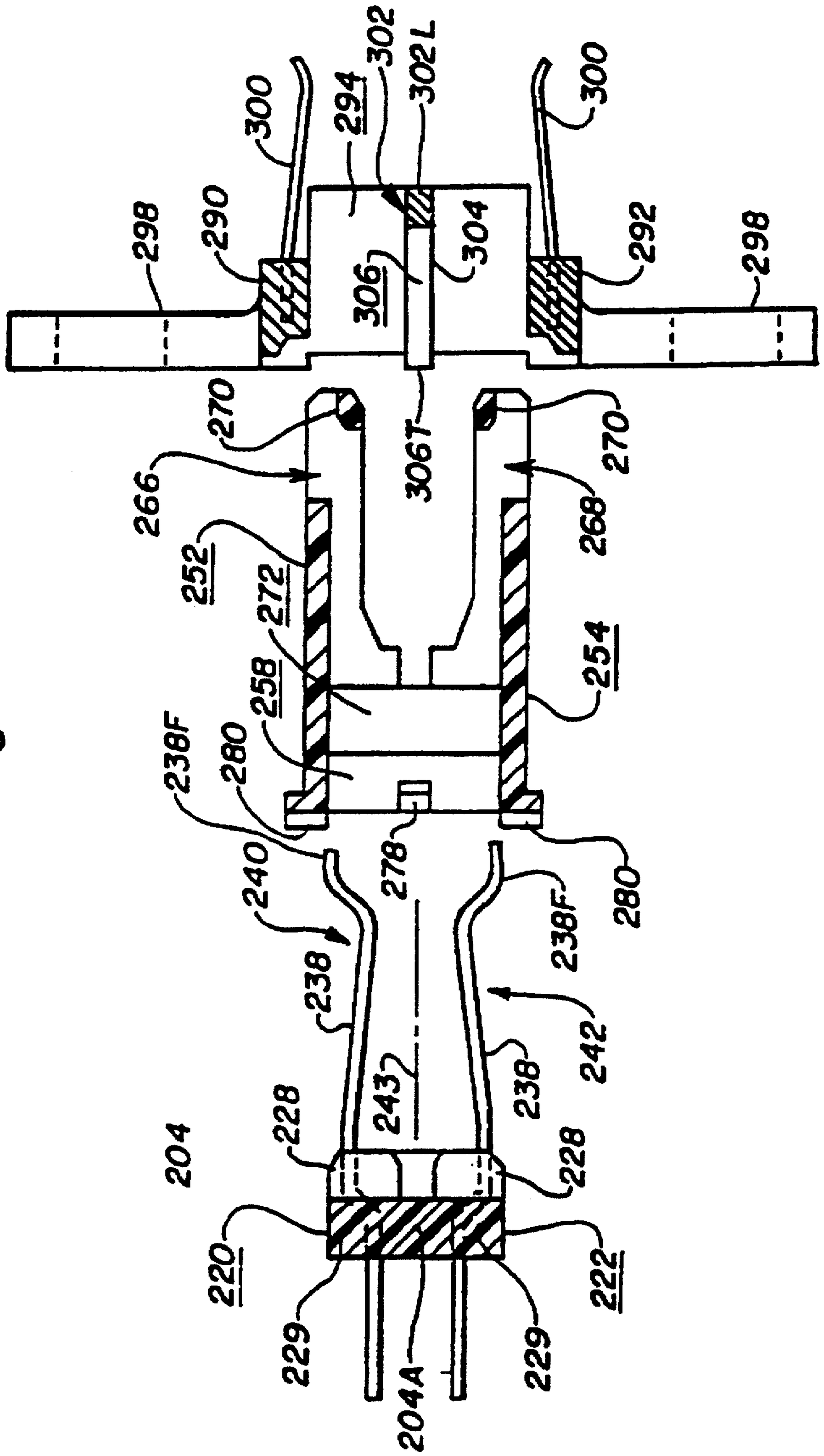
B
280
229
T
204A
229
280

Fig. 3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306T
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268
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258
238F
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240
278
238F
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238
243
238
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204
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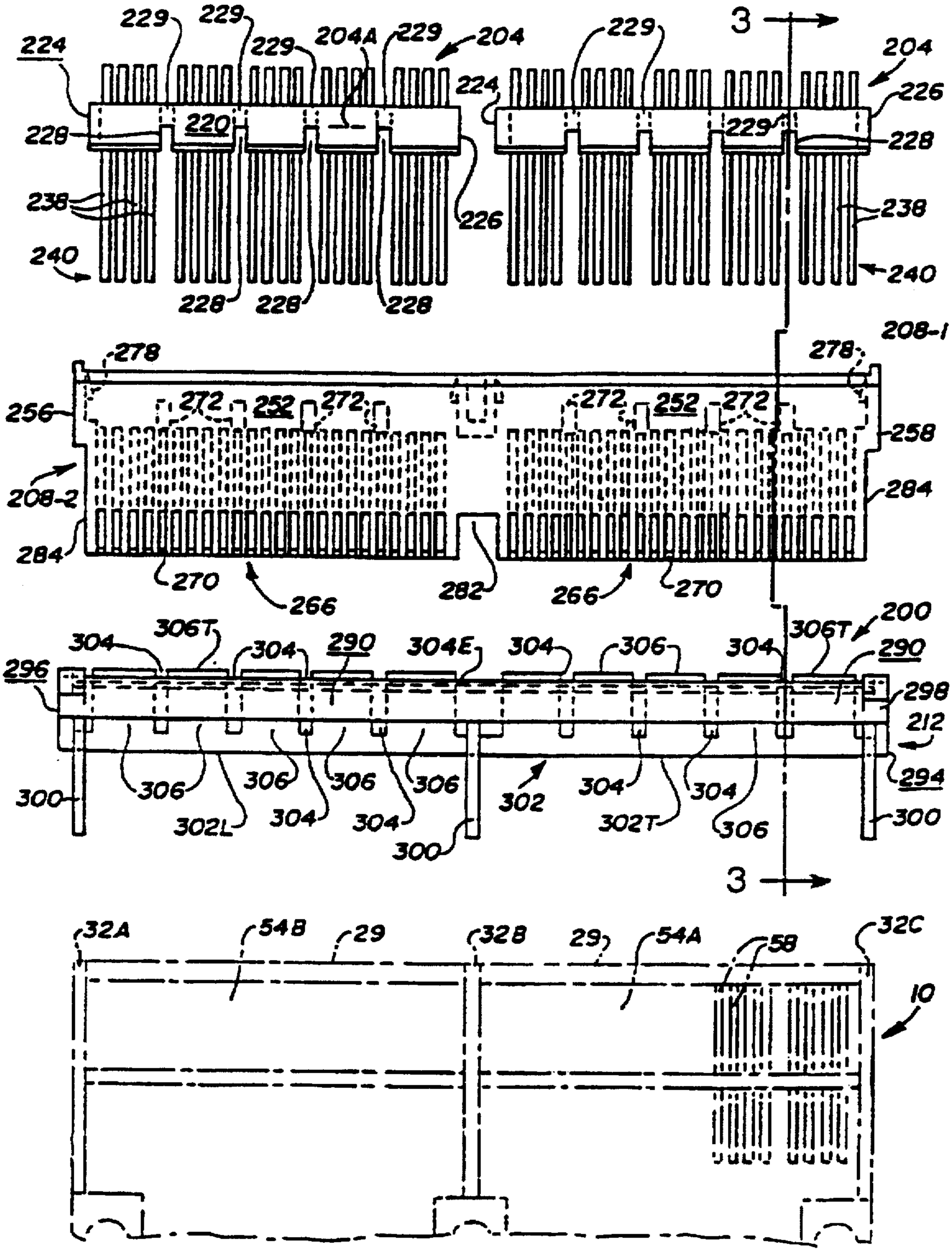
222
229
204A
229

Fig. 4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228
228
228
208-1
278
278
272
252
272
272
252
272
256
258
208-2
284
284
270
266
282
266
270
306T
304
304
290
304E
304
306
304
306T
200
290
296
298
212
294
300
306
306
306
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306
304
304
304
306
300
302L
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302T
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3
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54B
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328
29
54A
58
32C
10

