



(86) Date de dépôt PCT/PCT Filing Date: 1996/11/15
(87) Date publication PCT/PCT Publication Date: 1997/06/05
(45) Date de délivrance/Issue Date: 2002/03/19
(85) Entrée phase nationale/National Entry: 1998/05/14
(86) N° demande PCT/PCT Application No.: US 1996/018827
(87) N° publication PCT/PCT Publication No.: 1997/019617
(30) Priorité/Priority: 1995/11/16 (60/006,833) US

(51) Cl.Int.⁶/Int.Cl.⁶ A47B 87/00, E04B 2/82

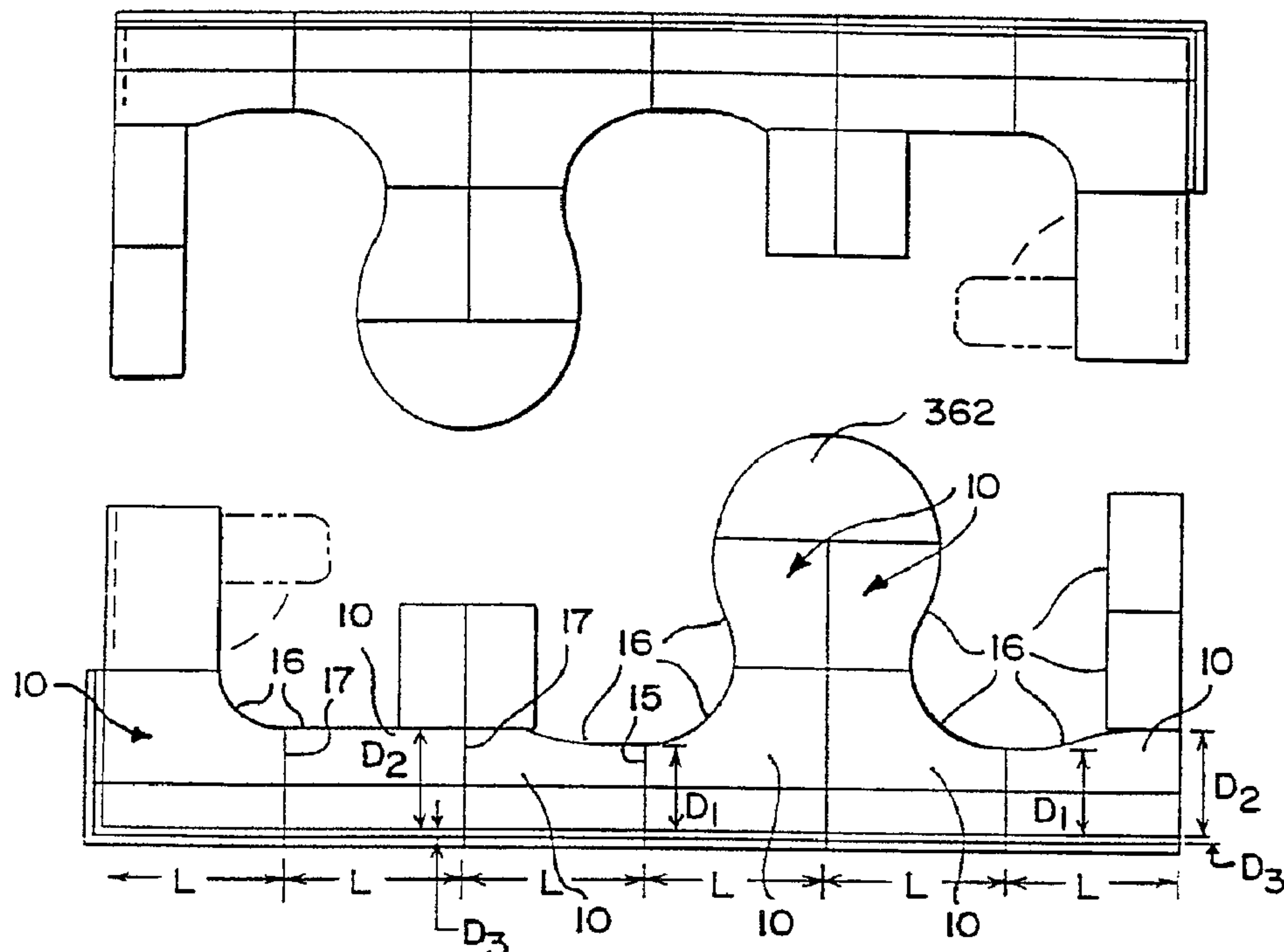
(72) Inventeurs/Inventors:
GARTLAND, Paul Stephen, US;
McCLUNG, Duane Gene, US;
KELLEY, James O., US;
KURRASCH, Andrew, US;
CHADWICK, Donald T., US;
BECK, Robert, US;
PEARSONS, Errol, US;
...

(73) Propriétaire/Owner:
HERMAN MILLER, INC., US

(74) Agent: CASSAN MACLEAN

(54) Titre : BUREAU MODULAIRE ET SYSTEME DE BUREAU

(54) Title: MODULAR DESK AND DESK SYSTEM



(57) Abrégé/Abstract:

A modular desk positioned on a floor includes a worksurface member, a pair of legs and a module maintainer. The worksurface member has a front edge, a back edge, a top surface and a bottom surface. Each leg is mounted to the bottom surface of the worksurface member. The module maintainer includes a pair of support members and a generally vertical wall extending between the support members. The generally vertical wall runs substantially the length of worksurface member. The wall has a boundary surface which is the most rearward surface of the desk and a bottom edge spaced apart from the floor. The wall is also spaced apart from the back edge of the worksurface member to thereby allow for the passage of cables between the vertical wall and the back edge. Another aspect of the invention is a modular power unit mounted to a bottom of the module maintainer. The power unit includes a power distribution system disposed in a housing.



(72) Inventeurs(suite)/Inventors(continued): CLARK, Jeffrey L., US; OREN, Robert A., US

**PCT**WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁶ : A47B		A2	(11) International Publication Number: WO 97/19617
			(43) International Publication Date: 5 June 1997 (05.06.97)
(21) International Application Number: PCT/US96/18827 (22) International Filing Date: 15 November 1996 (15.11.96) (30) Priority Data: 60/006,833 16 November 1995 (16.11.95) US (60) Parent Application or Grant (63) Related by Continuation US 60/006,833 (CIP) Filed on 16 November 1995 (16.11.95) (71) Applicant (for all designated States except US): HERMAN MILLER, INC. [US/US]; 855 East Main Avenue, Zeeland, MI 49464-0302 (US). (72) Inventors; and (75) Inventors/Applicants (for US only): KELLEY, James, O. [US/US]; 19130 North Shore Drive, Spring Lake, MI 49456 (US). CHADWICK, Donald, T. [US/US]; 1812 Melhill Way, Los Angeles, CA 90049 (US). KURRASCH, Andrew [US/US]; 904 Allegan Road, Saugatuck, MI 49453 (US). OREN, Robert, A. [US/US]; 7310 Windgate Drive, Jenison, MI 49428 (US). CLARK, Jeffrey, L. [US/US]; 1252 Marlene Street, Holland, MI 49423 (US). PEARSONS,			Errol [US/US]; Apartment D, 15234 Clovernook, Grand Haven, MI 49417 (US). BECK, Robert [US/US]; 8279 Port Sheldon Road, Zeeland, MI 49464 (US). McCLUNG, Duane, Gene [US/US]; 6572 West Main Street, Kalamazoo, MI 49009 (US). GARTLAND, Paul, Stephen [US/US]; 14186 Pheasant Run, Holland, MI 49424 (US). (74) Agent: FREEMAN, John, C.; Brinks Hofer Gilson & Lione, NBC Tower, Suite 3600, 455 North Cityfront Plaza Drive, Chicago, IL 60611-5599 (US). (81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, HU, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, TJ, TM, TR, TT, UA, UG, US, UZ, VN, ARIPO patent (KE, LS, MW, SD, SZ, UG), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG). Published Without international search report and to be republished upon receipt of that report.
(54) Title: MODULAR DESK AND DESK SYSTEM			
(57) Abstract			
A modular desk positioned on a floor includes a worksurface member, a pair of legs and a module maintainer. The worksurface member has a front edge, a back edge, a top surface and a bottom surface. Each leg is mounted to the bottom surface of the worksurface member. The module maintainer includes a pair of support members and a generally vertical wall extending between the support members. The generally vertical wall runs substantially the length of worksurface member. The wall has a boundary surface which is the most rearward surface of the desk and a bottom edge spaced apart from the floor. The wall is also spaced apart from the back edge of the worksurface member to thereby allow for the passage of cables between the vertical wall and the back edge. Another aspect of the invention is a modular power unit mounted to a bottom of the module maintainer. The power unit includes a power distribution system disposed in a housing.			

MODULAR DESK AND DESK SYSTEM
BACKGROUND OF THE INVENTION

The present invention relates generally to systems for configuring and equipping workstation environments, and in particular, to a modular desk for use in such a system.

Large open office spaces are commonly partitioned into workstations through the use of wall panel systems. Panel systems typically consist of free standing panels that are joined together in a spatial pattern to define the desired sub-area or workstation space. Each workstation space is then supplied with individual workstation components such as desks, file-cabinets and storage space. Some of these workstation components are attached directly to and supported by the panels. To facilitate planning and installation of the panels and componentry, and to reduce inventory costs, panel systems are usually modular, meaning that the components, i.e., panels, desks, cabinets, etc., have uniform dimensions which allow for interchangeability. In addition to providing a divided work space, panel systems also typically provide cable management systems for power and data transmission cables.

Although useful, office panel systems lack a certain degree of versatility and flexibility. Most importantly, they can be difficult to disassemble, reconfigure and reassemble. Indeed, a skilled mechanic may be needed to reconfigure certain panel workstations. In the modern office environment, however, workstations can require frequent reconfiguration as new work projects evolve, thereby requiring new work environments. In addition, it is often desired to maintain an open work environment, without the interference of walls or panels, so as to facilitate communication between team members using the workstation.

To counter some of these problems, some office space environments employ free standing desk systems and storage units, which can be organized into workstations that promote team work and open communication. Because each free standing furniture unit is independently

2

supported on the floor of an open office space, they typically are easy to relocate and require minimal disassembly. However, many free standing desk systems are not equipped for the modern office environment. With electronic technology being a big part of most work environments, office furniture systems must be responsive to managing such key functions as energy distribution, cable management, outlet access, and equipment support. Most desk systems do not accommodate these many needs. For example, most desk systems do not have their own power distribution systems. Thus, to provide power to various office equipment, such as computers, each desk in the system must be located near an outlet.

Alternatively, some free standing systems use a separate power trunk system which runs adjacent to the base of a desk or a system of desks, typically by positioning the unit between abutting desks, as shown in U.S. Patent No. 5,220,871, issued to Grund et al. However, in order to supply power to abutting desks, the power system extends beyond the rear surface of the desk, thereby interfering with the modularity of the system. Moreover, when the power unit is positioned at the base of the desk or desk system, power cables running to the outlets are visible and can either interfere with the user's feet, if located under the worksurface, or pose a tripping hazard, if located behind the desk. In addition, installation of separate power trunks can be time consuming and difficult, as the layout of the power system must be done prior to and in anticipation of the installation of the desk system.

Modern free standing desks also require certain cable management capabilities. Without cable management, computer and phone cables can be exposed, becoming both an eyesore as well as a potential hazard. When managed in some sort of system, cables can be hidden as well as organized. Moreover, desk systems often do not allow for cables to be passed from one desk to another. Rather, the desks typically include a sidewall, which prevents cable passage from one desk to the next. Desk systems which do provide a continuous passage for cables, are generally limited in space and carrying capacity.

3

Free standing desks also typically do not have overhead storage units such as those mounted to panel systems above individual work surfaces. Those free standing desks which do provide overhead units, such as those shown in Grund et al., provide for those units to be attached to and to extend from the support leg structure. However, if the worksurface member is made height adjustable, the overhead unit does not move with the worksurface and the distance between the worksurface and overhead unit is not maintained as a constant. As a result, objects placed on the worksurface member may interfere with the overhead as the worksurface member is moved upwardly.

Free standing desk systems are typically installed by abutting two adjacent desks together, or by abutting a desk up against a system panel or a rigid wall. Generally, an installer will attempt to line up the desks to provide an organized workstation whereby the fronts of the desks appear as a smooth and continuous line. However, when it is desired to install an object between two abutting desks, such as a privacy screen or overhead storage unit, the desks may have to be separated or moved away from each other to provide room for the installation of the additional component. Similarly, when cables are run from a worksurface to the space behind a desk, any adjacent desk or other surface may have to be separated from the workstation to provide clearance for the cables. Thus, the desks can become disorganized, and the smooth appearance of the workstation can be interrupted as the units are shifted to accommodate the various needs of the system.

In essence, typical free-standing desk systems are not modular, i.e., they lack a certain degree of dimensional stability when certain componentry is added to the system. In modern office environments, where workstations are constantly being reconfigured with new components, a non-modular system can quickly become disorganized and aesthetically displeasing.

Moreover, free standing desks, which have a back panel substantially closing off the entirety of the space formed between the

4

worksurface member and the floor, can also interfere with the modularity of a system, as well as decrease the openness of the system. For example, the back panel can interfere with objects protruding from an adjacent wall. Thus, a user would be unable to abut a desk, having a back panel, up against a wall that has an outlet protruding from it. Conversely, the back panel can cover up outlets positioned in adjacent walls, thereby preventing access for plugs extending from various electronic equipment. Finally, a back panel typically limits the ability of a user to pass cables or other items between adjacent desks having rear surfaces abutting each other.

SUMMARY OF THE INVENTION

Briefly stated, the invention is directed to a modular desk positioned on a floor. The modular desk has a worksurface member, a pair of legs and a module maintainer. The worksurface member has a front edge, a back edge, a top surface and a bottom surface. Each leg is attached to the bottom surface of the worksurface member and has a rear surface. The module maintainer includes a pair of support members, each having a base section and an arm extending rearwardly and upwardly from the base section, and a vertical wall. The vertical wall extends between the arms of the support members and is parallel to and substantially the same length as the back edge of the worksurface member. The wall is spaced rearwardly from the back edge of the worksurface member to thereby allow for the passage of cables between the vertical wall and the back edge. The wall has a boundary surface maintained as the most rearward structure of the desk and a bottom edge, which is positioned above the floor, thereby forming a substantially open space between the bottom edge and the floor such that the wall does not interfere with objects protruding into the substantially open space formed below it.

In one aspect of the invention, the module maintainer includes an upper portion and a lower portion. The upper portion includes the generally vertical boundary wall extending between the arms of the support

member.

The lower portion, which can include the base section of the support members, is mounted to and extends rearwardly from said pair of legs. The lower portion has a bottom edge spaced above the floor to provide a space below the module maintainer to thereby allow for the passage of cables below the module maintainer.

The module maintainer allows the desk to maintain a constant footprint in a system of like desks regardless of whether cables are passed behind the rear edge of the worksurface member or under the module maintainer.

In a preferred embodiment, the module maintainer includes a beam member extending between the support members. The beam member is preferably formed out of a back member and a front member and includes a base section and the boundary wall which defines a boundary surface. A top surface of the base section forms a ledge which can serve as a cable management apparatus. The base section has an opening formed in a front surface and cavity formed within it.

In another aspect of the invention, a modular power unit is mounted to a bottom of the beam member. The modular power unit is positioned forwardly of the boundary surface. The modular power unit includes a power distribution system disposed in a housing. The power distribution system includes at least one receptacle module, which provides power to office equipment located on the worksurface member. The modular power unit can be electrically connected to adjacent power units positioned in adjacent desks in the system.

In another aspect of the invention, an accessory member is removably attached to the support members. A back surface of the accessory member is maintained substantially flush with the boundary surface. Because the desk is modular, the accessory can be installed or removed without moving the desk and disturbing the footprint of the system.

In another aspect of the invention, an overhead member is

6

removably mounted to the worksurface member. The back surface of the overhead member is positioned forward of the boundary surface. Preferably, the overhead member is positioned on the top surface of the worksurface member and is clamped to the back edge of the worksurface member. As
5 with the accessory members, the overhead can be installed or removed without disturbing the footprint of the desk system, i.e., without introducing creep into the system. In addition, because the overhead member is attached to the worksurface member, the distance between the worksurface member and overhead is maintained even if the height of the worksurface member is
10 adjusted.

In addition to overhead members, various cabinet assemblies and tool supports can be attached to the worksurface member. As with the overhead, the cabinet members and tool supports move with the worksurface member and can be installed without disturbing the footprint of the desk
15 system.

In another aspect of the invention, the legs are height adjustable. The height adjustment can be accomplished in a variety of ways, including manual adjustment and automatic, or powered adjustment.

In another aspect of the invention, a plurality of modular desks
20 are arranged in a system, so as to provide any number of distinct workstations. In addition, the desks can be used in combination with wall panel systems, including the connection of the power unit to a power source in the panel.

In another aspect of the invention, various tables, such as D-
25 shaped tables or tear-drop shaped tables are incorporated into the system of desks. These tables increase the versatility of the system and provide additional work surface area. A significant aspect of these tables is that they are supported by a modular support assembly, which can be easily reconfigured to have two, three or four support feet, thereby providing the
30 user with a variety of configurations. In addition, various size feet, i.e., long or short, can be easily removed or exchanged. For example, a shorter foot can

be installed to minimize interference with the user's feet, or a longer foot can be used to increase the stability of the worksurface member.

The present invention provides significant advantages over other desk systems. Most importantly, the module maintainer maintains modularity when several desks are used in a system, thereby eliminating the problem of creep. Because the boundary surface is maintained as the most rearward surface, regardless of whether an accessory member or overhead member is also incorporated, the spacing between the units remains constant. Moreover, because the boundary surface is spaced apart from the floor, a desk can be abutted up against surfaces, such as walls or panels, that have protruding objects, such as power outlets with cords inserted. Conversely, the desk does not block access to wall outlets when placed up against a wall. In addition, the substantially open space facilitates access between abutting desks. Accordingly, cables or power cords can be easily passed beneath one desk to another.

Other advantages include the ledge and cavity formed in the base section of the beam member, which provide cable management capabilities as well as storage space for power cords. Furthermore, the modular power unit provides an outlet for electronic components as well as allowing for connection of adjacent power units, which in turn provides flexibility for the system. Finally, overhead members can be mounted directly to the work surface member, rather than relying on attachment to a system panel or attachment to the desk's support legs. This, in turn, provides the user with more flexibility and space. Moreover, the overhead moves with the work surface member when the support legs are made height adjustable, thereby avoiding any interference with the vertical adjustment of the worksurface member.

Another aspect of the present invention regards a furniture and panel system having a panel supported on a support surface, wherein the panel is positioned substantially perpendicular to the support surface. The system includes a piece of furniture having a wall that extends substantially

8

perpendicular to the support surface. An attachment system is attached to the panel and the wall of the piece of furniture. The attachment system has a bracket positioned above the support surface and attached to the panel and the wall of the piece of furniture and a plate lying on the support surface, wherein the plate has a first receptacle for receiving a portion of the panel and a second receptacle for receiving a portion of the wall of the piece of furniture.

Another aspect of the present invention regards a screen attachment system having a first screen with a retractable male member that is positioned within an opening and a second screen having a female member, wherein the male member is inserted within the female opening

Another aspect of the present invention regards a method of attaching a first element to a second element, the method including the steps of retracting a male member of a first element into an opening formed in the first element and extending a male member of a second element into the opening.

The present invention, together with further objects and advantages, will be best understood by reference to the following detailed description taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGURE 1 is a top view showing a system of free standing modular desks integrated with a perimeter of panels.

FIGURE 2 is a top plan view showing a system of free standing modular desks.

FIGURE 3 is a perspective view of a modular desk with a screen being applied thereto.

FIGURE 4 is a perspective view of a modular corner desk.

FIGURE 5 is a perspective view of a modular extension desk.

FIGURE 6 is a perspective view of a modular bridge member with a module maintainer.

FIGURE 7 is a perspective view showing a system of modular

9

desks integrated with a perimeter of panels.

FIGURE 8 is an exploded view of a preferred embodiment of the modular maintainer and power unit.

FIGURE 9 is a perspective view of a modular desk with a screen and an overhead applied thereto.

FIGURE 10 is a front view of a modular table desk with an overhead applied thereto.

FIGURE 11 is a cross-section view of the modular desk taken along line 11-11 of FIGURE 10.

FIGURE 12 is an exploded view of an alternative embodiment for a module maintainer and power unit.

FIGURE 13 is a side view of two modular desks arranged in a back-to-back configuration.

FIGURE 14 is a rear view of a bridge member and module maintainer attached to an adjacent modular desk.

FIGURE 15 is a fragmentary view showing the power unit interconnection between two modular desks arranged in a side-by-side configuration.

FIGURE 16 is a front view of the modular desk with a crank assembly attached thereto.

FIGURE 17 is a bottom view of the modular desk with a crank assembly attached thereto.

FIGURE 18 is a front view of the modular desk with an electric motor assembly attached thereto.

FIGURE 19 is a bottom view of the modular desk with an electric motor assembly attached thereto.

FIGURE 20 is a cross-sectional view showing the top of the height adjustment mechanism.

FIGURE 21 is a side cross-sectional view of an alternative manual height adjustment mechanism.

10

FIGURE 22 is a rear view of a corner modular desk with the worksurface member omitted.

FIGURE 23 is an exploded view of a modular desk and panel assembly.

5 FIGURE 24 is a connector bracket for a modular desk and panel assembly.

FIGURE 25 is a side view of a cabinet assembly.

FIGURE 26 is an exploded view of a cabinet assembly.

10 FIGURE 27 is a front perspective view of a cabinet assembly.

FIGURE 28 is a front perspective view of a tool rail assembly.

FIGURE 29 is a rear perspective view of a tool rail assembly

FIGURE 30 is an exploded view of a tool rail assembly.

FIGURE 31 is an exploded view of a tear-drop shaped table assembly.

15 FIGURE 32 is an exploded view of a D-shaped table assembly.

FIGURE 33 is a perspective view of peninsula table.

FIGURE 34 is a perspective view of a modular desk and a power transition unit extending from a wall panel.

20 FIGURE 35 is a perspective view of a modular desk electrically connected to a wall panel.

FIGURE 36 is a front view of a modular desk with wire management accessories applied thereto.

FIGURE 37 is an exploded view of a height adjustable leg.

25 FIGURE 38 is a perspective view of an embodiment of a modesty screen employing a screen attachment system according to the present invention.

FIGURE 39 is a second embodiment of a modesty screen employing a screen attachment system according to the present invention.

30 FIGURE 40A is a perspective view of an embodiment of a privacy screen employing a screen attachment system according to the present invention.

//

FIGURE 40B is a front cross-sectional view of the privacy screen of FIGURE 40A.

FIGURE 40C is a side view of the privacy screen of FIGURE 40A.

5 FIGURE 41A is a perspective view of a second embodiment of a privacy screen employing a screen attachment system according to the present invention.

FIGURE 41B is a front cross-sectional view of the privacy screen of FIGURE 41A.

10 FIGURE 41C is a side cross-sectional view of the privacy screen of FIGURE 41A.

FIGURE 41D is a top view of the privacy screen of FIGURE 41A.

15 FIGURE 42 is an exploded view of a second preferred embodiment of the modular maintainer and power unit.

FIGURE 43A is a perspective view of a support member to be used with the modular maintainer and power unit of FIG. 42.

FIGURE 43B is a right side view of the support member of FIGURE 43A.

20 FIGURE 43C is a left side cross-sectional view of the support member of FIGURE 43A.

FIGURE 43D is a top view of the support member of FIGURE 43A.

25 FIGURE 43E is a bottom view of the support member of FIGURE 43A.

FIGURE 43F is a front view of the support member of FIGURE 43A.

FIGURE 44A is a perspective view of a spring to be used with the modular maintainer and power unit of FIG. 42.

30 FIGURE 44B is a left side view of the spring of FIGURE 44A.

FIGURE 45 is a perspective view of two screens employing a

12

screen attachment system according to the present invention.

FIGURE 46A is a side view of male member and a handle to be used with the screen attachment system of the present invention.

5 FIGURE 46B is a front view of the male member and handle of FIGURE 46A.

FIGURE 46C is a cross-sectional view of the male member and handle of FIGURE 46A taken along lines A-A.

FIGURE 46D is a cross-sectional view of the male member and handle of FIGURE 46A taken along lines B-B.

10 FIGURE 47 is a perspective view of a second embodiment of a screen attachment system according to the present invention.

FIGURE 48A is a perspective view of the screens of FIGURE 46 being attached.

15 FIGURE 48B is a perspective view showing an alternative manner of attaching the screens of FIGURE 46.

FIGURE 49 is a perspective view of a third embodiment of a screen attachment system.

FIGURE 50 is a an exploded view of an open shelf used with a system of modular desks.

20 FIGURE 51 is a bottom view of the open shelf of FIGURE 50.

FIGURE 52 is a perspective view of the support legs for the open shelf of FIGURE 50.

FIGURE 53 is a perspective view showing the frame of the support legs of FIGURE 52.

25 FIGURE 54 is a top cross-sectional view of the frame of FIGURE 53.

FIGURE 55 is a perspective view of a base plate to be used with the support legs of FIGURE 52.

30 FIGURE 56 is a perspective view of a clamp to be used with the support legs of FIGURE 52.

FIGURE 57 is a perspective view showing an attachment

13

system for attaching a piece of furniture to a panel.

FIGURE 58 is a perspective view of a bracket to be used with the attachment system of FIGURE 57.

FIGURE 59 is a perspective view of the attachment system of FIGURE 57 when used to attach a single panel.

FIGURE 60 is a perspective view of the attachment system of FIGURE 57 when used to attach a pair of panels.

FIGURE 61 is a perspective view of a support plate to be used with the attachment system of FIGURE 57.

FIGURE 62 is a perspective view showing the attachment of a piece of furniture and a panel to the support plate of FIGURE 61.

FIGURE 63 is a perspective view of a second embodiment of an attachment system for attaching a piece of furniture to a panel.

FIGURE 64 is a perspective view showing of a support plate to be used with the attachment system of FIGURE 63.

FIGURE 65 is a perspective view showing attachment of a piece of furniture to the support plate of FIGURE 64.

FIGURE 66 is a perspective view of a second embodiment of a bracket to be used with the attachment system of FIGURE 57.

FIGURE 67 is an exploded view of the bracket of FIGURE 58.

FIGURE 68 is an exploded view of the bracket of FIGURE 66.

FIGURE 69 is an exploded view of the support plate of FIGURE 61.

FIGURE 70 is an exploded view of a second embodiment of a bracket to be used with the attachment system of FIGURE 66.

FIGURE 71 is an exploded view of the bracket used with the attachment system of FIGURE 66.

FIGURE 72 is an exploded view of a support plate to be used with the attachment system of FIGURE 66.

FIGURE 73A is an exploded view of a three corner table attached to a panel.

14

FIGURE 73B shows a variety of table tops that can be used with the three corner table of FIGURE 73A.

FIGURE 74 is an exploded view of an attachment system to be used with the table and panel of FIGURES 73A-B.

5 FIGURE 75 is an exploded view of a second embodiment of a bracket to be used with the attachment system of FIGURE 74.

FIGURE 76 is an exploded view of the bracket used with the attachment system of FIGURE 74.

10 FIGURE 77 is a perspective view of a dislodgment clip to be used with the bracket of FIGURE 71.

FIGURE 78 is a perspective view of a dislodgment clip to be used with the bracket of FIGURES 66 and 68.

FIGURE 79 is a perspective view of a dislodgment clip to be used with the bracket of FIGURE 70

15 FIGURE 80 is an exploded view of a second embodiment of a tool rail assembly according to the present invention.

FIGURE 81 is an exploded view of a third embodiment of a tool rail assembly according to the present invention.

20 FIGURE 82 is a top view of a connector for a panel to be used with the attachment system of FIGURE 74.

FIGURE 83 is a side view of the connector of FIGURE 82.

FIGURE 84 is a top view of a connector for a slide to be used with the attachment system of FIGURE 74.

FIGURE 85 is a side view of the connector of FIGURE 84.

25 FIGURE 86 is a perspective view of a two piece support plate when attaching the three corner table and the panel of FIGURES 73-74.

FIGURE 87 is a bottom view of the two piece support plate of FIGURE 86.

30 FIGURE 88 is a bottom view of a manual height adjustment system for the three corner table of FIGURES 73-74.

15

FIGURE 89 is a bottom view of a motorized height adjustment system for the three corner table of FIGURES 73-74.

FIGURE 90 shows a side view of a bracket engaging a seam according to the present invention.

5 FIGURE 91 shows a hook being inserted within a slot.

FIGURE 92 shows front view of a dislodgment clip engaging a slot.

FIGURE 93 shows a side view of a second embodiment of a bracket engaging a seam according to the present invention.

10 FIGURE 94A is a top perspective view of a second embodiment of removable support for the height adjustable leg of FIGURE 37.

FIGURE 94B is a bottom perspective view of the removable support of FIGURE 94A.

15 FIGURE 94C is a cross-sectional view of the removable support of FIGURE 94A.

FIGURE 95 shows the interior of a screen.

FIGURE 96 shows a bracket to be used with the screen of FIGURE 95.

20 FIGURE 97 shows a mounting bracket to be used with the screen of FIGURE 95.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to the drawings, FIGS. 9 - 11 show a modular desk 2, including a worksurface member 10, a pair of legs 20 and a module maintainer 30. Each leg 20 has a top portion 22, a bottom portion 24 and a rear surface 26. As shown in FIG. 11, the top portion 22 of each leg 20 is attached to a mounting bracket 28. The bottom portion 24 of each leg 20 is attached to a support member 29. The support member 29 is adapted to engage a support surface 3, typically a floor.

30 The worksurface member 10 has a top surface 12, a bottom surface 14, a pair of side edges 15, a front edge 16, and a back edge 18.

16

5 The bottom surface **14** of the worksurface member is attached to the mounting bracket **28**. As shown in FIGS. 1 to 6, the worksurface member **10** can be configured in a variety of shapes. In particular, the contour of the front edge **16** of the worksurface member **10** can be altered to produce a variety of worksurface shapes, including square, rectangular, concave and curvilinear shapes.

10 In order to maintain the modularity of the desk, the side and back edges **15** and **18** are preferably linear. Accordingly, it is the contour of the front edge **16** which can be altered to provide any desired curvilinear appearance. The width of the modular desk **2** is typically maintained a specific and constant distance (L), as shown in FIGS. 1 to 3. In the desk **2** shown, the width (L) is about 48 inches, which allows for easy handling and moving of the desk **2**, while maintaining an adequate area of work space on the worksurface member **10**. When the width of the desk is maintained
15 constant, the desk **2** can be removed and another installed in its place without having to move or adjust adjacent desks or panels in the system. In essence, the modularity of the system is maintained.

20 Alternatively, desks of varying widths can be used in the system to provide particular sizes of work spaces. Typically, the width can range between 24 and 72 inches. In this regard, a system planner can use varying width desks without disturbing the overall footprint of the system. For example, the planner could substitute two 24 inch wide desks for one 48 inch desk. Also, the planner can swap the position of two desks with different widths in the same line without changing the footprint.

25 An important feature of the desk of the present invention is that it provides a consistent, modular footprint, particularly in the distance from the back of the desk to the front. This is true regardless of whether the desk is used in a system where the back of the desk abuts a like desk, or whether it abuts a movable panel or a wall. This is also true regardless of whether the
30 cables, such as power or data cables, are passed behind the work surface, and regardless of whether privacy screens or overhead units are attached to

/7

the desks as shown in FIGS. 11 and 13.

In a system of desks with simple rectangular work surfaces such as those shown in FIG. 9, the result is that the depth D would remain constant across all of the desks arranged side to side, and the front edges 16 of all of the desks arranged side to side would line up in a straight line.

Alternatively, the desks may not have a rectangular work surface. For example, the desks shown in FIG. 1 have curvilinear edges where one side edge has a depth D1 and the second side edge has a depth D2. While not maintaining a straight line across the front of the desks of this embodiment, the invention does provide the advantage that adjacent side edges are guaranteed to line up so long as they are the same length.

In the system shown in FIG. 1, the work surface member 10 has a depth (D1) of about 21.75 inches, and a depth (D2) of about 27.75 inches. Obviously, other depths would be acceptable, so long as they are maintained at certain constant values. Thus, it should be understood that a plurality of depths can be used to provide flexibility in designing a work space, so long as they are uniformly applied to the system of desks. It should also be understood that a single depth can be used. In essence, the depths simply must allow individual modular desks to be configured in a system that permits interchangeability of different desks, while maintaining an aesthetically pleasing appearance.

In order to maintain a smooth and unbroken appearance of the front edges of a desk system, it is important therefore to ensure that the depth of the side edge of a first worksurface member installed in the system corresponds to the depth of the adjacent side edge on a second work surface member, whether it be a depth (D1) or (D2). Thus, a desk having a work surface member with a first side edge of depth (D1) should abut a desk having a work surface member of corresponding depth (D1). Similarly, a second side edge of depth (D2) should abut a corresponding side edge of depth (D2).

The module maintainer 30 is mounted to and extends

j8

rearwardly from the pair of legs **20**. In a preferred embodiment, the module maintainer **30** includes a pair of support members **40**. Each support member **40** includes a base section **42** and an arm **44** extending upwardly and rearwardly from the base section **42**. A lower portion of the arm forms an acute angle with the vertical plane, while an upper portion of the arm is generally vertical. As shown in FIG. 11 and 12, the base section **42** is attached to the support leg **20** with a plurality of fasteners. The upper portion of arm **44** includes an end portion **43** having an opening **47**. Preferably, the support member **40** is an aluminum casting.

As shown in FIG. 13, the module maintainer includes a vertical wall **48** having a boundary surface **32** positioned rearwardly of the back edge **18** of the worksurface member **10** as shown in FIG. 13. The wall **48** extends between the arms **44** of the two support members **40**. The boundary surface **32** is also positioned rearwardly of the rear surfaces **26** of the legs and the foot member **29**. Preferably, the rear surface **26** of the legs are positioned about 4 inches forward of the boundary surface **32**, such that the legs **20** will not interfere with an outlet **206**, or a plug **306** inserted into the outlet, if the boundary surface **32** of the desk **2** is placed up against a wall having an outlet substantially aligned with the leg **20** as shown in FIG. 11. Similarly, the rear surface of the foot member **29** is positioned about 1.6 inches forward of the boundary surface, such that the foot will not interfere with a floor board **302** or other object extending from an adjacent surface, such as a base cover on a wall panel.

The boundary surface **32** has a bottom edge **51**. The bottom edge **51** is elevated and positioned distally from the floor **3** so as to provide a substantially open space between the boundary surface **32** and the support surface **3**, as shown in FIG. 11. In the exemplary embodiment shown in FIG. 11, the bottom edge **51** is positioned about 19.5 inches above the floor **3**, which is more than half the distance from the floor to the worksurface member when the desk is at its lowest height. The boundary surface **32** is spaced apart from the floor **3** so that it does not interfere with or preclude access to

79

outlets **206** positioned in abutting panels **200** or walls **210**. Similarly, providing space between the boundary surface and the floor ensures that the desk **2** will not interfere with any protruding objects **300**, such as communication boxes, cords plugged into wall outlets, or cable outlets, when abutted against the panel **200** or wall **280**. Finally, this space provides a generally open environment beneath the desk **2** to permit access between adjacent and abutting desks when installed in a system as shown in FIG. 13. Thus, cables can be passed underneath the boundary surface **32** of the desk **2** to an abutting desk **2**.

The boundary surface **32** is maintained at a specific and uniform distance (D3) from the back edge **18** of the worksurface member **10**. In a preferred embodiment, (D3) is about 2.25 inches.

As shown in FIGS. 11 and 13, the boundary surface **32** is maintained as the most rearward surface of the entire modular desk **2**. Accordingly, the module maintainer **30** defines a specific footprint for the modular desk **2**. The footprint is defined by the width of the desk (L), and the depth of the desk, i.e., the depth (D3) plus the depth of either (D1), (D2), or both.

When two desks are positioned next to each other in a side-by-side arrangement, as shown in FIG. 15, the modular maintainers **30** are preferably secured to each other by connecting adjacent sidewalls **31** of the support members **40** with fasteners, as shown in FIGS. 14 and 15. When the desks are powered, or one or more ends of the work surface member are not supported by a leg, adjacent module maintainers are necessarily connected by securing the adjacent sidewalls **31** to each other.

FIG. 8 shows an exploded view of the preferred embodiment of the module maintainer **30** and a modular power unit **70**. The preferred embodiment of the module maintainer **30** includes a beam member **210**, which is shown throughout the Figures and in particular in FIGS. 15, 21 and 23. As shown in FIG. 15, the beam member **210** extends between the support members **40** and is substantially the same length as the back edge

20

18 of the worksurface member. The beam member **210** includes a base section **282** and an upper portion which forms the generally vertical boundary wall **48**. The upper portion extends rearwardly and upwardly from the base section **282** and includes an angled portion positioned at an acute angle to the vertical plane and a vertical portion extending vertically from the end of the angled portion. As described previously and as shown in FIGS. 11 and 13, the boundary wall **48** defines the boundary surface **32**.

A top surface **232** of the base section forms a ledge which can be used to support and store various cables and wiring, as shown in FIGS. 10-11. A bottom portion of the base section forms a trough **224** for storing cables. The base section also has a opening **242** formed in a front surface and a cavity **240** formed within it. As shown in the preferred embodiment in FIG. 13, the rear surface of the base section **282**, is spaced forwardly of the boundary wall **48** and boundary surface **32**, thereby providing a generally open space below the boundary wall **48**.

As shown in FIGS. 11 and 13, the base section of the beam member and the base section of the support member form a lower portion **283** of the module maintainer. Similarly, the vertical wall and the arms of the support member make up the upper portion **283** of the module maintainer. However, it should be understood that the entire module maintainer (lower and upper portions), including the support members and the beam member (having a base section and vertical wall), could be made out of a single member, such as an extrusion. In such an embodiment, the ends of the extrusion which are attached to the legs could function as the aforescribed support members, and could be defined as such. Similarly, a lower portion of the extrusion extending between the legs could function as the base section of the beam member, and could include a ledge for supporting cables, a cavity for storing cables and a forwardly facing opening for accessing the cavity. In addition, an upper portion of the extrusion could be formed as the vertical wall, thereby defining the boundary surface of the module maintainer.

In a preferred embodiment of the module maintainer shown in

21

FIG. 8, the beam member **210**, including the base section and the vertical wall, is preferably formed out of a back member **220** and a front member **230**.

The back member **220** is configured in substantially the same shape and has the same contour as a back surface **45** of the support member **40**. The back member **220** is fastened to the end portion **43** and a bottom surface of the support member **40**. The back member **220** also includes a bottom lip **222** which extends upwardly between the support members **40** to form the trough **224**, which is ideally suited for storing cables. A vertical section **211** of the back member **220** defines the boundary surface **32**. The back member **220** also wraps around to form a top section **226** and an upper lip **228** which are adapted to engage the end portion **43** of the arm. A bottom portion **223** of the back member defines a bottom surface **225** of the module maintainer **30**. In a preferred embodiment, the bottom surface **225** is spaced above the floor **3** at least half the height of the legs **20** to provide a space below the module maintainer **30** whereby cables can be passed below the module maintainer **30** to an adjacent desk.

The front member **230** is configured in substantially the same shape and has the same contour as a front surface **39** of the support member. The front member **230** extends between the support members **40** and is fastened to the front surface **39** of the support member. A horizontal surface of the front member defines the top of the base section and forms the ledge **232** where excess lengths of cables can be stored. An upwardly extending portion **234** of the front member includes a lip **236** which underlies the overlapping upper lip **228** of the back member when the members are attached to the support member **40**. When attached to the support member, the vertical section **211** and the upwardly extending portion **234** of the front member form the generally vertical boundary wall **48**, as shown in FIGS. 11 to 15. The back and front members also form a cavity **240** between them in the base section. In addition, a bottom lip **238** of the front member and the bottom lip **228** of the back member form the elongated opening **242** between them, which faces forwardly as shown in FIGS. 10 and 16. A user can pass

22

cables or excess lengths of power cords through the opening **242** into the cavity **240** and lay them in the trough **224**.

The ledge **232** or top surface of the base section, shown in FIGS. 10, 11, and 13, is ideally suited for storing excess cables. For example, the ledge **232** provides adequate storage for approximately ten 25-pair cables. Cables lying on the ledge **232** can also pass over the beam member **210** and be stored in the cavity **240**, or be connected to a modular power unit **70**. To help organize the cables, and retain them on the ledge, a plurality of wire management clips **600** can be attached to the lip **238** of the front member as shown in FIG. 36. Each clip **600** has an arm **602** which extends upwardly from the ledge **232**. The arm **602** maintains the cables on the ledge **232**, thereby allowing the cables to be stacked and prevented from falling off of the ledge and interfering the user's legs. The cables can be passed over the edge of the ledge **232** between the arms **602** and stored in the trough **224**.

Alternatively, a vertical wire management tube **604** shown in FIG. 36 can be secured to the front of the module maintainer **30**. The tube **604** runs in a generally vertical direction from the floor **3** to the surface of the ledge **232**. In addition, the top portion of the tube **604** has slots **607** positioned in the side walls **606** so as to allow cables or wires lying in the trough **224** to pass through the elongated opening **242** through the slot **607** and be disposed in the tube **604**. Similarly, wires or cables lying on the ledge **232** can be passed over the edge and into the tube **604**. The tube **604** provides a device whereby wires or cables can be passed from the module maintainer to the floor **3** in an organized fashion, while simultaneously improving the aesthetics of the desk by eliminating unsightly loose wires and also eliminating a potential interference between the wires and the user's feet.

In an alternative embodiment of the module maintainer, shown as an exploded view in FIG. 12, the module maintainer **30** includes a beam member having a base section **34** and a separate wall member **248**, rather than the two members being integrally formed as previously shown in FIG.

23

11. In this alternative embodiment, the base section 34 spans at least the distance between the legs 20. The base section 34 is mounted to the support members 53. As shown in FIG. 12, the base section 34 is C-shaped. Because of its C-shaped configuration, the base section 34 has an elongated opening 36 which faces forwardly and a cavity 38 formed within it. The cavity 38 formed within the base section 34 is ideally suited for storing cables and excess lengths of power cords.

In the embodiment of FIG. 12, the wall member 248 defines the vertical boundary surface 32. A lower portion of the wall member forms an acute angle with the surface of the base section 34 as it extends upwardly and outwardly from the base section. As stated previously, the wall member and base section are separate components, as shown in FIG. 12, rather than being integrally formed as part of the beam member as shown in FIG. 11. The lower portion of the wall includes a lip which wraps around to form a trough 54. The trough 54 is suited for storing excess cables. The trough 54 includes several openings 55 which permit cables lying in the trough 54 to pass through the openings 55 and access available power sources positioned below the module maintainer.

In another aspect of the invention, the modular desk 2 has a modular power unit 70 attached to it as shown in FIGS. 8, 11 and 12. The modular power unit 70 includes a housing 78 and a power distribution system. The power distribution system includes a pair of power distribution servers 71 and a pair of electrical power harnesses 80. For a complete description of the power distribution server 71 and power harnesses 80, see U.S. Patent No. 5,112,240, issued to Nienhuis et al. on May 12, 1992.

As shown in FIG. 8, the housing 78 includes an upwardly opening channel 82 and a top cap 84. The top cap 84 is fixedly mounted to a bottom 37 of the beam member 34, 210 using a plurality of fasteners (not shown). The channel 82 includes a front member 608, which is preferably fixedly mounted to the rear surface 26 of the support legs 20 so that the

24

housing is not removable, and a back member **610**. In a preferred embodiment, the back member **610** is pivotally attached to the front member **608** along a bottom edge **61** as shown in FIG. 8. Preferably, one end of each of the front member and back member are formed into opposing channels **622**, **624**. The channels form a hinge **626** when they are interlocked as shown in FIG. 8. In addition, the front and back members **608**, **610** include inwardly facing and elongated flange members **614**. The free edge of each flange member **614** forms a head **616** which is received within an elongated socket **618** extending from the top cap **84**. The flange **614** and socket **618** run substantially the length of the housing **78**. To interconnect the channel **82** and top cap **84**, the head **616** on each flange **614** is slidably received in an opposing socket **618**. Alternatively, the head **616** of the flange on the back member **610** is adapted to snap fit into the opposing socket in the top cap **84**. In this way, the back member **610** can be disengaged from the top cap and pivoted about the axis of the hinge **626** in order to provide access to the power distribution server **71**.

Alternatively, the channel **82** can be secured to the top cap **84** by a plurality of posts **628** which are disposed in the channel **82** and interconnect a bottom of the channel **82** and the top cap **84**, as shown in FIG. 12.

As shown in FIGS. 11 and 13, the rear surface **91** of the housing **78** is positioned forwardly of the boundary surface **32**. Indeed, the housing **78** is positioned sufficiently forward of the boundary surface **32** so as to allow an electrical plug to be inserted into a rearwardly facing receptacle module **73** without the plug and accompanying cord extending rearwardly of the boundary surface **32**. For example, as shown in FIG. 11, the rear surface **91** of both the housing **78** and base section of the beam are positioned about 2 inches forward of the boundary surface **32**. Alternatively, a plug can be inserted into a forwardly facing receptacle module.

The pair of power harnesses **80** are secured to the top cap **84** and disposed in the channel **82**, which is also secured to the top cap **84**, as

25

previously described. The top cap **84** and channel **82** form a tube, or housing **78**. Each end of the housing **78** has an opening **79** which can be covered with a removable end cap **92**. The power harnesses **80** are suspended in the housing by a plurality of retainer clips **81**. The clips **81** are secured to the top cap **84** with a plurality of fasteners.

The power harness **80** supplies power to a plurality of receptacle modules **72**, **73** which, in turn, provide power for various electronic components placed on the worksurface member **10**, or positioned nearby. The power cords for the components are plugged into a socket **74** contained in the receptacle modules **72**, **73**. The power unit **70**, shown in FIG. 12, includes four receptacle modules **72**, **73**, two modules **72** facing forwardly and two modules **73** facing rearwardly. Each module **72**, **73**, in turn, has two three-prong sockets **74** adapted to receive a three-prong electrical plug as shown in FIG. 10.

The modules **73** facing rearwardly can be accessed by free standing electrical components located adjacent to the desk **2** or by power cables passing beneath the power unit **70** from the modular desk. The modules **73** facing forwardly can be accessed by cables passing over the ledge, by cables running from the trough, or by free standing electronic components.

The power harness **80** is capable of carrying 120/240 Volt single phase power, although other voltage configurations can be used depending on the desired output, such as 208 Volt 3-phase power. The modules **72**, **73** are secured to the harness **80** using a plurality of retaining brackets **87**. As discussed previously, the power unit **70** shown in FIGS. 8 and 12 has four modules **72**, **73** placed in a back-to-back arrangement, whereby two modules **73** face forwardly and two modules **72** face rearwardly. Openings **86** are positioned in the housing channel **82** so as to be aligned with the modules **72**, **73**. As shown in FIGS. 8 and 12, the openings **86** are positioned midway along the length of the channel **82**.

The modular power unit **70** also includes electrical connector

26

ports **76** positioned at one end of each harness **70**. The electrical connector ports **76** provide a means for electrically connecting adjacent desks **2**, such that a first desk receives power from a second desk. In this way, desks can be arranged in a system without having to rely on wall panels or fixed outlets for a source of power.

The end of the power harness **80** terminates in the connector port **76**. Each electrical connector port **76** is adapted to interface with an opposing connector port **76** attached to a corresponding harness **80** positioned in an adjacent modular desk **2**. The other end of each harness **80** terminates in a receptacle port **77**. The harnesses **80** are positioned such that the receptacle ports **77** are adjacent to each other, but open toward opposite ends of the power unit **70**. The receptacle ports **77** are adapted to engage each other. The retaining brackets **87**, which receive the modules **72**, are attached to a side portion of each receptacle port **77**. Contact channels located in the receptacle port **77** engage opposing contact channels in the modules **72**, **73**.

As shown in FIGS. 8 and 11, a first end of the power harness is provided with some slack so as to allow the connector port **76** attached to the first end to extend from the end of the power unit **70** and mate with the connector port **76** in the adjacent desk. When not being used, the end cap **92** can be placed in the opening **79** in the end of the housing **78** to conceal and protect the electrical connector ports **76** and the attached electrical harness **80**.

As shown, the power unit **70** is modular, meaning that it is interchangeable and comes in a standard size corresponding to the width (L) of the modular desk **2**. Accordingly, the modular power unit **70** shown in FIGS. 8 and 11 is approximately 48 inches long, corresponding to the length of the modular desk **2**.

As shown in FIGS. 10, 11 and 13, the bottom surface **225** of the module maintainer **30** and the bottom surface **61** of modular power unit **70** are both substantially spaced apart from the support surface **3**. As a result,

27

power cords and plugs interfacing with the power unit **70** are also raised above the floor. As a result, the power cords and plugs are not visible by a person standing near the work station. Thus, the aesthetics of the work station are greatly improved. In addition, the power cords and plugs are positioned away from the user's feet, thereby avoiding inadvertent disconnection and eliminating potential entanglement. Moreover, for plugs and cords interfacing with the rearwardly facing modules **72**, the raised modular power unit **70** eliminates a potential tripping hazard for pedestrian traffic near the rear of the desk **2**. Finally, the open space formed between the bottom surface **61** of the modular power unit **70** and the floor **3** provides installers and users with access from one desk to an adjacent, abutting desk. Similarly, if the modular desk **2** is not equipped with a power unit **70**, the open space formed between the bottom surface **225** of the module maintainer **30** and the floor provides access for cables to be passed beneath the module maintainer and provides clearance for outlets and other objects protruding into the space.

In another aspect of the invention, the modular desk **2** includes an accessory member **100**, as shown in FIG. 3. The accessory member **100** is removably mounted to the support members **40** and the boundary wall **48**, **248**. As shown in FIGS. 3 and 11, the accessory member **100** is a screen. The screen **100** can be a short screen, described as a modesty screen, or a tall screen, described as a privacy screen. A privacy screen separates a seated user from persons standing on the other side of the desk, thereby providing the user with seated privacy. Although shown as a screen, it should be understood that the accessory member could be configured in a variety of ways, including for example, a light, a tackboard, or even an overhead storage unit. As shown, the screen can be made out of a translucent material, or simply covered with cloth. When covered with cloth, the underlying layer can be a tackable material, such as fiberboard. The accessory member **100** has a bottom surface **102** and two mounting members **108**, or posts, extending downwardly from the bottom surface **102**.

28

The openings **47** in the support member **40** are adapted to receive the mounting members **108**. When installed, the bottom surface **102** of the accessory member **100** engages the top surface **226** of the boundary wall **48**. Thus, the accessory member **100** is supported by the top of the boundary wall **48**, while the mounting members **108** provide lateral stability.

The accessory member **100** has a front surface **104** and a rear surface **106**. When installed, the back surface **106** is maintained substantially flush with the vertical boundary surface **32** as shown in FIG. 11. In addition, the front surface **104** is maintained substantially flush with the upwardly extending portion **234** of the front member, or the front surface of the boundary wall **48**. The front surface **104** of the accessory member is positioned rearwardly of the back edge **18** of the work surface member. Because the front surface **104** of the accessory member and back edge **18** of the worksurface member are spaced apart, cables running from various electronic components, such as computers, can pass over the back edge **18** of the worksurface member **100** through the opening between the accessory member **100** and the back edge **18**, and be positioned on the ledge **232**, or passed over the ledge through the elongated opening and laid in the trough **224**.

By attaching the accessory member **100** to the module maintainer, the modular desk **2** eliminates the need for bulky free standing screens. Free standing screens require movement of abutting desks for installation and can be expensive. Thus, the module maintainer provides a simple but effective way to maintain system modularity, while simultaneously providing a simple and inexpensive method for separating adjacent workstations.

Other embodiments for the accessory member **100** of FIGS. 3 and 11 are possible. For example, as shown in FIGS. 38-49, the accessory member **100** may include a screen attachment system for attachment to a second accessory member **100**. As shown in FIG. 38, the accessory member **100** may be a rectangular modesty screen with two mounting members or

29

posts **108** that are inserted into and mounted into the openings **47** formed in the top surface of the worksurface member also having a front edge, a back edge and a bottom surface. Note that the posts **108** up into the screen, as shown in FIG. 95. To prevent the post from rotating, a bracket **2000** (FIG. 96) is mounted to the frame of the screen so that a hollowed end of the post **108** is inserted into a male element **2002**. A mounting bracket **2004** (FIG. 97) then engages the post **108** and the other male element **2006** via slots **2008** and **2010**, respectively. As shown in FIGS. 3 and 11, the worksurface member is attached to a pair of legs of a piece of furniture, such as a modular desk **2**.

As shown in FIG. 39, the modesty screen of FIG. 38 may be modified so that one of the ends is extended to cover a gap between two like corner screens. To extend the screen, a screw **1021** is removed and the corner bracket **1024** is removed. Then a flexible filler material **1023** is inserted into the screen. The bracket can be reattached or the filler material can be extended to another screen. Of course, the screen attachment system may be employed with the privacy screen of FIGS. 40A-C. Like the modesty screen of FIG. 39, the privacy screen of FIGS. 40A-C may be extended in a manner similar to that described with the extended screen of FIGS. 41 A-D.

In each of the screens shown in FIGS. 38-41, when the mounting members or posts **108** are inserted into the worksurface member they are adjacent to the support members **40** of the module maintainer **30** and the modular power unit **70** of FIGS. 8 and 42. The embodiment of FIG. 42 is similar to that described for the embodiment of FIG. 8. For example, the structure and attachment of the back member **220**, front member **230** and top cap **84** of the embodiment of FIG. 42 is similar to that of the embodiment of FIG. 8. Note that FIG. 42 shows how holes formed in the back member **220**, front member **230** and top cap **84** and have bolts **1002** inserted therethrough so as to attach the members together.

As shown in FIGS. 42 and 43A-F, a pair of aluminum support

30

members **40** are provided for mounting the back member **220** and the front member **230** to the modular desk **2**. The base section **42** of the support members **42** are attached to the support leg **20** by inserting bolts through the legs **20** and into the holes **1002** formed in the base section **42**.

5 A back member **220** is attached to the end portion **43** and a bottom surface of each support member **40**. As shown in FIG. 42, the back member **220** is configured in substantially the same shape and has the same contour as a back surface **45** of the support member **40**. The back member forms a top section **226** and an upper lip **228** which engages the end portion
10 **43** of the support member **40** when it is inserted therein. Brackets **1004** are used to attach the back member **220** and the support member **40** via a bolt inserted through a hole in the bracket **1004** and holes **1006** and **1008**.

 Note that a steel spring **1010** is inserted between an arcuate side surface **1012** of the support member **40**. As shown in FIGS. 44A-B, the
15 spring **1012** has a semi-cylindrical surface **1014** that expansively engages the surface **1012**. A T-shaped appendage **1016** extends from the surface **1014** and presses against the posts **108** of the screens.

 The back member **220** also includes a bottom lip **222** which extends upwardly between the support members **40** to form the trough **224**.
20 The bottom surface **225** of the back member **220** is spaced above the floor **3** at least half the height of the legs **20** to provide a space below the module maintainer **30** whereby cables can be passed below the module maintainer **30** to an adjacent desk.

 The front member **230** is configured in substantially the same
25 shape and has the same contour as a front surface **39** of the support member. The front member **230** extends between the support members **40** and is fastened to the front surface **39** of the support member. A horizontal surface of the front member defines the top of the base section and forms the ledge **232** where excess lengths of cables can be stored. An upwardly
30 extending portion **234** of the front member includes a lip **236** which underlies the overlapping upper lip **228** of the back member when the members are

31

attached to the support member **40**. When attached to the support member, the vertical section **211** and the upwardly extending portion **234** of the front member form the generally vertical boundary wall **48**. The back and front members also form a cavity **240** between them in the base section. In addition, a bottom lip **238** of the front member and the bottom lip **228** of the back member form the elongated opening **242** between them so that a user can pass cables or excess lengths of power cords through the opening **242** into the cavity **240** and lay them in the trough **224**.

To help organize the cables, and retain them on the ledge **232**, a plurality of wire management clips **600** can be attached to the lip **238** of the front member in a manner as shown and described with respect to FIG. 36.

The beam member **210** includes a base section **282** and an upper portion that are configured in a manner similar to that shown and described with respect to the embodiment of FIG. 13. Accordingly, the base section **282** and the upper portion form the generally vertical boundary wall **48**. The upper portion extends rearwardly and upwardly from the base section **282** and includes an angled portion positioned at an acute angle to the vertical plane and a vertical portion extending vertically from the end of the angled portion.

It should be understood that the entire module maintainer (lower and upper portions), including the support members and the beam member (having a base section and vertical wall), could be made out of a single member, such as an extrusion. In such an embodiment, the ends of the extrusion which are attached to the legs could function as the aforescribed support members, and could be defined as such. Similarly, a lower portion of the extrusion extending between the legs could function as the base section of the beam member, and could include a ledge for supporting cables, a cavity for storing cables and a forwardly facing opening for accessing the cavity. In addition, an upper portion of the extrusion could be formed as the vertical wall, thereby defining the boundary surface of the module maintainer.

The top cap **84** of the embodiment of FIG. 42 can be attached to

32

the housing **78** and pair of power harnesses **80** shown in FIG. 8 and in a manner described previously. As shown in FIG. 42, the top cap **84** can be fixedly mounted to a bottom **37** of the beam member **34**, **210** using a plurality of fasteners (not shown). The top cap **84** is attached to a three front

5 members **608**, which are preferably fixedly mounted to the rear surface **26** of the support legs **20** so that the housing is not removable, and a back member **610**. In a preferred embodiment, the back member **610** is pivotally attached to the front members **608** along a bottom edge **61** in a manner similar to that described for the embodiment of FIG. 8. The bottom interior edges of the

10 front and back members have ridges that are similar in shape to those shown in the embodiment of FIG. 8. The ridges of the front and back members of the embodiment of FIG. 42 interlock with one another in a manner similar to that shown and described with respect to FIG. 8. Accordingly, one end of each of the front member and back member of the embodiment of FIG. 42 are

15 formed into opposing channels which form a hinge. In addition, the front and back members **608**, **610** include inwardly facing and elongated flange members **614**. The free edge of each flange member **614** forms a head **616** which is received within an elongated socket **618** extending from the top cap **84**. The flange **614** and socket **618** run substantially the length of the housing

20 **78**. To interconnect the channel **82** and top cap **84**, the head **616** on each flange **614** is slidably received in an opposing socket **618**. Alternatively, the head **616** of the flange on the back member **610** is adapted to snap fit into the opposing socket in the top cap **84**. In this way, the back member **610** can be disengaged from the top cap and pivoted about the axis of the hinge **626** in

25 order to provide access to the power distribution server **71**.

Alternatively, the channel **82** can be secured to the top cap **84** by a plurality of posts in a manner described previously with respect to the embodiment of FIG. 8.

With the above description of the housing **78** of FIG. 42, the rear

30 surface **91** of the housing **78** is positioned forwardly of the boundary surface **32** so as to allow electrical plugs to be inserted into a rearwardly facing

33

receptacle module in a manner similar to that described with respect to the embodiment of FIG. 8.

A pair of power harnesses **80** are secured to the top cap **84** and disposed in the housing **78**. Each end of the housing **78** has an opening **79** which can be covered with a removable end cap, such as the cap of FIG. 8. The power harnesses **80** are suspended in the housing by a plurality of retainer clips **81**. The clips **81** are secured to the top cap **84** with a plurality of fasteners. The power harnesses **80** have a structure and supply power in a manner described with respect to the power harnesses of the embodiment of FIG. 8. Note that rectangular caps **1017** can be attached to the middle front members **608** so as to cover the openings **86** and deny access to modules **72** and **73**.

Each of the screens of FIGS. 38-39 includes one (FIG. 39) or a pair (FIG. 38) of retractable male members **1018** that are positioned within a female receiving element such as opening **1020** formed in the top corners **1022** of the screen. The opening **1020** is cylindrical in shape having a diameter of approximately 0.312" and a length of approximately 1.75". As shown in FIG. 45, the opening **1020** is formed in a steel or zinc die cast corner bracket **1024** that is mounted to the top corner of the screen. A rectangular slot **1026** is formed in the top of the corner bracket **1024** and extends into the opening **1020**. The slot **1026** has a length of approximately 1.25". The slot **1026** has an upper recess **1027**, having a width of approximately 0.375", and a lower recess **1031** having a width of approximately 1/8" and a depth of approximately 1/8". It is understood that a wide variety of shapes and sizes for the opening **1020** and the slot **1026** are possible without departing from the spirit of the invention. For example, the upper recess **1027** can be eliminated as shown in FIG. 47.

As shown in FIGS. 46A-D the retractable male member **1018** is made of a resilient material, such as steel or 30% glass filled nylon, and includes a cylindrical-like base **1028**, including slots **1029**, which is integrally attached to a handle **1030**. The cylindrical base **1028** has a length of

34

approximately 1.141" and a diameter of approximately 0.312" so as to snugly fit within the opening **1020**. The handle **1030** is attached at to the end of the base **1028** furthest from the side edge of the screen and rises substantially perpendicular to the base **1028** so as to be positioned within the upper recess **1027** of the slot **1026**. As shown in FIG. 47, the handle **1030** may be positioned above the slot **1036** as well. Moving the handle **1030** towards a position located at the front edge **1032** of the slot **1026** nearest the side edge of the screen causes the cylindrical base **1028** to partially extend outside of the opening **1020** by approximately 0.5". Movement of the handle **1030** towards a position located at the rear edge **1034** of the slot **1026** causes the base **1028** to be totally retracted within the opening **1020** so that the end of base **1028** furthest from the handle **1038** is approximately 0.6" from the exterior edge of the opening **1020**.

With the above description in mind, the attachment of a pair of screens having identical retractable receiving elements is easily understood. As shown in FIGS. 48A-B and 49, a side of a screen is placed adjacent to a side of a second screen so that the retractable male members **1018** of each screen are aligned with the female receiving elements or openings **1020** of the other screen. As shown in FIGS. 45 and 48A one manner of attaching the screens is to retract the male member **1018** of the right screen into the opening **1020** of the right screen. The male member **1018** of the left screen is partially extended out of the opening **1020** of the left screen and inserted into the opening **1020** of the right screen. An alternative method of attaching the screens is shown in FIG. 48B where the male member **1018** of the left screen is retracted into its corresponding opening **1020** and partially extending the male member of the right screen and inserting it into the opening **1020** of the left screen. One rule of thumb for attachment that is shown in FIGS. 48A-B is that if the handles **1030** of the screens are moved in the same direction, either left or right, then a male member **1018** will be partially extended so as to be inserted into an opening in the other screen.

As shown in FIGS. 9-11, another aspect of the modular desk **2**

is an overhead member **110**. The overhead member **110** has a back surface **112**. When attached to the back edge **18** of the worksurface member **10**, the back surface **112** is positioned forwardly of the front surface **104** of the accessory member, when the two members are used in combination. In addition, the back surface **112** of the overhead member is maintained forwardly of the boundary surface **32** of the module maintainer **30**. Accordingly, the overhead member **110** does not interfere with the modularity, or footprint, of the desk **2**.

As shown in FIG. 11, the overhead member **110** is removably attached to the worksurface member **10**. Preferably, the overhead member **110** is positioned on the top surface **12** of the worksurface member **10**. For example, the overhead member **110** is shown positioned on the top surface **12** and clamped to the back edge **18** in FIG. 11. Alternatively, a screen or other accessory can also be mounted directly to the worksurface member as shown for the overhead unit in FIG. 11. In addition, it should be understood that the overhead member **110** can also be attached to a side edge of the worksurface member, or to both the back edge and side edge. As with screens, off-unit or freestanding overhead storage units are bulky and expensive. In addition, installation of such units can disrupt the footprint of the system. In contrast, the overhead member shown in FIG. 11 conserves space, reduces costs, and does not interfere with system modularity.

Because the overhead member **110** is not mounted to the support legs **20** at the corners of the worksurface member as shown in FIGS. 9 and 10, it is not attached to or dependent on the legs **20** for support. Thus, if the legs **20** are made height adjustable, the overhead member **110** simply moves up or down with the worksurface member **10**. Accordingly, the distance between the overhead member **110** and work surface member **10** is maintained as a constant. Therefore, various components, such as tack boards, storage trays or electronic equipment, can be positioned between the overhead member and worksurface member without having to be moved or adjusted with each adjustment of the height of the worksurface member.

30

Indeed, any object can be placed between the overhead unit and the worksurface member without it being disturbed due to height adjustments. The overhead member **110** is preferably secured to the work surface member **10** using a C-shaped clamp **114** shown in FIG. 11, although other methods of attachment are possible, including the use of fasteners passing through the worksurface member.

In an exemplary embodiment, shown in FIGS. 9-11, the overhead member **110** includes a storage unit **116**. The storage unit **116** has parallel side walls **118**, a top wall **120**, a bottom wall **122** and a back wall **124** defining the back surface **112**. The storage unit **116** is secured to top portions **127** of a pair of support legs **126**. Bottom portions **129** of the support legs are positioned on the worksurface member **10**. The storage unit **116** has an opening **128** framed by the side walls **118**, top wall **120** and bottom wall **122**. As shown in FIG. 9, the opening has a door positioned in it. The door can be a tambour door **130**, as shown in FIG. 9, a flipper door, a hinged door, or a sliding door. Alternatively, a drawer can be disposed in the opening.

It should be understood that a wide variety of overhead members are available. Accordingly, the overhead member is not limited to the aforescribed storage unit. For example, an open shelf **132**, such as those shown in FIG. 7 and FIG. 50, can be installed on the worksurface member **10**. The shelf **132** has a bottom surface **134** and three sides forming a rim **136**. As with the storage unit, the shelf **132** is supported by a pair of support legs **126**. As shown in FIGS. 50-51, a mounting plate **1036** can be attached to the top of the support legs **126** in a well known manner such as welding. The mounting plate **1036** and the bottom surface **134** have holes **1038** into which bolts (not shown) can be inserted so as to attach the bottom surface **134** of the shelf **132** to the support legs **126**. A rear wall of the shelf defines the back surface.

The support legs **126** can be attached or unattached to the worksurface member **10**. Attachment can be achieved in a well known

37

manner by bolting the bottom of the support legs **126** to the top surface **12** of the worksurface member **10**. The embodiment of FIGS. 50-56 shows an alternative form of attachment. A base plate **1040** shown in FIG. 55 is attached in a well known manner, such as welding, to the bottom of the frame **1042** of the support leg **126** shown in FIGS. 53-55. The top of the base **1044** of a J-shaped clamp **1046** (see FIG. 56) is then attached to the underside of the base plate **1040** by inserting bolts through holes **1048** and into the base plate **1040**. The above-described support legs **126** are shown in FIGS. 50 and 53 and are attached to the worksurface member **10** by sliding the back edge **18** between the clamp **1046** and rotating the handle **1050** so that the top **1052** of the clamp engages the bottom surface **14** of the worksurface member **10**.

The above-described leg support and clamp structure of FIGS. 50-56 can be used to attach a closed cabinet to the worksurface member **10**.

The support legs **126** of FIGS. 7 and 50-56 each have a rear surface **125** positioned forwardly of the back surface **112** of the overhead member. In such an embodiment, a tackboard, having a tackable surface, can be attached to the rear surface of the legs. A rear surface of the tackboard is maintained forwardly of the rear surface of the overhead member. As mentioned previously, the tackboard can be secured to the overhead member, even if the worksurface member is height adjustable.

In addition to the overhead, various other storage devices can be secured to the worksurface member. For example, as shown in FIG. 5, a cabinet assembly **500** and tool rail assembly **540** are secured to the back edge of the worksurface member. It should be understood that these members can be secured at an infinite number of locations along the back or side edges of the worksurface member, and are not dependent on any particular structure or holes for their placement.

As shown in FIGS. 25-27, the cabinet assembly **500** includes a cabinet member **502** and a support member **504**. The cabinet member **502** has two side walls **506**, a back wall **508**, a top wall **510**, and a bottom wall

38

522. The side walls each have two vertical rows of holes **523** which oppose each other. The holes **523** are adapted to receive posts. The posts can be arranged in a variety of patterns to support shelves.

5 The support member **504** includes an upper section **512** having a support surface **513** and an arm **514** extending upwardly from the back edge of the upper section **512**. The support member also includes a lower section **516** having a support surface **517** which rests on and engages the top surface **12** of the work surface member **10**. A web section **519** interconnects the upper and lower support sections. The support member **504** also

10 includes a C-shaped mounting member **518** which is adapted to slidably engage the work surface member **10**. The size of the opening **520** formed by the C-shaped member is slightly greater than the thickness of the worksurface member **10**. To install the support member, a user slides the support member **504** on to an edge of the worksurface member as shown in

15 FIG. 25 and installs a screw to clamp the support member **504** to the work surface member **10**. Note that the C-shaped mounting member **518** may be integral with the support member **504** (see FIGS. 25-27) or it may be separate. An example of a separate C-shaped mounting member **518** is shown in FIGS. 80-82. The separate C-shaped mounting member **518** has a

20 top plate **521** which is placed adjacent to the bottom surface of lower section **516** and is attached thereto via a number of screws **525** inserted through holes formed in the top plate **521** and into the bottom surface of the lower section **516**.

25 The cabinet member is disposed on the support member **504**, so that the back wall **508** engages a front surface of the arm **514** and the bottom wall **522** engages the upper support surface **513**. The cabinet member is secured to the support member **504** with a plurality of fasteners, as shown in FIG. 26.

30 The tool rail assembly **540**, shown in FIGS. 28-30, includes a support member **550**, a pair of rail members **560** and a tool **570**. The support member **550** includes a base **552**, an arm **554** extending upwardly from the

39

base **552**, and a support flange **556** extending outwardly from the base **552**. The base **552** includes a lower support surface **558** which is disposed on and engages the top surface of the work surface member. The base also includes a downwardly extending flange **560** which engages the back edge of the work surface member when the support member **550** is disposed on the worksurface member. The flange **560** includes a boss **562** having a hole **564** disposed in it. A J-shaped clamping member **566** is disposed in the hole **564**, and a nut **568** is secured to the top of the clamping member **566**. As the nut is tightened, the support member **550** is secured to the work surface member by the clamping member **566**. Alternatively, the support member can include a C-shaped mounting member and screw as described above for mounting the tool rail assembly to the work surface member.

An upper and lower rail member **560** each include a back plate **572**, a plurality of rails **574** configured as T-shaped members extending outwardly from the back plate **572** in a generally horizontal orientation, and an upper lip **576** that curves outwardly and downwardly. The upper lip **576** of the lower rail member operably engages a downwardly extending portion **578** of the bottom most T-shaped member **574** of the upper plate so that the plate members are interlocked. The plate members are disposed on the support flange **556** and the back plate **572** engages the arm member **554**. The plate members are secured to the arm member with a plurality of fasteners (not shown).

The tool, configured in FIGS. 28-29 as a tray, includes a bottom wall **580**, a pair of side walls **582** and a back wall **584**. The forward edge **586** of the bottom surface has a cut away portion, or notch **588**, so that a user can grip various items disposed in the tray. A curved lip **590** extends rearwardly from the back wall **584** of the tray. Alternatively, a channel extends outwardly from the back wall. The curved lip **584** or channel are adapted to engage an upwardly extending portion **592** of the T-shaped member as the back surface of the back wall **584** rests up against the top of the T-shaped member. Thus, the tray can be disposed on and releasably engage any one of the T-shaped

40

members. It should be understood that any number of trays can be disposed on the tool rail. It should also be understood that other tool devices, besides a tray, can be configured to engage the T-shaped rail members. For example, telephone stands and file holders can be also be used.

5 Alternative support members **550'** are shown in FIGS. 80-81. The support member **550'** includes a base **552'**, an arm **554'** extending upwardly from the base **552'**, and a support flange **556'** extending outwardly from the base **552'**. . A separate C-shaped mounting member **518** is attached to the bottom of the base **552'** by inserting a number of screws **525**
10 through holes formed in the top plate **521** and into the bottom of the base **552'**. Once attached, the top plate **521** lies adjacent to the bottom of the base **552'**. Next, the back edge of the work surface is inserted into the space formed between the bottom plate **527** and the top plate **521** and the mounting screw **529** is tightened so that the support member is attached to the
15 worksurface.

 An upper and lower rail member **560'** (FIG. 80) or a fabric covered tackable surface **531** (FIG. 81) may be attached to the support members **550'**. As shown in FIG. 80, for each member **560'** a plurality of U-shaped rails **574'** are formed from a single sheet of material, such as steel or
20 aluminum. Consecutive U-shaped rails **574'** are separated from one another by rectangular channels **533**. The upper and lower rail members **560'** and the tackable surface **531** are each attached to a rectangular mounting board **535** via fasteners **537**. The rectangular mounting board **535** is then attached to the arm **554'** by inserting fasteners **539** through holes in the board **535** and
25 into holes **541** formed in the arm **554'**.

 The tool shown in FIGS. 28-29, such as a tray, may be attached to the upper rail member **560'** in a similar manner that the tool is attached to the upper rail member **560** of FIGS. 28-30.

 In a preferred embodiment, the legs **20** of the desk **2** are height
30 adjustable, as shown in FIG. 11. Each leg **20** includes a lower member **25** and an upper member **23** slidably received in the lower member **25**. The

upper member **23** can be raised or lowered within the lower member **25**, which remains stationary. In this embodiment, the modular maintainer **34** is attached to the lower member **25**. Accordingly, the module maintainer **30** remains stationary when the upper member **23**, and attached worksurface member **10**, are raised or lowered.

A height adjustment mechanism **160**, disposed in each leg **20**, interconnects the support member **29** and the mounting bracket **28**. The mechanism includes a drive tube **162** and a screw **164**. A top end of the screw **164** is rotatably mounted to the mounting bracket **28**. The lower end of the screw threadably engages a nut **166** mounted in the top portion of the drive tube **162**. A first bevel gear **168** is mounted to the top end of the screw **164** and operably engages a second bevel gear **172** mounted to a horizontal drive shaft **174**. The screw **164** may be located in a variety of positions, such as near the front of the leg **20**.