Fig. 5

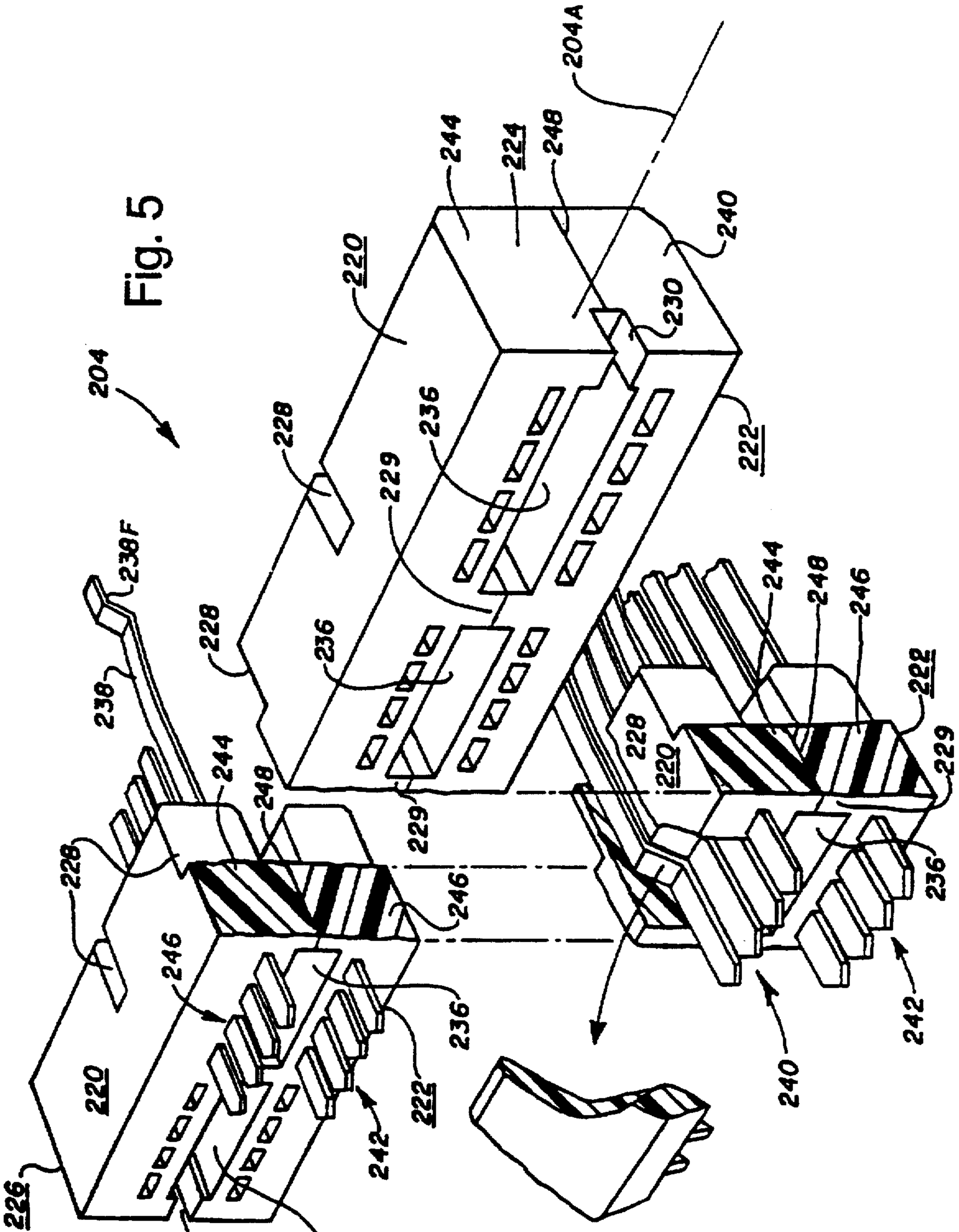
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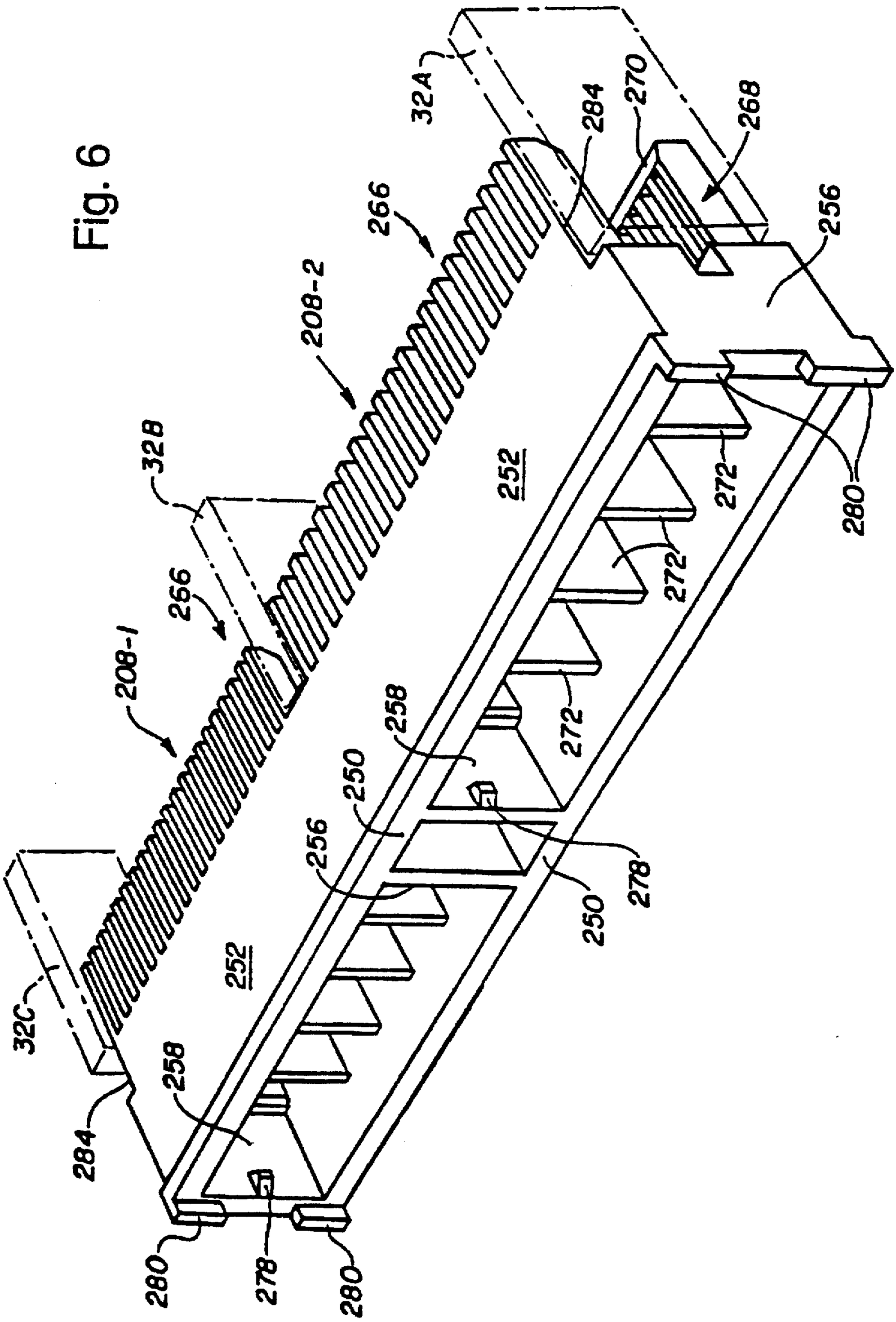
Fig. 6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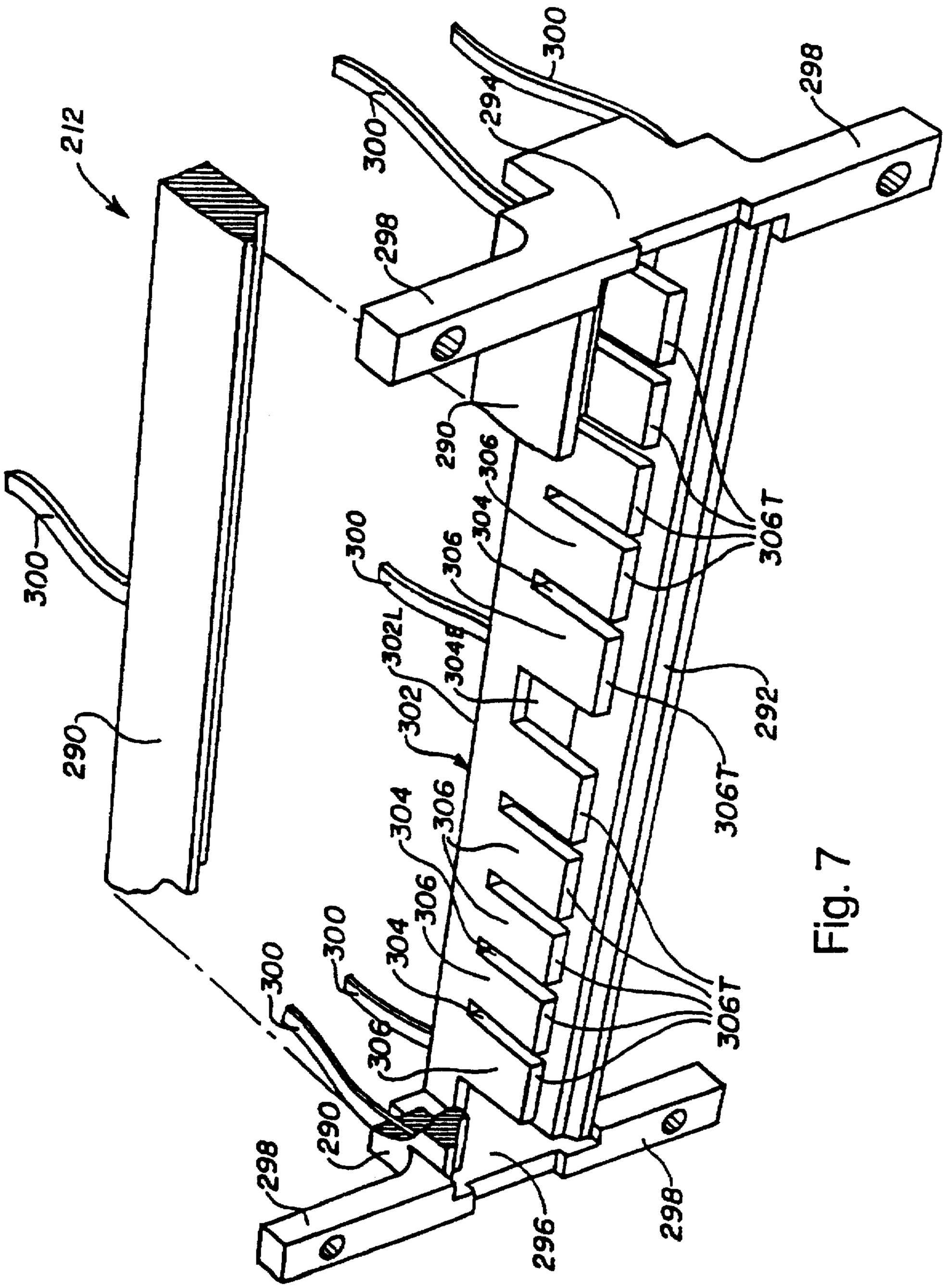

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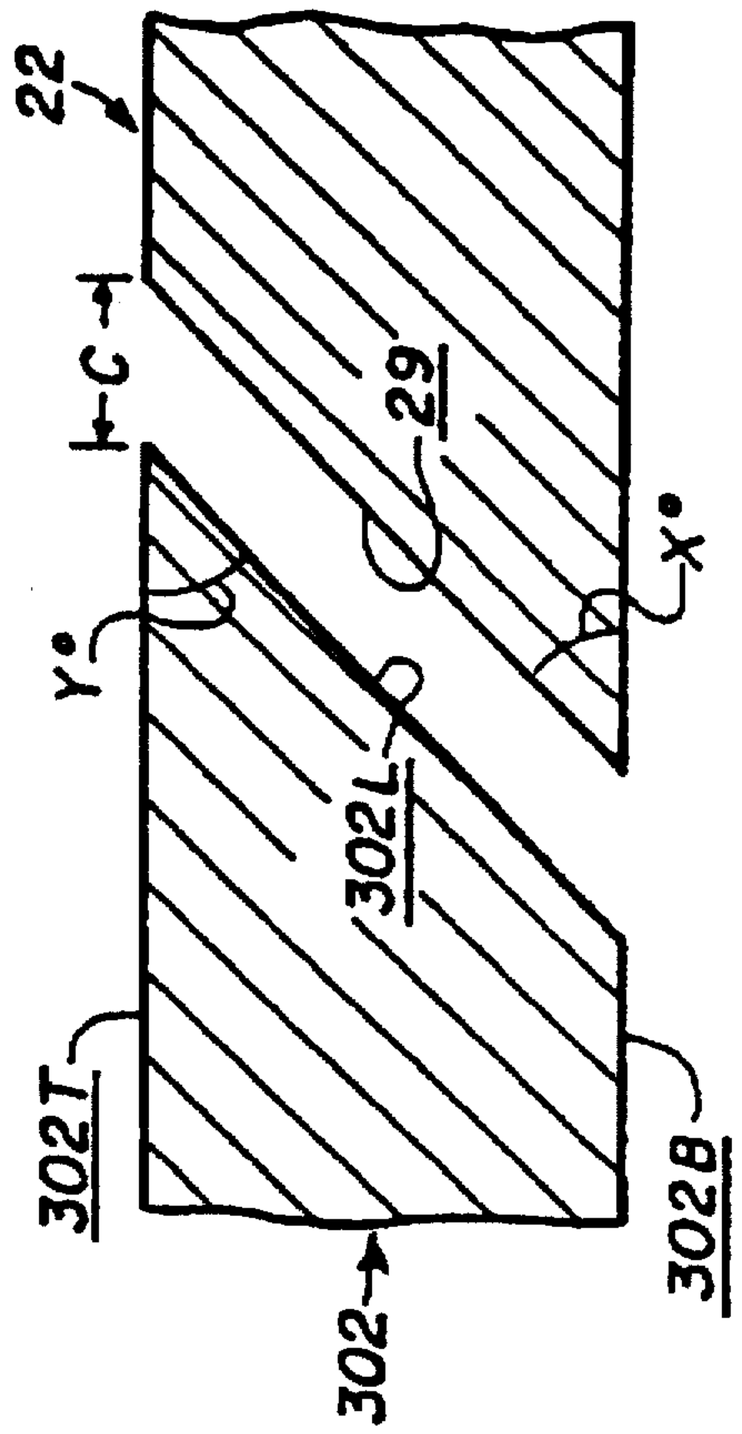
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C
29
X°
Y°
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302T
302B
302