In operation, the mechanism **160** can be actuated either manually or automatically. For manual operation, a miter gear box **176** is secured to the bottom surface **74** of the worksurface member as shown in FIG. 17. It should be understood that one skilled in the art would recognize how to design a miter gear box **176** in order to provide a differential gearing system. Furthermore, one of ordinary skill in the art would recognize that the shape of the miter box **176** can have a wide variety of shapes, such as rectangular, without departing from the spirit of the invention. Accordingly, the details of the miter box have been omitted for simplicity. An end of the drive shaft **174**, which extends from each leg **20**, is disposed in the gear box. A tube **180** and extendible crank **170** extend forwardly from the gear box **176**. In operation, a user rotates the crank **170**, which causes the gear box to rotate the drive shafts **174**. The drive shafts **174**, in turn, cause the screw **164** in each leg to rotate through the intermeshing of bevel gears **168**, **172**. When rotated, the screw **164** engages the threaded nut **166** in the drive tube **162**, thereby causing the mounting bracket **28** and worksurface member **10** to move in a vertical direction.

42

For automatic operation, the mechanism **160** includes a motor **182** mounted to the bottom surface **14** of the worksurface member, as shown in FIG. 19. It should be understood that one skilled in the art would recognize how to design a motor **182** in order to automatically rotate the pair of drive shafts **174**. Furthermore, one of ordinary skill in the art would recognize that the shape of the motor **182** can have a wide variety of shapes, such as rectangular, without departing from the spirit of the invention. Accordingly, the details of the motor **182** have been omitted for simplicity. When turned on, the motor **182** rotates the pair of drive shafts **174**, which move the worksurface member in the same way as just described for manual operation.

Alternatively, a nut **190** can be secured to the bottom end of the upper member **23** of the leg, as shown in FIG. 21. A screw **192** is provided which threadably engages the nut **190** and is rotatably attached to the foot member **29**. The screw includes a drive head **194** that extends below the bottom of the foot member **29**. The screw **192** may be in several positions, such as the rear of the leg, without departing from the spirit of the invention. In operation, a user turns the drive head **194** which rotates the screw **192** and causes the upper member **23** to move in a vertical direction.

The desk is also provided with a support member **29** attached to the bottom of each leg **20**. In a preferred embodiment the support member includes a leveling device, as shown in FIGS. 11 and 21. The leveling device provides leveling for the C-shaped desk while simultaneously maintaining a low profile at the forward end of the protruding foot member. For a complete description and disclosure of that device and the benefits of having a C-shaped leg with a low-profile foot member, see co-pending U.S. Provisional Patent Application Serial Number 60/006,834, entitled Leveling Device For A Support Leg, the entire disclosure of which is incorporated herein by reference.

The leveling device is typically not used with the third leg **326**, which is positioned at the corner of the corner table, as shown in FIG. 4, or with the two support legs, which are attached to the module maintainer **30** on

43

the peninsula table **350**, as shown in FIG. 33. Indeed, an elongated foot member at those locations could unnecessarily interfere with the user's chair or feet. Thus, the support member used at those locations shown in FIG. 37, simply includes a pair of adjustable glide members **364** disposed in opposite ends of the foot member **366**. The glide members **364** can be used to adjust the height and level of the support member. The third leg **326** typically employs the manual height adjustment mechanism described in FIG. 21. The third leg **326** may or may not employ the top plate for attachment to the work surface member **354** as shown in FIG. 37. Furthermore, the removable top support **327** may have a variety of shapes such as shown in FIGS. 37 and 94A-C.

As shown in FIG. 6, an alternative embodiment of the modular desk, called a bridge member **140**, has a worksurface member **10**, but not any legs. Rather, the bridge member **140** is adapted to be positioned in the space located between adjacent, spaced apart modular desks. Because the desks are modular, i.e., the length of the desks is maintained as a constant, the space between adjacent, spaced apart desks is maintained as a constant (L). For example, the space can have a length L of approximately 6". The total amount of space for three or more desks would be multiples of L. Thus, three desks in series would have two spaces therebetween and a total space of 12". Note that the bridge member **140** also has a width equal to the length L of the space.

The worksurface member **10** of the bridge member **140** is releasably attached to a pair of adjacent desks using a bridge plate **142**, shown in FIG. 14. When installed, the top surface **12** of the bridge member is maintained substantially flush with the top surfaces **12** of the adjacent work surface members.

When using a bridge member **140**, a separate module maintainer **30** and power unit must also be attached to adjacent module maintainers **30** and power units **70** positioned on either side of the module maintainer **30** and power unit. As described previously, the sidewalls **31** of

~~44~~

the abutting modular maintainer support members are preferably interconnected with a plurality of fasteners **40** as shown in FIG. 14.

Another variation of the modular desk is an extension member **150**, shown in FIG. 5. The extension member **150** includes a work surface member **10**, a module maintainer **30** and one leg **20** attached to the bottom surface **14** of the work surface member adjacent one of the side edges **15**. The extension member has a free edge **152** opposite the side edge supported by the leg. The free edge **152** is adapted to be releasably secured to the side edge of an adjacent desk using a bridge plate. The top surface **12** of the extension member work surface member is maintained substantially flush with the top surface of the work surface member of the adjacent desk. Similarly, the free edge of the module maintainer and power unit is attached to the adjacent module maintainer and power unit as discussed previously.

Yet another variation of the modular desk is the corner desk **320**, shown in FIG. 4. The corner unit can have two or three legs. The third corner leg **326** can be made height adjustable. When a third leg is installed, a corner module maintainer **330** is attached to the third leg **326**, as shown in FIG. 22. The module maintainers **30**, positioned perpendicularly to each other and running along the back edges of the corner desk, are then attached to opposing sides of the corner module maintainer **330** by fastening together interfacing sidewalls. Similarly, a corner power unit **340** can be secured to the third leg **326** and a bottom of the corner module maintainer **330**. The power units **70** running perpendicular along the back edges of the corner desk are electrically interconnected with the corner power unit **340**.

As shown in FIG. 33, a peninsula desk **350** has an elongated work surface member **354** extending forwardly from a pair of support legs. The free end **355** of the work surface member **354**, which preferably has an arcuate shape, is supported by a third support leg **352**. The peninsula desk **350** provides a user with additional work surface area. Typically, the peninsula desk **350** is installed between a pair of two-legged modular desks, so as to provide a shared work surface area for users of the adjacent desks.

45

A tear-drop shaped table **360** and a D-shaped table **362** are shown in FIGS. 31 and 32 respectively. These tables can be incorporated into various systems of modular desks, for example, in order to provide additional work surface, as shown in FIG. 1. One aspect of these tables is the modular support assembly **700** used to support a tear-drop shaped work surface member **361** and a D-shaped work surface member **363**.

The modular support assembly **700** includes a tube **702**, a rod **704**, an upper support bracket **706** and a plurality of feet members **708**, **710**. Each foot member **708**, **710** includes a base section **712** and a support member **714**, **716** extending outwardly from the base section. A caster **718** is attached to the end of each support member **714**, **716** and is adapted to engage the floor. The base section **712** includes an inner concave surface **720** shaped to receive the rod **704**, an outer convex surface **722**, and an upper and a lower conically shaped surface **724**, **726**. The tube **702** has four lobes **728** or curved portions, each one shaped to receive the convex surface **722** of the base section **712**.

The upper support bracket **706** has a center portion **730** and a plurality of arms **732** extending outwardly from the center portion **730**. The support bracket for the D-shaped table includes three arms, while the support bracket for the tear-drop shaped table has four arms. The center portion **730** of the bracket also has an opening **734** passing through it. When installed, a one piece or a two piece washer **736** is interposed between the support bracket **706** and a top portion of the tube **702**. To provide height adjustment of the worksurface member, additional washers can be installed, thereby increasing the distance between the worksurface and the floor.

To assemble the modular support assembly **700**, a nut **736** is first threaded onto a lower portion of the rod. Then, a cone shaped washer **730**, opening downwardly and shaped to receive the upper surface **724** of the base section, is disposed on the rod **704**. A second cone shaped washer **742**, opening upwardly and shaped to receive the bottom surface **726** of the base section, is threaded onto the rod **704**, leaving a space between the two

46

washers **740, 742**. Next, the feet member **708, 710** are positioned between the two washers **740, 742** such that the inner concave surface **730** of each foot interfaces with the rod **704**. Either the bottom cone washer or the nut is then tightened, thereby clamping the feet members between the washers **740, 742** as they interface with the upper and lower surfaces **724, 726** of the base section. A bottom portion **744** of the tube is then disposed over the base sections of the plurality of feet. An inner concave surface **746** of the tube engages the outer convex surface **722** of the base sections.

Finally, the upper support bracket **706** is placed on top of the two-piece washer **736** which is positioned on top of the tube member **702**. An upper end **748** of the rod passes through the opening **734** in the center portion **730** of the bracket and a nut **750** is threaded onto the upper end **748** of the rod. When tightened, the nut **750** and rod **704** clamp together the upper bracket **706**, the tube **702**, and the feet members **708, 710**.

By using a two-piece washer between the tube and support bracket, the washer can be easily removed simply by loosening the nut **750**, removing the washer (or inserting additional washers) from between the tube and support bracket, and retightening the nut **750**. Thus, the support assembly does not have to be completely disassembled to exchange, replace, or add new washers. A plurality of washers can be used to provide the work surface member with height adjustability.

The modular support assembly has several advantages over conventional supports. For example, if a user wishes to exchange a shorter foot member **710**, as shown in FIG. 32, for a longer foot member **708**, the user simply loosens the bottom cone washer, slides the foot member out from between the two cone washers and from beneath the tube, and installs a new foot member in its place. If it is desired to only have three feet members, as shown in FIG. 32, one simply removes one of the feet and installs a spacer **760** in its place. The spacer is configured the same as the base section of the foot member, but does not include a corresponding support member or caster.

47

It should be understood that a user can reconfigure the support assembly to include one, two, three or four legs. Similarly, the assembly can contain any combination of shorter or longer legs. The user may wish to have one or more legs shortened to minimize interference with the user's feet, or lengthened to increase the stability of the worksurface. Thus, the modular support assembly provides a great deal of flexibility in configuring a support for a table, while minimizing the cost and number of parts the user needs for that reconfiguration.

When creating a workspace environment, a plurality of modular desks 2 can be arranged in a predetermined pattern so as to form a modular desk system as shown in FIGS. 1, 2 and 7. The plurality of modular desks 2 can be arranged in a side-by-side pattern, a back-to-back pattern, or a combination of such patterns.

For example, to assemble two modular desks 2 in a side-by-side arrangement, as shown in FIG. 15, an installer places the desks 2, having matching depths, next to each other, such that the side edges 15 abut each other. In addition, the desks 2 are positioned such that the boundary surfaces 32 lie flush or lie in the same plane as each other. When so arranged, cables laid on the ledge 232 may pass from that ledge 232 to the next ledge 232. It should be understood that any number of modular desks can be arranged in this manner.

When two desks 2 are arranged in a side-by-side pattern, opposing ends of adjacent power units 70 are also aligned. Accordingly, the electrical connector port 76 extending from a first desk can be connected to the electrical connector port 76 positioned in the adjacent desk, such that the first desk supplies power to the adjacent desk as shown in FIG. 15. When a plurality of desks are positioned together, and the desk's power units are interconnected, the entire system can be powered from a single source.

To arrange two desks in a back-to-back arrangement, the installer simply positions the desks such that the boundary surfaces of the adjacent module maintainers abut each other. When so arranged, as shown

48

in FIG. 13, accessory members **100** can be installed on top of each boundary wall **48** without having to move or adjust the abutting desks. Similarly, overhead members **110** can be installed on the worksurface member **10** without having to move or adjust abutting desks. Furthermore, cables can be passed over the back edge of the worksurface member **10** and laid on the ledge **232** or in the trough **224** without having to move or adjust the adjacent modular desk, as shown in FIGS. 10 and 11.

The modular desks can also be used in combination with wall panel systems, such as the ACTION OFFICE or ETHOSPACE wall panel systems commercially available from the Herman Miller Inc. of Zeeland, Michigan. As shown in FIG. 7, the modular desks **2** are positioned such that the boundary surface **32** abuts the wall panel surface **202**. When positioned in this manner, the modular desk can be mechanically fastened to the panel with a connector bracket **800**, as shown in FIG. 23, in order to provide support for the panel and to prevent the desk from being displaced.

The connector bracket **800** includes a plate member **802** and a plurality of hooks **804** extending rearwardly from the plate member. The hooks **804** are shaped to operably engage slots **806** positioned in a standard **808** attached to an end of the panel **200**. The plate member **802** has four openings arranged in a generally vertical direction. Two upper holes **810** are positioned so as to be aligned with the holes **814** located in the sidewall **31** of the module maintainer support member. Two lower openings **813** are slotted in the vertical direction. Two fasteners are disposed in the slots **813** and secure a foot bracket **816** to the connector bracket **800**. The foot bracket **816** includes two perpendicular flanges **818**, **820** and a hook member **822** extending outwardly from one of the flanges. The hook member **822** operably engages a back portion **823** of the support member **29**. The two lower openings are slotted to ease installation of the foot bracket **816**.

When installed, the hook member **822** on the foot bracket **816** engages the back **823** of the support member, and the plate **802** is attached to the side wall with a plurality of fasteners. In addition, the hook members

49

804 are inserted into and operably engage the slots **806** in the standard **808**. In this way, the modular desk is removably secured to the panel.

Other examples of attaching the modular desk **2** to a panel or wall such that the boundary surface **32** abuts the wall panel surface **202** is shown by the furniture and panel systems of FIGS. 58-79. As shown in FIG. 58, a pair of panels **200** are attached to and aligned along each other along a seam **1056** and are positioned substantially perpendicular to a support surface **1060**, such as a floor. The panels **200** include stands or glides **1058** that aid in supporting the panels **200** on the support surface **1060**. A piece of furniture, such as the modular desk **2**, is positioned so that the back edge **18** of the worksurface member **10** is substantially parallel to the panels **200** and the side walls **31** of the support members **40** are substantially perpendicular to the panels **200**. Note that the side walls **31** may include support stands or glides **1062** where rotation of the glide causes a screw to rotate and either raise or lower the desk. An attachment system **1064** for attaching the side walls **31** and the panels **200** is shown in part in FIG. 58. A connector bracket **1066** is positioned above the support surface **1060** and is attached to the panels **200** and the side walls **31** by inserting fasteners, such as bolts, through the slots **1068** of the bracket **1066** and into the corresponding holes **1070** formed in the side walls **31**. As shown in FIGS. 58, 67 and 90-93, the rear end of the bracket **1066** has a plurality of angled hooking elements such as T-shaped hooks **1072**. The hooks **1072** are angled relative to the rectangular plate **1074** by approximately 30° to match the angled slot and are pushed into slots or gaps **1076** formed between consecutive tabs **1078** that are attached to and arranged vertically along the seam **1056** between the panels **200**. Once inserted through the gaps **1076**, the bracket **1066** and hooks **1072** are pushed downward (see arrow in FIG. 91) so as to engage the tabs **1078**. The bracket **1066** also includes a steel dislodgment clip **1080**. As shown in FIGS. 58, 67, 90 and 92-93, the dislodgment clip **1080** includes a first pair of prongs **1082** that engage the bracket **1066** by having two L-shaped appendages **1084** slid between spaces **1086** and engage the edges

50

1088 of the bracket **1066**. Vertical appendage **1090** is inserted through slot **1092**. A second pair of prongs **1094** are angled so as to be parallel to hooks **1072** and to engage the panel.

As shown in FIGS. 90 and 92-93, when the hooks **1074** are slid down to properly engage in the tabs **1078**, one prong **1094** and a middle finger **1097** of the bracket **1066** will enter (the prong **1094** will spring into the gap) into and fill the gap **1076** (see FIG. 92). Since the gap **1076** is filled, the bracket **1066** cannot move up or down relative to the seam **1056**. The plate **1074** cannot be removed until the prong **1094** is pulled or pushed out of the gap **1076**. The prongs **1094** have lengths long enough to penetrate beyond gap **1076**.

Note that the connector bracket **1066** shown in FIGS. 57, 58 and 67 is designed to attach a modular piece of furniture to the ACTION OFFICE wall panel system commercially available from Herman Miller, Inc. of Zeeland, Michigan. A connector bracket **1066'** and dislodgment clip **1080'** to be used for attaching modular furniture to the ETHOSPACE wall panel system commercially available from the Herman Miller Inc. of Zeeland, Michigan are shown in FIGS. 66, 68 and 78. As shown in the figures, connector brackets **1066** and **1066'** and dislodgment clips **1080** and **1080'** are similar in shape, structure and function. One difference is that the prongs **1094'** are offset by approximately 0.20" and are parallel to plate **1074'**. Furthermore, the plate **1076'** includes two additional slots **1095** which receive the appendages **1084'** of the dislodgment clip **1080'**. The prongs **1094'** are parallel to and offset by approximately 0.11" with respect to the prongs **1082'**. The prongs **1094'** have lengths long enough to penetrate beyond gap **1076'**.

A second component of the attachment systems **1064** of FIGS. 58-63 and 66-69 is a support plate **1096** lying on the support surface **1060**. The support plate can be used with both the OFFICE ACTION and ETHOSPACE panel systems mentioned previously. As shown in FIGS. 61, 62 and 69, the support plate **1096** includes a panel receptacle **1098** for receiving a portion of a panel **200** and a wall receptacle **1100** for receiving a

51

portion of the side wall **31** of the piece of furniture. The panel receptacle **1098** is shown in FIGS. 61 and 69 and has three rectangular mounting pieces **1102** that are formed from and are substantially perpendicular to the support plate **1096**. The mounting pieces **1102** define an area A that allows a support stand or glide **1058** of the panel **200** to be inserted therein. The mounting pieces **1102** abut and engage the sides of the glide **1058** so as to prevent the removal of the support plate **1096** from the panel **200** (see FIG. 61)

The support plate **1096** is adjustable to accommodate different sizes of pieces of furniture. As shown in FIGS. 61, 62 and 69, the wall receptacle **1100** has a pair of slots **1106** and **1108**. A tab **1110** formed in the panel receptacle **1098** is inserted into one of the slots **1106** and **1108**, depending on the type of modular desk being attached. For example, if tab **1110** is inserted into slot **1106**, then a power crank adjustable table desk can be attached to the wall receptacle **1100**. Attachment is accomplished by lowering the glide **1062** so that a mounting piece, such as the front tab **1112**, is inserted into a slot (not shown) formed in the bottom of the glide **1062**. Attachment of a fixed height table desk is accomplished in the same manner as the power crank adjustable table desk, except that the tab **1110** is inserted into slot **1108**.

Once the desk **2** is attached to the panels **200**, a second desk **2** can be attached adjacent thereto in a similar manner as shown in FIG. 60. In that case, the desks **2** are attached to the panels **200** by a common connector bracket **1066** or **1066'** and a pair of nuts and washers **1114** and bolts **1116** inserted through the aligned slots **1068**, **1068'** and holes **1070**. Ganging plate **1118** may be attached to both of bottom surfaces **14** of the desks **2** to insure that that the side edges of the worksurface members are separated by a uniform gap.

Note that if either bracket **1066** or bracket **1066'** is to be attached to an end panel **200**, then a standard **808** can be attached to the free end of the panel **200** in a manner as shown in FIGS. 23 and 60. The standard **808** has a plurality of slots **806** in which the hooks **1072** and **1072'**

52

can be inserted. A bolt plate **1116** is inserted over the slots **1068**, **1068'** so that access to the slots is prevented. The threaded posts **1118** of the bolt plate **1116** are inserted into slots **1068**, **1068'** and into the corresponding holes **1070** and attached to the side walls **31** by threading the nuts and washers **1120** onto the posts **1118**.

Another variation of attachment of a modular desk **2** to a panel **200** is to have a side wall **31** adjacent to and parallel to the panels **200**. In this case, a L-shaped connecting brackets **1122** and **1122'** are used for attachment to ACTION OFFICE and ETHOSPACE panels respectfully. Brackets **1122** and **1122'** are identical to brackets **1066** and **1066'**, respectively, except that the plates **1074** and **1074'** are bent by 90° about the fold lines **1124** and **1124'**, respectively, as shown in FIGS. 70 and 71. The corresponding dislodgment clips are also bent by 90° as shown in FIGS. 71, 71, 77 and 79. A bolt plate **1116** attaches the brackets **1122** and **1122'** to the side wall **31** in the manner described previously. Likewise, the hooks **1072** and **1072'** are attached to the seam **1056** between the panels **200** in the manner described previously.

In the variation shown in FIGS. 64, 65 and 72, an adjustable support plate **1126** is used to attach modular furniture to the previously mentioned ACTION OFFICE and ETHOSPACE panel systems. The support plate **1126** includes a panel receptacle **1128** for receiving a portion of a panel **200** and a wall receptacle **1130** for receiving a portion of the side wall **31** of the piece of furniture. The panel receptacle **1128** has two rectangular mounting pieces **1102** and a wall **1131** attached to one of the mounting pieces **1102**. The glide **1058** is placed in the area A and engaged by the mounting pieces **1102** and wall **1130**. Spacers **1104** may be attached to one or more of the mounting pieces **1102** so as to provide better engagement with smaller diameter glides **1058**, such as those used in the ACTION OFFICE panel system. As shown in FIGS. 64 and 72, the panel receptacle **1128** has three pairs of slots **1106**, **1108** and **1132**. A pair of tabs **1110** formed in the wall receptacle **1130** are inserted into one of the pair of slots **1106**, **1108** and

1132, depending on the type of modular desks and panels being attached to each other. For example, if tabs 1110 are inserted into slots 1106, then a power crank adjustable table desk can be attached to ETHOSPACE panels by lowering the glide 1062 so that the front tab 1112 is inserted into a slot (not shown) formed in the bottom of the glide 1062. Attachment of a fixed height table desk to OFFICE ACTION panels is accomplished in the same manner as the power crank adjustable table desk/ETHOSPACE system, except that the tabs 1110 are inserted into slots 1108. Insertion of tabs 1110 into slots 1132 allows either fixed height tables to be attached to ETHOSPACE panels or power/crank adjustable tables attached to ACTION OFFICE panels.

Alternatively, the modular desk can be positioned such that the side of the desk abuts the wall panel surface as shown in FIG. 35. In this embodiment, an alternative connector bracket 840, shown in FIG. 24, can be used to secure the desk to the panel, as shown in FIG. 35. The connector bracket includes a plate member 842 and a flange 844 extending perpendicularly from the plate member. The flange includes a plurality of hook members 846 adapted to operably engage slots in a panel standard. The plate member 842 includes a plurality of openings as previously described, thereby providing a means for attaching the connector bracket to the module maintainer and to a foot bracket.

The modular desk can also be electrically connected to adjacent panels, thereby supplying power to individual modular desks or a system of modular desks. For example, as shown in FIG. 35, a harness 900 can interconnect and supply power from a panel receptacle module 902 to a socket and corresponding receptacle module in the power unit. Alternatively, the harness can be used to interconnect and supply power from a building source, such as the floor outlet 904 shown in FIG. 35, to the socket and corresponding receptacle module disposed in the power unit attached to the modular maintainer and support legs.

In yet another embodiment, shown in FIGS. 34 and 36, the harness 900 interconnects and supplies power from the panel receptacle

54

module **902** to the electrical connector ports positioned in the power unit. In this embodiment, the harness can be disposed in a cable/power transition unit **906** extending outwardly from and attached to the panel wall. The transition unit includes a panel **908** and a cover **910** spaced apart from and attached to the panel **908**. The harness **900** is disposed between the cover **910** and panel **908** so that it does not become entangled with the user's feet or become inadvertently disconnected. Similarly, cables or wires placed on the ledge can be passed through the open space at the end of the module maintainer and be disposed in the transition unit. In this way the cables or wires can be run to the base of the panel and passed into wire management channels in the base of the panel. The transition unit **906** also serves as a support for an off-panel worksurface member.

Another embodiment is shown in FIGS. 73-76 and 82-89 where a three legged corner table **1134** is attached to a panel **200**. The corner table **1134** includes two module maintainers **30** mounted to and extend rearwardly from corresponding pair of legs **20** as shown in FIG. 73. As shown in FIG. 73B, a wide variety of worksurfaces **1134** may be attached to the top of legs **20** and **1137**. The module maintainers **30** may have the structure of either the embodiment of FIG. 8 or FIG. 42. The module maintainers **30** are attached to each other by a corner bracket **1136** that is attached to the middle leg **1137** via nuts and bolts **1138**. Attachment of an ETHOSPACE panel is accomplished by attaching plate **1140**, bracket **1142'**, and end cap **1144** in series to the left support member **40** via the bolt plate **1116**. Note that plate **1140** is used to connect two corner tables together when electrical raceways are used. The plate **1140** may or may not be used when attaching the corner table to a panel **200**. The exposed corner between the two module maintainers **30** is covered by a corner mask **1146** that is attached by one or more hook and loop connectors **1148**, such as those sold under the trademark VELCRO. A pair of U-shaped covers **1139** may be used to cover the flexible shafts **1161**. The connectors **1148** are attached to both support members **40** and inside the corner mask **1146**. Note that a pair of drive shaft

55

assemblies **174** and a crank assembly **170** interact with a height adjustment mechanism **160** such as that described with respect to FIGS. 16-21 so as to allow manual adjustment of the height of the table. Height adjustment can also be accomplished via motor **182** that is powered by a power pack **1141** in a manner described with respect to FIGS. 16-21.

The bracket **1142'** is shown in FIGS. 74 and 76 and has a structure similar to the bracket **1066'** shown in FIG. 68. One difference is that the bracket **1142'** is L-shaped. The dislodgment clip **1080'** is identical to the dislodgment clip shown in FIGS. 68 and 78. The bracket **1142'** is attached to an ETHOSPACE panel in the same manner that the bracket **1066'** is attached to the ETHOSPACE panel system. Similarly, the L-shaped bracket **1142'** shown in FIG. 75 can be attached to the table **1134** in the same manner as bracket **1066'**. Furthermore, the L-shaped bracket **1142** of FIG. 75 has a structure similar to that of bracket **1066** is attached to an OFFICE ACTION panel system in the same manner as described previously for bracket **1066**.

A two piece support plate **1096'** is placed on the support surface **1060**. The support plate can be used with both the OFFICE ACTION and ETHOSPACE panel systems mentioned previously. As shown in FIGS. 74 and 82-85, the support plate **1096'** includes a connector **1143** for the panel **200** and a connector **1145** for the glide **1062** for the corner table. Both connectors **1143** and **1145** are interconnected with one another by inserting threaded posts **1147** of the connector **1143** through slots **1149** and **1151** formed in the connector **1145**. As shown in FIGS. 82-83, connector **1143** is rectangular in shape have a width of approximately 2.5" and a length of approximately 12". As shown in FIGS. 84-85, connector **1145** is rectangular in shape have a width of approximately 2.5" and a length ranging from approximately 7.5" to approximately 8.5" depending on the panel being connected. For example, attachment of an ETHOSPACE panel is accomplished with a connector **1145** having a length of approximately 8.5" and an ACTION OFFICE panel would attached via a 7.5" long connector **1145**. Slot **1151** subtends an angle ranging from approximately 66.5° to

56

78.2°. The slot **1151** allows the connector **1143** to pivot relative to the connector **1145**. When the connector **1143** has been pivoted to a desired position, nuts and washers **1153** are screwed onto the posts **1147** so as to maintain the desired position.

5 Support plate **1096'** operates by inserting the glide **1058** in the area A defined by the tabs **1155** and **1157** and the bent rear wall **1169** of the connector **1145** in a manner similar to that described previously for tabs **1102**. A wall receptacle **1100'** for receiving a portion of the side wall **31** of the piece of furniture is shown in FIGS. 74 and 84-85. The wall receptacle **1100** has
10 two tabs **1159** that are inserted into the glides **1062** of the leg **1137**. By pivoting the connectors **1143** and **1145**, it is possible to adjust the attachment in view of the type of panel being attached.

 When installing the modular desks **2** and **1134** described previously up against a panel or wall, the accessory member **100** and
15 overhead member **110** can be installed, alone or in combination, on the modular desk **2** without the panel **200** or desk **2** having to be moved. Thus, the predetermined pattern, or footprint, of the system remains intact due to the uniformity of each modular desk footprint. Similarly, cables can pass over the back edge of the worksurface member and be laid on the ledge or in the
20 trough without the modular desk or panel being moved.

 In addition, since the rear surface of the support member is spaced apart from the panel, a wire access trough in the bottom of the panel can be accessed, by removing a cover, without moving the desk.

 It should be understood that a plurality of modular desks can be
25 arranged in a limitless number of predetermined patterns, either alone or in combination with a plurality of panels. In all such patterns, both the footprint of the modular desk and the footprint of the system are maintained as a constant by the module maintainers. Thus, any system employing the modular desk can be easily reconfigured to include accessory members, such
30 as screens, and overhead members, alone or in combination, without having to reconfigure, move or modify the preexisting pattern of modular desks

It should be understood that a plurality of modular desks can be arranged in a limitless number of predetermined patterns, either alone or in combination with a plurality of panels. In all such patterns, both the footprint of the modular desk and the footprint of the system are maintained as a constant by the module maintainers. Thus, any system employing the modular desk can be easily reconfigured to include accessory members, such as screens, and overhead members, alone or in combination, without having to reconfigure, move or modify the preexisting pattern of modular desks and/or panels. Similarly, cables can be passed over the back edge, stored and organized without moving any of the modular desk units. Thus, the module maintainer eliminates the problem of creep, and provides a unique device for creating simple but effective work spaces.

In addition, the modular power unit provides a unique way for powering and electrically connecting an entire desk system without reliance on either a panel or nearby wall outlet. By moving away from panel dependency, work space environments may be made more open and flexible.

Although the present invention has been described with reference to preferred embodiments, those skilled in the art will recognize that changes may be made in form and detail without departing from the spirit and scope of the invention. As such, it is intended that the foregoing detailed description be regarded as illustrative rather than limiting and that it is the appended claims, including all equivalents thereof, which are intended to define the scope of the invention.

We claim:

1. A modular desk positioned on a floor comprising:

5 a worksurface member having a front edge, a back edge, a top surface and a bottom surface;

a pair of legs, each attached to the bottom surface of said worksurface member, and each having a rear surface; and

a module maintainer comprising:

10 a pair of support members, each of said support members having a base section mounted to one of said legs and an arm extending rearwardly and upwardly from said base section;

15 a vertical wall extending between said arms of said support members, the vertical wall being parallel to and substantially the same length as the back edge of the worksurface member, the vertical wall being spaced rearwardly from the back edge of the worksurface member to thereby allow for the passage of cables between the vertical wall and the back edge, the vertical wall having a boundary surface which is the most rearward surface of the desk and a bottom edge spaced
20 apart from the floor to provide an open space between the floor and the vertical wall;

25 whereby said module maintainer allows the desk to maintain a constant footprint in a system of like desks regardless of whether cables are passed behind the rear edge of the worksurface member or under the module maintainer, or whether objects protrude into the substantially open space formed below the vertical wall.

2. The desk of claim 1 wherein said module maintainer further comprises

30 a beam member extending between said support members, said beam member comprising a base section having a top surface forming a ledge

59

which extends forwardly from said vertical wall, whereby cables can be passed over the back edge of said worksurface member and be laid on said ledge.

5 3. The desk of claim 2 wherein said beam member comprises said vertical wall integrally formed with said base section.

10 4. The desk of claim 2 wherein said base section of said beam member has an opening facing forwardly, whereby cables can pass through said opening and be stored in said base section.

5. The desk of claim 4 wherein said opening is elongated.

15 6. The desk of claim 5 wherein said base section of said beam member has a cavity formed within it, and wherein a bottom portion of said base section forms a trough, whereby said cables can be laid in said trough after passing through said opening.

20 7. The desk of claim 6 further comprising a modular power unit, said modular power unit comprising a housing mounted to a bottom of said beam member and a power distribution system disposed in said housing, said power distribution system electrically connectable with power distribution systems positioned in adjacent modular desks.

25 8. The desk of claim 7 wherein said power distribution system comprises a harness disposed in said housing, an electrical connector port attached to an end of the harness, and a receptacle module connected to said harness, said receptacle module adapted to receive an electrical plug, wherein said electrical connector port is adapted so as to allow electrical connection to a
30 connector port of a power distribution system positioned in an adjacent desk.

60

9. The desk of claim 1 further comprising an accessory member attached to said vertical wall.

5 10. The desk of claim 9 wherein said accessory member has a downwardly extending mounting member, and wherein each of said support members has an upwardly facing opening, wherein said mounting member is removably mounted in said opening in said support member.

10 11. The desk of claim 10 wherein said accessory member has a bottom surface engaging a top of said vertical wall.

15 12. The desk of claim 11 wherein said accessory member has a front surface and a back surface, wherein said back surface is maintained substantially flush with said boundary surface of said module maintainer, and wherein said front surface is positioned rearwardly of said back edge of said worksurface member, whereby cables can be passed over the back edge of the worksurface member through the opening between the back edge and the front surface of the accessory member.

20 13. The desk of claim 12 further comprising an overhead member removably mounted to said worksurface member, said overhead member having a back surface positioned forwardly of said front surface of said accessory member.

25 14. The desk of claim 9 wherein said accessory comprises a screen.

15. The desk of claim 14 wherein said screen is tackable.

30 16. The desk of claim 1 wherein each of said legs is height adjustable.

61

17. The desk of claim 16 wherein each of said legs comprises a moveable upper member and a stationary lower member.

5 18. The desk of claim 17 wherein said upper member is attached to the bottom surface of said worksurface member, said upper member disposed in said lower member, and a height adjustment device comprising a threaded member secured to one of said upper member and said lower member and a screw member adapted to threadably engage said threaded member, said
10 screw member rotatably mounted to the other of said upper member and said lower member, whereby rotation of said screw causes said screw to move vertically in relation to said threaded member thereby causing said upper member and said worksurface member to move vertically in relation to said lower member.

15 19. The desk of claim 1 further comprising an overhead member removably attached to said worksurface member, said overhead member having a back surface positioned forwardly of said boundary surface of said module maintainer.

20 20. The desk of claim 19 wherein said overhead member is positioned on the top surface of said worksurface member and is releasably clamped to the back edge of the worksurface member.

25 21. The desk of claim 20 wherein said overhead member comprises a pair of legs and a storage unit attached to a top portion of said legs, said legs releasably clamped to said work surface member.

30 22. The desk of claim 1 further comprising a cabinet assembly, said cabinet assembly comprising a single support member releasably clamped to the back edge of said worksurface member and a cabinet member attached

62

to said support member.

23. The desk of claim 1 further comprising a tool rail assembly, said tool rail assembly comprising a support member, a rail member attached to said support member, and a tool, said rail member comprising a back plate and a plurality of rails extending outwardly from said back plate, said rails adapted to support said tool.

24. A modular desk positioned on a floor comprising:
a worksurface member having a front edge, a back edge, a top surface and a bottom surface;
a pair of legs, each attached to the bottom surface of said worksurface member, and each having a rear surface; and
a module maintainer comprising:

a lower portion which is mounted to and extends rearwardly from each of said legs, the lower portion having a bottom surface spaced above the floor to provide a space below the module maintainer to thereby allow for the passage of cables below the module maintainer;

an upper portion extending upwardly and rearwardly from said lower portion, said upper portion comprising a generally vertical wall parallel to and substantially the same length as the back edge of the worksurface member, the vertical wall being spaced rearwardly from the back edge of the worksurface member to thereby allow for the passage of cables between the vertical wall and the back edge, the vertical wall having a boundary surface which is the most rearward surface of the desk and a bottom edge spaced apart from the floor to provide an open space between the floor and the vertical wall;

whereby said module maintainer allows the desk to maintain a constant footprint in a system of like desks regardless of whether cables are passed behind the rear edge of the worksurface member or under the module

maintainer, or whether objects protrude into the substantially open space formed below the vertical wall.

25. The desk of claim 24 wherein a top surface of said lower portion forms a ledge, whereby cables can be passed over the back edge of said worksurface member and be laid on said ledge.

26. The desk of claim 25 wherein said lower portion has an opening facing forwardly, whereby cables can pass through said opening and be stored in said lower portion.

27. The desk of claim 26 wherein said opening is elongated.

28. The desk of claim 26 wherein said lower portion has a cavity formed within it, and wherein a bottom of said lower portion comprises a trough, whereby said cables can be laid in said trough.

29. The desk of claim 24 further comprising a modular power unit, said modular power unit comprising a housing mounted to a bottom of said lower portion and a power distribution system disposed in said housing, said power distribution system electrically connectable with power distribution systems positioned in adjacent modular desks.

30. The desk of claim 29 wherein said power distribution system comprises a harness disposed in said housing, an electrical connector port attached to an end of the harness, and a receptacle module connected to said harness, said receptacle module adapted to receive an electrical plug, wherein said electrical connector port is adapted so as to allow electrical connection to a connector port of a power distribution system positioned in an adjacent desk.

64

31. The desk of claim 24 further comprising an accessory member mounted to said upper portion of said module maintainer.

5 32. The desk of claim 31 wherein said accessory member has a downwardly extending mounting member and said upper portion has an upwardly facing opening, wherein said mounting member is removably mounted in said opening and a bottom surface of said accessory engages a top of said upper portion.

10 33. The desk of claim 31 wherein said accessory member has a front surface and a back surface, wherein said back surface is maintained substantially flush with said boundary surface of said module maintainer, and wherein said front surface is positioned rearwardly of said back edge of said
15 worksurface member, whereby cables can be passed over the back edge of the worksurface member through the opening between the back edge and the front surface of the accessory member and be laid on the top surface of said lower portion and passed over the top surface and through said elongated opening and be laid in said beam.

20 34. The desk of claim 33 further comprising an overhead member removably mounted to said worksurface member, said overhead member having a back surface positioned forwardly of said front surface of said accessory member.

25 35. The desk of claim 31 wherein said accessory comprises a screen.

36. The desk of claim 35 wherein said screen is tackable.

37. The desk of claim 24 wherein said legs are height adjustable.

65

38. The desk of claim 37 wherein each of said legs comprises a lower member and an upper member attached to the bottom surface of said worksurface member, said upper member disposed in said lower member, and a height adjustment device comprising a threaded member secured to one of said upper member and said lower member and a screw member adapted to threadably engage said threaded member, said screw member rotatably mounted to the other of said upper member and said lower member, whereby rotation of said screw causes said screw to move vertically in relation to said threaded member thereby causing said upper member and said worksurface member to move vertically in relation to said lower member.

39. The desk of claim 38 wherein said threaded member is disposed in an end of a tube member, said tube member secured to a bottom of said lower member, and wherein said screw member is rotatably secured to said upper member, said screw member comprising a first bevel gear attached to one end, and a drive shaft rotatably mounted to a bottom of said worksurface member, said drive shaft comprising a second bevel gear intermeshing with said first bevel gear, whereby rotation of said drive shaft causes said second bevel gear to rotate which causes said first bevel gear to rotate which causes said screw member to operably engage said threaded member, thereby causing said worksurface member to move in a vertical direction.

40. The desk of claim 24 further comprising an overhead member removably attached to said worksurface member, said overhead member having a back surface positioned forwardly of said boundary surface of said module maintainer.

41. The desk of claim 40 wherein said overhead member is positioned on the top surface of said worksurface member and is releasably clamped to the back edge of the worksurface member.

66

42. The desk of claim 41 wherein said overhead member comprises a pair of legs and a storage unit attached to a top portion of said legs, said legs releasably clamped to said work surface member.

5

43. The desk of claim 24 comprising a cabinet assembly, said cabinet assembly comprising a single support member clamped to the back edge of said worksurface member and a cabinet member attached to said support member.

10

44. The desk of claim 43 wherein said support member comprises an upper and lower support surface and an arm member, said lower support surface engaging said work surface member, said cabinet disposed on said upper support surface and engaging said arm.

15

45. The desk of claim 24 further comprising a tool rail assembly, said tool rail assembly comprising a support member, a rail member attached to said support member, and a tool, said rail member comprising a back plate and a plurality of rails extending outwardly from said back plate, said rails adapted to support said tool.

20

46. A modular desk comprising:

a worksurface member having a front edge, a back edge, a top surface and a bottom surface;

25

a pair of legs mounted to said worksurface member, each of said legs having a rear surface;

a module maintainer comprising:

a pair of support members, each of said support members having a front surface, a back surface, a base section and an arm extending rearwardly and upwardly from said base section;

30

67

a front member disposed on the front surface of said support member, said front member having a top surface forming a ledge and a upwardly extending portion forming a front surface of a vertical wall;

a back member disposed on the back surface of said support member, said back member having a vertical portion forming a back surface of said vertical wall, said back surface comprising a boundary surface which is the most rearward surface of the desk.

47. The modular desk of claim 46 wherein said front member has a downwardly extending lip and said back member has a upwardly extending lip, said lips spaced apart from each other to form an elongated opening between them, said front and back members also forming a cavity between them, whereby cables can be passed through said opening and be stored in said cavity.

48. A modular desk comprising:

a worksurface member having a front edge, a back edge, a top surface and a bottom surface;

a pair of legs mounted to said worksurface member, each of said legs having a rear surface;

a module maintainer mounted to and extending rearwardly from said pair of legs, said module maintainer comprising a vertical boundary surface positioned rearwardly of said back edge of said worksurface member and said rear surface of said legs; and

a modular power unit comprising a housing mounted to a bottom of said module maintainer and a power distribution system disposed in said housing, said power distribution system electrically connectable with power distribution systems positioned in adjacent modular desks, and said housing positioned forwardly of said boundary surface;

whereby said module maintainer maintains the footprint of the desk when the desk is incorporated into a system of desks or panels and

68

electrically connected to adjacent desks.

49. The desk of claim 48 wherein said power distribution system comprises a harness disposed in said housing, an electrical connector port attached to an end of the harness, and a receptacle module connected to said harness, said receptacle module adapted to receive an electrical plug, wherein said electrical connector port is adapted so as to allow electrical connection with a connector port of a power distribution system positioned in an adjacent desk.

50. A modular desk system comprising:
a plurality of modular desks arranged in a predetermined pattern, each modular desk comprising:

a worksurface member having a front edge, a back edge, a top surface and a bottom surface;

a pair of legs, each attached to the bottom surface of said worksurface member, and each having a rear surface; and

a module maintainer comprising:

a pair of support members mounted to said legs, each of said support members having a sidewall, the sidewall being the outermost surface of each end of the module maintainer;

a beam member extending between said support members, the beam member having a bottom surface spaced above the floor to provide a space below the module maintainer to thereby allow for the passage of cables below the module maintainer;

a generally vertical wall extending between said support members, the vertical wall being parallel to and substantially the same length as the back edge of the worksurface member, the vertical wall being spaced rearwardly from the back edge of the worksurface member to thereby allow for the passage of cables between the vertical wall and the back edge, the vertical wall having a boundary surface which is the most rearward surface of the desk and a bottom

69

edge spaced apart from the floor to provide an open space between the floor and the wall;

whereby said module maintainer allows the desk to maintain a constant footprint in a system of like desks regardless of whether cables are passed behind the rear edge of the worksurface member or under the module maintainer, or whether objects protrude into the substantially open space formed below the vertical wall.

51. The modular desk system of claim 50 wherein said plurality of desks comprises at least two modular desks positioned such that the sidewall from one desk abuts the side wall of the other desk, wherein said desks placed side by side are connected by securing the sidewalls to each other with a fastener.

52. The modular desk system of claim 51 wherein said desks placed side by side each include a modular power unit, said power unit comprising a housing mounted to a bottom of said beam member and a power distribution system disposed in said housing, each of said power distribution systems electrically connectable with the power distribution system positioned in the adjacent modular desk.

53. The desk of claim 52 wherein each of said power distribution systems comprises a harness disposed in said housing, an electrical connector port attached to an end of the harness, and a receptacle module connected to said harness, said receptacle module adapted to receive an electrical plug, wherein said electrical connector port in each desk is connected to the an electrical connector port of a power distribution system in the adjacent desk, whereby said desk is supplied with power from the adjacent desk.

54. The modular desk system of claim 53 wherein at least one modular desk is adapted to receive an overhead member, wherein said overhead

member is removably mounted to said modular desk without moving said desks and modifying said pattern.

55. The modular desk system of claim 54 wherein said plurality of desks comprises at least two modular desks arranged such that opposing boundary surfaces of said module maintainers abut each other.

56. The modular desk system of claim 55 wherein said beam member comprises a base section having a top surface which forms a ledge, wherein cables laid on the ledge of one desk can be passed to the ledge of the adjacent desk.

57. The modular desk system of claim 56 further comprising a bridge member having a worksurface member, and at least two modular desks positioned in a side by side arrangement such that the desks form a space between them, said bridge worksurface member positioned in said space between the adjacent desks and removably mounted to said worksurface members of said desks.

58. The modular desk system of claim 57 further comprising an extension member, said extension member comprising a worksurface member, a leg mounted to one end of said work surface member, and a module maintainer attached to said leg, said module maintainer comprising a sidewall, wherein a free edge of said extension member is positioned adjacent to one of said plurality of modular desks and removably mounted to said worksurface member of said modular desk, and said sidewall of said modular maintainer is attached to the sidewall of an adjacent modular maintainer with a fastener.

59. The modular desk system of claim 50 further comprising a corner desk, said corner desk having a work surface member, three legs mounted to a bottom of said worksurface member, one of said legs mounted at the back

7/

corner of the desk, a pair of module maintainers mounted to said legs along a rear edge of said worksurface member so that they are perpendicular to each other, and a corner module maintainer mounted to the leg positioned at the back corner, wherein said corner module maintainer interconnects the pair of module maintainers.

60. The modular desk system of claim 59 further comprising a pair of power units attached to the bottom of said pair of module maintainers, each of said power units comprising a power distribution system, and a corner power unit attached to one of said corner leg and said corner module maintainer, said corner power unit comprising a power distribution system, wherein said corner power unit electrically connects said power units running along the back edge of said corner desk.

61. A modular workspace system for creating workspaces comprising:
a plurality of modular desks and a plurality of wall panels arranged in a predetermined pattern;

each of said modular desks comprising:

a worksurface member having a front edge, a back edge, a top surface and a bottom surface;

a pair of legs, each attached to the bottom surface of said worksurface member, and each having a rear surface; and

a module maintainer comprising:

a sidewall;

an upper portion comprising a generally vertical wall parallel to and substantially the same length as the back edge of the worksurface member, the vertical wall being spaced rearwardly from the back edge of the worksurface member to thereby allow for the passage of cables between the vertical wall and the back edge, the vertical wall having a boundary

72

surface which is the most rearward surface of the desk and a bottom edge spaced apart from the floor to provide an open space between the floor and the wall; and

a lower portion which is mounted to and extends rearwardly from each of said legs, the lower portion having a bottom surface spaced above the floor to provide a space below the module maintainer to thereby allow for the passage of cables below the module maintainer;

each of said wall panels comprising a panel member and a standard secured to each end of said panel member, said standards each having a plurality of slots adapted to receive a hook member.

62. The workspace system of claim 61 further comprising a connector member interconnecting one of said modular desk and one of said wall panel.

63. The workspace system of claim 61 wherein said connector member comprises a plurality of rearwardly extending hook members, said hook members adapted to engage said slots in said standard, said connector member attached to said sidewall of said modular desk with a plurality of fasteners.

64. The modular work space system of claim 61 wherein at least one of said modular desks and at least one of said wall panels are arranged such that said boundary surface of said module maintainer of said desk abuts a surface of said wall panel.

65. The modular desk system of claim 61 wherein said plurality of desks and wall panels comprises at least one modular desk and at least one wall panel positioned such that said side edge is parallel to a surface of said wall panel, said desk further comprising a modular power unit attached to said module maintainer, and a harness electrically interconnecting said power unit

73

and a power source positioned in the abutting wall panel.

66. The modular desk system of claim 65 further comprising a utility transition unit positioned in between said side edge and said panel, said transition unit comprising a panel connected to said wall panel and a cover, wherein said harness is disposed between said panel and said cover.

67. A module maintainer for mounting to a desk and which allows the desk to maintain a constant footprint in a system of like desks when cables are passed over a back edge of the desk worksurface, said modular maintainer comprising:

a lower portion comprising a generally flat upper surface for supporting cables, a bottom portion forming a trough for storing cables, and a front surface, said front surface adapted for mounting to said desk and having an opening;

an upper portion comprising a generally vertical wall parallel to and substantially the same length as the back edge of the desk, said upper portion extending rearwardly and upwardly from said lower portion such that said wall is spaced rearwardly from said back edge of said desk when said module maintainer is mounted to said desk, said vertical wall having a boundary surface which is the most rearward surface of the module maintainer.

68. A module maintainer for mounting to a desk and which allows the desk to maintain a constant footprint in a system of like desks when cables are passed over a back edge of the desk worksurface, said modular maintainer comprising:

a pair of support members having a base section and an arm extending rearwardly and upwardly from said base section;

a beam member comprising a base section having a top surface for supporting cables, a bottom portion forming a trough for storing cables,

74

and a front surface, said front surface adapted for mounting to said desk and having an opening formed therein for passing cables into said base section for storage in said trough;

an upper portion comprising a generally vertical wall parallel to and substantially the same length as the back edge of the desk, said upper portion extending rearwardly and upwardly from said lower portion such that said wall is spaced rearwardly from said back edge of said desk when said module maintainer is mounted to said desk, said vertical wall having a boundary surface which is the most rearward surface of the module maintainer.

69. A modular power unit for mounting to a desk so as to electrically connect adjacent desks, said power unit comprising:

a housing adapted for mounting to said desk; and

a power distribution system disposed in said housing, said power distribution system electrically connectable with power distribution systems positioned in adjacent modular desks.

70. The modular power unit of claim 69 wherein said power distribution system comprises a harness disposed in said housing, an electrical connector port attached to an end of the harness, and a receptacle module connected to said harness, said receptacle module adapted to receive an electrical plug, wherein said electrical connector port is adapted so as to allow electrical connectability with a connector port positioned in an adjacent desk, whereby said desk is supplied with power from an adjacent desk when said electrical connector ports are interconnected.

71. The modular power unit of claim 70 wherein said power distribution system includes four receptacle modules, two modules facing forwardly and two facing rearwardly.

FIG. 1

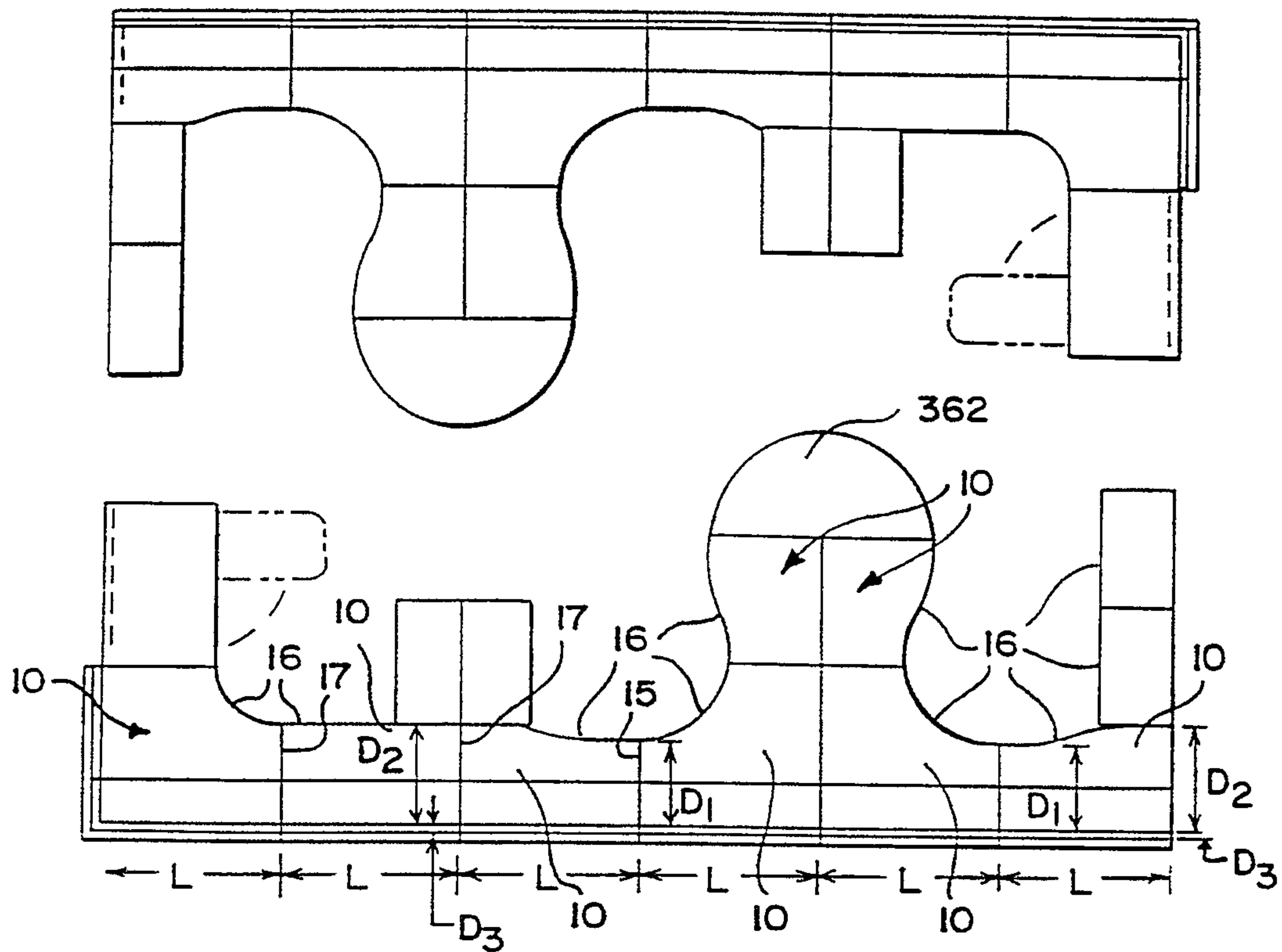


FIG. 2

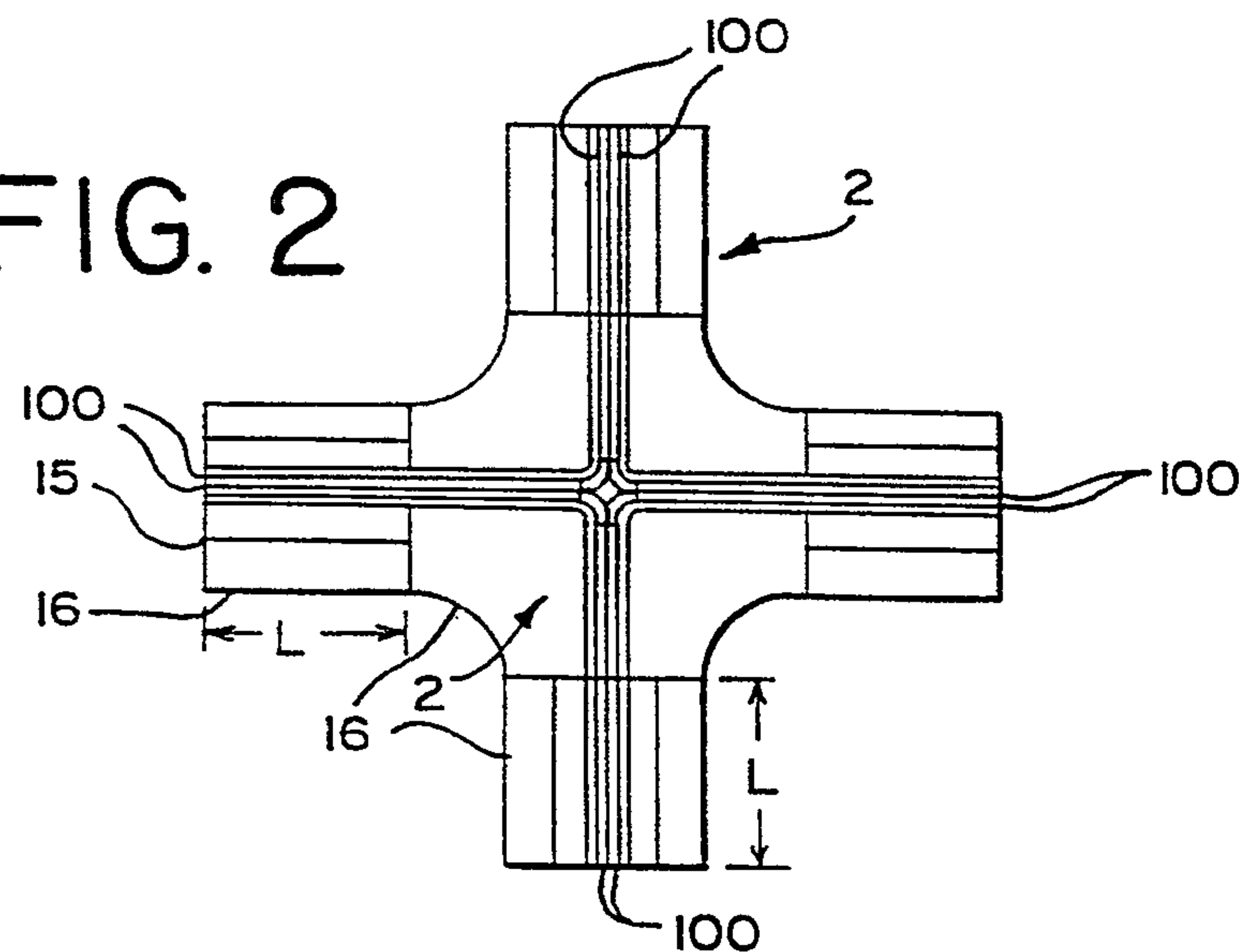


FIG. 3

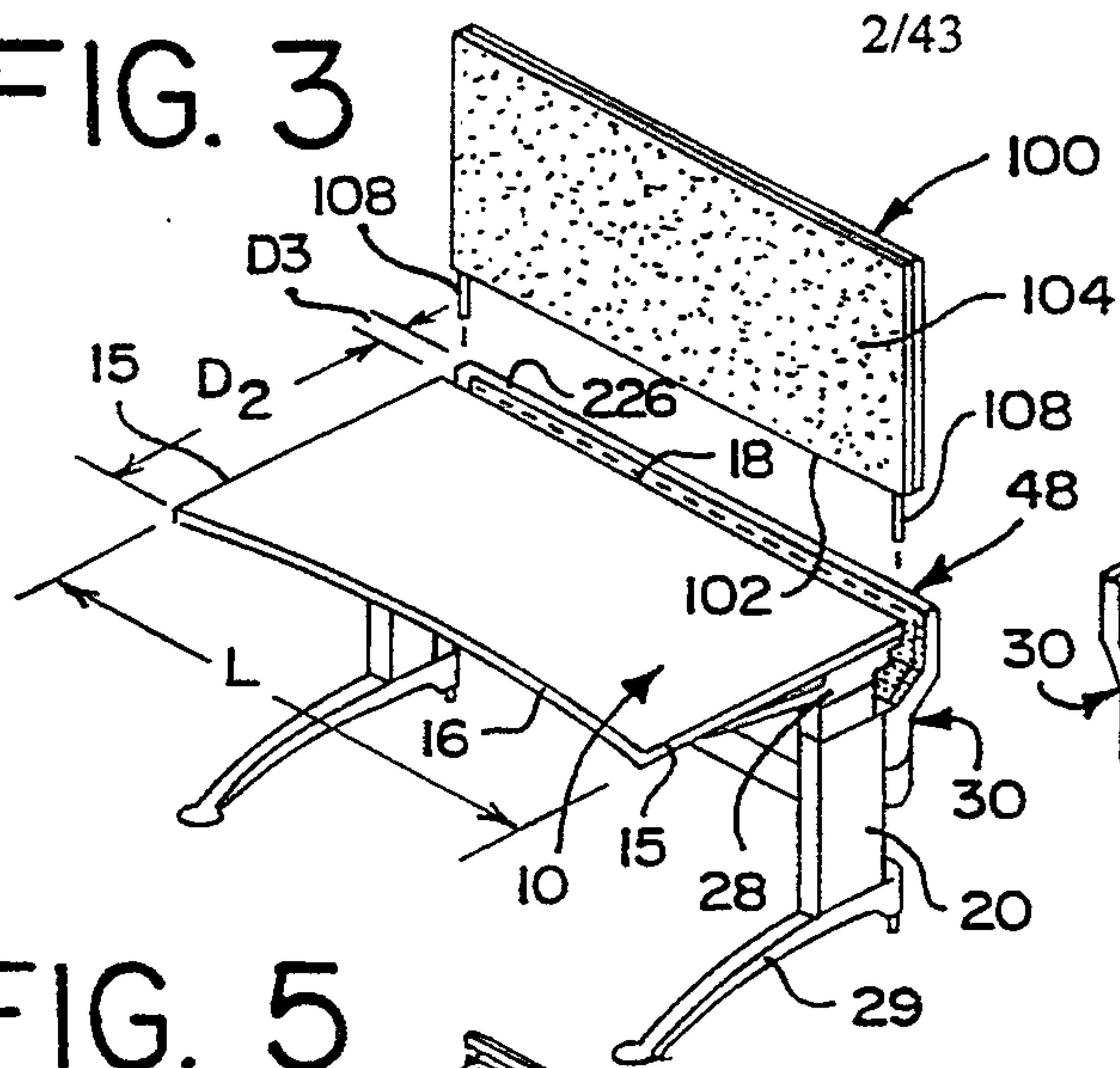


FIG. 4

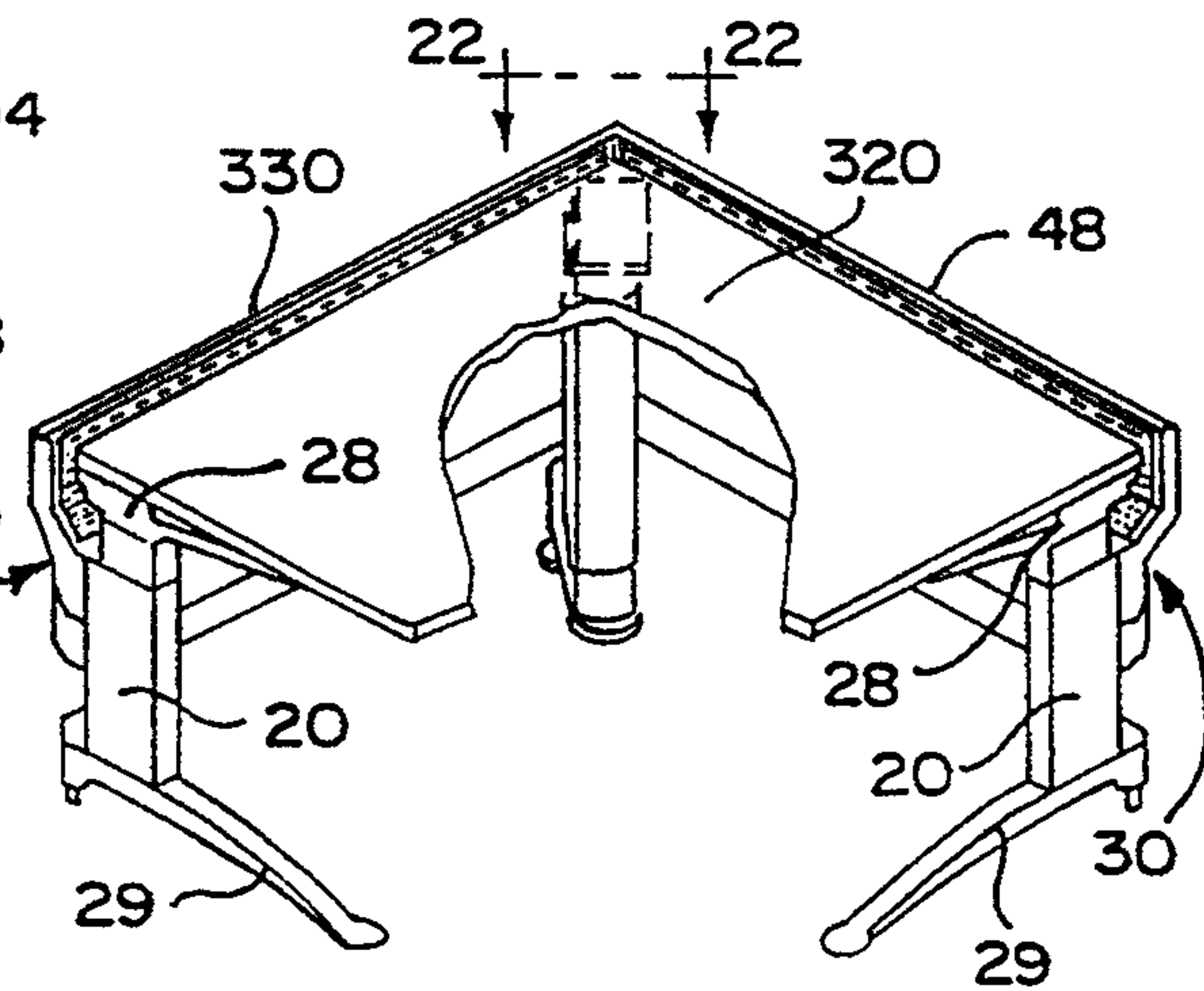


FIG. 5

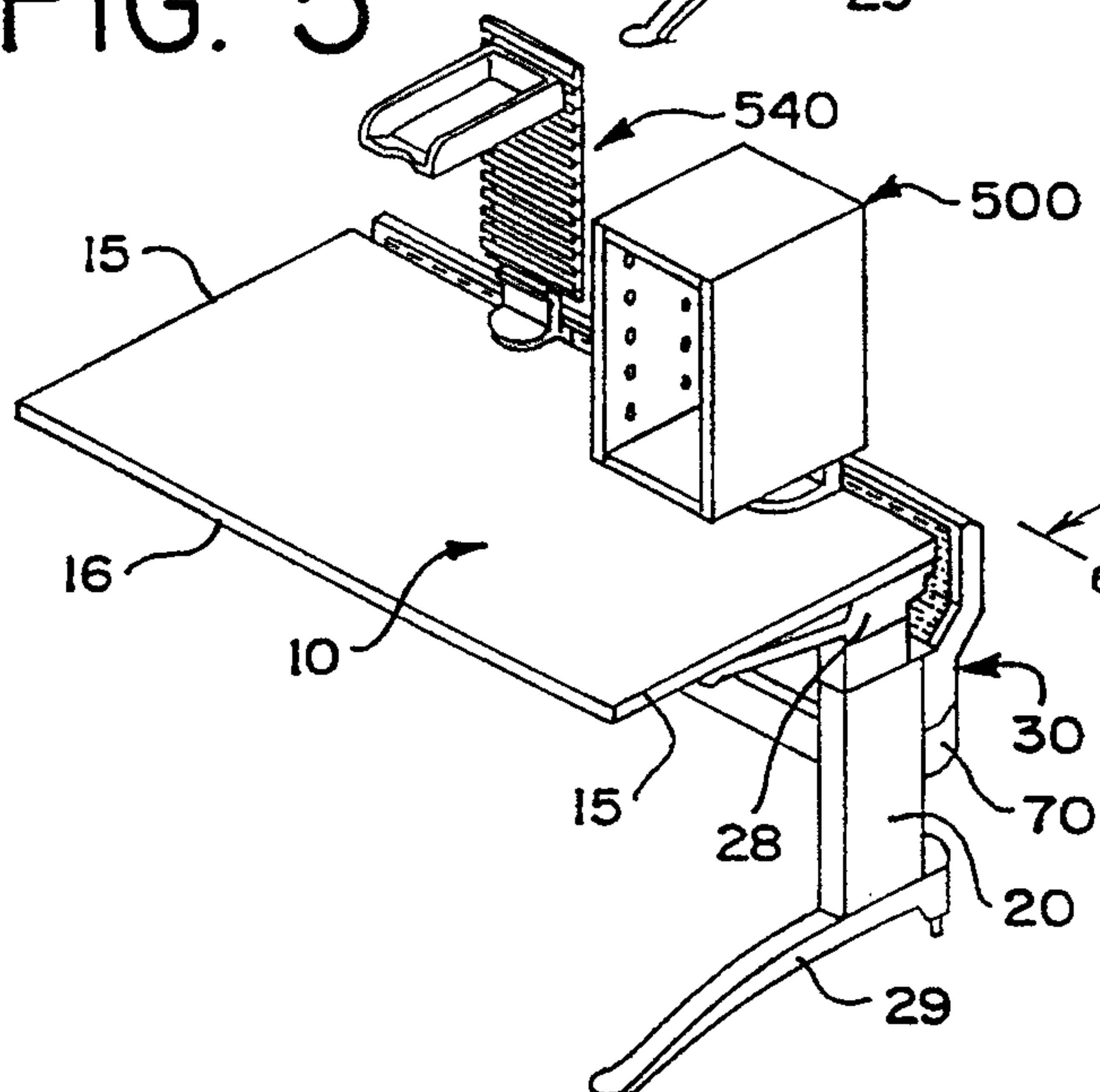


FIG. 6

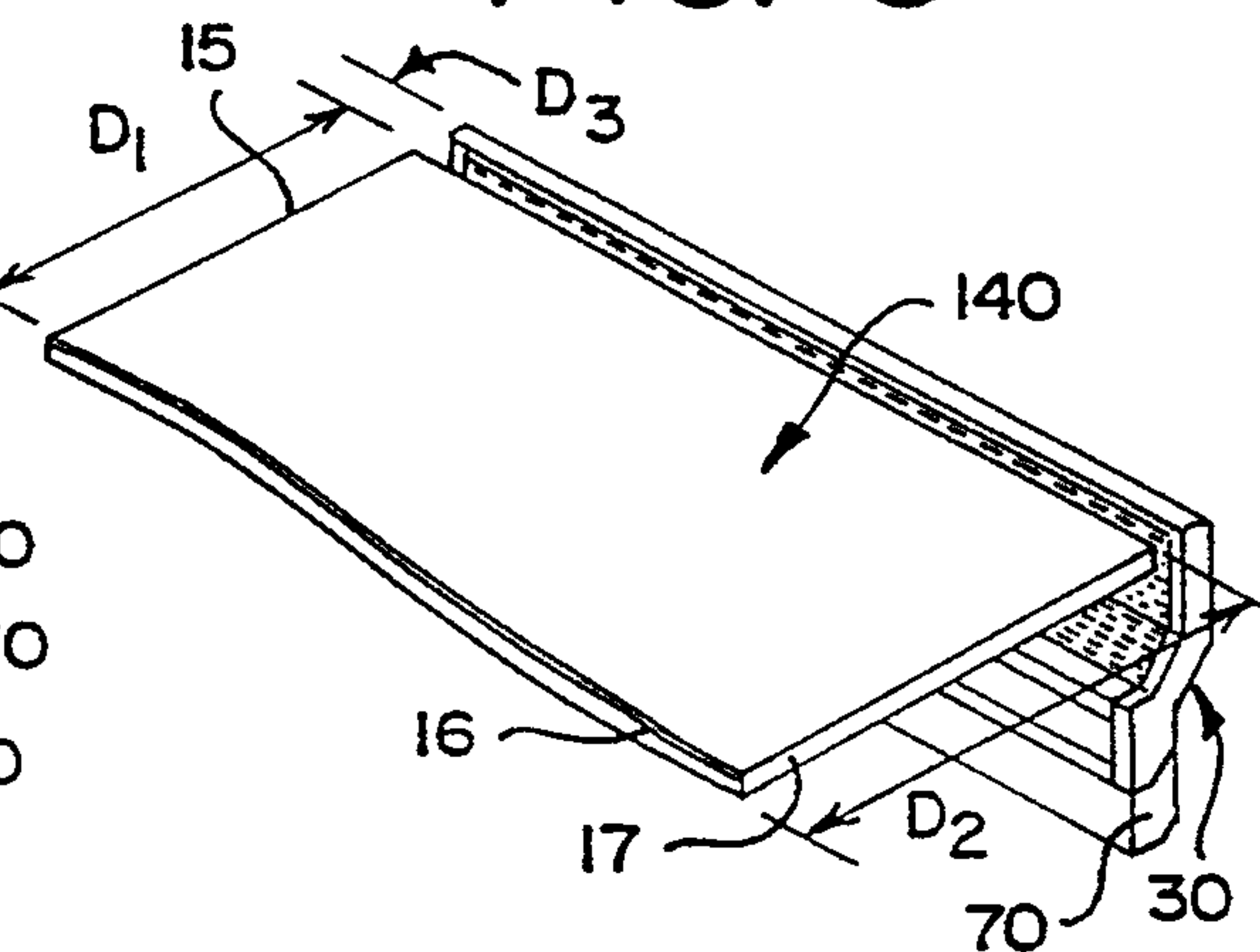


FIG. 7

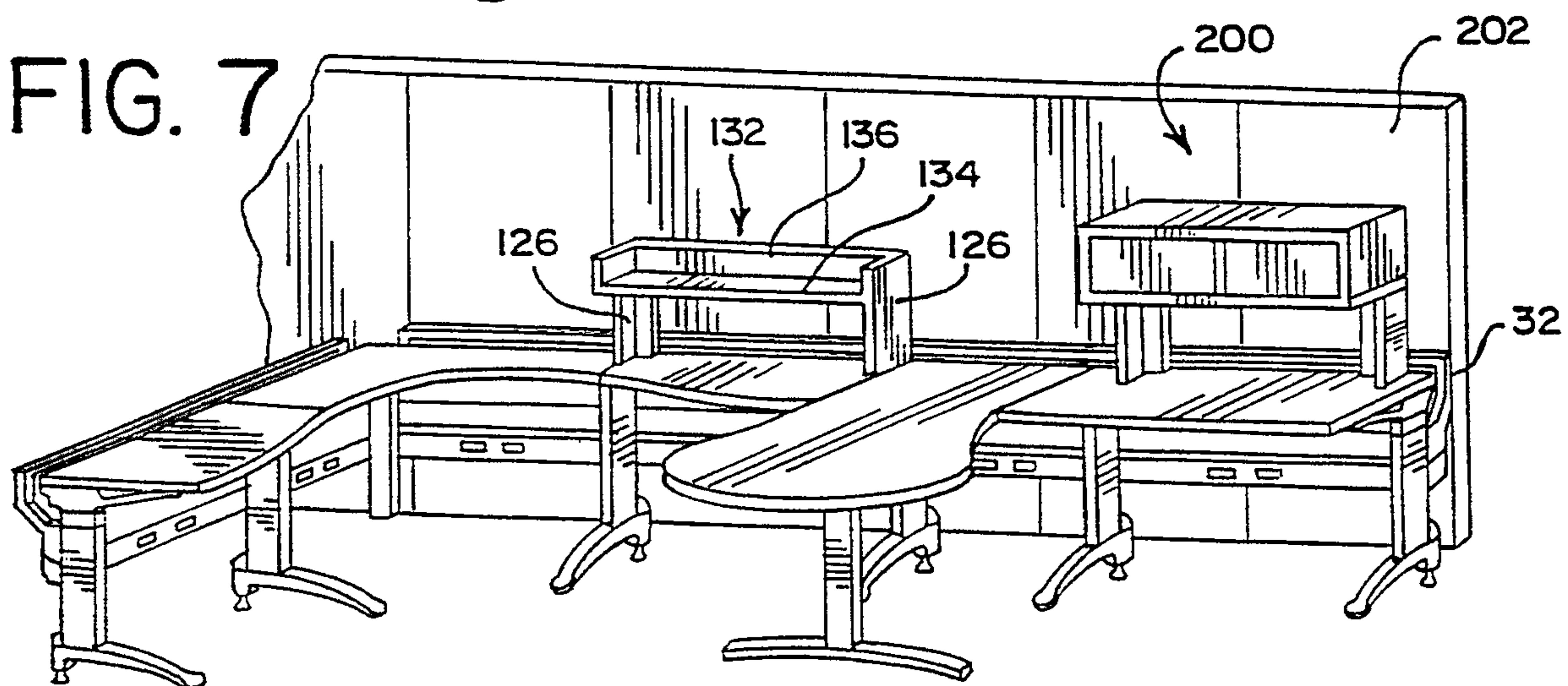
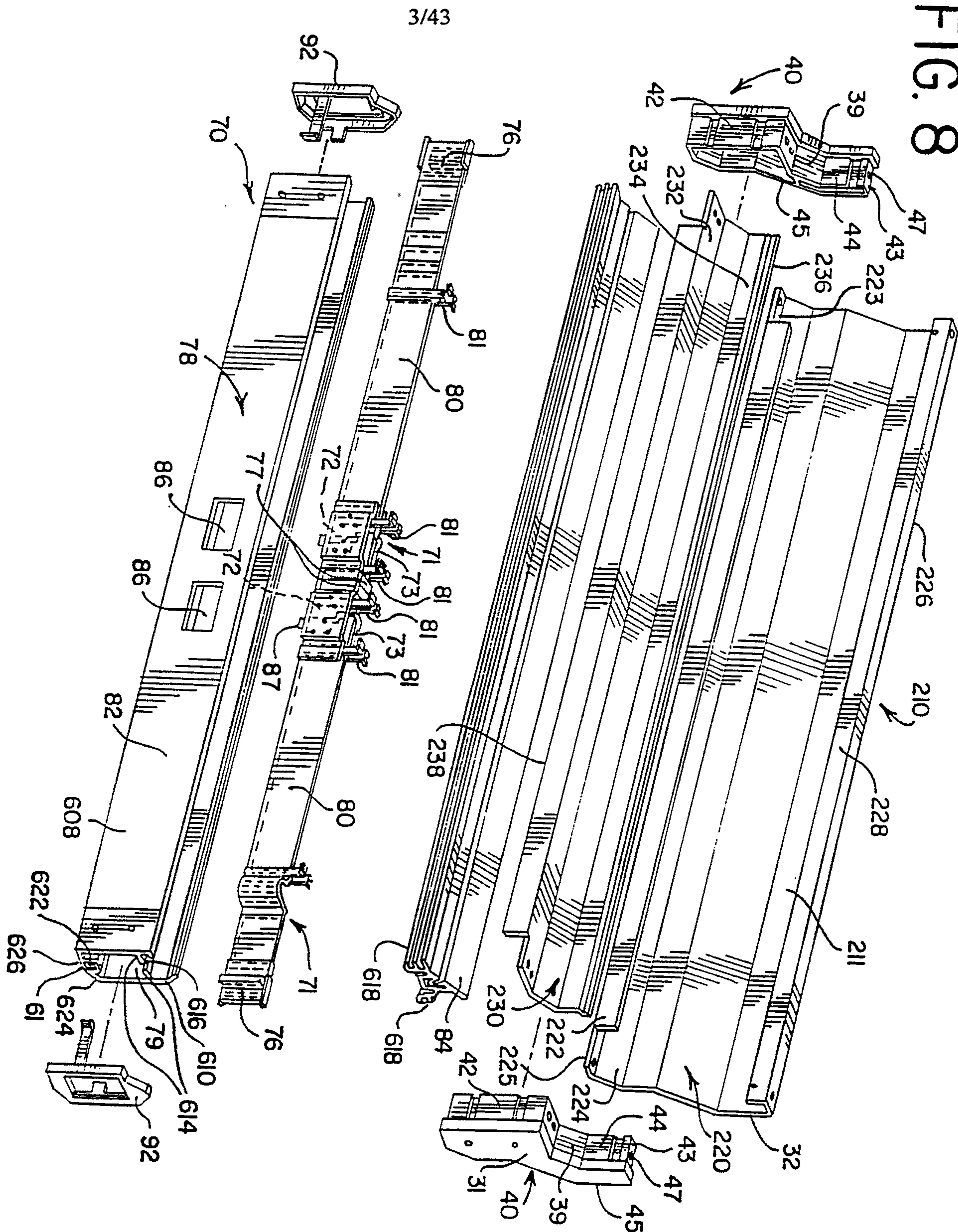