Fig. 10

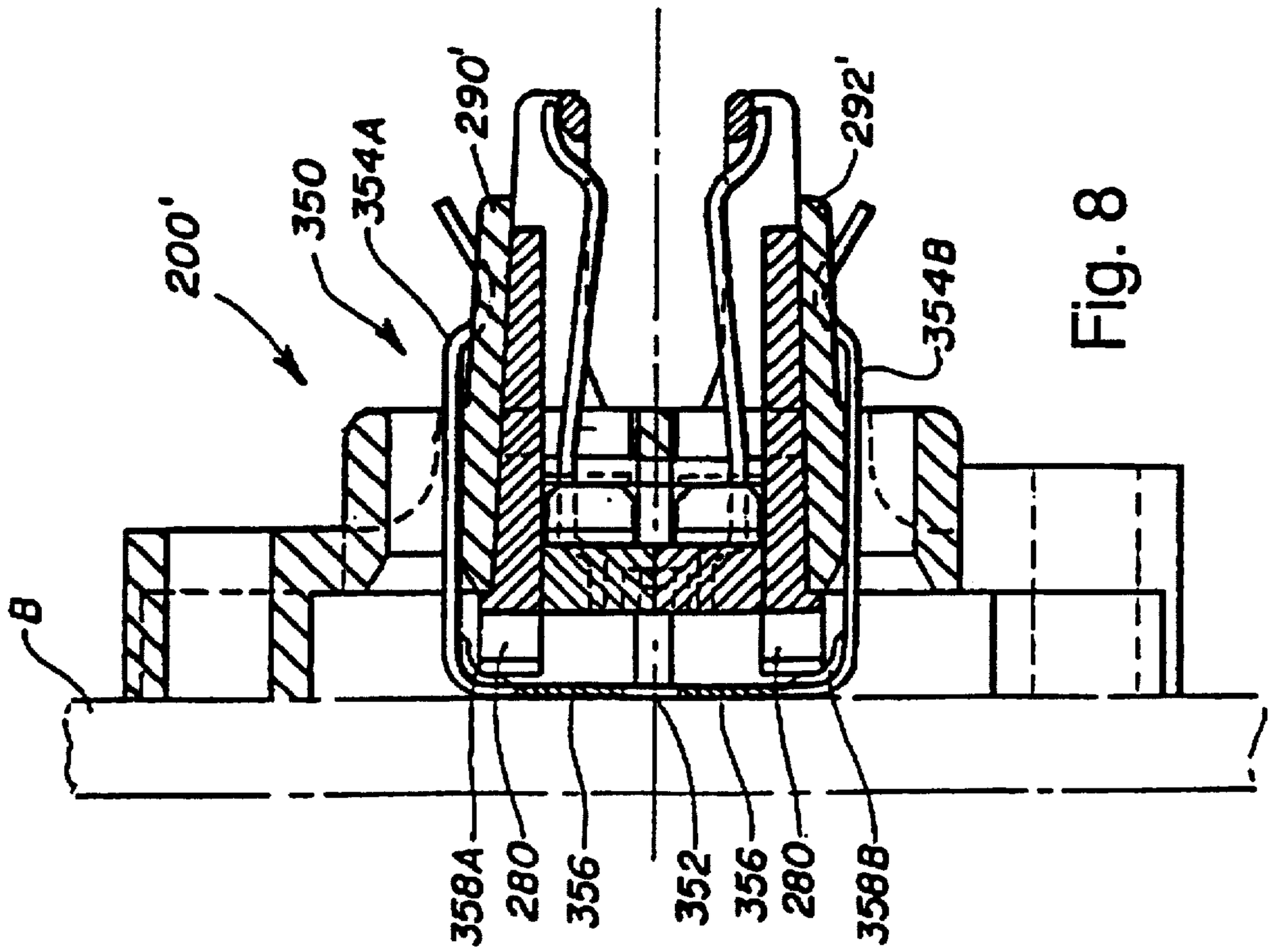
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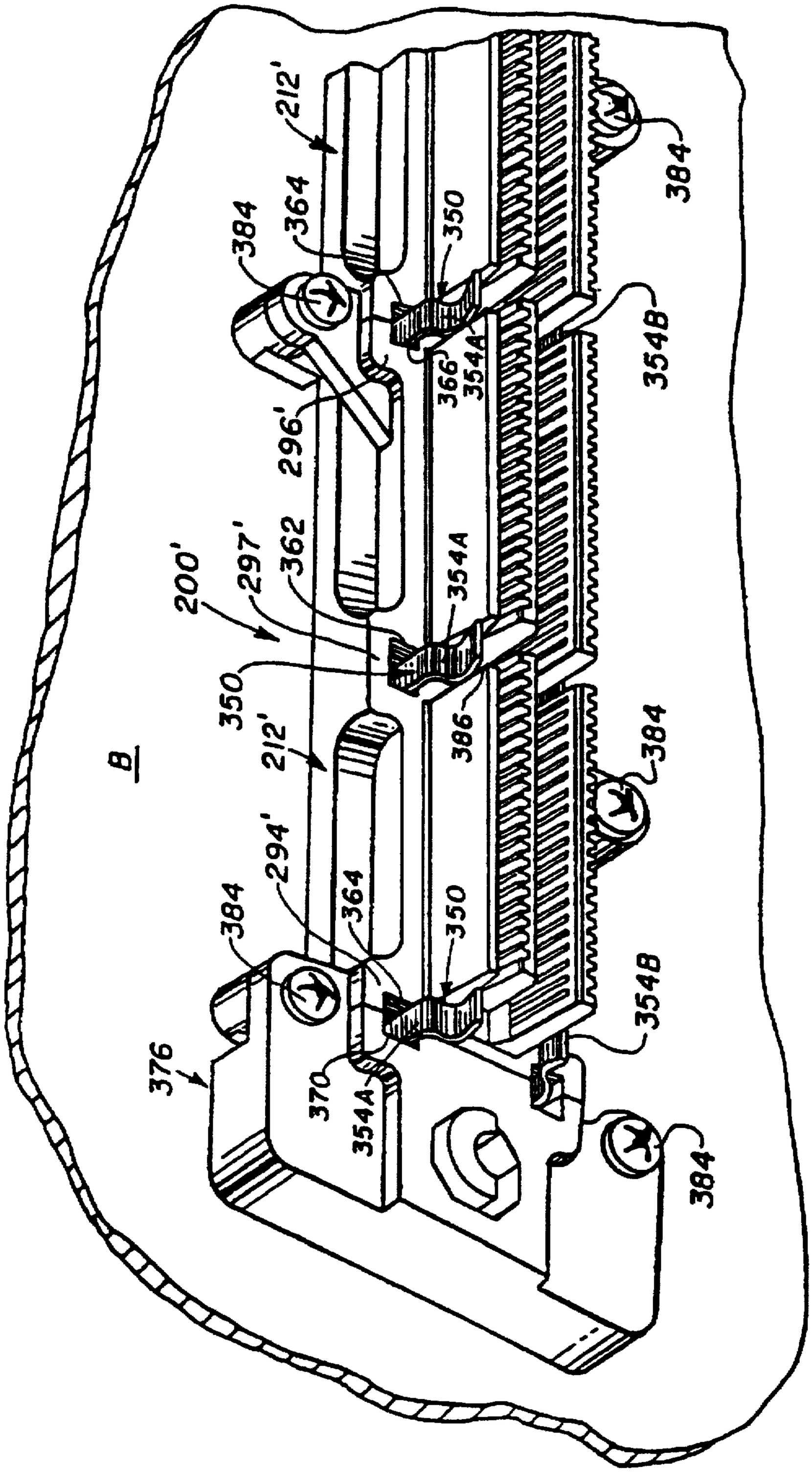
Fig. 8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296'
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3548
200'
297'
362
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384
294'
384
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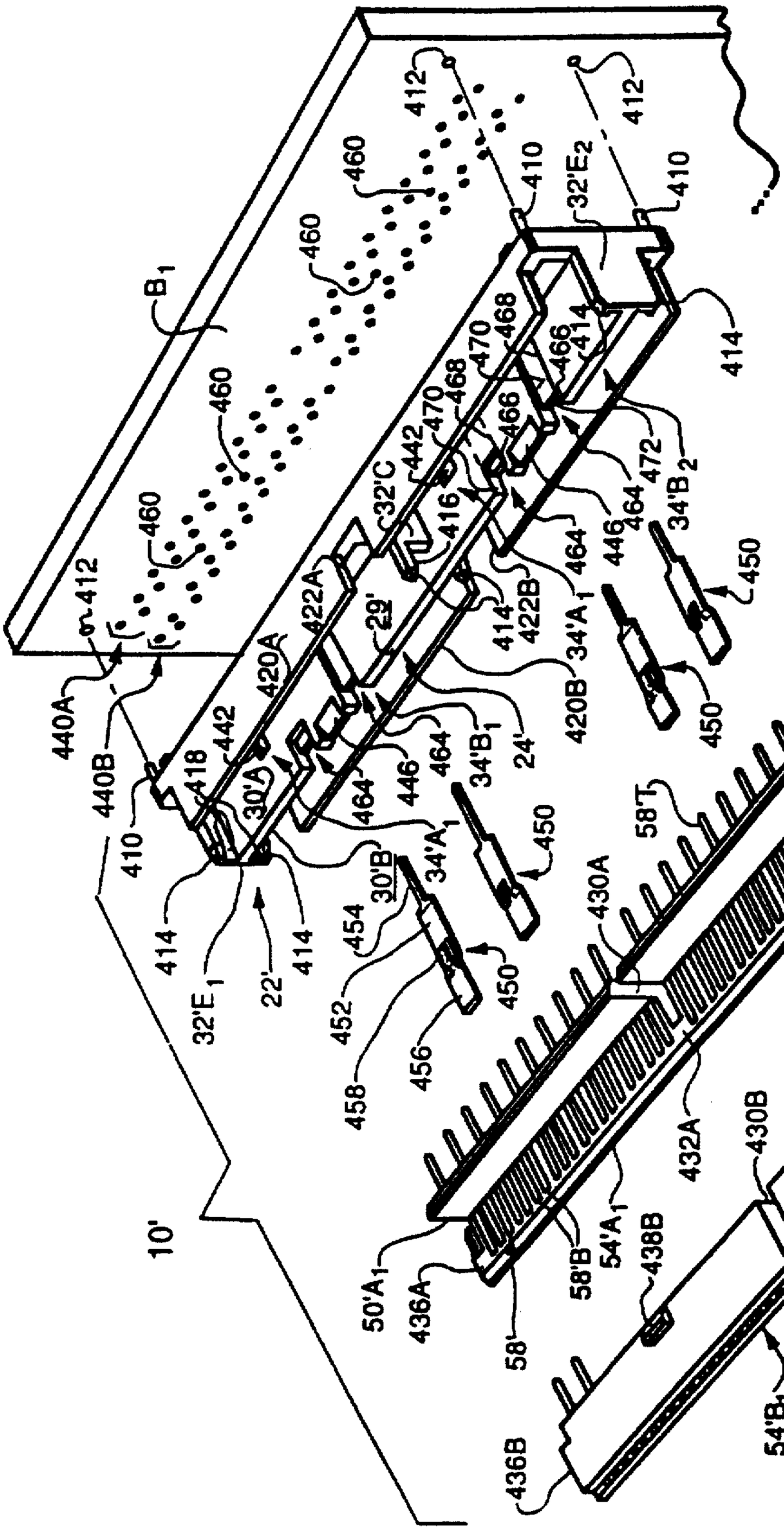
350
376
370
3548
354A
384

Fig. 9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440A
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410
412
460
B_1
A_1
420A
422A
29'
32'C
442
470
468
466
414
416
472
$34'B_2$
464
446
$34'A_1$
450
422B
420B
30'A
418
$32'E_1$
22'
24'
$34'B_1$
30'B
454
452
458
456
$50'A_1$
436A
58'B
58'T
$54'A_1$
438B
430A
$54'A_2$
$50'A_2$
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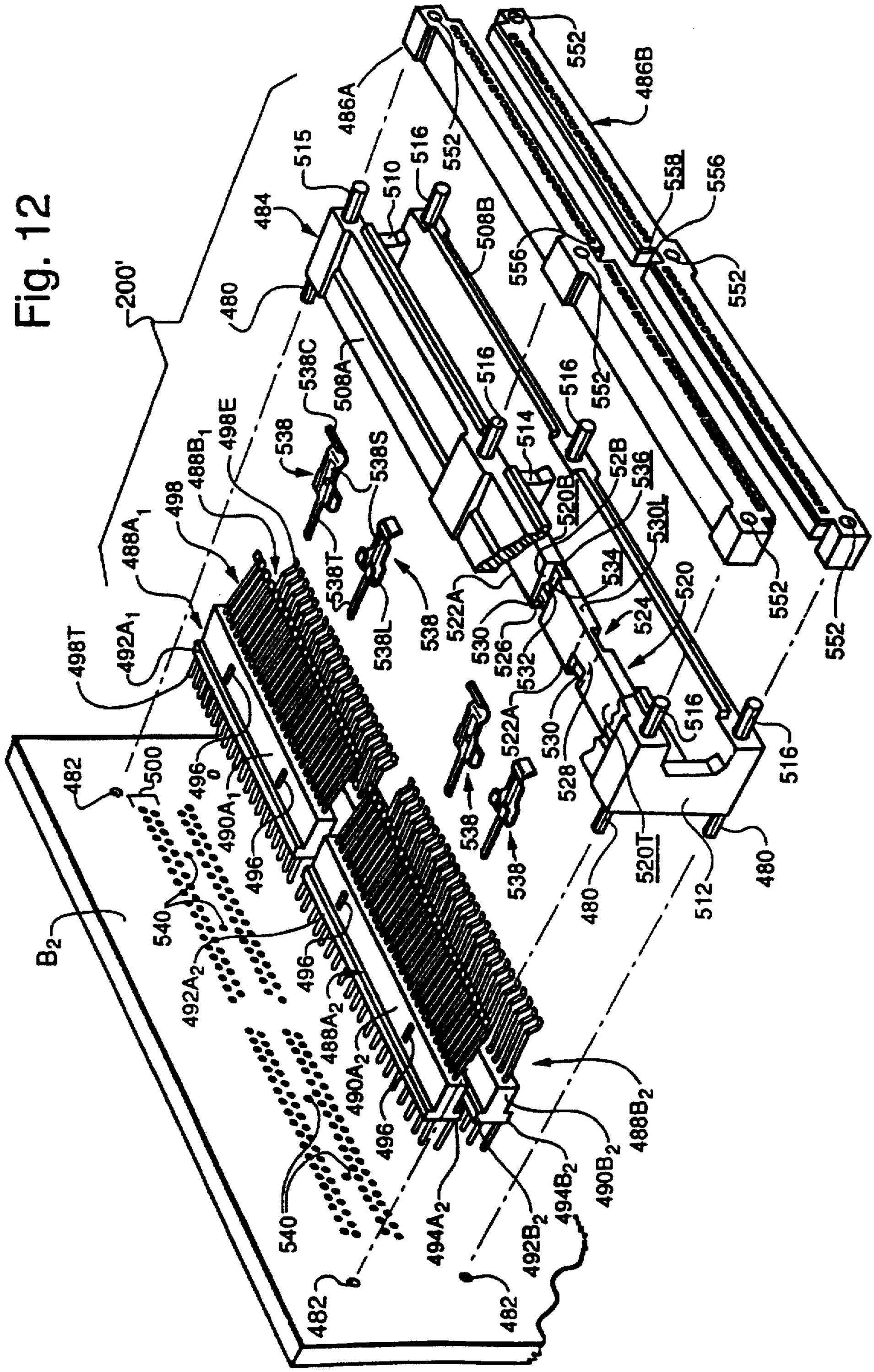
44'B
436B