FIG. 8



4/43

FIG. 9

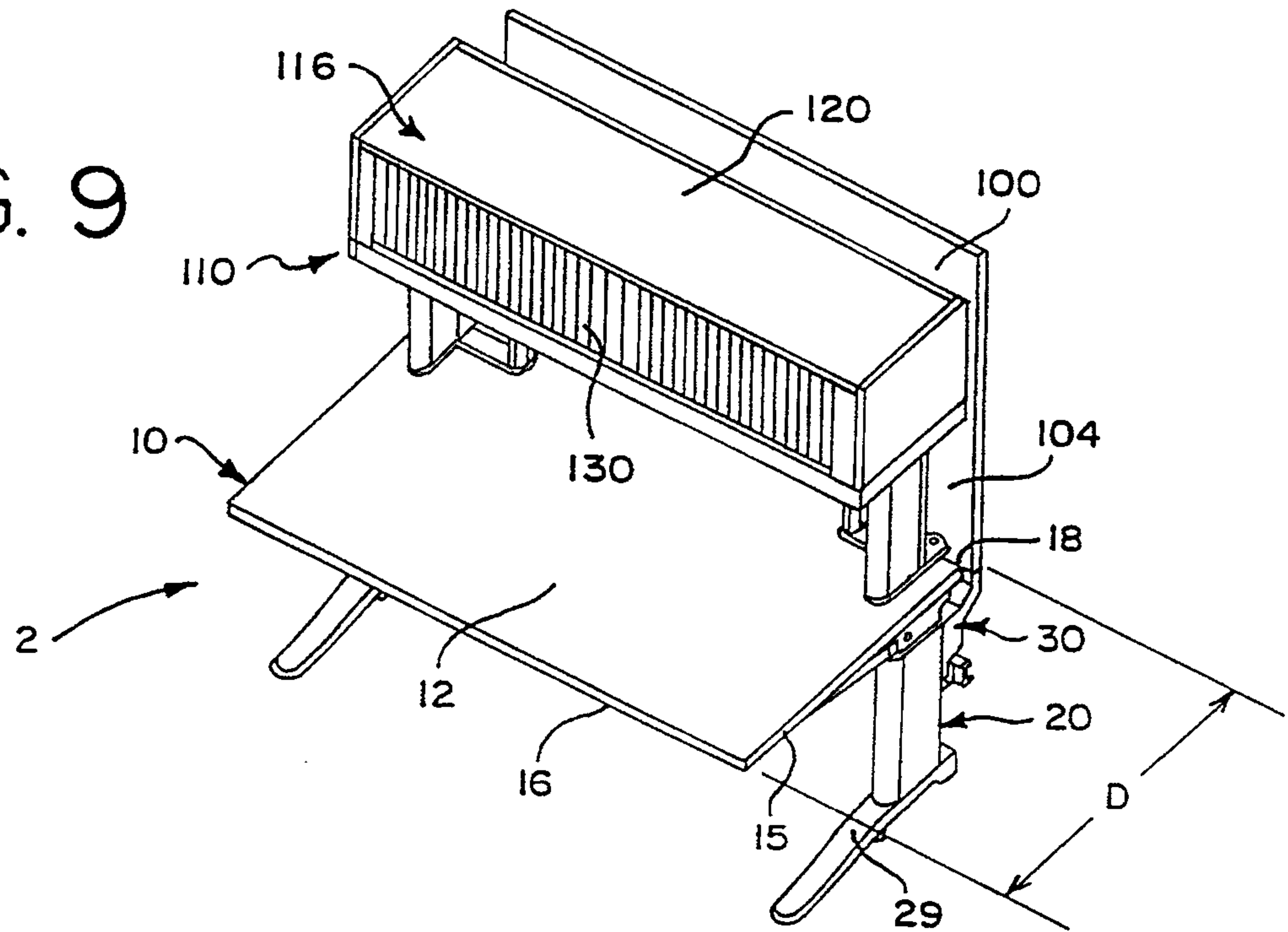
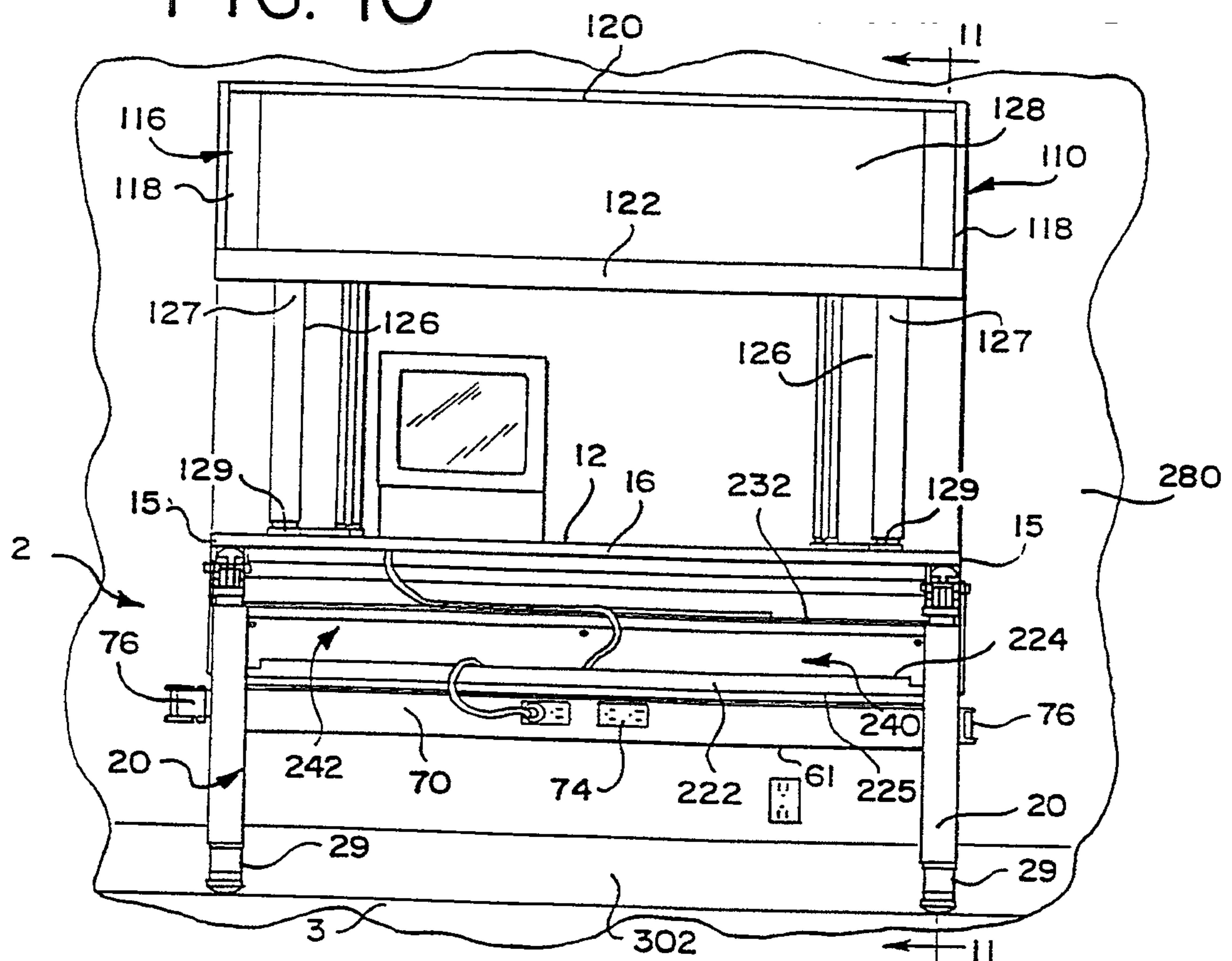


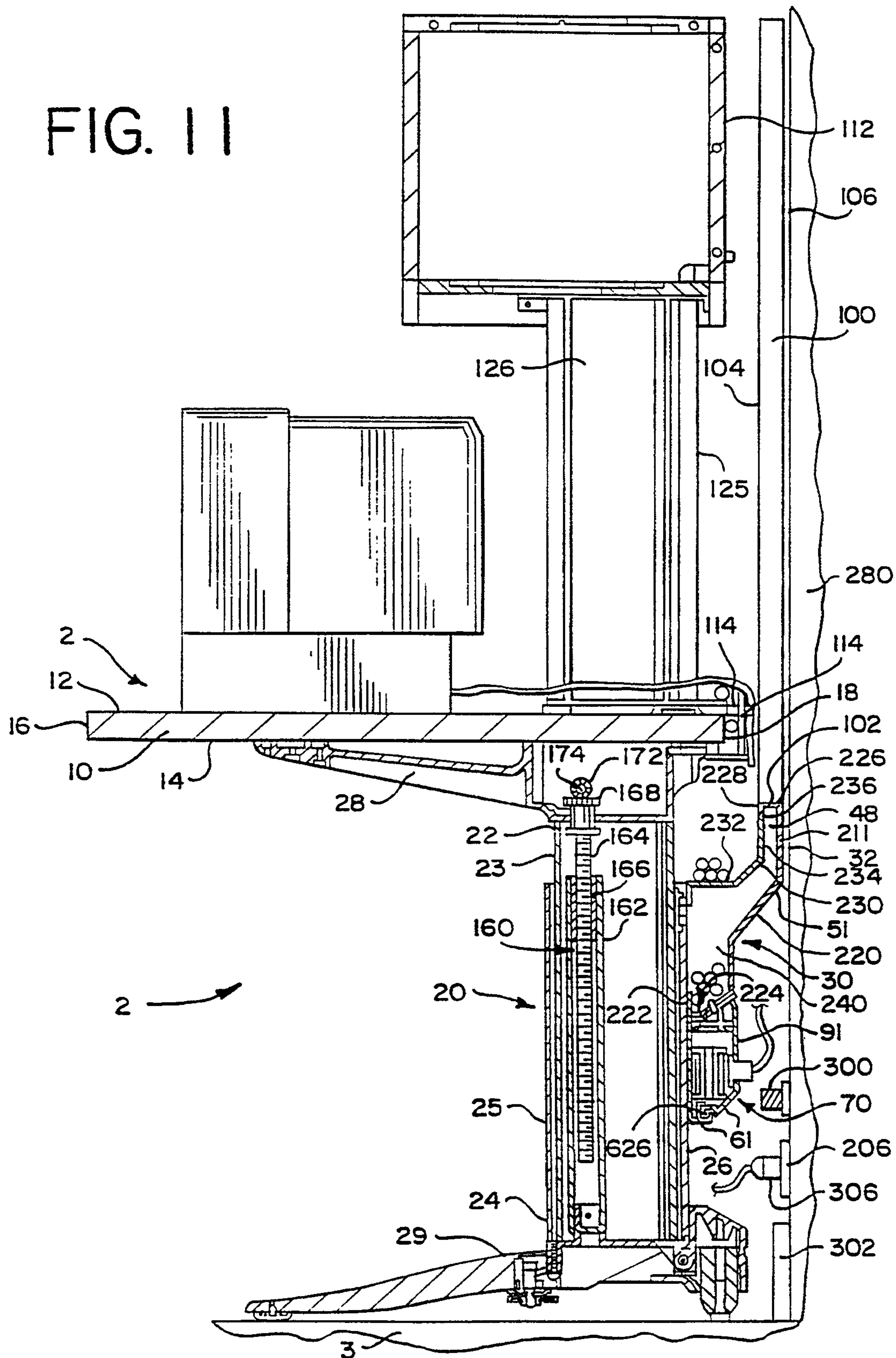
FIG. 10



SUBSTITUTE SHEET (RULE 26)

5/43

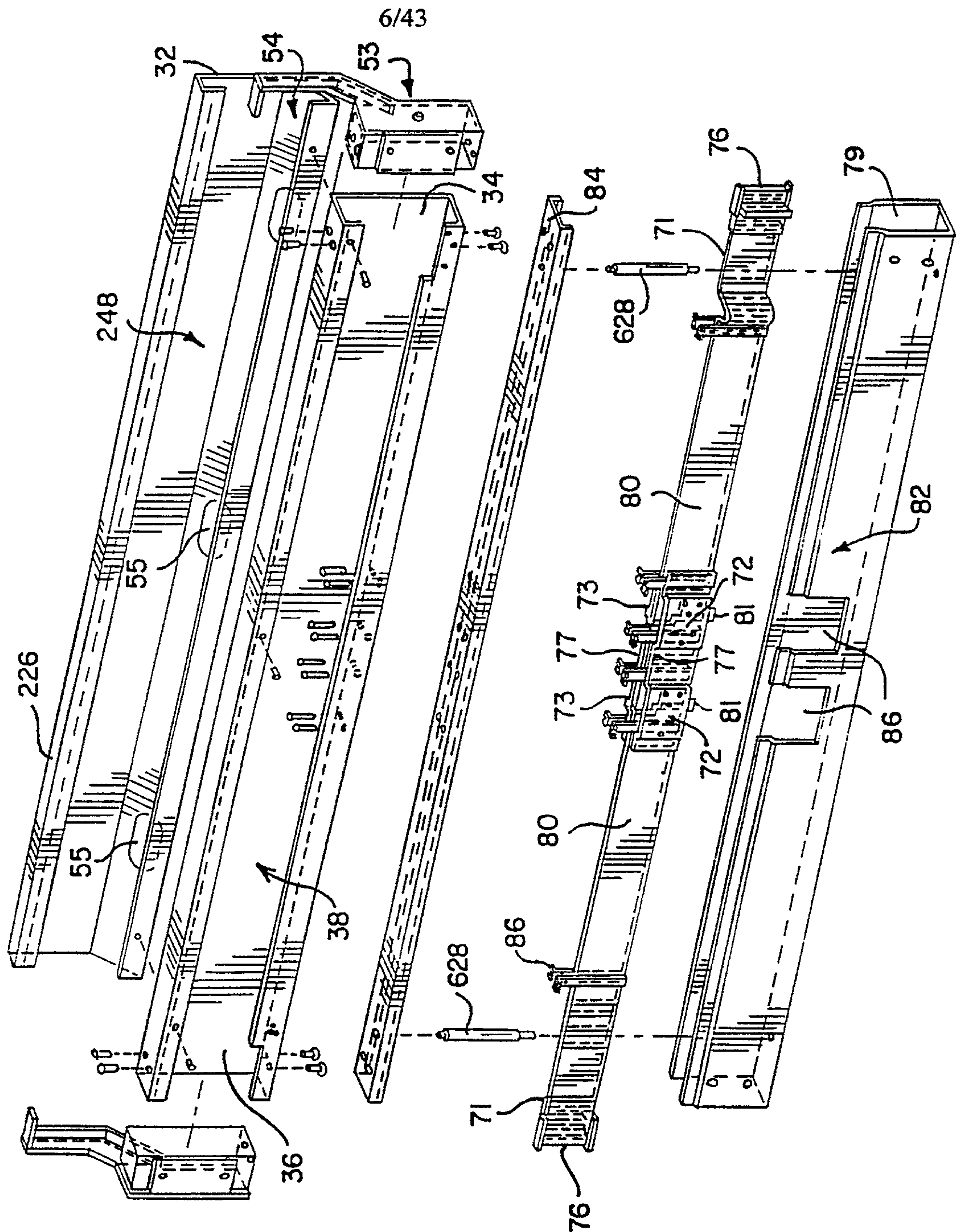
FIG. 11



SUBSTITUTE SHEET (RULE 26)

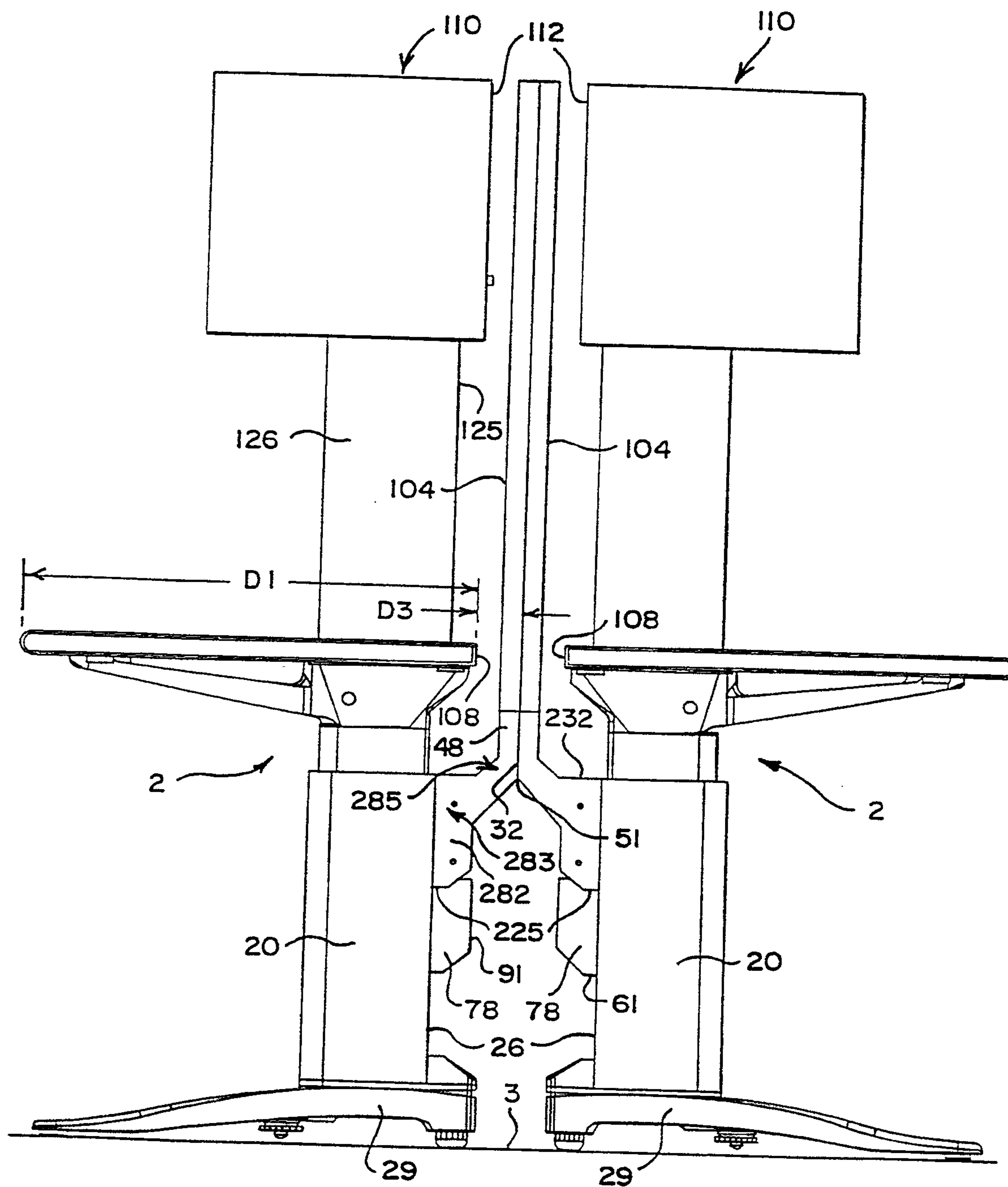
FIG. 12

SUBSTITUTE SHEET (RULE 26)



7/43

FIG. 13



SUBSTITUTE SHEET (RULE 26)

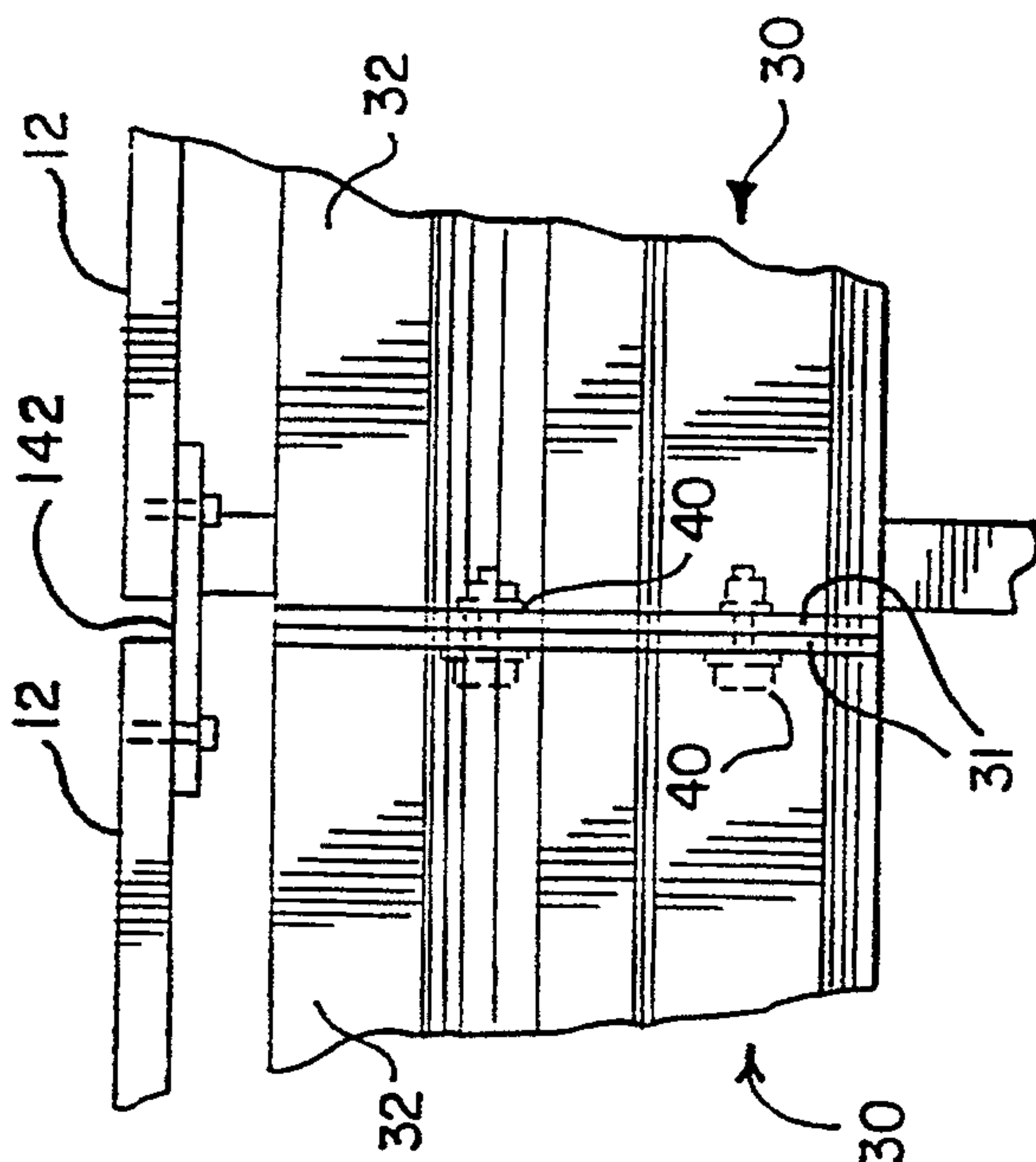
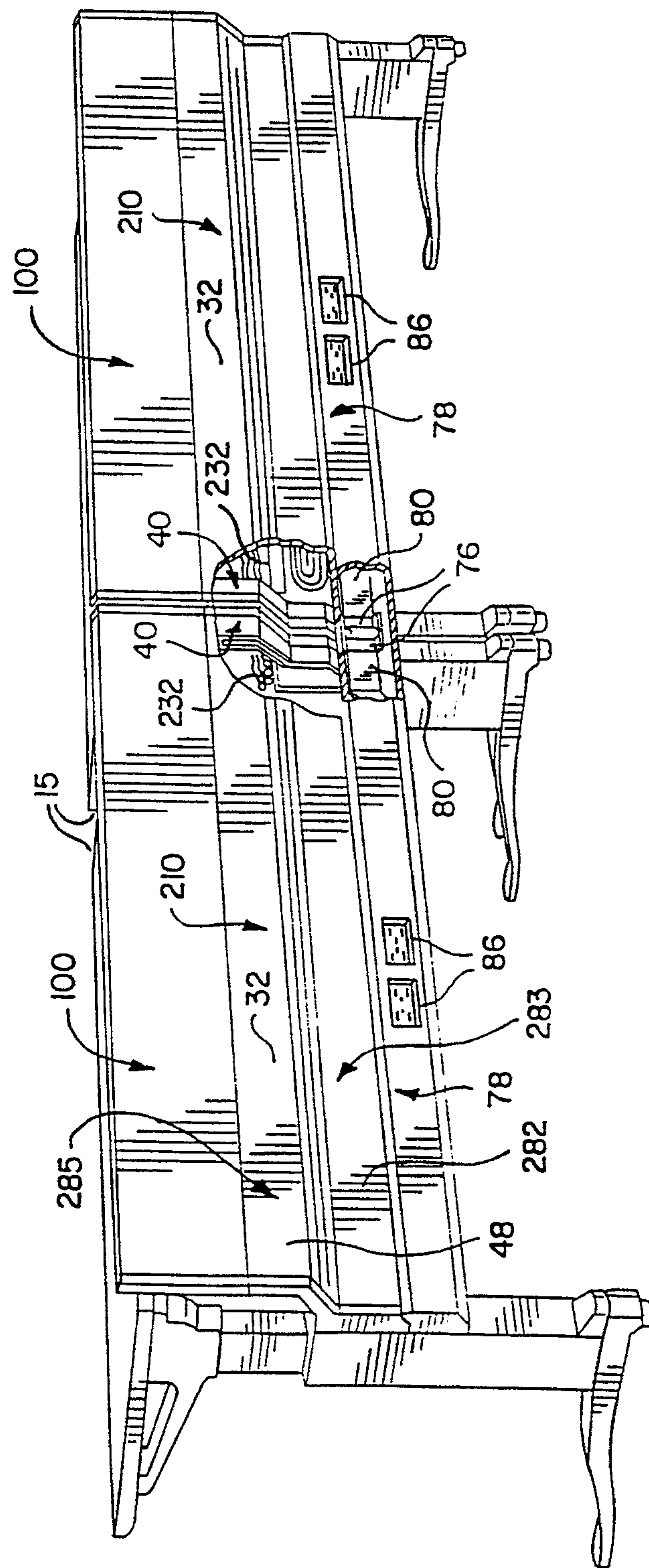


FIG. 14

FIG. 15



9/43

FIG. 16

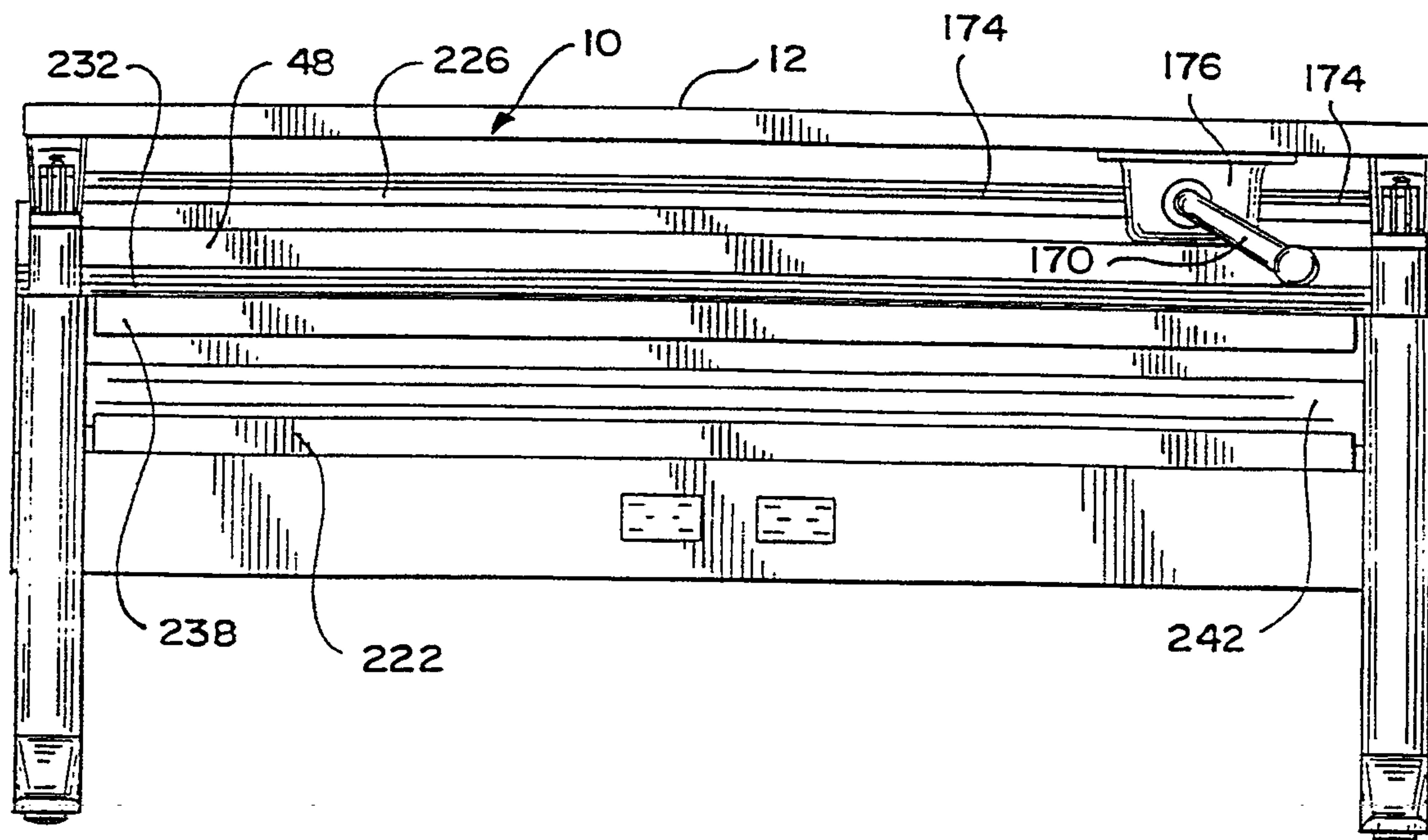
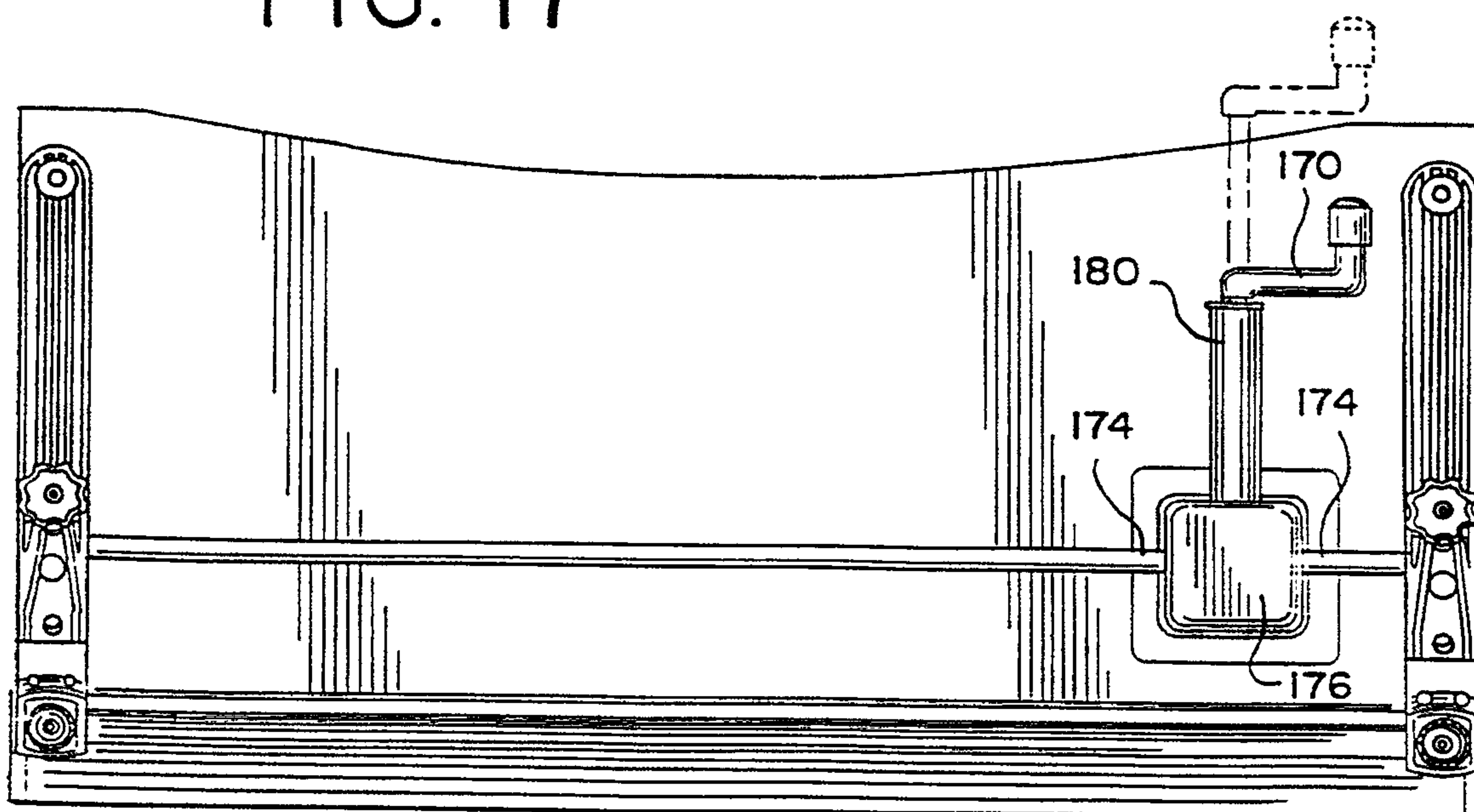