Fig. 11

Fig. 12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486A
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490A1
490B2
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494B2
496
498
498E
498T
500
508A
508B
510
512
514
515
516
520
520B
520T
522A
524
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530L
532
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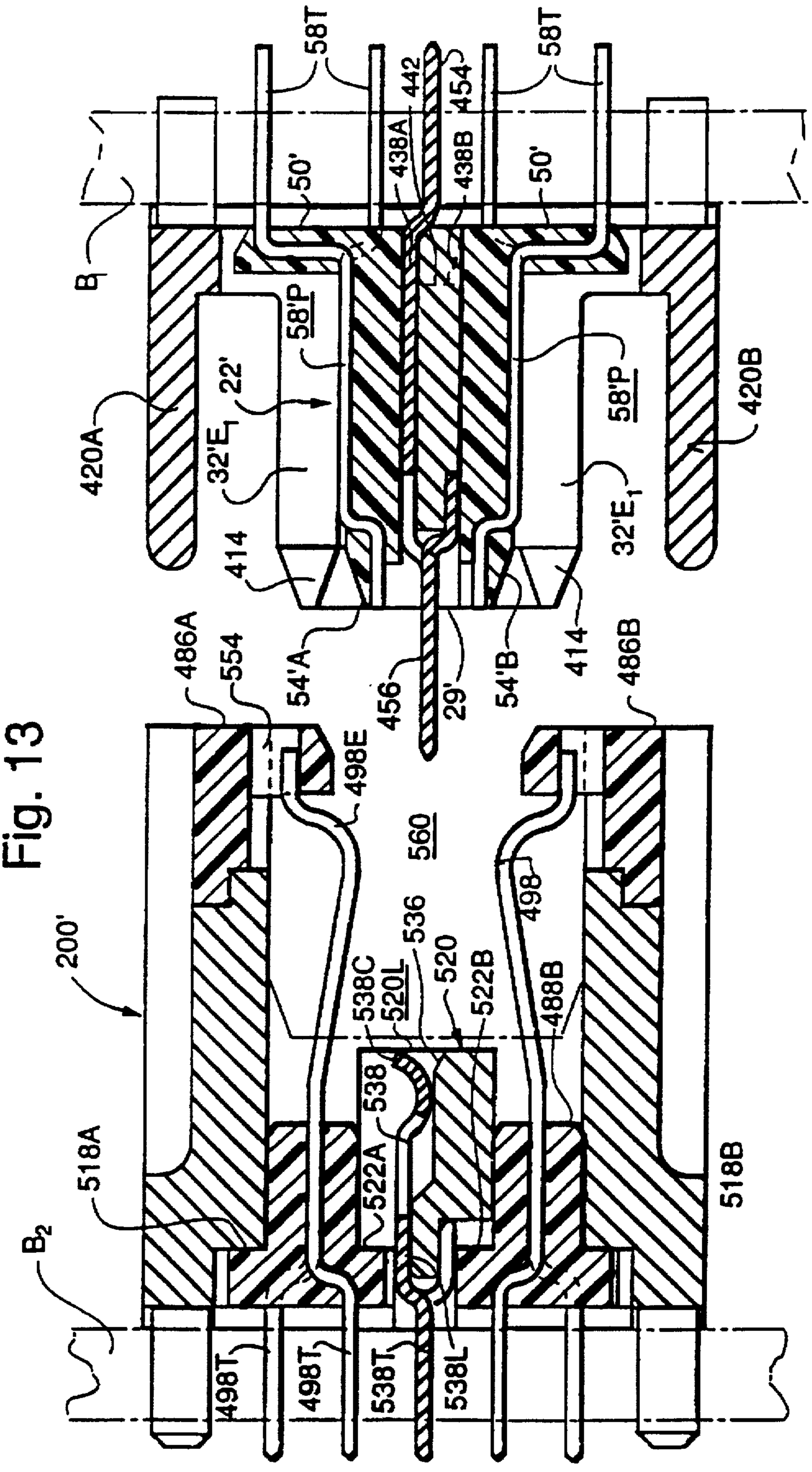
538C
538L
538S
538T
540
552
556
558
B2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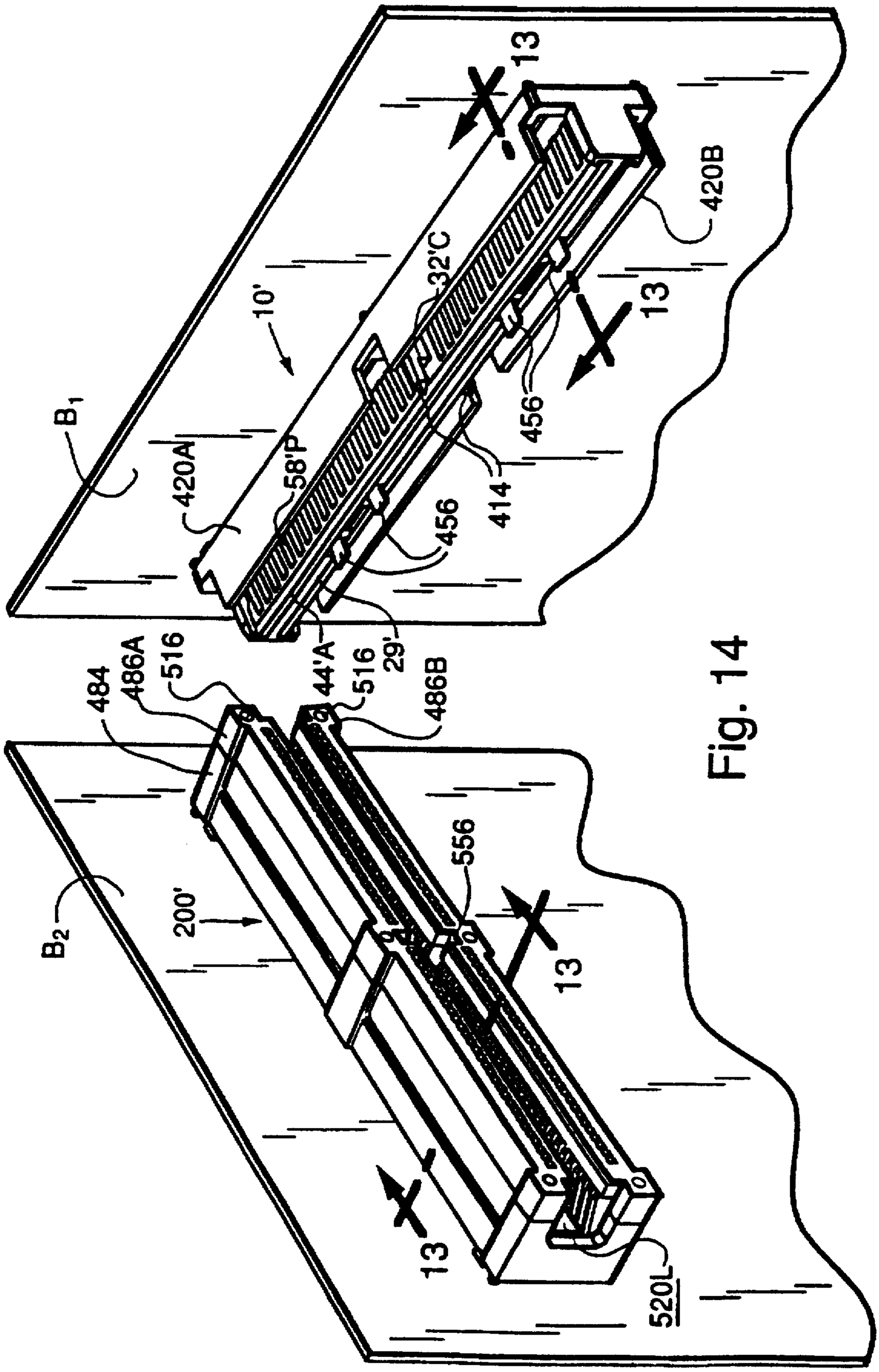
438A
438B
50'
50'
B
58'P
22'
32'E1
420A
58'P
420B
32'E1
414
414
486A
554
54'A
54'B
486B
456
29'
498E
560
200'
536
538C
520L
520
522B
498
488B
538
522A
518A
518B
B2
498T
498T
538T
538L

Fig. 13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32'C
10'
B1
420A
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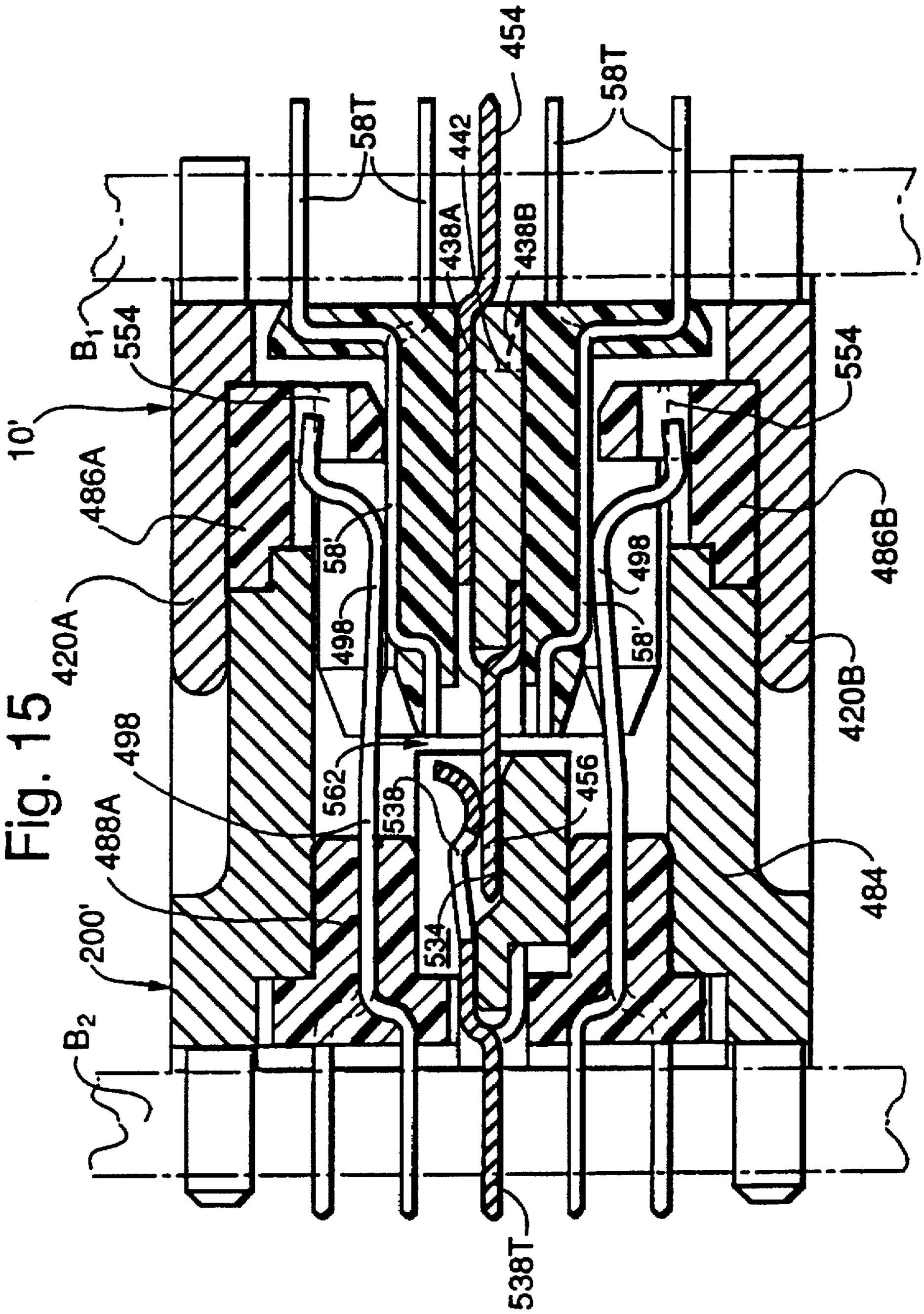
29'
486B
556
200'
B2
13
520L

Fig. 14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420A
420B
498
562
538
456
488A
534
484
200'
B_2
538T

Fig. 15

PLUG TERMINATOR HAVING A GROUNDING MEMBER

Matter enclosed in heavy brackets [ ] appears in the original patent but forms no part of this reissue specification; matter printed in italics indicates the additions made by reissue.

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a division of copending application Ser. No. 07/609,941, filed Nov. 7, 1990, now U.S. Pat. No. 5,057,028, issued Oct. 15, 1991, which is a continuation-in-part of United States national stage application Ser. No. 07/460,856, filed Mar. 8, 1990 now abandoned, which derives priority from PCT application Ser. No. PCT/US89/02082, filed May 12, 1989, which is itself a continuation-in-part of U.S. application Ser. No. 07/285,533, filed Dec. 16, 1988, now abandoned, which is itself a continuation-in-part and includes subject matter divided from application Ser. No. 07/193,611, filed May 13, 1988, now U.S. Pat. No. 4,824,383, issued Apr. 25, 1989, which is itself a continuation-in-part of application Ser. No. 091,002, filed Sep. 2, 1987, now abandoned, which is itself a continuation-in-part of application Ser. No. 06/932,921, filed Nov. 18, 1986, now abandoned.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a plug terminator having electrical contacts therein, each contact being connectable to one of a multiplicity of electrical conductors, and in particular, to a terminator having a projecting ground structure therein arranged to isolate each electrical contact. In addition, the present invention relates to a receptacle structure useful with such plug terminator.

2. Description of the Prior Art

As the performance of electronic devices has increased exponentially it has become recognized in the art that the transmission of electrical signals, whether within a given electronic apparatus or between coupled apparatuses, must be approached from a system viewpoint. Such a viewpoint mandates that not only must each individual component in the signal transmission system be optimized for high speed operation, but also the interfaces between components in the transmission system must be able to perform interactively without degrading the performance of an adjacent component.

One of the first components in the signal transmission system to receive attention is the transmission cable itself. The realization has been made that the cable handling the high speed signals is the electrical equivalent of a transmission line in that it extends an electrically great distance with respect to the wavelength of the transmitted signals. This is true even though in most instances the cable extends only a physically short distance between components of a given apparatus or between cooperating apparatus.

The design of electrical cable has advanced to a point wherein the cable can be precisely engineered to exhibit predetermined electrical properties. Exemplary of such cable structure is the flat cable and the round cable respectively disclosed and claimed in U.S. Pat. No. 4,800,236 (Lemke), and in U.S. Pat. No. 4,920,234 (Lemke), both assigned to the assignee of the present invention. The cables disclosed in these last-mentioned patents include a corrugated ground structure which defines separate enclosed regions, or envelopes, which extend throughout the entire length of the cable. Each of the envelopes receives one or more ordinary jacketed conductors. When the ground structure is connected to a predetermined electrical potential the conductor in each envelope is isolated from those conductors disposed in adjacent envelopes. As a result such a cable exhibits electrical properties closely similar to those attainable from coaxial cable despite the fact that only ordinary jacketed conductors are utilized.

The system viewpoint has expanded to include considerations of electrical performance in the transition region intermediate the end of the cable and the cable terminator. The connector structure disclosed and claimed U.S. Pat. No. 4,731,031 (Lemke), assigned to the assignee of the present invention, utilizes a ground plane spaced predetermined distances from the ends of the conductors in the cable, from the contacts in the connector, and from the interconnection therebetween, for the purpose of minimizing electrical discontinuities in the system.

Density of the terminator, that is, the number of signals that can pass through a given terminator, is also an important consideration. In conventional systems attempts have been made to extend the shielding and control the impedance of the system beyond the transmission line by simply dedicating alternating contacts in the linear array of contacts in the terminator as ground contacts. The contact is not physically altered, but is merely designated as a ground contact and connected to a predetermined ground potential. The net result of these factors is that the density of the terminator is limited.

The plug terminator disclosed and claimed in U.S. Pat. No. 4,824,383 (Lemke), issued Apr. 25, 1989, extends the system concept to the individual terminator of the transmission system in a way that increases the density of the terminator. The terminator shown in this last mentioned patent is adapted for use with either a multiple conductor cable or a multiple tracing substrate and is thus adapted to interconnect in substrate-to-substrate, cable-to-cable, or cable-to-substrate form. This terminator includes structure that serves to electrically isolate individual or groups of contact elements in the terminator to prevent or to minimize cross talk between adjacent conductors and to prevent or minimize degradation of signal transmission. The isolating structure in the terminator is such that the contacts need not themselves be included as part of the isolating structure, whereby the signal density of the terminator may be increased.

The terminator includes a metallic ground structure which electrically isolates individual or groups of adjacent electrical contact elements disposed on or in a contact support member of the terminator. The ground structure has a baseplate with at least one wall that extends upwardly from a working surface of the baseplate. In the preferred case one or more walls also extend from the opposite working surface of the baseplate. The wall(s) define(s) a plurality of channels that extend in side-by-side relationship across the surface of the baseplate.

The insulated support member has a body portion with an array of extending fingers. The insulated support member is mounted on the baseplate with the fingers thereof extending into the channels on the baseplate. A single electrical contact element or a plurality of such contact elements is mounted on each of the fingers. In one arrangement the fingers may be provided with a recess in which an individual contact or a group of contacts is disposed.

The walls on the baseplate walls extend above the baseplate for a greater distance than do the electrical contacts. As a result, with the ground structure connected to a predetermined potential, each of the individual contacts or each group of contacts is electrically isolated from the adjacent contact or group of contacts, as the case may be, thus preventing or minimizing cross talk therebetween.

SUMMARY OF THE INVENTION

The present invention relates, in one aspect, to a receptacle for a plug terminator of the type disclosed in the above-referenced U.S. Pat. No. 4,824,383, that is, a terminator of the type having a metallic ground structure with a wall upstanding therefrom which defines a plurality of channels thereon. In this first aspect the receptacle comprises a housing, a contact block having a first and a second array of contact elements thereon received within the housing, and a frame having a central plate extending through the housing and the block. The central plate lies along a predetermined bisecting plane within the receptacle intermediate the first and the second arrays of contact elements. The receptacle is arranged to receive the terminator such that the leading edge of the ground structure thereof and the leading edge on the central plate lie within a predetermined close distance of each other. The forward edge of the ground structure is chamfered at a predetermined angle and the leading edge surface of the central plate is chamfered at a corresponding angle, so that the forward edge surface of the ground structure and the leading edge surface of the central plate lie parallel to each other.

The central plate is connectable to a predetermined electrical potential thereby to isolate the first and the second array of contact elements from each other. The frame further comprises a crossbar extending in parallel to the central plate. The crossbar has a ground contact thereon that is engageable with the wall on the ground structure when the terminator is received by the receptacle.

In one subsidiary aspect the crossbar has a blind opening therein, and the ground contact is press fit within the blind opening in the crossbar. Alternatively, the crossbar may have an opening, either in the form of a full bore or a slot, extending therethrough. The ground contact is a generally U-shaped member comprising a base portion with a pair of legs extending therefrom, the legs of the U-shaped member extending through the opening in the crossbar. The U-shaped member has a stiffener disposed between the base and each leg. The housing has standoffs thereon, the standoffs being engageable against the stiffeners to clamp the U-shaped member against a surface.

In a second major aspect, the present invention relates to a improved plug terminator arrangement. The plug terminator is generally similar to that discussed above, but improved in that at least one grounding contact, preferably connected to the baseplate of the terminator, projects forwardly past the forward edge of the metallic grounding structure. The ground contact has a planar portion with a tang offset therefrom while the central plate has a first and a second surface thereon and a recessed tongue formed therein. The recessed tongue is defined by a full groove extending across one surface of the plate and a partial groove defined across the other surface of the plate. The planar portion of the ground contact is receivable in the full groove and the forked clip is receivable in the partial groove, thereby to secure the ground contact to the baseplate.

In subsidiary aspects the terminator may have a latch disposed on a surface of at least one of the fingers thereof,

and the baseplate has a notch sized to receive the latch, thereby to secure the finger to the baseplate. One of the walls of the terminator has a predetermined dimension and a finger has a slot therein, the slot being sized to closely accept the wall such that the finger is precisely located with respect to the baseplate. The one wall may also have a tapered guide portion thereon.

An improved receptacle, in accordance with still another major aspect of the invention, comprises a frame, preferably a die east metallic member, formed of an upper and lower crossbar connected at opposed ends by uprights. The frame has a central plate extending between the uprights in generally parallel relation to the crossbars. Each crossbar has a forward surface thereon. A nosepiece having a plurality of windows therein and formed of an insulating material is mounted to the forward surface of the crossbar, typically with an interference fit. A contact block comprising an insulating body member having a plurality of contact springs cantilevered therefrom is received, also preferably with an interference fit, into the frame, with the end of each of the contact springs being received within a window of the nosepiece and supported thereby. The nosepiece has a slot formed therein that is sized to closely accept the tapered guide portion of the terminator. The receptacle may include a ground contact connected to the central plate thereof, the ground contact having a planar portion with a forked clip offset therefrom. The central plate has a first and a second surface thereon, and a recessed tongue formed therein by a full groove extending across one surface of the plate and a partial groove defined across the other surface of the plate. The planar portion of the ground contact is receivable in the full groove and the forked clip is receivable in the partial groove, thereby to mount the ground contact to the central plate. When the terminator is received in the receptacle, the ground contact on the terminator is clamped between the ground contact and the central wall of the receptacle.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be more fully understood from the following detailed description thereof, taken in connection with the accompanying drawings which form a part of this application and in which:

FIG. **1** is an exploded perspective view of a plug terminator of the type disclosed in U.S. Pat. No. 4,824,383, having a metallic ground structure with least one wall defining a plurality of channels, and an insulated contact support member having plural fingers thereon, plural electrical contacts being provided on each of the fingers;

FIG. **2** is a side elevational view, entirely in section, illustrating a fully assembled receptacle in accordance with a first aspect of the present invention for receiving a plug terminator of the type shown in FIG. **1**;

FIG. **3** is an exploded, side elevational section view of the receptacle shown in FIG. **2**;

FIG. **4** is an exploded plan view of the receptacle shown in FIG. **2**;

FIG. **5**, **6**, and **7** are, respectively, enlarged perspective views of a contact block, housing and frame used in a receptacle shown in FIG. **2**;

FIG. **8** is a view generally similar to FIG. **2** illustrating an alternate form of a receptacle for receiving a plug terminator of the type shown in FIG. **1**;

FIG. **9** is a perspective view of a receptacle shown in FIG. **8** mounted to a board;

FIG. **10** is a side elevational view of an alternate arrangement of the central plate of the receptacle of the present invention;

FIG. **11** is an exploded perspective view of the plug terminator, generally similar to that shown in FIG. **1**, having forwardly extending grounding blades thereon;

FIG. **12** is an exploded perspective view of an alternate embodiment of a receptacle for the plug terminator of the type shown in FIG. **11**;

FIG. **13** is a side sectional view of both the receptacle and the plug terminator shown in FIGS. **11** and **12** taken along section lines as shown in FIG. **14**;

FIG. **14** is a perspective view of the plug terminator of FIG. **11** and the corresponding receptacle of FIG. **12** in confrontational relationship; and

FIG. **15** is a side elevational view, in section, of the interconnected terminator of FIG. **11** as received within the receptacle of FIG. **12**.

DETAILED DESCRIPTION OF THE INVENTION

Throughout the following detailed description similar reference numerals refer to similar elements in all figures of the drawings.

With reference to FIG. **1** shown is a terminator generally indicated by reference character **10** of the type in accordance with U.S. Pat. No. 4,824,383 (Lemke). This patent is hereby incorporated by reference herein. Since the terminator **10** may be implemented in a form compatible for terminating a multiple conductor cable (as illustrated in FIG. **1**) or in a form adapted for use with a multiple tracing substrate (as described in the immediately above-referenced patent) only the essential structural features of the terminator are discussed herein, with the details of the interconnection between the terminator and the conductors it is terminating being ommitted for clarity of discussion. Such interconnection details are set forth in the above-incorporated patent.

The heart of the plug terminator **10** is a metallic ground structure **22**. The ground structure **22** includes a baseplate **24** having a main planar surface **26** with an integral portion **28** projecting forwardly therefrom. The projecting portion **28** terminates in a generally planar forward edge surface **29**. Although the ground structure **22** is shown as being provided with an upper and a lower working surface **30**A and **30**B respectively thereon, it should be understood that a ground structure **22** having only one working surface **30** may be used and remain within the contemplation of the present invention. More specifically, the terminator can be implemented with a ground structure that includes only the structure on the upper working surface **30**A of the ground structure **22** (that is, the structure above the dividing plane **31** extending through the baseplate portion **24** of the ground structure **22**). In such an instance the opposite surface of the ground structure **22** would preferably be planar. Moreover, the remaining elements of the terminator as hereafter described would be appropriately modified to accept a ground structure **22** of this form.

In FIG. **1** a plurality of walls **32** extends from the forward projecting portion of the respective upper and lower working surfaces **30**A, **30**B of the baseplate **24**. The walls **32** are arranged in side-by-side relationship to define a plurality of channels **34** across the surfaces of the projecting portion **28** of the baseplate **24**. At least two such channels are defined. In the preferred embodiment the axes of the adjacent channels **34** are parallel to each other, although it is understood that such a relationship is not mandated. It should also be understood that although each working surface **30**A, **30**B of the baseplate **24** is shown as having the same number of channels **34**, such a situation is also not necessarily required. It should also be appreciated that the walls **32** of the lateral extremities of the ground structure **22** may be ommitted, if desired.

The planar portion **26** of the baseplate **24** behind the projecting portion **28** has flanges **38** which flare farther rearwardly and slightly outwardly from the baseplate **24**. The flanges **38** carry posts **40**. In some instances it may be desired that the posts **40** be electrically conductive and in electrical contact with the conductive material of the baseplate **14**. It should be appreciated that a ground structure of more than two working surfaces may be defined by disposing additional baseplates **24** (whether each baseplate implemented with one or two working surfaces) in any convenient stacked relation.

The plug terminator **10** further comprises a contact support member **44** having a main body portion **46** with an array of trenches **48** formed therein. The contact support member **44** is formed of an insulating material. A partition **50** having an indentation **50**G is provided near the forward end of the body portion **46** of the contact support member **44**. An array of apertures **52** (visible on the lower member **44** in FIG. **1**) is provided through body **46** of the support member **44** in the region behind the partition **50**, with one of the apertures **52** being aligned with the mouth of each of the grooves **48** for a purpose to be described. An array of fingers **54** extends forwardly from the body **46**. The fingers **54** correspond in number to the number of channels **34** provided on the ground structure **22**. In the assembled condition the fingers **54** extend into the channels **34** so that the forward ends of the fingers **54** are coterminal with the forward edge of the ground structure **22**.

A groups of electrical contact elements **58** of any suitable configuration is embedded in the insulating material of each of the fingers **54**. The contact elements **58** are arranged such that the planar blade of each contact element **58** is exposed on the surface of the finger **54** in which it is disposed. The contact element **58** extends rearwardly from the fingers **54** through the material of the partition **50**. The contact element **58** ends in an overlying relationship with the apertures **52** in the body **46** just forwardly of the mouths of the trenches **48** therein. As seen in the Figures the top surfaces of the walls **32** of the ground structure **22** extend above the contact elements **58** when the same are received in the channels **34**.

Although not here shown, each finger may be narrowed in transverse dimension and carry only a single contact element. Further, the insulating support structure of the plug terminator may alternatively be provided in a form in which each finger has a hollow recess in which individual or plural contacts may be housed.

The terminator **10** includes a protective casing generally indicated by reference character **64**. The casing **64** is defined by complementary shell members **66**A, **66**B. Each shell member **66**A, **66**B has a forward cutout **68** having a tongue **68**T therein. The configuration of the cutout **68** corresponds to the configuration of the body portion **46** of the contact support member in the vicinity of the partition **50**. The rear wall of each of the shell members **66**A, **66**B has cooperating grooved openings **70** therein. The openings **70** are shaped to generally conform to the exterior configuration of and are sized to closely accept the transmission cable **12** in either round or flat form.

Adjacent to the rear wall of the shells **66**A, **66**B is a pair of abutments **72** with recesses **74**. The recesses **74** are configured to accept snugly the posts **40** on the ground structure **22** in a press fit relationship. In the preferred case the shells **66**A, **66**B are each fabricated of a conductive

material. It should be understood that the shells may be fabricated from a plastic material in which case a conductive surface **76** is formed by a suitable conductor layer disposed on the inner surface of each of the shells **66**A, **66**B (as shown in FIG. **3** for economy of illustration). The sidewalls of the shells **66**A, **66**B each carry notches **78** sized to accept locking tabs **80** which serve to hold the casing **64** together.

In the assembled condition the complementary shells **66**A and **66**B close on each other and are locked together by the tabs **80** and the press fit engagement of the posts **40** in the recesses **74** in the abutments **72**. When so assembled the tongue **68**T near the cutout **68** adjacent the front of the casing **64** engages in the groove **50**G. To terminate a multiple conductor cable, as illustrated, the multiple conductors of the cable **12** extend through the registered openings **70** in the rear of the shells **66**A, **66**B and into the volume defined in the rear of the casing **64**. The external jacket **14** of the cable **12** is stripped a predetermined distance from its end to expose the individual jacketed conductors **16** therein. An insulation displacement contact **82** severs the exterior jacket **14** of the cable **12** and electrically interconnects with the ferrule **20** of the cable **12**. The insulation displacement contact **82** is captured in the grooved openings **70** adjacent the rear aperture of the shell to thereby electrically interconnect the conductive surface **76** on the interior of the casing **64** to a predetermined electrical potential.