FIG. 17



SUBSTITUTE SHEET (RULE 26)

10/43

FIG. 18

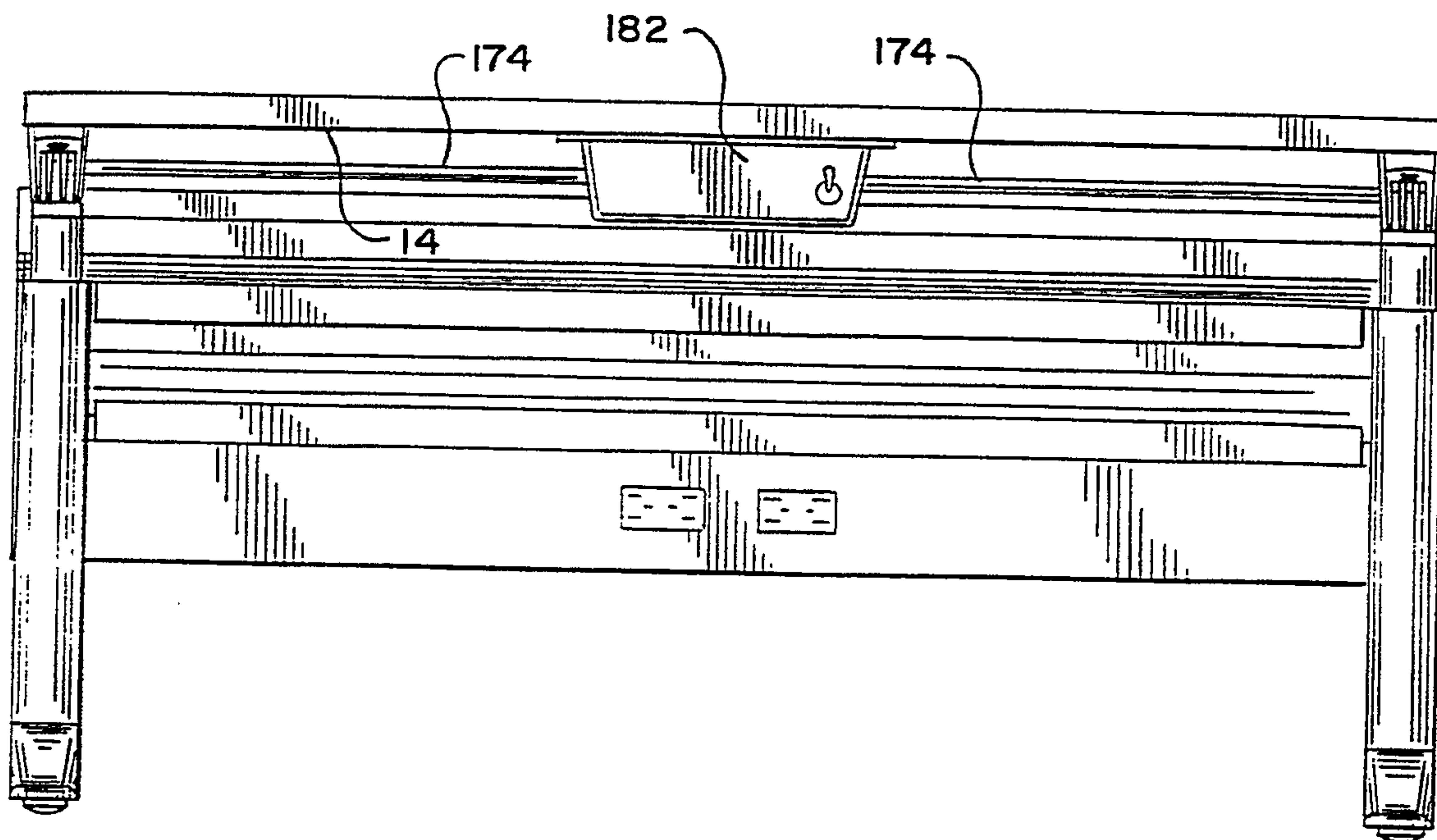
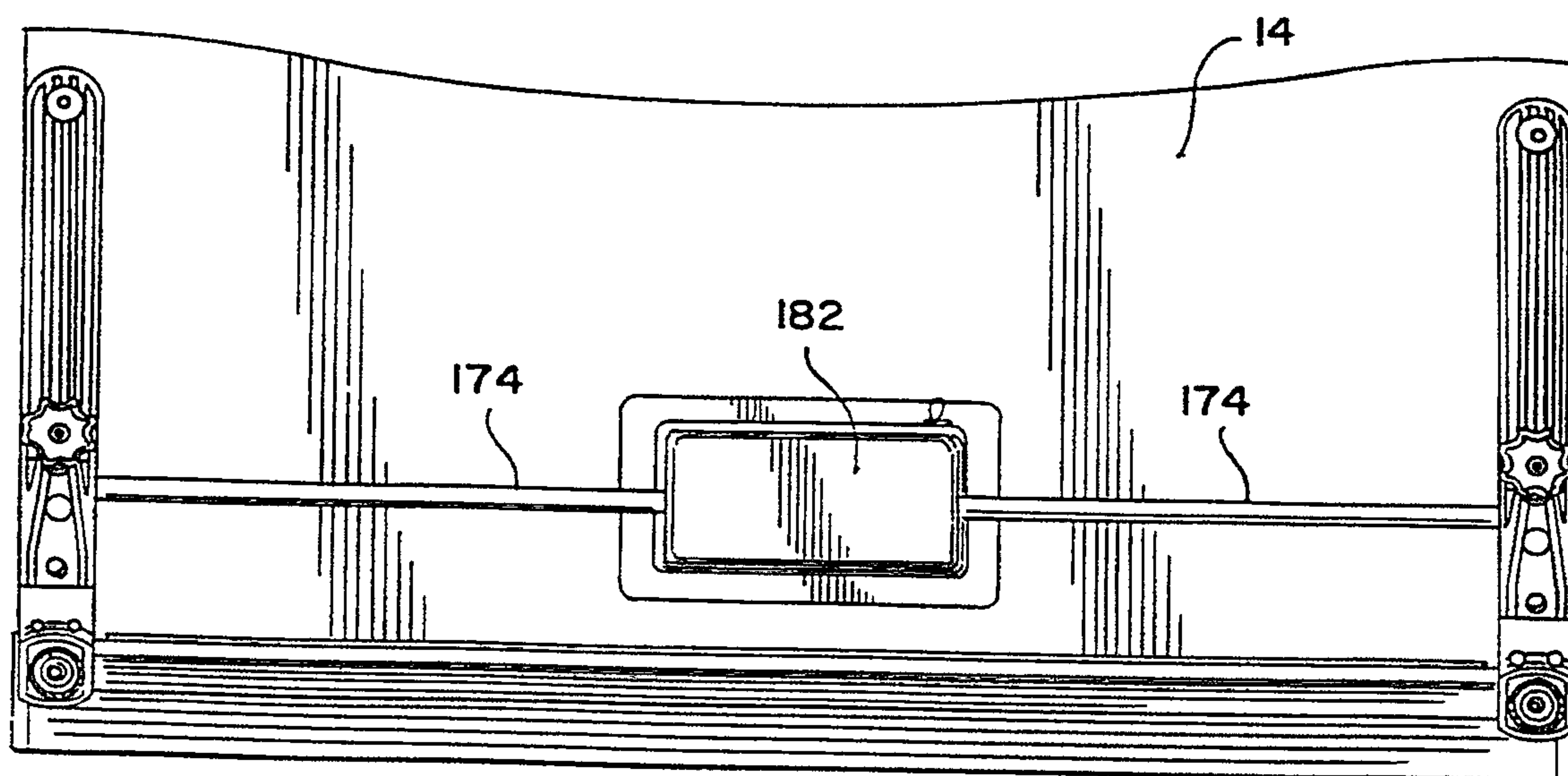


FIG. 19



SUBSTITUTE SHEET (RULE 26)

11/43

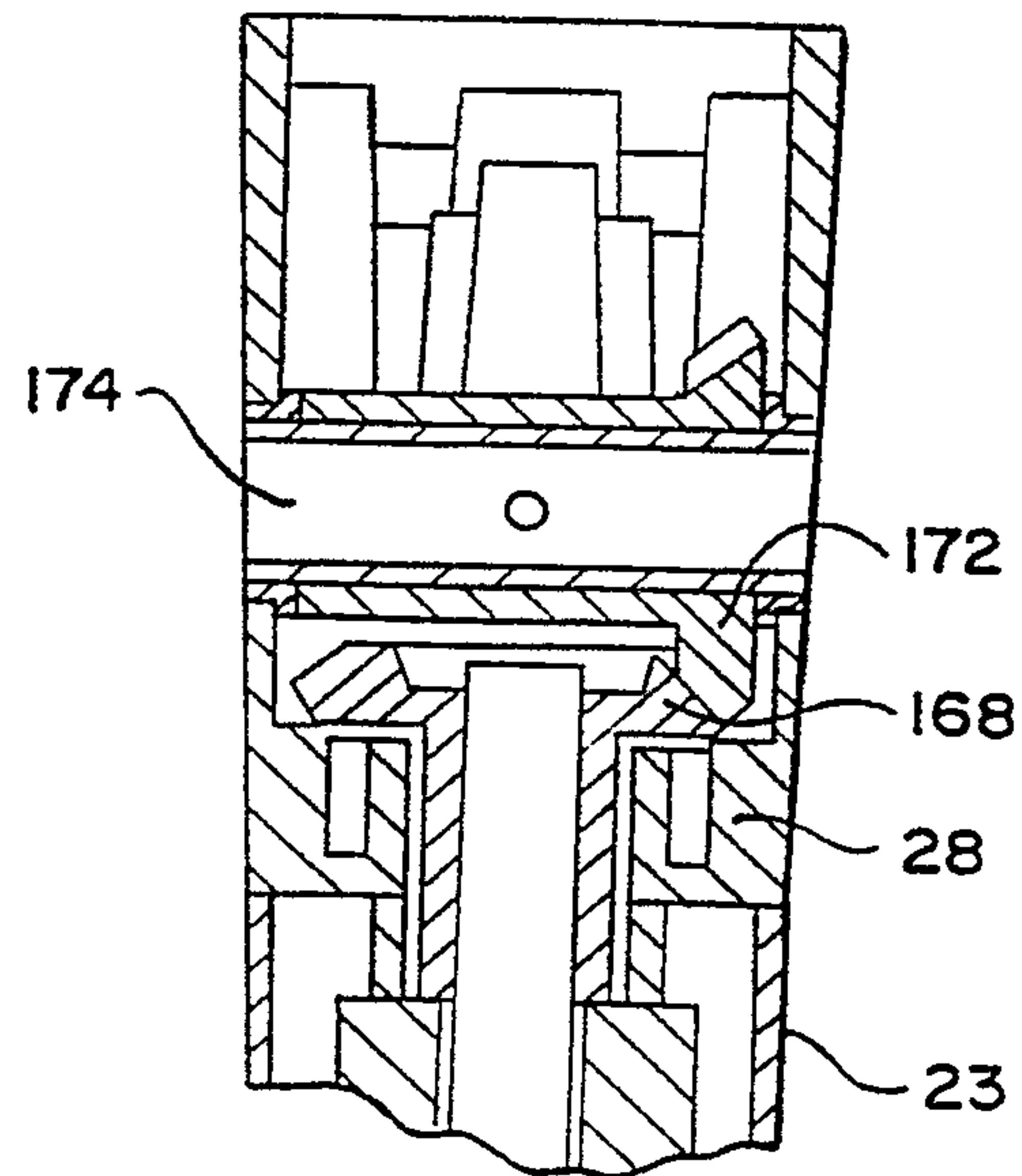


FIG. 20

FIG. 21

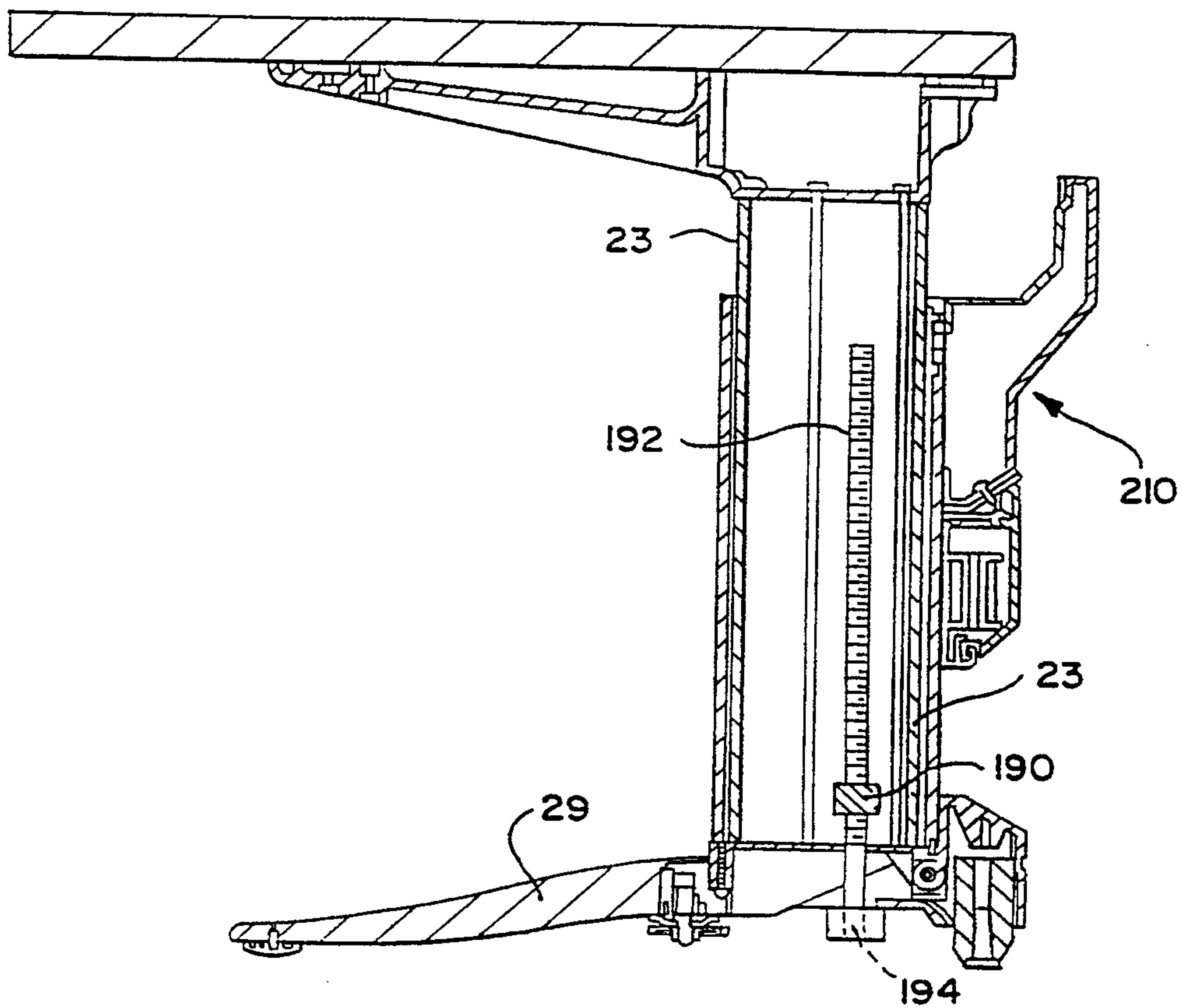


FIG. 22

12/43

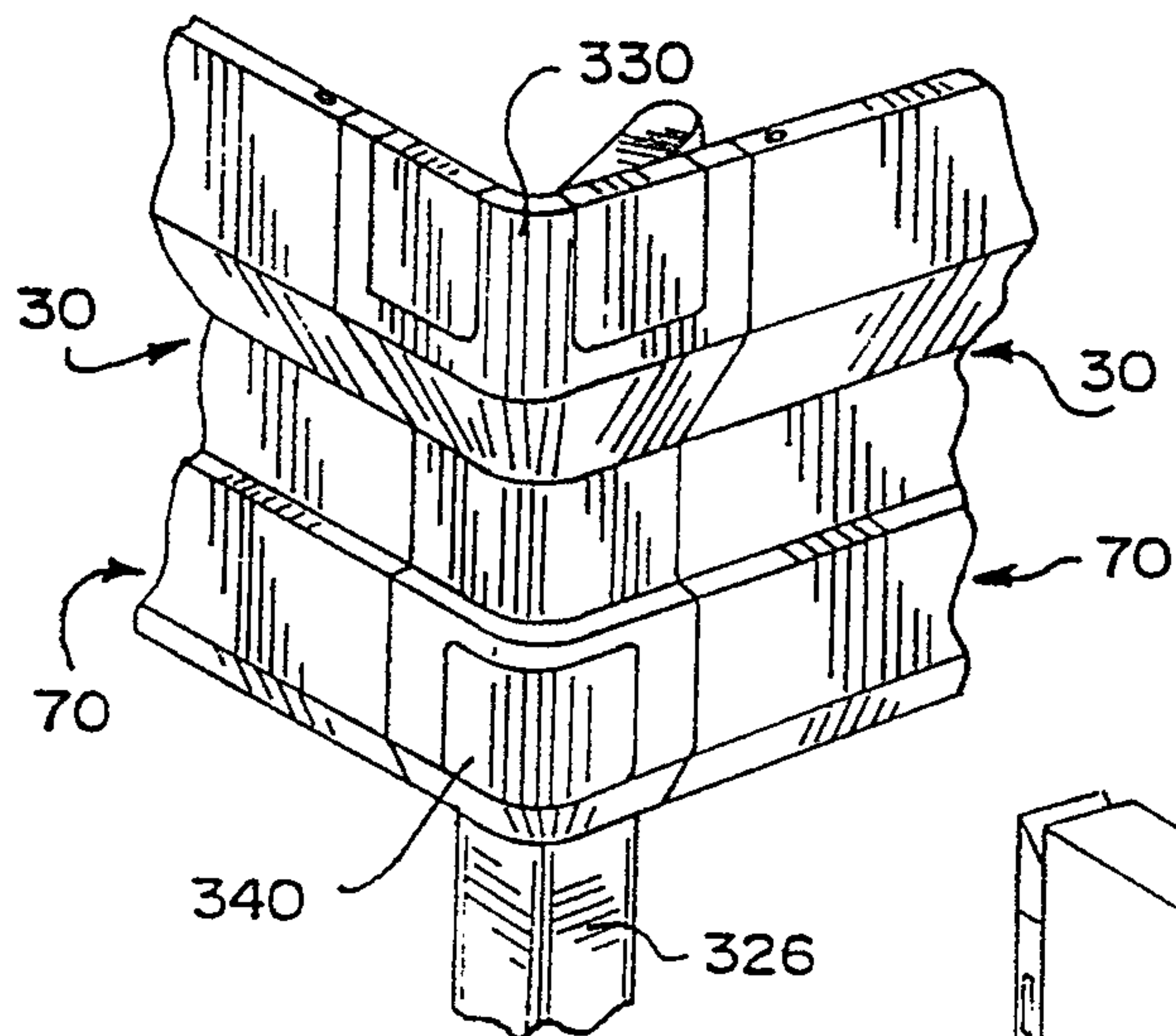


FIG. 24

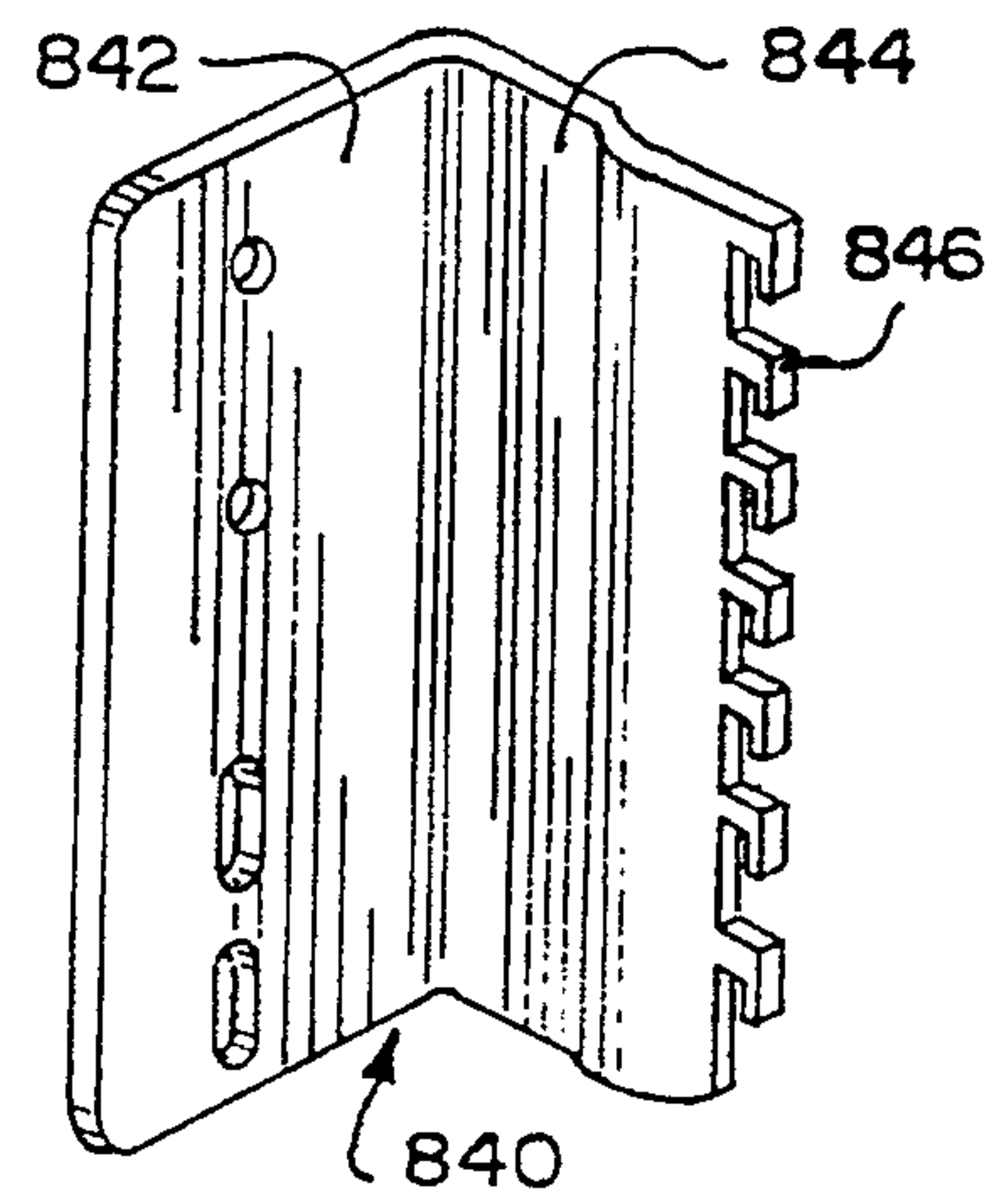


FIG. 23

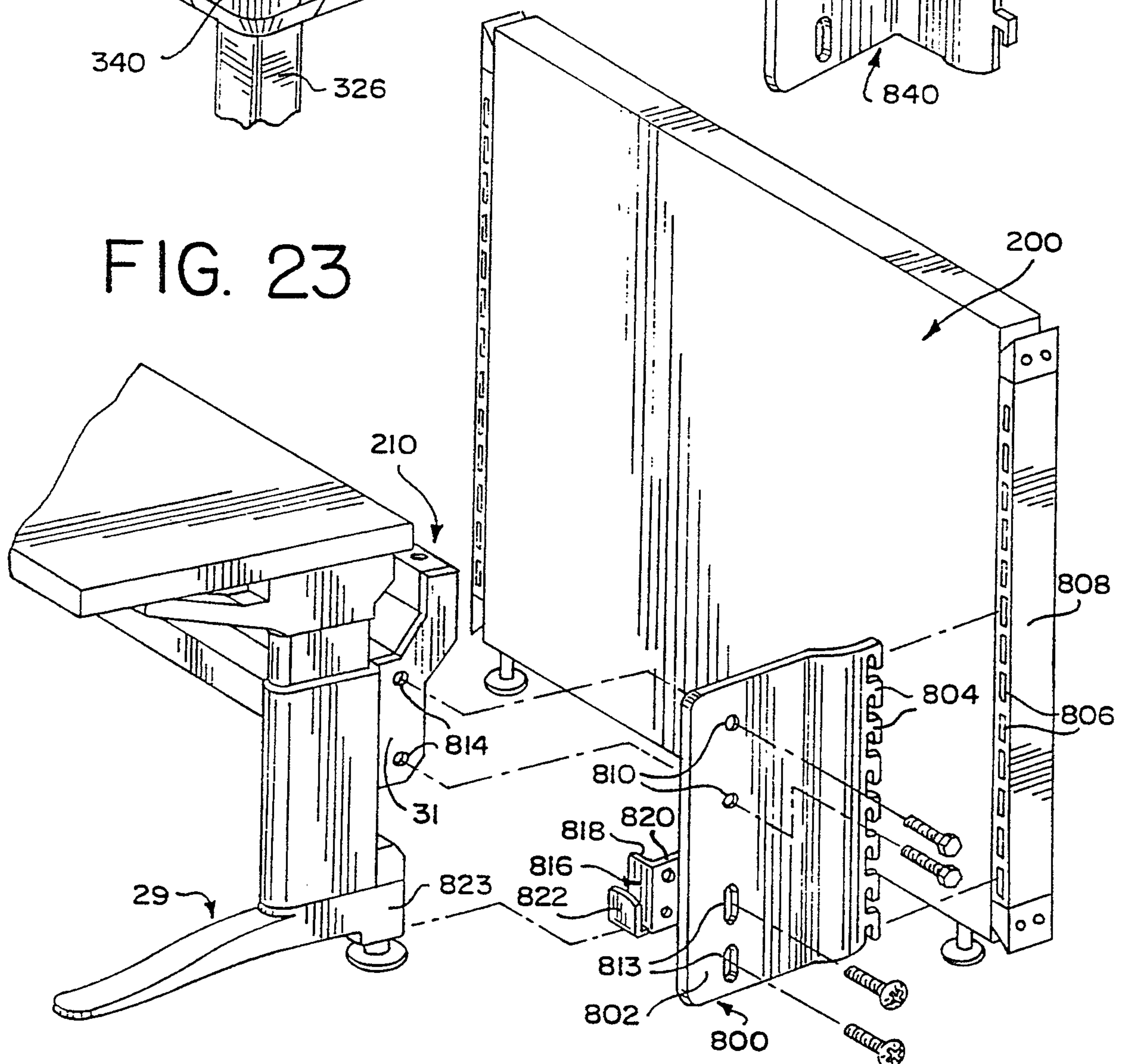
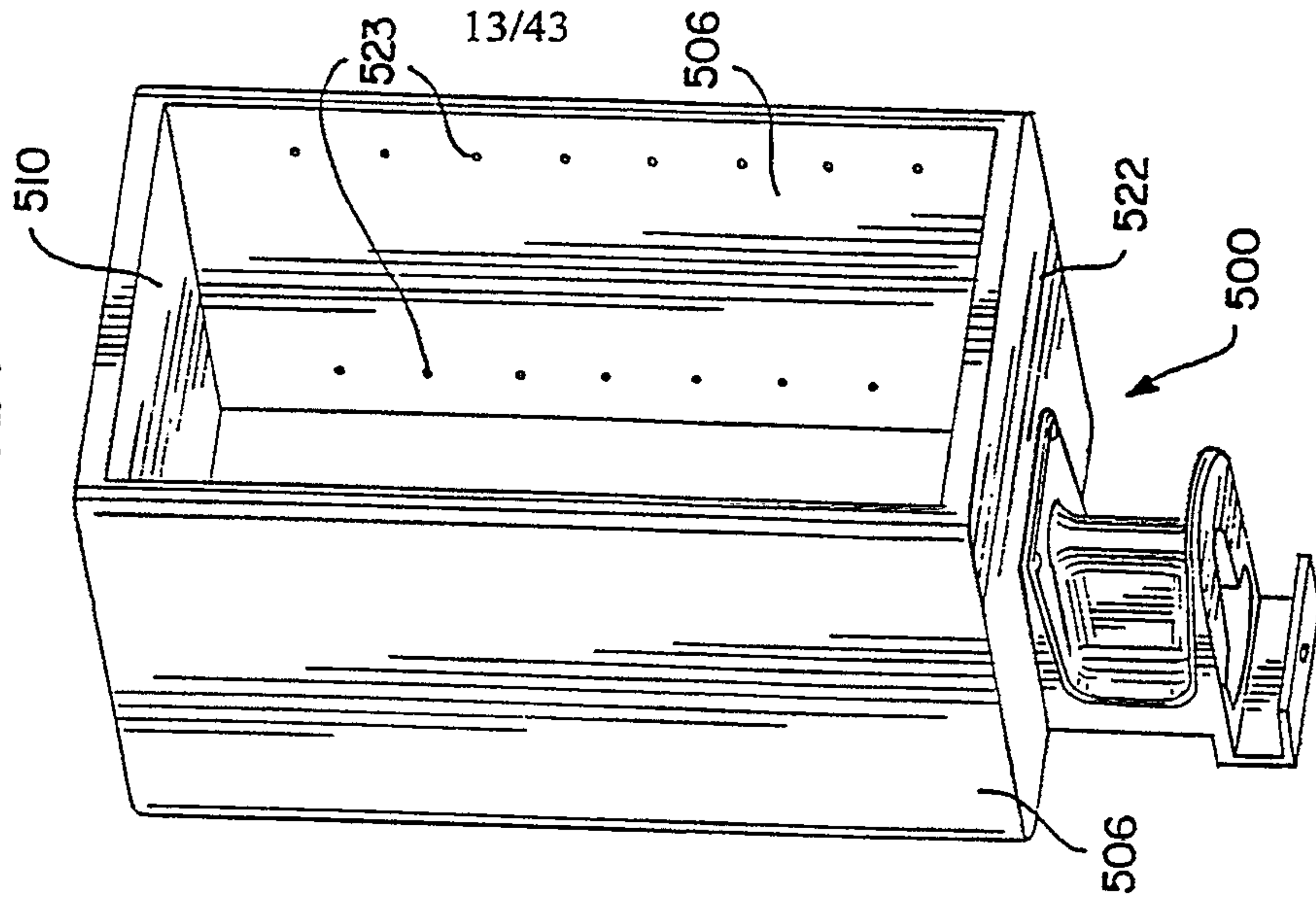
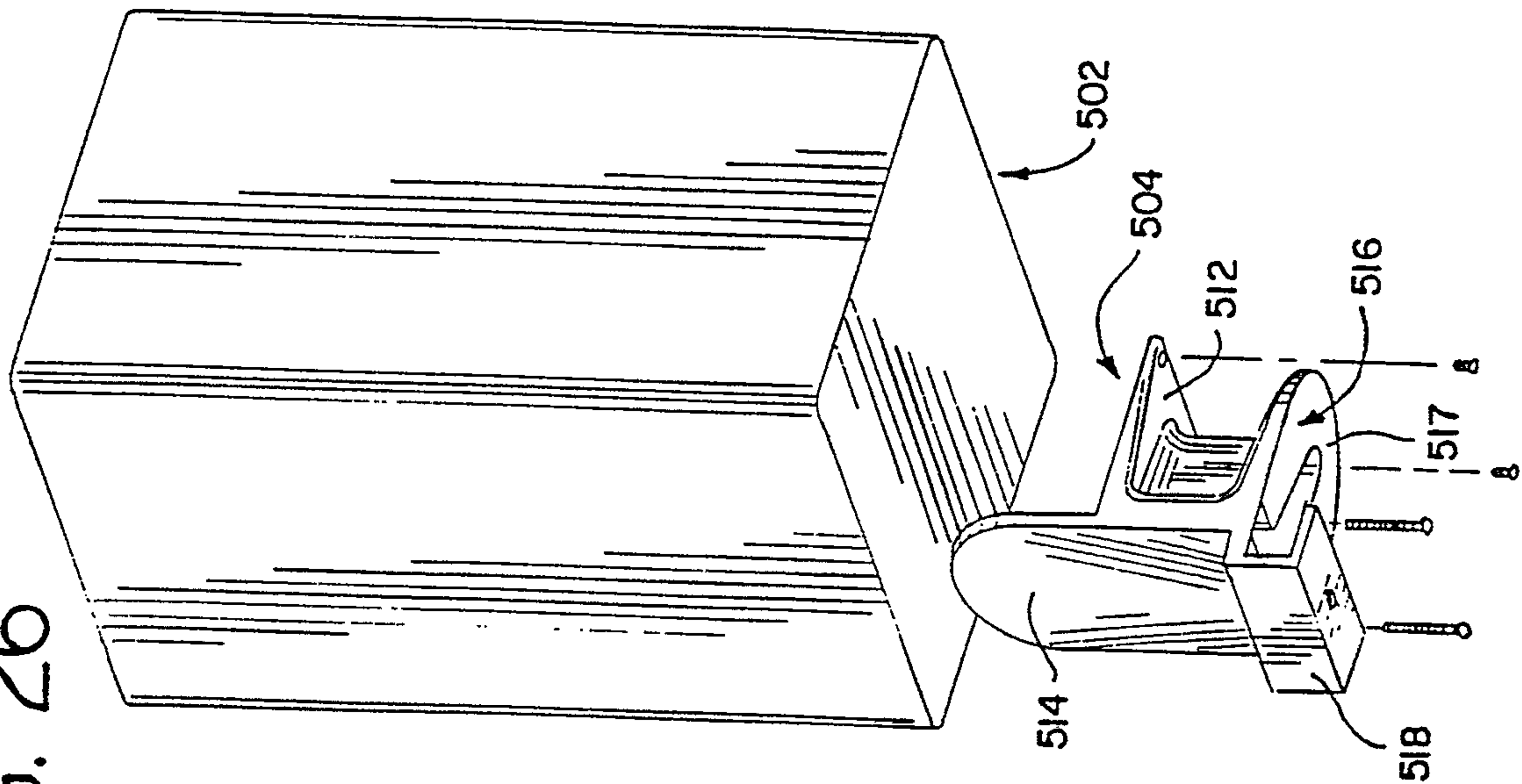
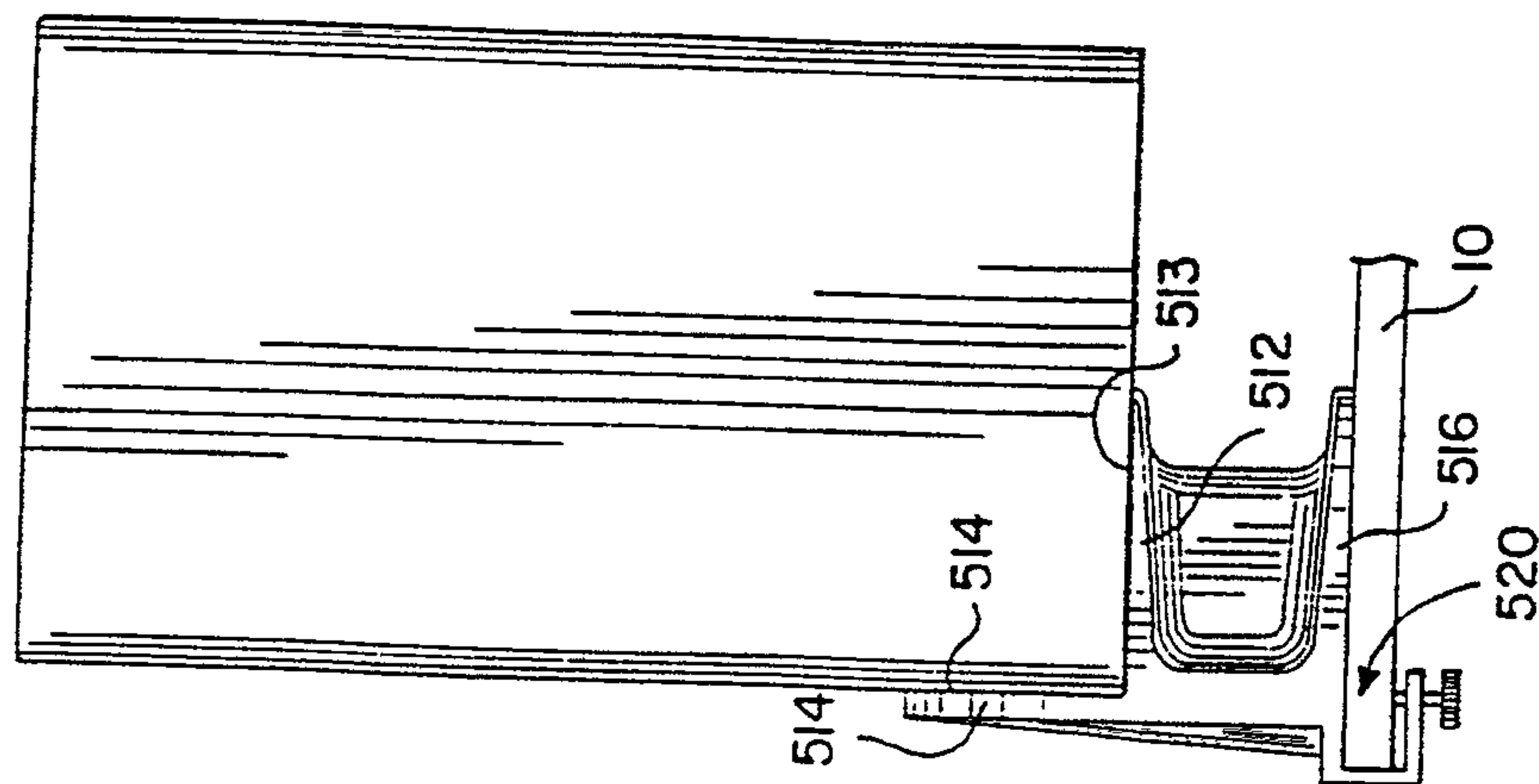