Prior to the closing of the casing by the interengagement of the shells **66**A, **66**B, the individual conductors **16** of the cable **12** are themselves stripped of their jackets **16**J and the conductive wires **16**W thereof laid in one of the trenches **48** extending in the body portion **46** of the contact support structure **44**. The end of each of the wires **16**W overlays the end of one of the contact elements **58**. The wires **16**W and the contacts **58** are be suitably attached by any convenient expedient.

FIG. **2** shows a side elevational view, entirely in section, of a receptacle **200** in accordance with the present invention in the fully assembled state and ready to accept a plug terminator **10** shown in phantom lines. FIGS. **3** and **4** are respectively exploded side elevation and plan views of the receptacle **200** shown assembled in FIG. **2**. Although the receptacle is adapted to accept a terminator in which each finger **54**A **54**B is provided with a plurality of contact elements **58** and the ground structure **22** thereof the terminator is provided with three walls **32**A, **32**B, and **32**C whereby two channels **34**A, **34**B are defined it should be understood that the receptacle may be modified to accept a terminator of the type in which a single contact element **58** is disposed on each finger. The leading edge surface of the ground structure **22** is again indicated in the FIGS. **2** and **4** by reference character **29**.

In FIG. **2** the receptacle is shown as mounted to the surface of a board B in a vertical through mount configuration. However, it should be appreciated that the receptacle of FIG. **2** may be implemented in any other mounting configuration, such as a right angle through mount configuration, a surface mount configuration, or a straddle mount configuration.

The receptacle **200** in accordance with the present invention includes three main structural components, namely, a contact block **204**, a housing **208** and a frame **212**.

With reference to FIG. **5** an isolated perspective of a single contact block **204** is shown, while in FIG. **4** a pair of the contact blocks **204** are shown. In the preferred case each contact block is an elongated member that is provided with upper and lower sidewalls **220**, **222** and end walls **224**, **226**. The sidewalls **220**, **222** have slots **228** formed therein, with the axis of the slots **228** extending perpendicularly to the axis **204**A of the block **204**. The remaining material of the block **204** directly adjacent to the slots **228** defines pillars **229**.

At each end of the block **204** there is provided a cutout which defines a latch space **230** in each of the end walls **224**, **226**, respectively. The block **204** is interrupted by spaces **236** (best seen in FIG. **5**) which have a major axis that extends generally parallel to the axis of the block **204** and which are provided for a purpose to be made clear herein. A plurality of electrical contact springs **238** are embedded into the block **204** and cooperate to define a first and a second array **240**, **242** of contact springs, respectively (FIG. **5**). In FIG. **5** a portion of the contact block **204** is broken to indicate the passage of the contact elements through the body of the block. The forward end of the contact spring **238** is curved, as at **238**F.

As seen in FIG. **3** each array **240**, **242** of contact springs is disposed in generally parallel relationship with respect to the axis of the block with one of the arrays (e.g., the array **240**) lying above a bisecting plane **243** containing the axis **204**A and the other of the arrays (e.g., the array **242**) lying below the bisecting plane **243** of the connector. If the receptacle of FIGS. **2** to **7** or the receptacle shown in FIG. **8** is to be used in connection with a terminator as shown in which the fingers have hollow recesses therein in which the contacts thereof are disposed, the springs **238** in the receptacle may be replaced by corresponding pins.

In the preferred instance the block **204** is formed by the jointure of a first and a second bar element **244** and **246**, respectively. Each of the bars **244**, **246** is a molded member fabricated from a plastic material. The bars **244**, **246** are held to each other along a jointure line **248** when the bars **244**, **246** are received within the homing **204**, as will be discussed. The latch spaces **230** and the spacers **236** may be defined by registered cut outs formed in each of the bars **244**, **246** if this mode of fabrication of the contact block is used. It should be appreciated, however, that the block **204** may be integrally fabricated and it is shown in FIGS. **2** and **3** as being formed as an integral member for convenience of illustration.

As noted earlier, the contact block **204** is received within a housing **208**. FIG. **6** illustrates a perspective view of a typical arrangement for a housing. The housing **208** shown in FIG. **6** is formed from two conjoined housing sections **208**-**1**, **208**-**2** connected in end to end relationship by webs **250**. The structure shown in FIG. **6** may be conveniently formed by molding as an integral place. A housing section (e.g., the section **208**-**1**) may be used singly or may form to any convenient length by molding or by connecting individual housing sections using any convenient mode of connection.

Each housing section **208** is a molded plastic member having an upper end and a lower sidewall **252**, **254** joined by end walls **256**, **258**. The forward portion of each of the sidewalls **252**, **254** is provided with an array of fingers **266**, **268**. The fingers in each array **266**, **268** are themselves joined at their forward ends by a retaining lip **270** (best seen in FIGS. **2** and **3**). The sidewalls **252**, **254** are joined together by ribs **272** which are spaced axially along the sidewalls. The ribs **272** serve to join the sidewall **252** to the sidewall **254** and thereby to stabilize the structure of the housing **208**.

The inside surface of each of the end walls **260**, **262** is provided with latches **278**. In the assembled condition the block **204** is introduced into the housing **208** such that the

slots **228** in the contact block **204** (FIG. **5**) each accept one of the ribs **272** of the housing **208**. When so arranged, each of the pillars **229** (FIG. **5**) of the contact block **204** is paired with and abuts a corresponding one of the ribs **272** of the housing. The contact springs **240**, **242** in the upper and lower spring arrays, respectively, project into the spaces between adjacent fingers in the upper array **266** and in the lower array **268**. The curved forward ends **238F** of the contact springs are retained by the lip **270**, as is best seen in FIGS. **2** and **3**. The block **204** is held in position in the housing **208** by the interengagement of the latch **278** on the end walls **256**, **258** with the spaces **230**, **232** in the end walls **224**, **226**. Standoffs **280** are provided at any convenient location on the housing **208**.

A gap **282** (FIG. **4**) is provided between the fingers in the upper array **266** and in the lower finger array **268**. As will be appreciated from FIG. **4**, the gap **282** is located on the housing **208** in a position that coincides with the position at which the wall **32B** on the terminator **10** will lie when the terminator is introduced into the receptacle. In addition, at each end of the housing **208** there is provided a step **284**, which is sized and located to accept the walls **32A**, **32C** on the terminator. It should be understood that the fingers in the arrays **266**, **268** may be appropriately interrupted by gaps analogous to the gap **282** to correspond to the locations of the walls **32** on the ground structure of the terminator being used with the receptacle.

The remaining component of the receptacle **200** is the frame **212**, illustrated in FIG. **7**. The frame **212** is a generally rectangular member formed from metal or metallized plastic. The frame **212** has upper and lower crossbars **290**, **292** which are interconnected at corresponding ends thereof by uprights **294**, **296** and at the midpoint thereof by an upright **297**. Mounting wings **298** extend from the uprights **294**, **296** to facilitate the mounting of the frame to the board B or the like. Forwardly projecting ground spring contacts **300** extend from the crossbars **290**, **292** at predetermined spaced locations thereon, generally in the vicinity of the uprights **294**, **296** and **297**. In the embodiment shown in FIGS. **2** to **7**, the spring contacts **300** are press fit into blind openings **301** in the crossbars **290**, **292**. The location of the ground contacts **300** corresponds to the locations of the gap **282** and the steps **284** on the housing **208**. If desired the openings **301** could take the form of through bores dimensioned to closely accept the contacts **300**.

In the embodiment of the receptacle **200'** shown in FIGS. **8** and **9**, the frame **212'** is modified to eliminate the necessity of press fitting the springs **300** into the blind openings **301**. In the modified frame **212'** the ground contacts **300'** take the form of generally U-shaped spring members **350** having a base **352** portion and forwardly extending legs **354A**, **354B**. If desired, two or more U-shaped springs **330** may be spaced axially and connected by axially extending webs **356** (shown in section in FIG. **20**). The corners between the legs **354A**, **354B** and the base **352** are provided with stiffeners **358A**, **358B**.

The frame **212'** is also modified to accept the modified springs **300'**. To this end the frame **212'** is provided with either a through bore **362** formed in the upright **297'** substantially midway between the uprights **294'**, **296'** (as seen in FIG. **9**) or with slots **364**, **366** respectively formed in the uprights **294'**, **296'**. As may be seen in FIG. **9**, in the case of the slot **364** in the upright **294'**, a corresponding slot **370** is provided in an endpiece **376** to form a bore to receive the spring member **350**. In the case of the slot **366** in the upright **296'**, the registration with the slot **364** in the upright **294'** on the frame **212'** of an adjacent receptacle **200'** closes the slot **366** thereby to define a bore.

When mounted to a board B each the spring member **350** is clamped thereagainst by standoffs **280** (FIG. **8**) which form part of the contact block **204**. The standoffs **280** act against the stiffeners **358A**, **358B**, to clamp the springs **350** against the board B when the receptacle **200'** is secured to the board B, as by screws **384**.

The crossbars **290'**, **292'** are modified from that shown in FIG. **2** in that in FIG. **8** they extend further forwardly to overlie a greater portion of the contact block **204**. The crossbars **290'**, **292'** have gaps, as at **386** (FIG. **9**), which accept the legs **354A**, **354B** of the spring **350** that extends through the central upright **297'**. The lateral ends of the crossbars **290'**, **292'** do not extend to the lateral ends of the uprights **294'**, **296'**, as the case may be, whereby the legs **354A**, **354B** of the springs passing through these uprights may be accommodated, as seen in FIG. **12**, at **388**, **390**, respectively. It should be noted that the full extent of the trailing portion **240T**, **242T** of the contacts **240**, **242** respectively, are not shown in FIG. **20**, but may be arranged in any fashion to permit any form of surface or through mounting of the receptacle **200'** to the board B. As will be developed, the trailing portions **240T**, **242T** are those portions of the contacts **240**, **242**, respectively, that are isolated by the plate **302**.

Since the remaining discussion is to understood as applying to both the embodiment of the receptacle **200** having the frame **212** or to the embodiment of the receptacle **200'** having the frame **212'**, the recitation of corresponding structural elements in the latter is omitted. A central plate **302** having a planar top and a planar bottom surface **302T** and **302B**, respectively, and a leading edge surface **302L** thereon, extends between the uprights **294**, **296** and **297** and across the frame **212** or **212'**. The plate **302** is disposed generally parallel to the crossbars **290**, **292**. The central plate **302** is provided with an array of slots **304** which define a plurality of tongues **306**. The lateral dimension of the slots **304** is sized such that as the frame **212** or **212'** is inserted into the housing **208** the slots **304** accept the ribs **272** formed in the housing **208** (FIG. **6**) and the pillars **229** in the contact block **204** (FIG. **5**). The slots **304** may be enlarged, if necessary, as shown at **304E**, to accommodate the spacing between the webs **250** in the housing **208**, if the same are provided.

When the frame **212** or **212'**, as the case may be, is inserted over the housing **208** the crossbars **290**, **292** lie exteriorly to the surfaces **252**, **254**, respectively, of the housing **208**. In addition, the tongues **306** on the frame **212** project through the housing **208** and into the spaces **236** formed in the block **204**. As seen in FIG. **2** the tips **306T** of the tongues **306** extend through the block **204**. When the receptacle is arranged with respect to the board B as shown in FIG. **2** the board may be provided with a ground tracing T such that the tips **3067** may abut the tracing T or lie within a predetermined close distance thereof. Also in the assembled condition, the tongues **306** of the frame surround each rib **272** and the abutted pillar **229** paired therewith.

As may be appreciated from the foregoing and as is best illustrated in FIG. **2**, when the components of the receptacle are assembled the central metallic plate **302** of the frame **212** extends through the receptacle to isolate electrically the trailing portions **240T**, **242T** (FIG. **2**) of the contact springs in the spring arrays **240**, **242**. The full extent of the trailing portions of the contact springs **240T**, **242T** is best illustrated in FIG. **2**. That is to say, when the central plate **302** is positioned in the receptacle and is connected to a suitable predetermined electrical potential the plate **302** forms a structure that serves to isolate the trailing portions **240T**, **242T** of the spring contacts in the contact arrays **240**, **242** they extend through the block **204** to the board B.

Moreover, when the terminator is introduced into the assembled receptacle the leading edge surface **29** of the ground structure **22** is brought into a predetermined close adjacency or into abutted relationship with the leading edge **302**L of the central plate **302**. At the same time the ground contacts **300** on the frame **212** (or the legs **354**A, **354**B of the spring member **350** in the case of the frame **212'**) electrically engage the walls **32** on the ground structure.

When the edge **29** on the ground structure **22** is, brought within a predetermined close distance of (on the order of 0.005 inch typically) or abutment with the edge **302**L of the central plate **302** it should be apparent that the ground structure **22** is, in effect, extended by the action of the central plate **302** through the receptacle. The cooperating interaction of the ground structure **22** in the terminator and the central plate **302** in the receptacle serves to electrically isolate and control the impedance of the grouped contacts on the terminator and on the receptacle.

This structure inherently forms a low impedance transmission line between the forward edge surface **29** of the ground structure **22** and the leading edge surface **302**L of the central plate **302** which functions as a "choke joint" to provide continuity of propagating ground current between the structure **22** and the plate **302**. The choke joint includes the confronting frontal surfaces **294**F, **296**F and **297**F (FIG. **7**) on the respective uprights **294**, **296** and **297** (and the corresponding surfaces on uprights **294'**, **296'**, **297'**) and the frontal surfaces **32**F (FIG. **2**) on the walls **32** of the ground structure **22**. The engagement of the ground contact **300** or **300'** of the frame **212** or **212'**, respectively, with the top surface **32**T of the walls **32** of the ground structure **22** terminates the low impedance transmission line choke joint. The inductance of the termination may be altered from that shown in FIG. **7** by physically locating the contacts **300** (or **350**) as close as possible to the frontal surfaces of the uprights which form part of the choke joint and by configuring the contacts **300** (or **350**) such that they contact the top surfaces **32**T of the walls **32** as close as possible to the choke joint.

As may be seen in FIG. **10** the impedance of the choke joint may be lowered by increasing the confronting surface areas of the forward surface **29** of ground structure **22** and the leading edge surface **302**L of the plate **302**. This may be accomplished by chamfering these surfaces at corresponding angles X and Y. Although any angle could be used, magnitudes of X and Y should preferably be on the order of forty-five degrees (45°) since too small an angle may be more difficult to manufacture.

By chamfering surfaces the impedance of the choke joint is made less dependent upon the clearance distance C.

Although the structure of the terminator and the receptacle as hereinabove described adequately serve to electrically isolate the signal carrying contacts, it is believed advantageous to provide an arrangement for these members that effects the interconnection between the ground structure of the terminator and the central plate of the receptacle in a more mechanically direct manner, and wherein the engagement of the terminator and the receptacle can be accomplished with less insertion force. Moreover, it is believed advantageous to provide a structure for the receptacle that eliminates tolerances due to the relatively loose fit between the housing of the receptacle and the contact block, as well as a source of tolerance variations due to the reaction of the plastic housing to the forces exerted thereon by the spring contacts. It is also believed advantageous to provide a receptacle arrangement wherein the interengaged signal contacts of the receptacle and the terminator are disposed more closely to the electrical ground.

Accordingly, in FIG. **1** through **15**, an alternate embodiment of both the plug terminator and the corresponding receptacle therefor are shown.

Referring to FIG. **11** an exploded perspective view of an alternate embodiment of a plug terminator **10'** is shown as mounted to the surface of a board B_1 in a vertical through mount configuration. Corresponding structural features of the terminator **10'** of FIG. **11** and those of the terminator of FIG. **1** are indicated by primed reference characters. It should again be noted that, similar to the situation with the terminator of FIG. **1**, the plug terminator **10'** of FIG. **11** may also be implemented in any other board mounted configuration or a in cable terminating configuration and remain within the contemplation of the present invention.

In the embodiment of the plug terminator **10'** shown in FIG. **11** the metallic ground structure **22'** takes the form of an open-backed, generally frame-like member. The baseplate portion **24'** of the ground structure **22'** is configured to define both an upper and a lower working surface **30'**A, **30'**B, respectively, although it should be understood that the terminator **10'** may be implemented with a ground structure that includes only a single working surface.

The baseplate **24'** extends centrally across the ground structure **22'**. A wall **32'**C disposed centrally along each working surface (although only one such wall is completely visible in FIG. **13**) and an end wall **32'**E_1, located respectively at each lateral extremity of the baseplate **24'** cooperate to define a pair of channels **34'**A_1, **34'**A_2 on the upper working surface **30'**A and a pair of channels **34'**B_1, **34'**B_2, on the lower working surfaces **30'**B. To facilitate the mounting of the terminator **10'** to the board B_1 mounting posts **410** are disposed on the rear surface of the terminator **10'**. The posts **410** are received in corresponding openings **412** provided in the board B_1.

The forward ends of the walls **32'**C, **32'**E_1 and **32'**E_2 are tapered, as at **414**, thereby to define lead-ins thereon. Each of the central walls **32'**C is undercut, as at **416**, such that a forward edge of each central wall **32'**C is spaced behind the forward edge surface **29'** of the ground structure **22'**. The inside surface of each of the end walls **32'**E_1, **32'**E_2 adjacent each working surface of the ground structure **22'** has a camming slot **418** provided therein.

An upper and a lower shroud **420**A, **420**B, respectively, is disposed in parallel relationship to the upper and lower working surfaces **30'**A, **30'**B of the baseplate **24'** of the ground structure **22'**. Each of the shrouds **420**A, **420**B has a respective cut out **422**A, **422**B that overlies the central wall **32'**C of the working surface to which it is proximate.

A first and a second contact support member **44'**A, **44'**B, each molded or otherwise formed of an insulating material, is arranged for receipt in the channels **34'**A_1, **34'**A_2, or **34'**B_1, **34'**B_2, respectively defined on each of the working surfaces **30'**A, **30'**B of the ground structure **22'**. Each contact support member **44'**A, **44'**B is generally L-shaped when viewed in side elevation. Each of the contact support members **44'**A, **44'**B is interrupted by the presence of a respective central slot **430**A, **430**B which defines on each of the contact support members **44'**A, **44'**B a first and a second contact finger **54'**A_1, **54'**A_2, and **54'**B_1, **54'**B_2, respectively. A partition **50'**A_1, **50'**A_2, and **50'**B_1 (not visible), **50'**B_2 extends from each respective finger **54'**A_1, **54'**A_2, and **54'**B_1, **54'**B_2.

Each of the fingers **34'**A_1, **54'**A_2, defined on the contact support member **44'**A corresponds to a respective channel **34'**A_1, **34'**A_2, provided on the working surface **30'**A of the

ground structure **22** while each of the fingers **54'B$_1$**, **54'B$_2$** defined on the contact support member **44'B** corresponds to a respective channel **34B$_1$**, **34'B$_2$** provided on the working surface **30'B** of the ground structure **22'**. As seen in FIG. **11**, the central slot **430A**, **430B** does not extend completely through the contact support member **44'** in which it is provided, thus define a web **432A**, **432B** on each member **44'**. Each lateral end of each contact support member **44'**, **44'B** has a tab **436A**, **436B** thereon, as the case may be, provided for a purpose to be described. In addition, the undersurface of the fingers **54'A$_1$**, **54'A$_2$**, **54'B$_1$**, **54'B$_2$** of the contact support members **44'**, **44'B** has a pair of locking latches **438A**, **438B** thereon. The latches **438A** are not visible in FIG. **11**, but may be seen in FIG. **13**.

A plurality of electrical contact elements **58'** of any suitable configuration is embedded in the insulating material of each fingers **54'A$_1$**, **54'A$_2$**, **54'B$_1$**, **54'B$_2$**, of each contact support member **44'A**, **44'B**. The contact elements **58'** are arranged such that the planar portion **58'P** of each contact element **58'** is exposed on the surface of the fingers **54'A$_1$**, **54'A$_2$**, **54'B$_1$**, **54'B$_2$**, in which it is disposed. The tail portion **58'T** of each electrical contact element **58'** extends rearwardly through the partitions **50A**, **50B** of the support member **44'A**, **44'B**, as the case may be. Not all of the tails from the support member **44'B** are illustrated. The tails **58'T** of the contact elements **58'** are offset in a predetermined pattern, and each tail **58'T** extends through one of a correspondingly arranged pattern of openings **440A**, **440B** provided in the board B$_1$.

Owing to the relative registered relation of the slot **330A**, **330B** with respect to the central walls **32'C** of the ground structure **22'**, as well as the precise dimensioning of the slots and the transverse dimension of the central walls, when the fingers **54'A$_1$**, **54'A$_2$**, **54'B$_1$**, **54'B$_2$**, on each contact support member **44'A**, **44'B** are inserted into a corresponding channel **34'A**, **34'B** in the ground structure **22'** each central wall **32'C** projects with close clearance into a slot of the contact support member, with the web **432A**, **432B** of each of the latter being closely received in the undercut **416** in the former. The close dimensioning of these members provides a guiding and a centering action which serves to precisely locate the fingers within the channels and thus, the contacts **58'** within the terminator **10'**.

Each of the camming slots **418** formed on the inside surface of each end wall **32'E$_1$**, **32'E$_2$**, of the ground structure **22'** receives one of the tabs **436A**, **436B** provided at each lateral end of the contact support member **44'A**, **44'B**. The fingers **54'** of each contact support member are thus supported on a working surface **30A**, **30B** of the baseplate, as the case may be. The partitions **50'** of the support member close the open back of the ground structure **22'**.

Each of the contact support members is secured in the ground structure **22'** by the engagement of the locking latches **438A**, **438B** on the undersurfaces of the fingers thereof into notches **442** formed in the rear edge of the baseplate **24'**. Entry of the contact support members into their respective channels is facilitated by lead-in ramps **446** formed on each working surface of the baseplate along the forward edges thereof.

In accordance with this embodiment of the invention, at least one but preferably a plurality of grounding contacts **450** is secured into electrically conductive engagement with the ground structure **22'**. As is better seen in the side sectional view of FIG. **13**, the grounding contacts **450** project forwardly past the forward edge surface **29'** of the ground structure **22'**. Each grounding contact **450** includes a generally planar shank portion **452** having a tail **454** extending rearwardly therefrom. The tail may have any convenient dimension or may be split into plural tails, if desired. The forward region of the shank portion is stamped, punched or otherwise worked to define a planar blade **456** having an associated tang **458**. The blade **456** and the tang **458** are vertically offset from the shank. The tails **454** of the grounding contacts **450** are received in openings **460** provided in the board B$_1$ for the purpose.

Each grounding contact **450** is received by the working surface **30'A**, **30'B** of the baseplate **24'** on which it is mounted by a recessed tongue arrangement generally indicated by the character **464**. The recessed tongue **464** is defined by a notch **466** formed in the forward edge surface **29'** of the baseplate **24'**. A first groove **468** extends rearwardly from each notch **466** over the entire width of one working surface **30'A**, **30'B** of the ground structure **22'**. A vertically registered cooperating second groove **470** extends partially across the opposite working surface **30'B**, **30'A**, as the case may be. In FIG. **11**, each working surface **30'A**, **30'B** of the baseplate **24'** of the ground structure **22'** has a pair of recessed tongues **464** provided thereon, one recessed tongue **464** for each working surface being located on each side of the central wall **32'C**. Of course, if an implementation of the terminator of this embodiment of the present invention uses a ground structure that is provided with only one working surface, the partial groove **470** corresponding to the full groove **468** is formed on the outside surface of the ground structure opposed to the working surface thereof. It is noted that the forward edge **472** of the tongue **464** of the baseplate remaining after the same is defined by the notches, full groove and partial groove formed is set back, or recessed, from the leading edge surface **29'** of the baseplate **24'**.

As is best seen in FIG. **13**, to mount the grounding contact **450** to the baseplate **24'**, the shank **452** is received into the full groove **468** defining the tongue **464**, while the tang **458** is accepted into the corresponding partial groove **470**. The blade portion **456** of the grounding contact **450** thus extends forwardly past the forward edge surface **29'** of the grounding structure **22'**, as seen in FIG. **13**.

A receptacle **200'** adapted to accept the terminator **10'** of the type shown in FIG. **11** having the projecting ground contacts **450** thereon is shown in exploded view in FIG. **12** and in side section in FIG. **13**. The receptacle **200'** is also shown as mounted to the surface of a board B$_2$ in a vertical through mount configuration. To effect the mounting posts **480** disposed on the rear surface of a die cast metal frame **484** of the receptacle **200'** are received in openings **482** provided in the board B$_2$ for this purpose.

In accordance with the present invention the receptacle **200'** includes a die cast metallic frame **484** having an upper and lower insulating nosepiece **486A**, **4896B**, respectively, mounted thereon and a predetermined number of contact blocks **488** introduced thereinto. The number of contact blocks **488** corresponds to the number of fingers on the associated plug terminator. Thus, contact blocks **488A$_1$**, **488A$_2$** (not totally visible), **488B$_1$**, **488B$_2$** are used in the embodiment of the invention implemented in the Figures.

With reference to FIG. **12** each contact block **488** takes the form of an elongated body portion **490** that is provided with a first shoulder generally indicated by the character **492** and a second shoulder generally indicated by the character **494**. Ribs **496** are formed on the body portion **490** of the contact blocks **488**. A plurality of electrical contact springs **498** is embedded into each block **488**. Each of the springs **498** on a given contact block **488A$_1$**, **488A$_2$**, **488B$_1$**, **488B$_2$**

corresponds to a contact element **58'** on the corresponding finger **54'**A_1, **54'**A_2, **54'**B_1, **54'**B_2 of the plug terminator **10'**. Each contact spring **498** is cantilevered from the contact block **488** in which it is embedded, with the extreme forward end **498**E of each spring **498** being curved. Each of the springs **498** has a tail portion **498**T that extends from the rear surface of the contact block **488** in which it is embedded. Preferably, the tails **498**T of the springs are offset in a predetermined pattern. Each tail **498**T is received in one of a corresponding pattern of openings **500**, **502**, formed in the board B_2. It should be noted that although each of the contact blocks **488** is shown as a separate member the plural blocks **488** may be interconnected using suitable webs, so long as appropriate clearance space is provided within the die cast frame **484** to accommodate the connecting webs, as should be clear to those with skill in the art.

The main structural component of the receptacle **200'** is the frame **484**. Preferably, the frame **484** is fabricated as a die cast metallic member, although it could, in principle, be molded from plastic. The frame **484** is a generally rectangular member having an open front and rear. The frame **484** includes upper and lower crossbars **508**A, **508**B, which are interconnected at corresponding ends by uprights **510**, **512** and at the midpoint by an upright **514**. A portion of the upper crossbar **508**A is cut away in FIG. **24** for clarity of illustration. The mounting posts **480** mentioned earlier are provided on the rear surface of the uprights **510**, **512**. Forwardly extending mounting pegs **516** extend from the crossbars **508**A, **508**B at predetermined space locations thereon, generally in the vicinity of the uprights **510**, **512** and **516**. The rear edges of the crossbars **508**A, **508**B have shoulders **518**A, **518**B (best seen in FIG. **13**) formed therein.