FIG. 25

FIG. 26

FIG. 27



14/43

FIG. 28

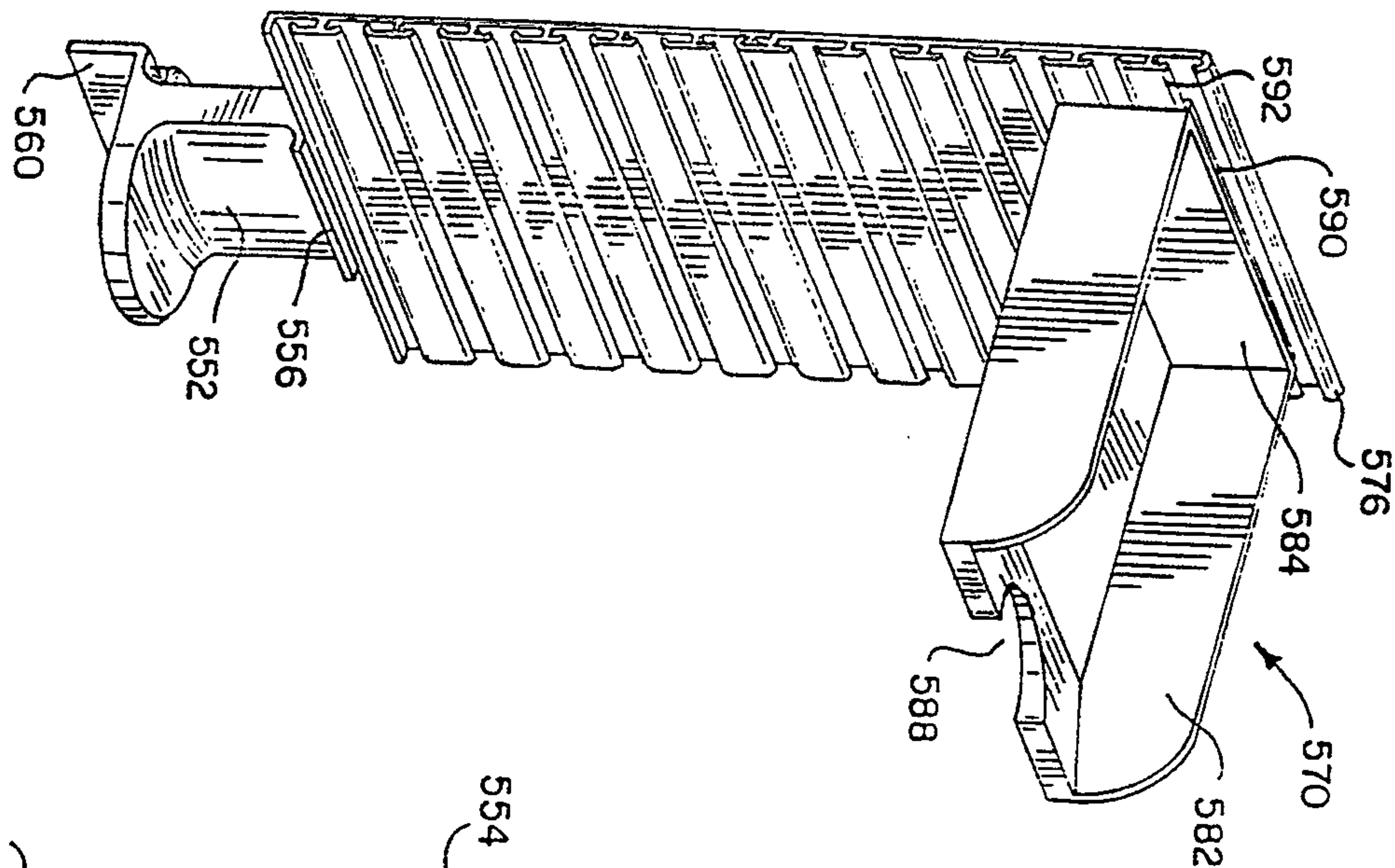


FIG. 29

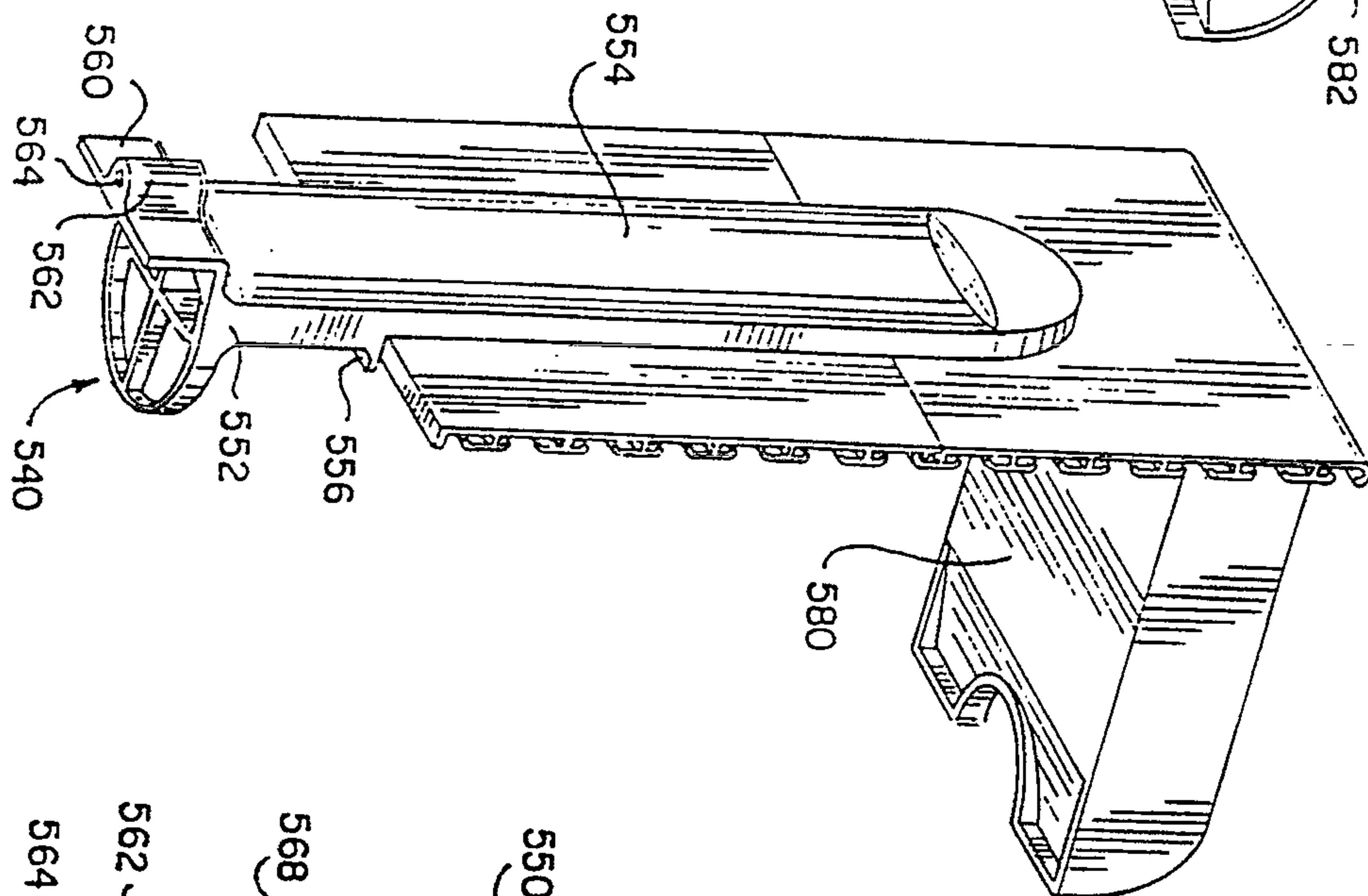
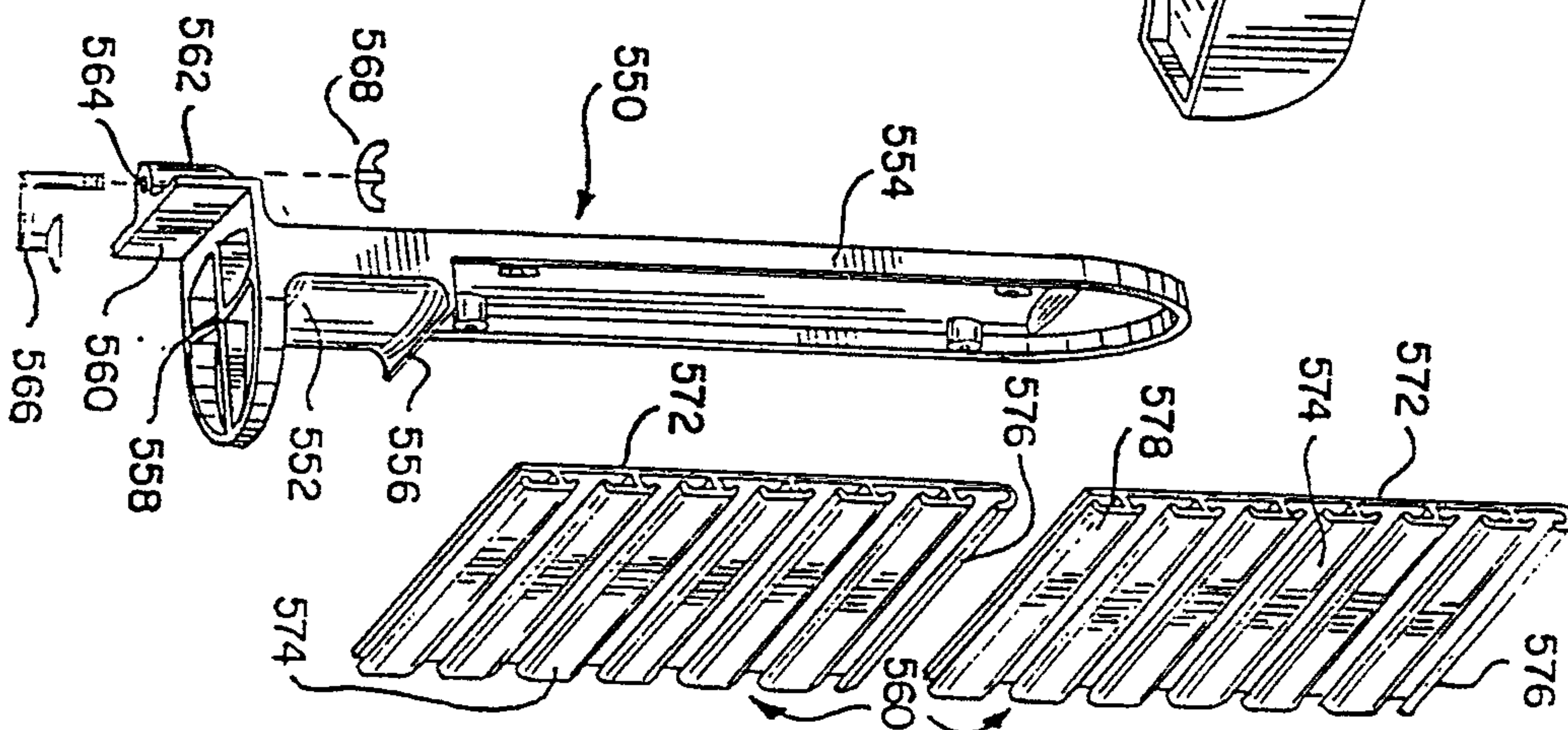


FIG. 30



15/43

FIG. 31

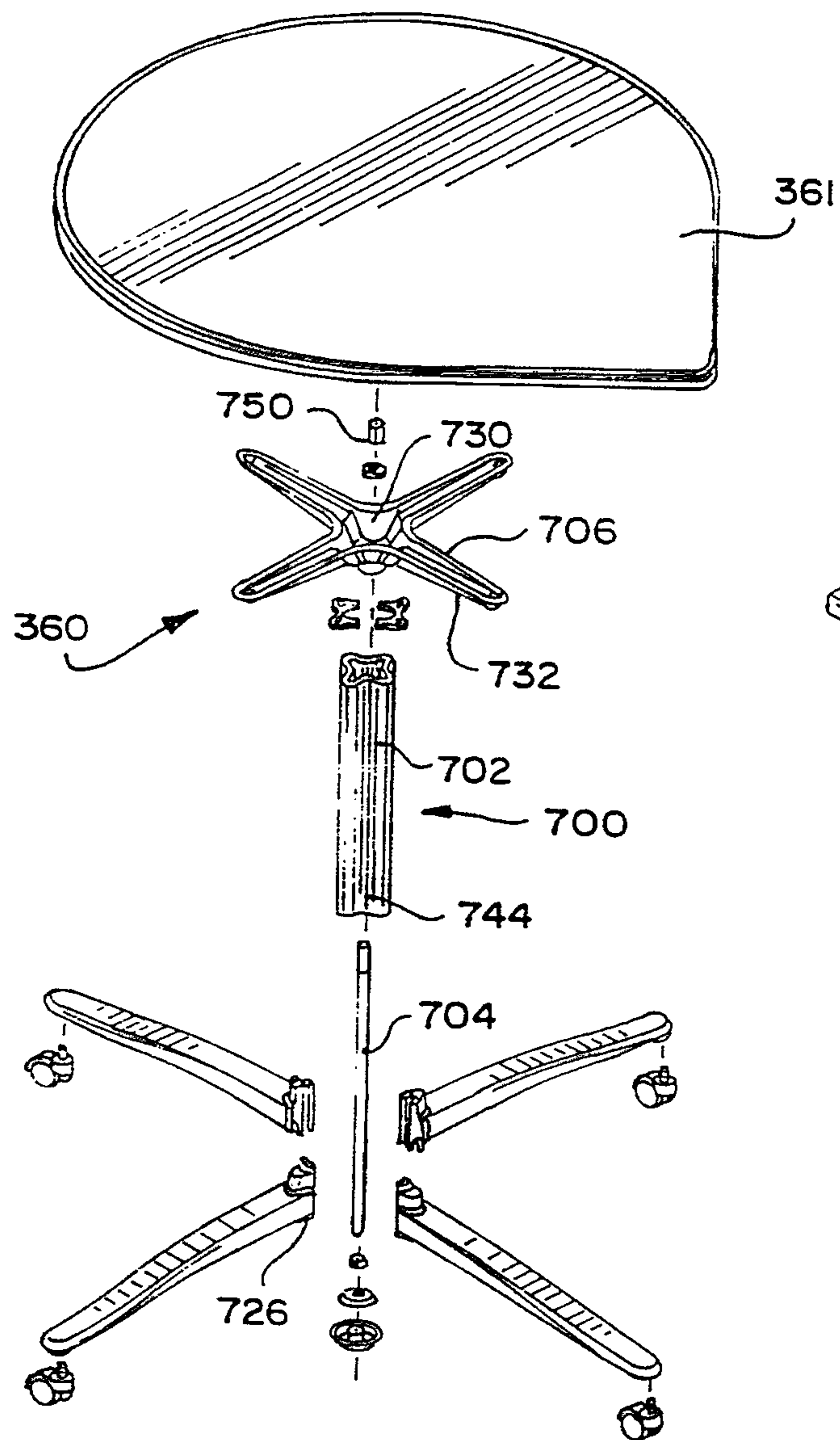


FIG. 32

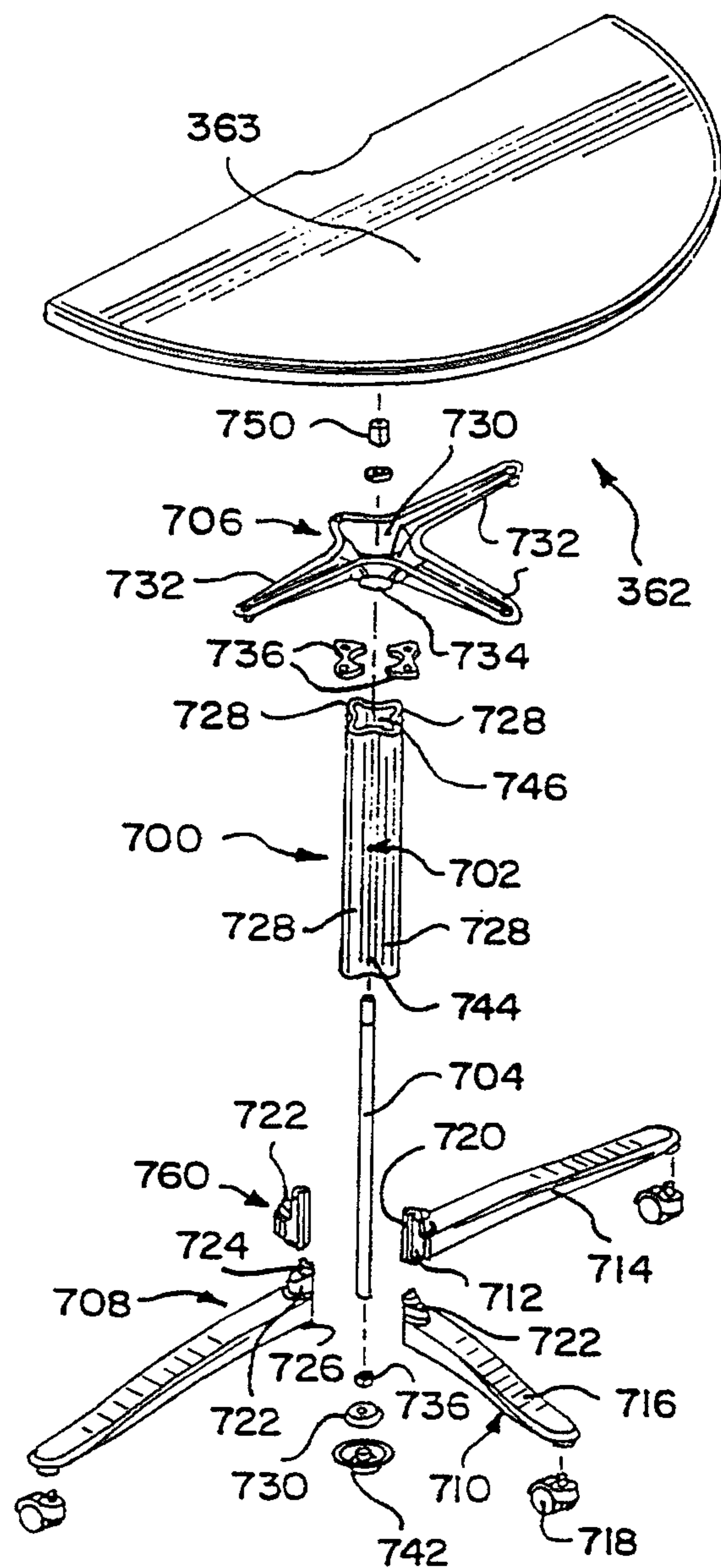


FIG. 33

16/43

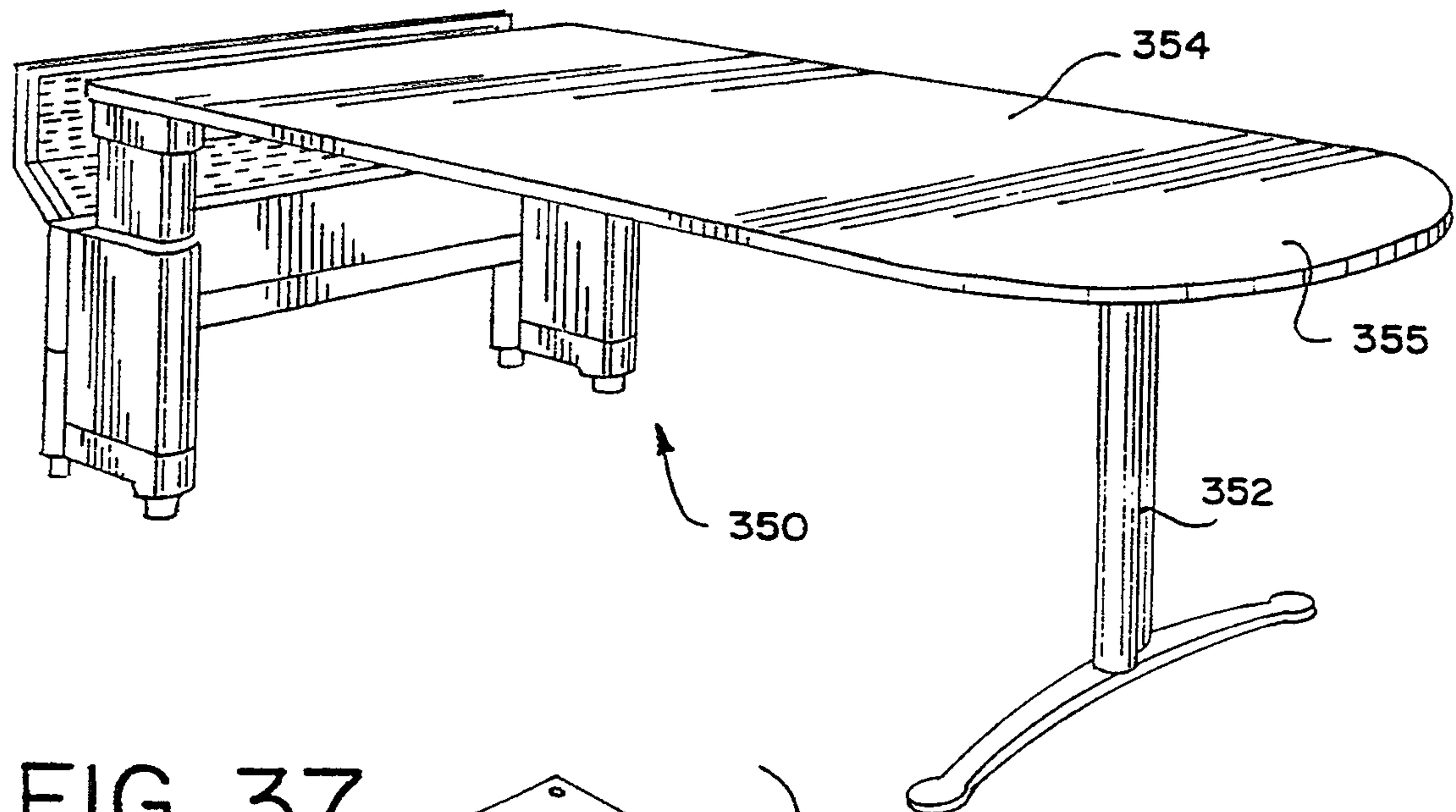
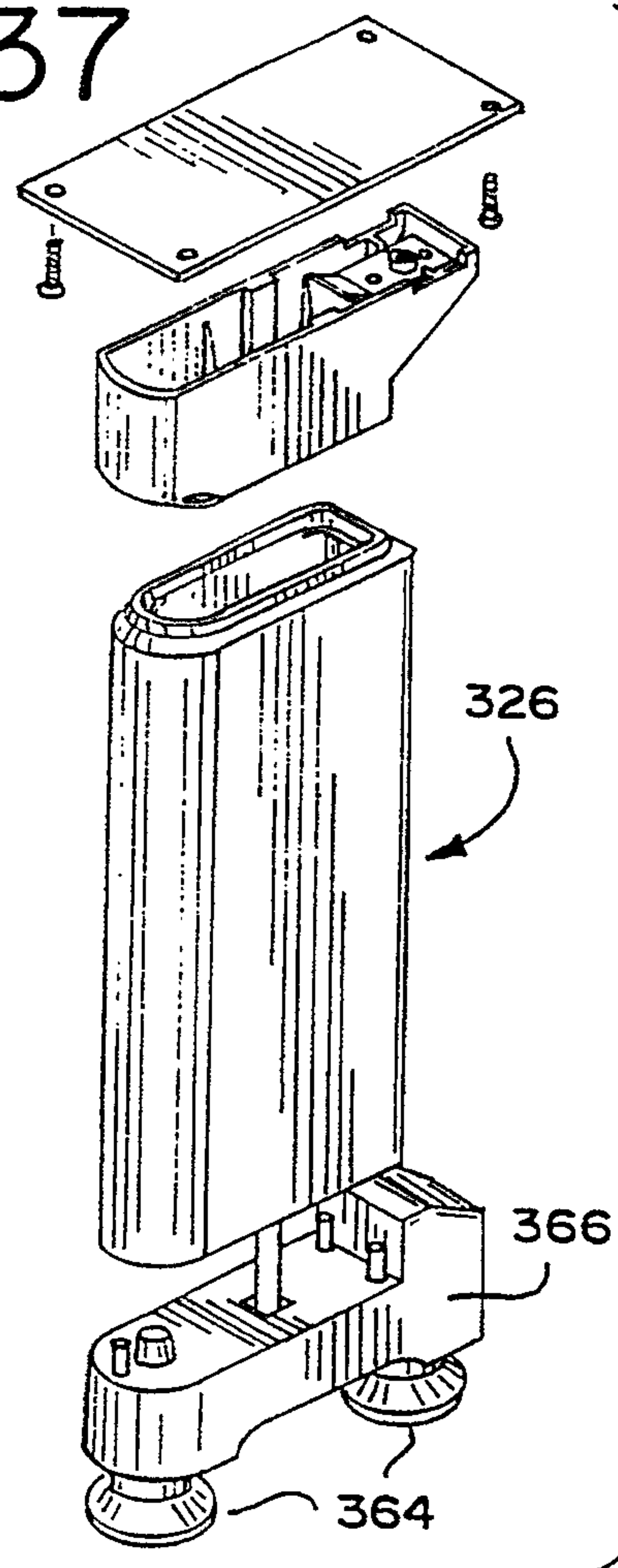


FIG. 37



SUBSTITUTE SHEET (RULE 26)

18/43

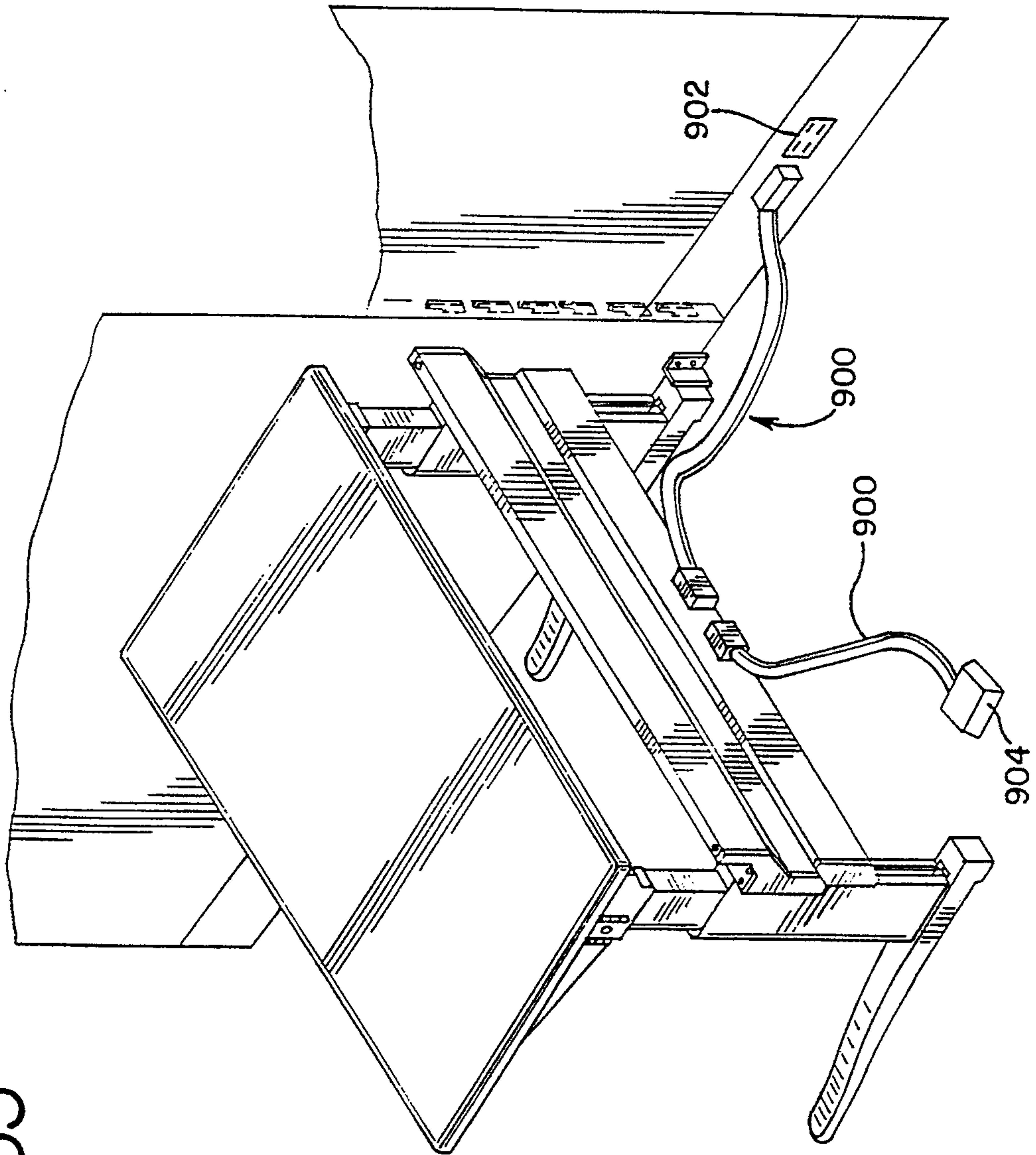
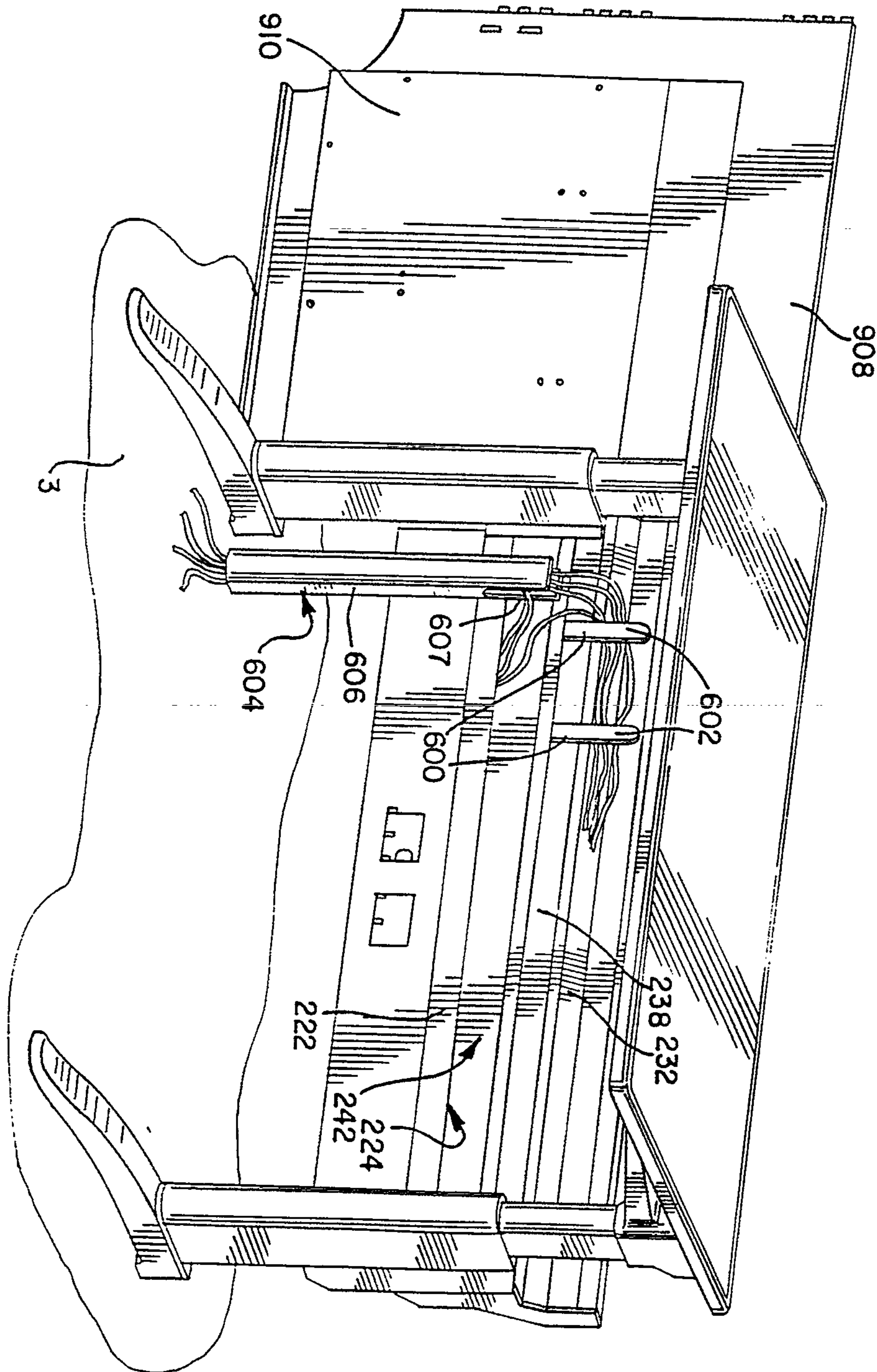