A central plate **520** having a planar top and a planar bottom surface **520**T and **520**B, respectively, and a leading edge surface **520**L thereon, extends across the frame **484** between the uprights **512** and **514** and between the uprights **414** and **410**. The central plate **420** is in generally parallel relationship to the crossbars **408**A, **408**B. The rear edges of the top and a bottom surfaces **520**T and **520**B have first and second shoulders **522**A and **522**B, respectively, thereon.

As is seen in the cutaway portion of FIG. **12**, in a manner similar to that discussed with the terminator **10'**, the central plate **520** is also provided with recessed mounting tongues **524**. The tongues **524** are defined by a notch **526**, and paired, vertically registered, full and partial grooves **528**, **530**, respectively. The full groove **528** extends across the entire upper or lower surface **520**T, **520**B of the central plate **520**, as the case may be, and interrupts both the front and rear edge surfaces thereof. Although not visible in the drawings, the full groove **528** has vertical lead-in surfaces disposed adjacent to the front and rear edge surfaces of the central plate **520**. The partial groove **530**, on the other hand, extends only partially across the other of the surfaces, and interrupts only the rear edge of the plate **520**. A vertical lead-in surface (not shown) is disposed adjacent to the rear edge surfaces of the central plate **520**. The full groove **528** is stepped, as at **532**, to define a shelf **534**. The forward edge of the full groove **528** has a beveled surface **536** thereon. Owing to the presence of the notches **526**, the tongues **524** are recessed, or inset, from the rear edge surface of the plate **520**.

Grounding contacts **538**, generally similar to those of the terminator **10'**, are secured to the central plate **520** at each of the tongues **424** thereof. The contacts **538** are generally planar members with a central slot **538**S formed thereon. A tail **538**T projects rearwardly from the planar portion. The tails **538**T are received in openings **540** provided in the board B_2 for that purpose. The front end of the contact **538** is curved, as at **538**C, while the rear edge of the planar portion is bent back on itself, thereby to define a fork-like locking clip **538**L.

As is better appreciated from the sectional view of FIG. **13**, a grounding contact **538** is introduced onto the central plate **520** of the die east metal frame **484** from the rear thereof, with the major planar portion of the contact **538** being accepted in the full groove **528** while the arms of the forked clip **538**L extend into the partial groove **530** that vertically registers with the full groove **528**. The curved leading edge **538**C of the ground contact **538** and the beveled surface **536** at the front end of the major groove **528** define a lead-in.

The final element of the receptacle is the nosepiece **486**A, **486**B. Although shown as two distinct pieces, it should be appreciated that they nosepiece may be defined by an integral member wherein the major sections thereof are linked together by suitable webs. Each of the nosepieces **486**A, **486**B has an opening **552** that receives one of the forwardly extending pegs **516** disposed at the forward edges of the crossbars **508**A, **508**B of the die cast metal frame **484**. The nosepieces **486**A, **486**B are interference fit onto the pegs **516**, or they may be otherwise there secured using any suitable expedient, such as adhesive or by deforming the peg.

Each nosepiece **486**A, **486**B is an elongated member molded of an insulating material. Each nosepiece **486** is provided with a plurality of windows **554**, each of which receives and supports the curved forward end **498**E of the springs **498** cantilevered from a contact block **488**. A precisely dimensioned guide slot **556** having a lead-in surface **558** thereon is formed in each nosepiece **486**A, **486**B, respectively.

To assemble the receptacle, the nosepieces **486**A, **486**B are secured to the pegs **416** on the die cast metal frame **384** and the ground contacts **538** are slipped onto the tongues **524** in the central plate **520**. The contact blocks **488** are then introduced through the open rear of the frame **484**, until the shoulders **492**, **494** on the blocks **488** engage with the shoulders **536** formed on the rear of the crossbars **508**A, **508**B and the shoulders **522**A, **522**B on the central plate **520**. The ribs **496** on the contact blocks **488** insure that the same are received with a tight, interference fit within the frame. The springs **538** project forwardly from the blocks **488**. The curved ends **538**E of each spring **538** is guided into a corresponding window **554** of the nosepiece **486**. This may be done by placing a member shaped similarly to the plug into the central cavity **560** (FIG. **13**) of the receptacle, and as the blocks are inserted into the frame the forward ends of the springs are lifted and snap into place in the windows.

With the plug terminator **10'** and the receptacle **200'** each fully assembled and in confronting relationship (FIG. **14**) the ground contacts on the terminator project toward the receptacle. As the components are brought together they are guided into aligned engagement with each other by the cooperative interaction between the tapered end of the central wall **32'**C on each working surface **30'**A, **30'**B of the terminator **10'** and the corresponding precisely dimensioned guide slot **556**A, **556**B formed in each respective nosepiece **486**A, **486**B. Recalling that the engagement of the slot **430** in the contact support members **44'** with the central wall **32'**C serves to accurately position the contacts **58'** on the terminator **10'** with respect to the wall **32'**C, it follows that precise engagement between the walls **32'**C and the nosepieces **486** serves to accurately align the contacts **58'** with respect to the springs **538** in the receptacle. Moreover, the

tight fitting engagement between the nosepieces **486** and the frame **484**, as well as the tight fit between the contact blocks **488** and the frame **484**, prevents the contacts **438** from becoming misaligned as the plug is received thereby. As a result, the terminator and plug arrangement described herein is adapted to provide accurate positioning of respective contact elements on center-to-center spacing as fine as 0.025 inches.

As the terminator and the receptacle are mated, the central portion of the contact springs **498** of the receptacle **200'** wipe against the exposed upper surfaces **58'**P of the contact elements **58'** on the terminator **10'** thereby to establish electrical contact therebetween. Ground contact between terminator **10'** and the receptacle **200'** is established as the planar blade portion **456** of the ground contacts **450** of the terminator **10'** lift and slide beneath the ground contact **538** mounted to the central plate **520** of the receptacle **200'**. The blade **456** is clamped between the ground contact **538** and the surface **534**.

As may be appreciated from the foregoing and as is best illustrated in the side sectional view of the fully assembled and interconnected components shown in FIG. **15**, since the central metallic plate **520** of the frame **484** and the edge surface **29'** on the ground structure **22'** are brought within a predetermined close distance of (on the order of 0.005 inch typically) or abutment with each other (the distance being exaggerated at **562**) it should again be apparent that the ground structure **22'** is, in effect, extended by the action of the central plate **520** through the receptacle **200'**. The cooperating interaction of the ground structure **22'** in the terminator **10'** and the central plate **520** in the receptacle **200'** again serves to electrically isolate and control the impedance of the grouped contacts on the terminator and on the receptacle. This structure may again be seen to form inherently a low impedance transmission line between the forward edge surface **29'** of the ground structure **22'** and the leading edge surface **520**L of the central plate **520** which functions as a "choke joint" to provide continuity of propagating ground current between the structure **22'** and the plate **520'**. However, in this embodiment, a joint having lower inductance joint is established, and the signal contacts are disposed more proximally to the ground plane extending through the engaged terminator/receptacle. If desired the modifications to the choke joint structure shown in FIG. **10** may also be used to advantage.

Those skilled in the art may readily appreciate that in view of the foregoing a receptacle has been provided that provides efficient continuation of the ground structure of the terminator through the receptacle. The reader skilled in the art may also readily appreciate modifications to the structure of the receptacle as hereinabove set forth. It should be understood, however, that such modifications are to be construed as lying within the scope of the present invention as set forth in the appended claims.

What is claimed is:

1. In a terminator for multiple electrical conductors of the type having

a metallic ground structure formed of a baseplate with a plurality of upstanding walls thereon cooperating to define a predetermined number of channels arranged in side-by-side relationship across the ground structure, the baseplate having a forward edge thereon;

an insulated support structure having a plurality of forwardly extending fingers thereon, the number of fingers corresponding to the number of channels on the baseplate, each of the fingers being received in one of the channels; and

at least one electrical contact element being disposed on each of the fingers, each of the contact elements being connectable to one of the conductors so that, in use, the ground structure is connectable to a predetermined electrical potential whereby the electrical contact elements are electrically isolated from each other;

the improvement comprising;

at least one grounding contact projecting forwardly past the forward edge of the baseplate of the metallic ground structure.

2. The terminator of claim **1** wherein one of the fingers has a latch disposed on a surface thereof and wherein the baseplate has a notch therein, the notch being sized to receive the latch thereby to secure the finger to the baseplate.

3. The terminator of claim **1** wherein the grounding contact is connected to the baseplate.

4. The terminator of claim **1** wherein the grounding contact has a planar shank portion with a tang offset therefrom and

wherein the baseplate has a first and a second surface thereon and a recessed tongue formed therein, the recessed tongue being defined by a full groove extending across one surface of the plate and a partial groove defined across the other surface of the plate,

the planar shank portion of the grounding contact being receivable in the full groove and the tang being receivable in the partial groove.

5. The terminator of claim **1** wherein one of the walls has a predetermined dimension and wherein the insulated support structure has a slot therein, the slot being sized to closely accept the wall such that the insulated support structure is precisely located with respect to the baseplate, the one wall having a tapered guide portion thereon.

6. The terminator of claim **1** wherein the forward edge of the baseplate is chamfered at a predetermined angle.

7. The terminator of claim **1** adapted for use with receptacle having a central plate with a leading edge thereon, wherein the leading edge of the central plate is chamfered at a predetermined angle, and wherein the forward edge of the baseplate of the ground structure is chamfered at a corresponding angle so that the forward edge of the ground structure and the leading edge of the central plate lie parallel to each other.

8. An electrical connector system, comprising:

a first connector having two arrays of contact elements and a first conductive plate separating said two arrays of contact elements;

a second connector having two arrays of contact elements and a second conductive plate separating said two arrays of contact elements; and

said second connector adapted to mate with said first connector so that said contact elements of said first and second connectors form electrical connections therebetween and so that said first and second conductive plates are brought to within a predetermined distance from each other thereby reducing crosstalk between adjacent contact elements.

9. The system of claim 8, wherein said predetermined distance is less than or equal to about 0.005 inches.

10. The system of claim 8, wherein said first connector is a receptacle and said second connector is a plug.

11. The system of claim 8, wherein said first connector comprises a conductive frame with said first conductive plate being integrally connected thereto.

12. The system of claim 8, wherein said second connector comprises a conductive frame with said second conductive plate being integrally connected thereto.

13. The system of claim 8, wherein said first connector is a receptacle comprising:

an insulative contact block for supporting at least a portion of an array of said contact elements;

a conductive frame in which said insulative contact block is received; and

said first conductive plate being integrally formed with said conductive frame.

14. The system of claim 13, wherein said conductive frame forms an elongated shell comprising an upper crossbar and a lower cross bar, said first conductive plate being centrally disposed between said upper and lower crossbars and being disposed in a plane substantially parallel with said upper and lower crossbars.

15. The system of claim 14, wherein each of said two arrays of contact elements extend from said insulative contact block in a plane parallel to said crossbars such that one array of contacts is disposed between said upper crossbar and said conductive plate and said other array of contact elements is disposed between said lower crossbar and said conductive plate, said one array of contact elements being deflectable in the direction toward said upper crossbar and said other array of contact elements being deflectable toward said lower crossbar.

16. The system of claim 15, wherein said receptacle further comprises:

an insulative housing being received in said conductive frame and for receiving said insulative contact block;

said housing having a plurality of fingers forming spaces therebetween and a retaining member connecting said fingers; and

each said contact element extending from said contact block into a corresponding one of said spaces such that the extended ends of each said contact element is retained by said retaining member.

17. The system of claim 15, wherein said receptacle further comprises:

an insulative retaining member connected to said conductive frame proximate to said upper and said lower crossbars, said insulative retaining member having a plurality of openings for receiving the ends of said contact elements and retaining said ends therein.

18. The system of claim 8, wherein said second connector is a plug and wherein said conductive frame comprises:

an upper shroud;

a lower shroud integrally formed with said upper shroud; and

said second conductive plate integrally formed with said upper and lower shrouds and disposed therebetween in a plane substantially parallel to both upper and lower shrouds.

19. The system of claim 18, wherein each shroud has at least one cut out portion.

20. A method of electrically connecting multiple electrical conductors, comprising the steps of:

connecting a first connector having two arrays of contact elements separated by a first conductive plate to a first set of conductors;

connecting a second connector having two arrays of contact elements separated by a second conductive plate to a second set of conductors;

mating said first and second connectors so that said contact elements of said first and second connectors form electrical connections therebetween and so that said first and second conductive plates are brought within a predetermined distance from each other thereby reducing crosstalk between adjacent contact elements.

21. The method of claim 20, wherein said predetermined distance is less than or equal to about 0.005 inches.

22. The method of claim 20, wherein said first connector comprises a conductive frame with said first conductive plate being integrally connected thereto.

23. The method of claim 20, wherein said second connector comprises a conductive frame with said second conductive plate being integrally connected thereto.

24. The method of claim 20 wherein said first and second connectors comprise respective first and second conductive frames, said first conductive frame comprises parallel upper and lower crossbars integrally formed together with said conductive plate centrally disposed between said upper and lower crossbars and in parallel with said crossbars, said upper crossbar having at least one raised section formed therein and said lower crossbar having at least one sunken section formed therein,

said second conductive frame comprises parallel upper and lower shrouds integrally formed together with said second conductive plate centrally disposed between said upper and lower shrouds and in parallel with said upper and lower shrouds, wherein each shroud has at least one cut out portion corresponding to said at least one raised section and said at least one sunken section, wherein the step of mating the connectors comprises the steps of:

aligning said cut out portions of said upper crossbar with said raised sections; and

aligning said cut out portions of said lower crossbar with said sunken sections; and

slidably forcing said second conductive frame onto said first conductive frame.

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