FIG. 35

19/43

FIG. 36



20/43

FIG. 38

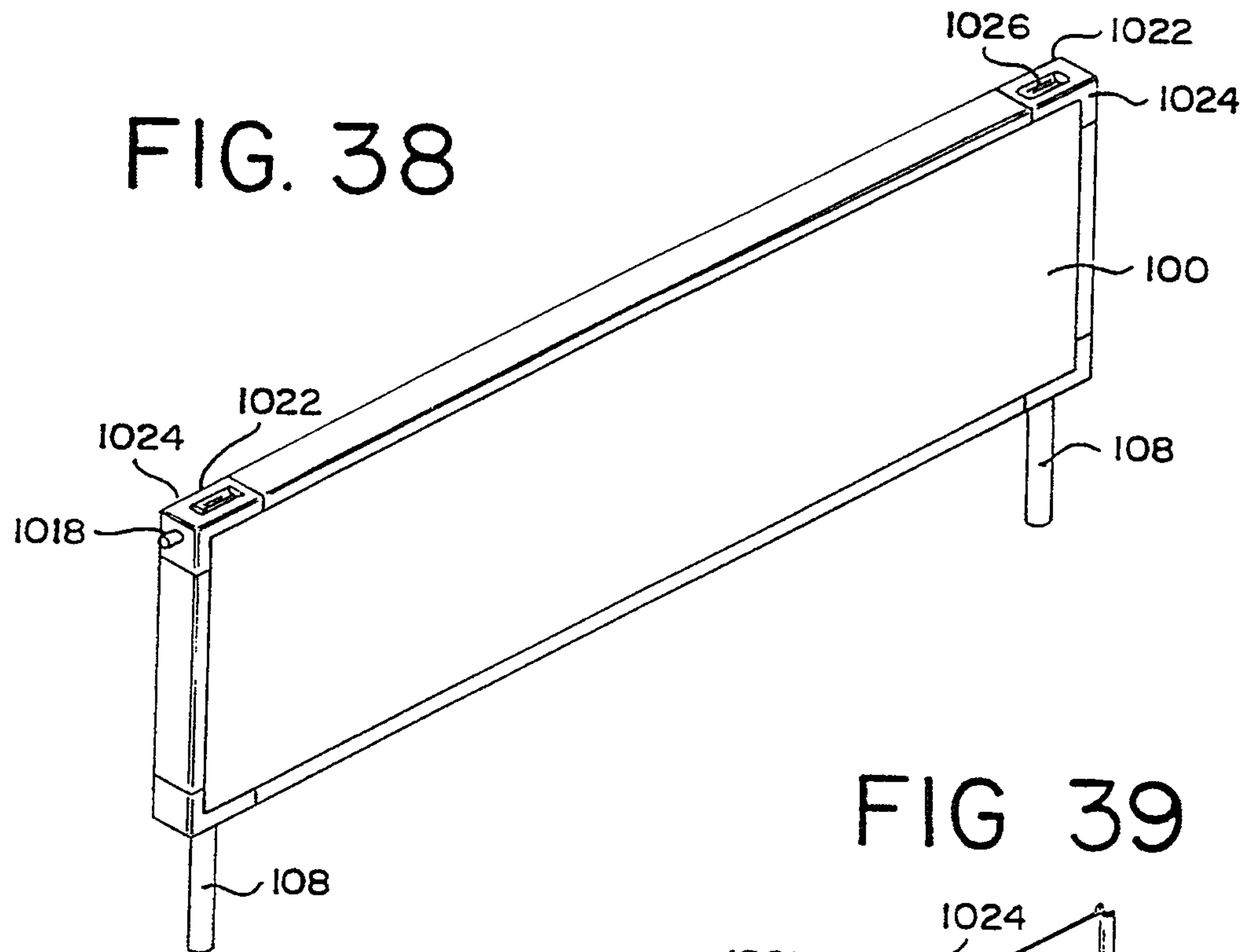
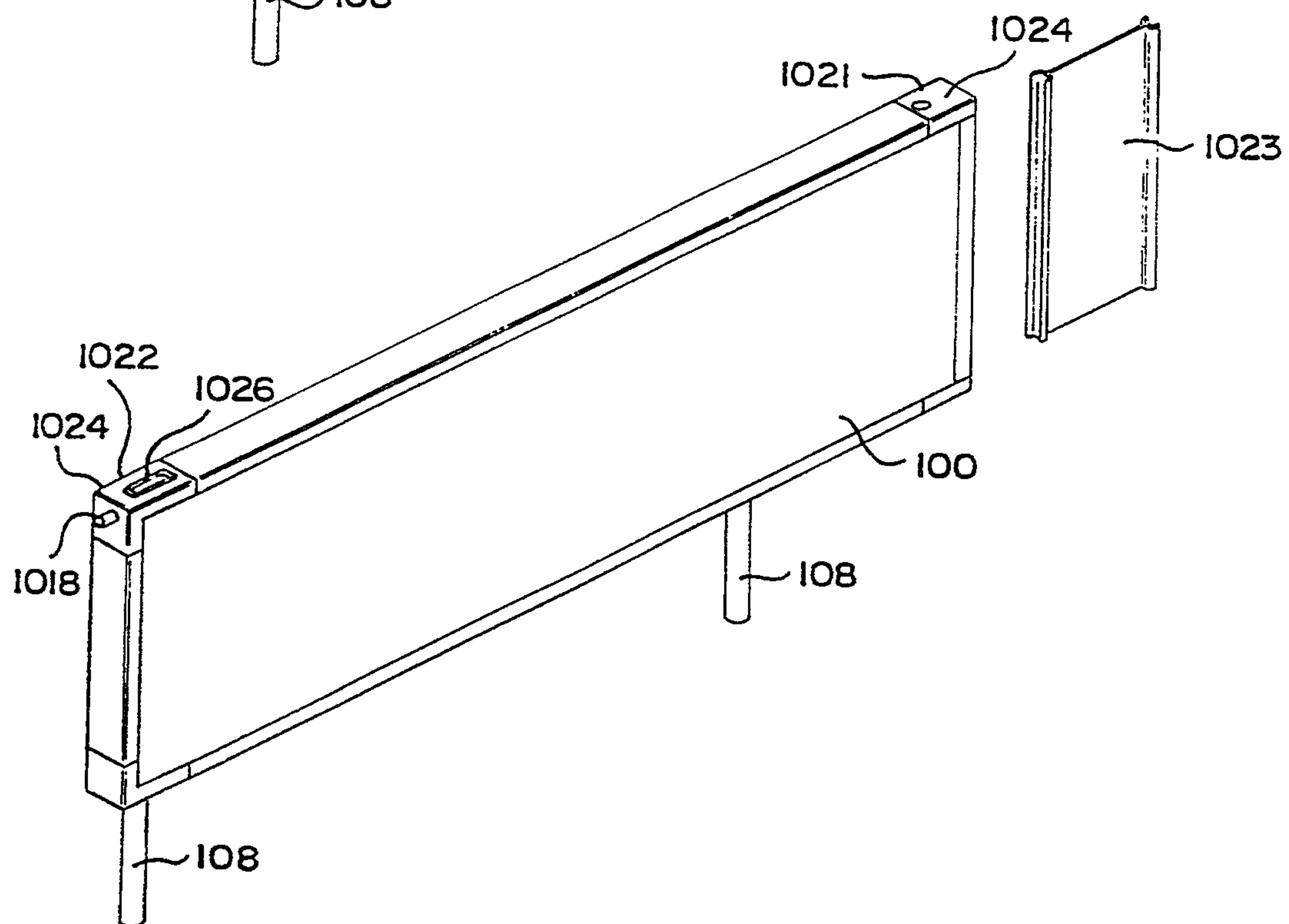


FIG 39



21/43

FIG. 40C

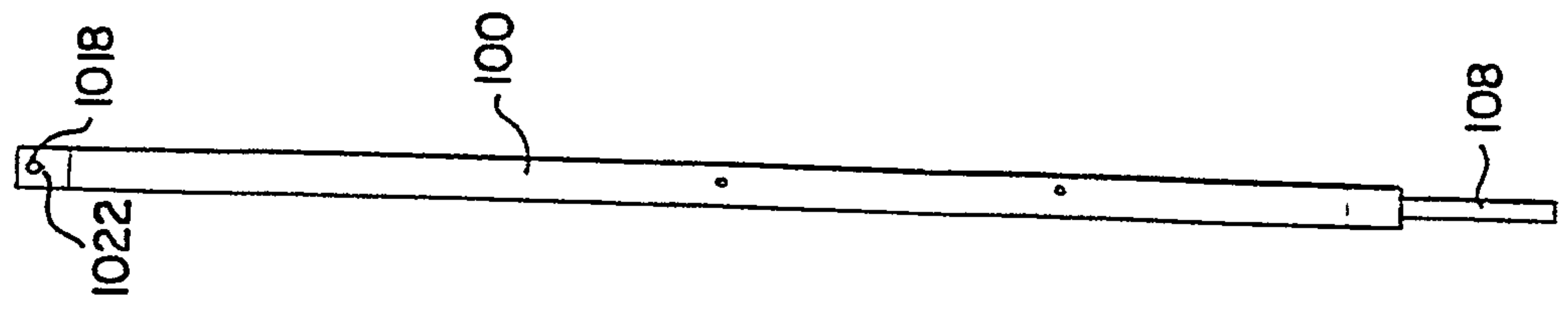


FIG. 40B

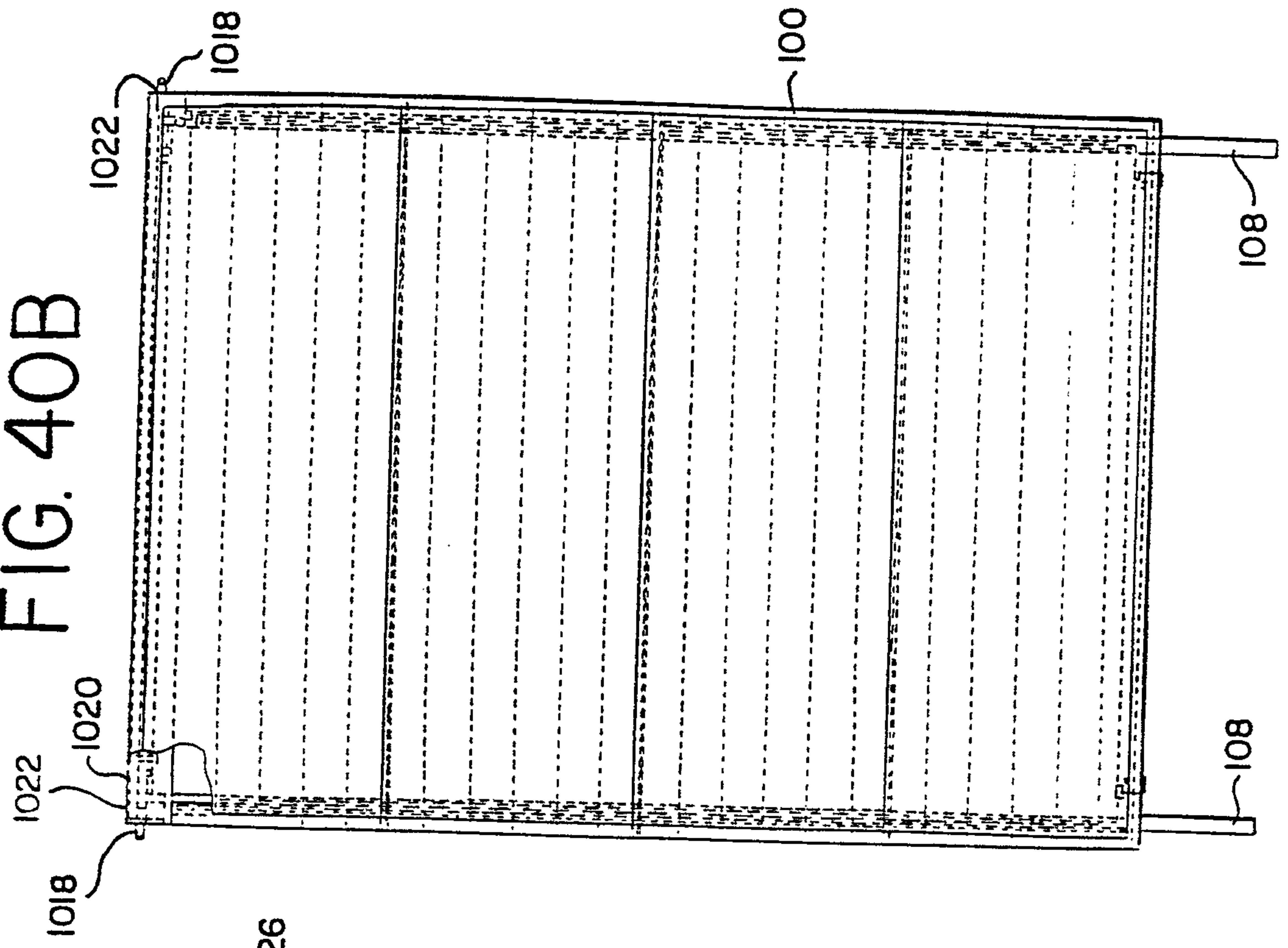
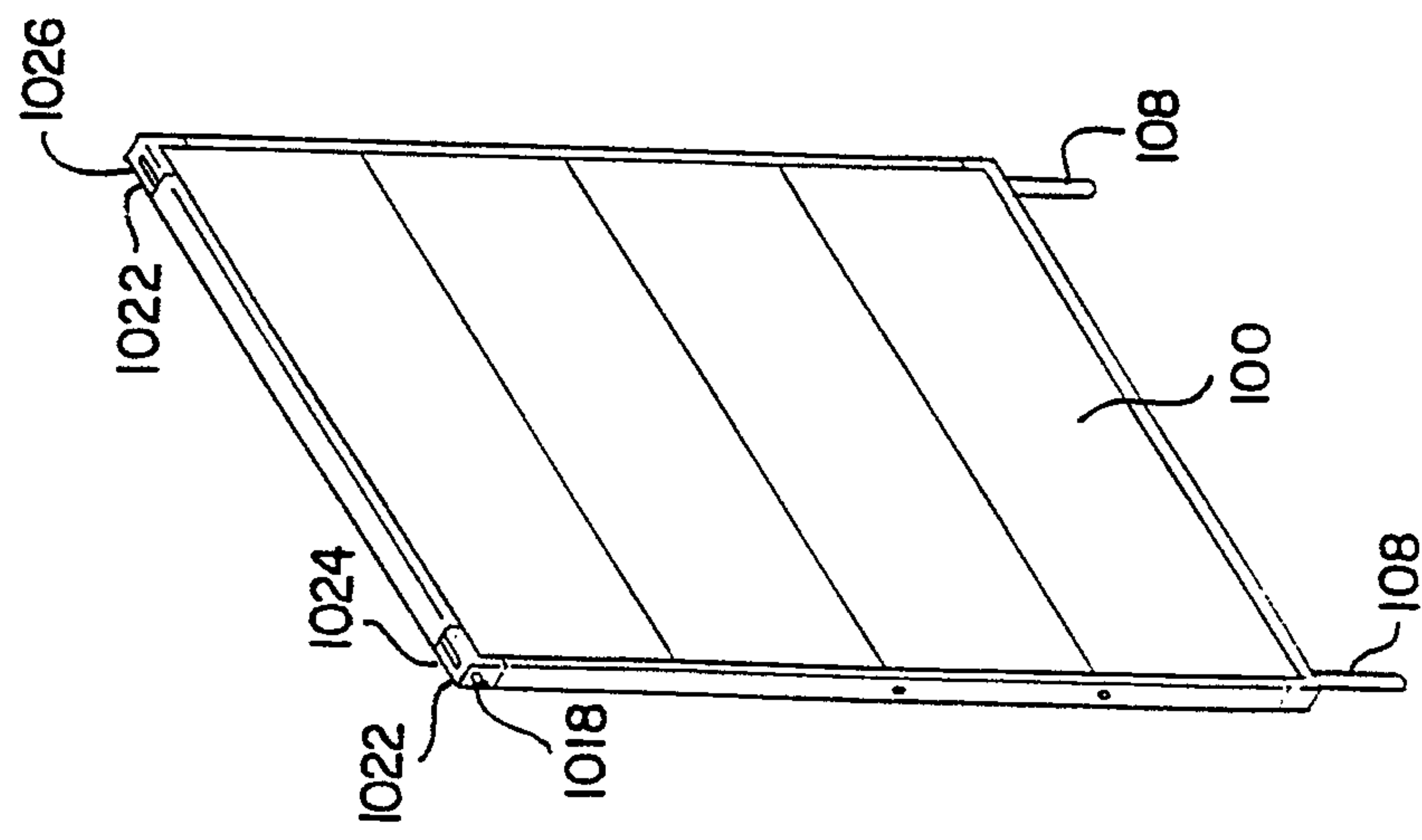


FIG. 40A



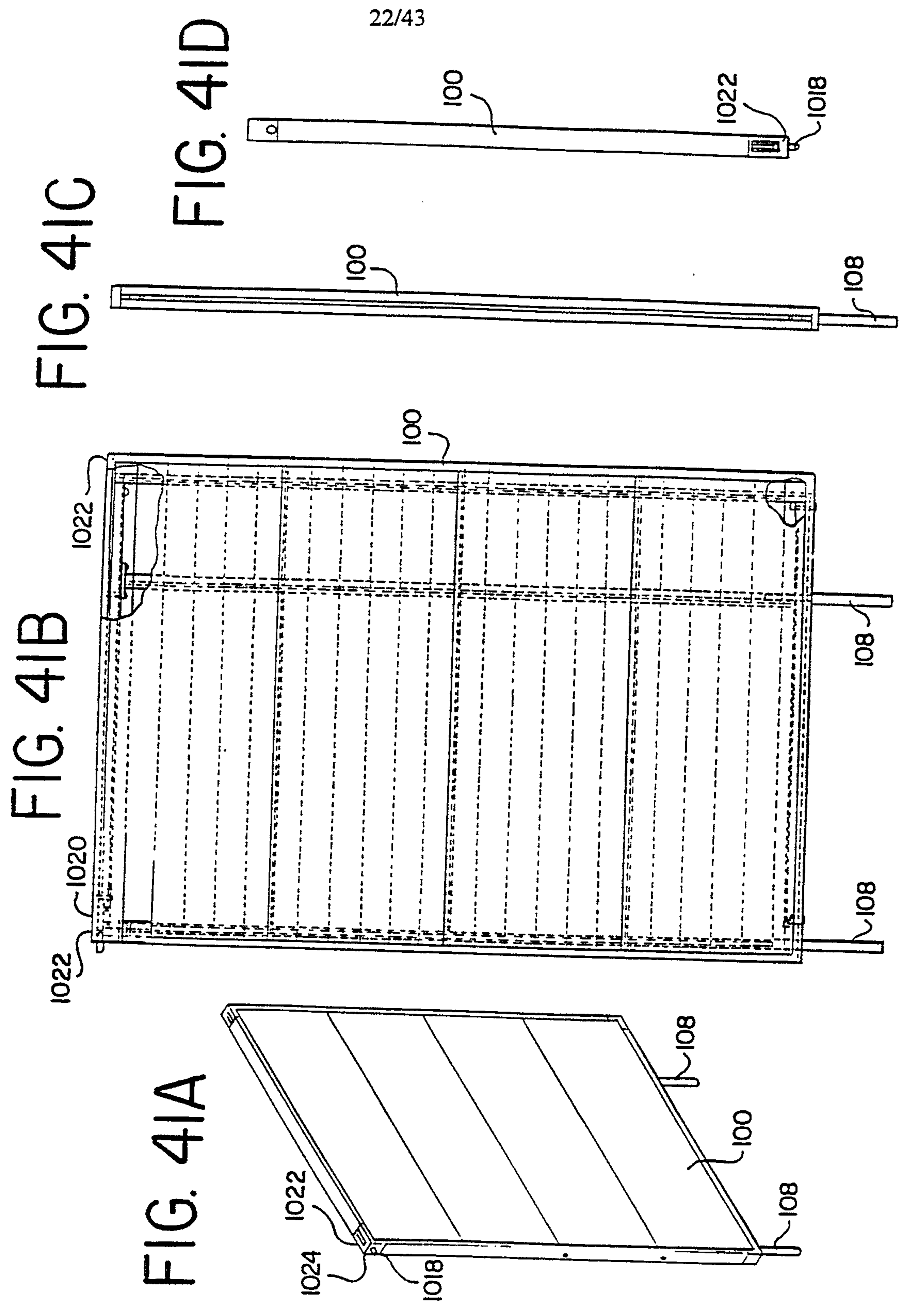
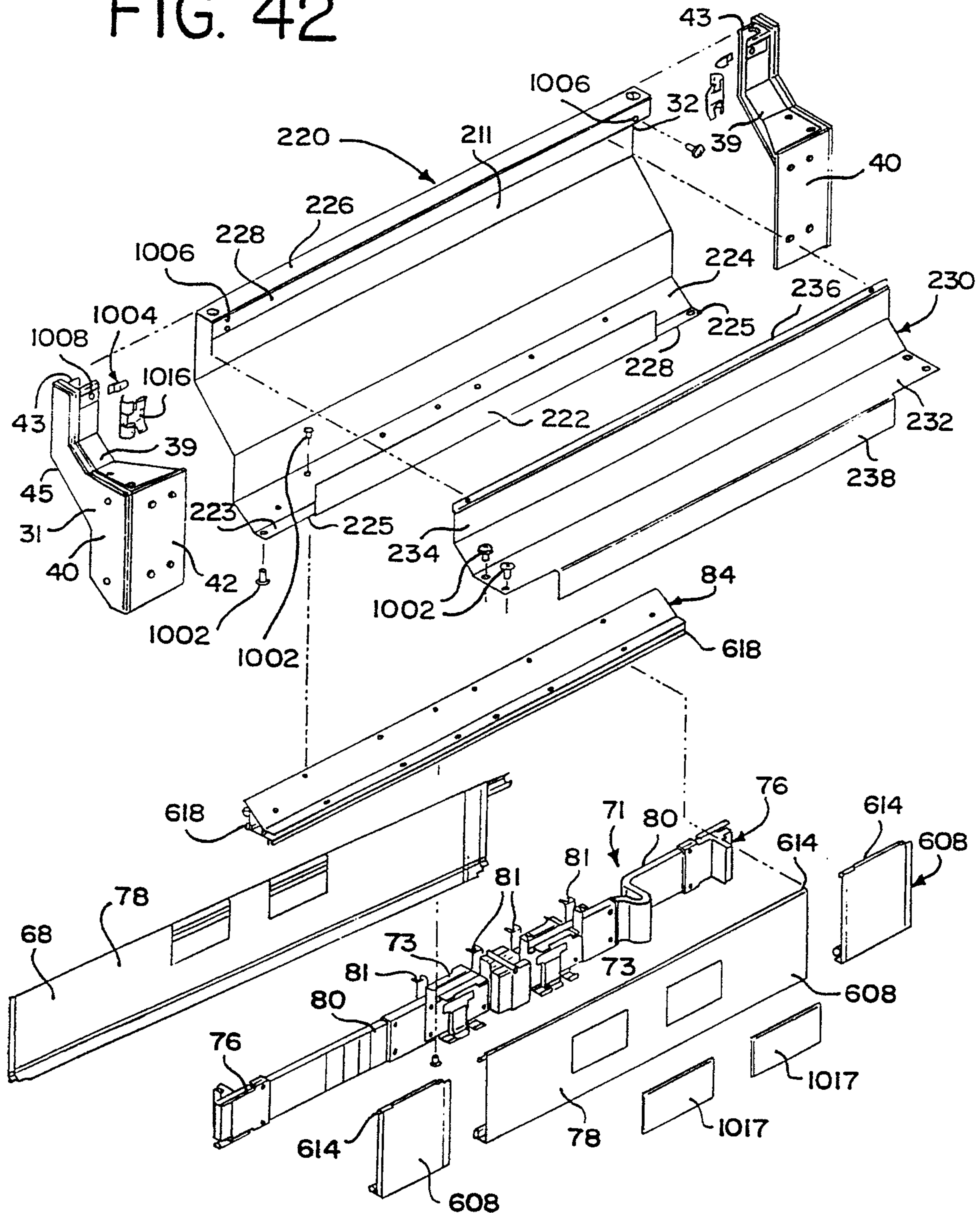


FIG. 42



24/43

FIG. 43A

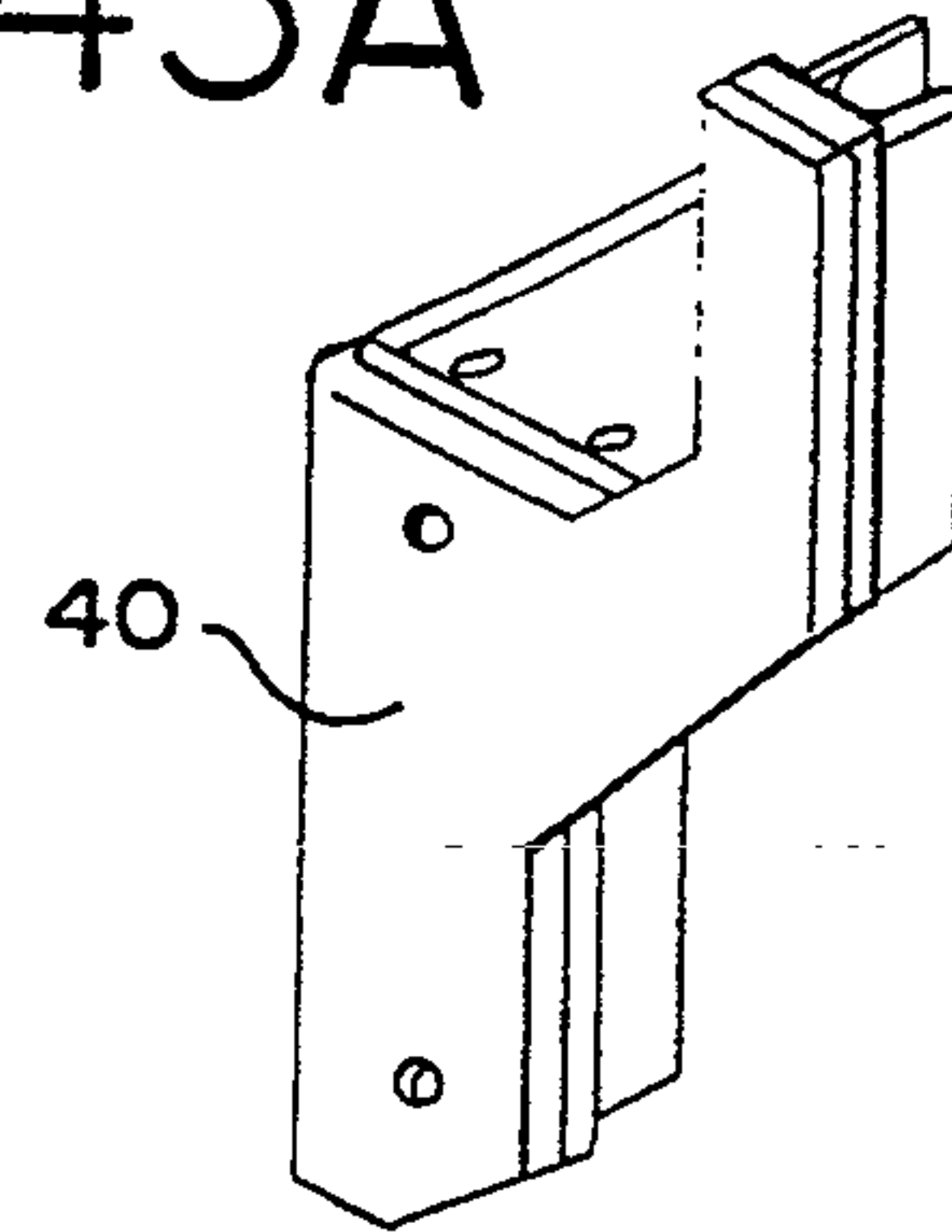


FIG. 43B

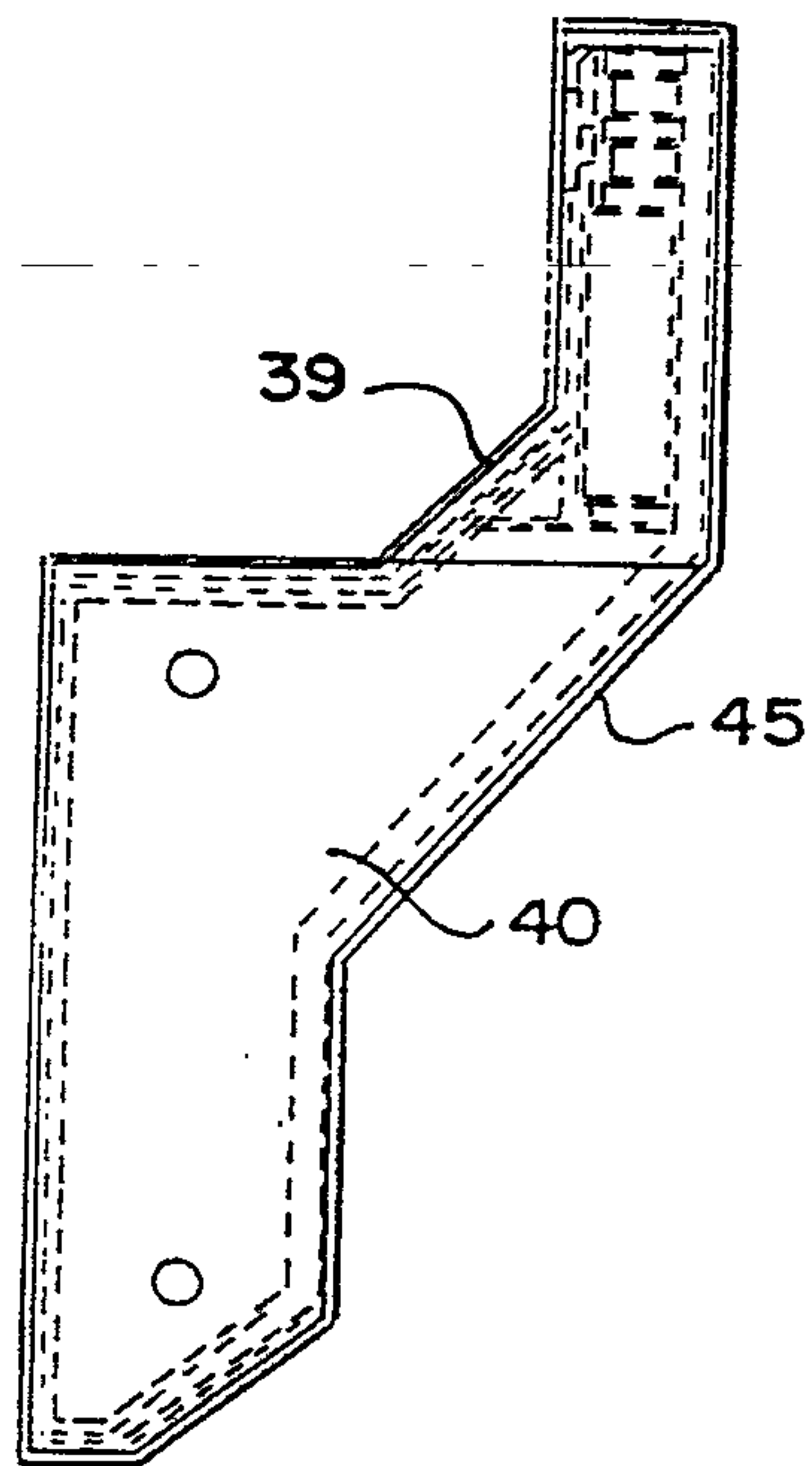


FIG. 43C

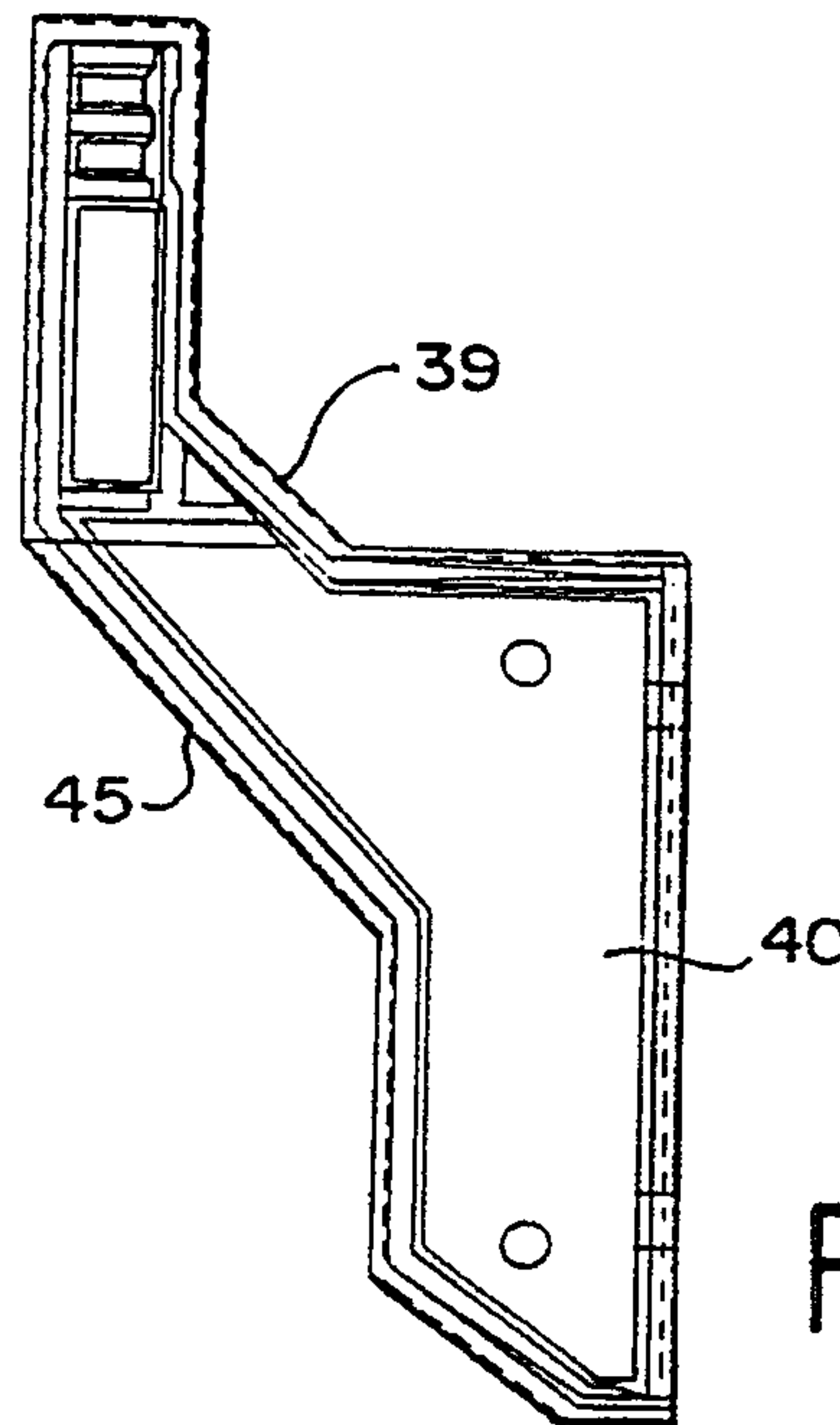


FIG. 43F

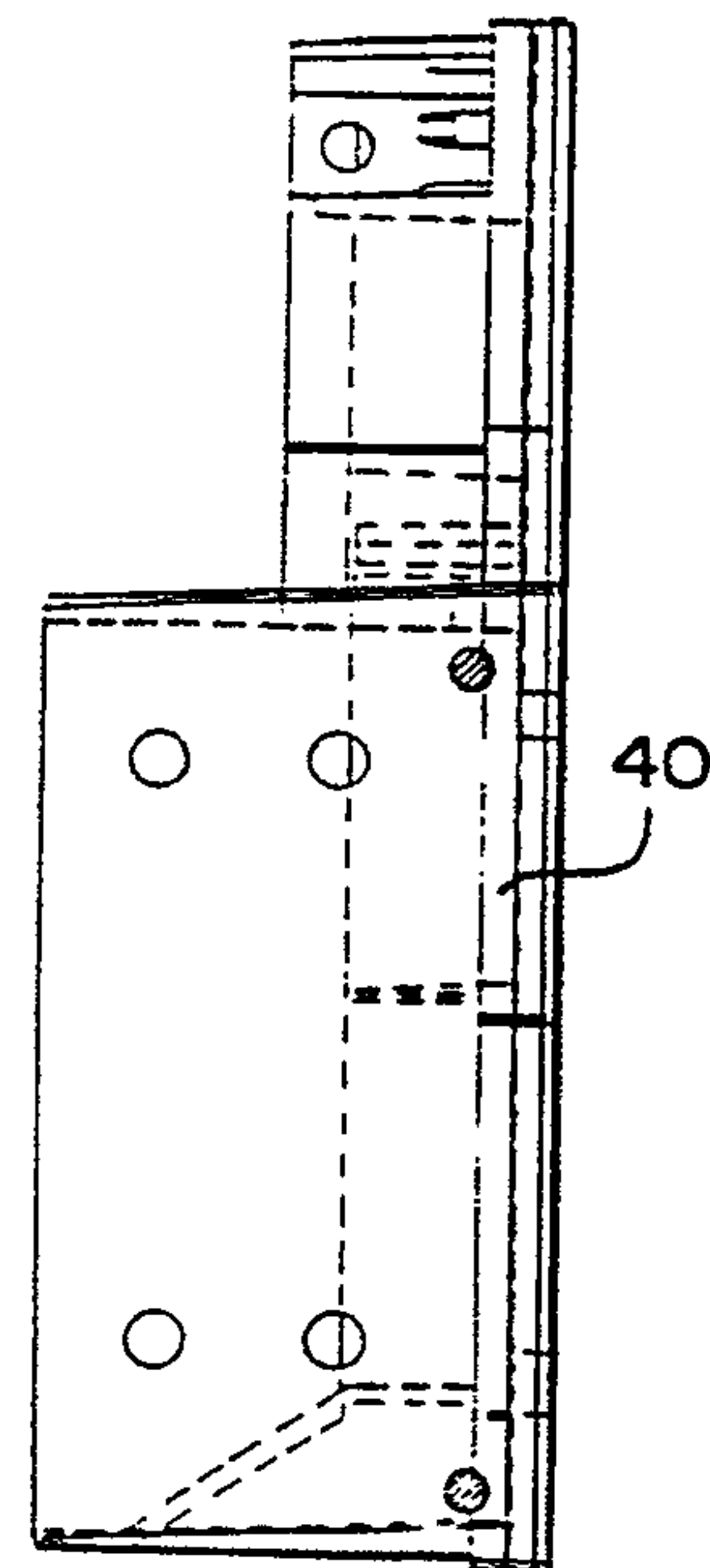


FIG. 43D

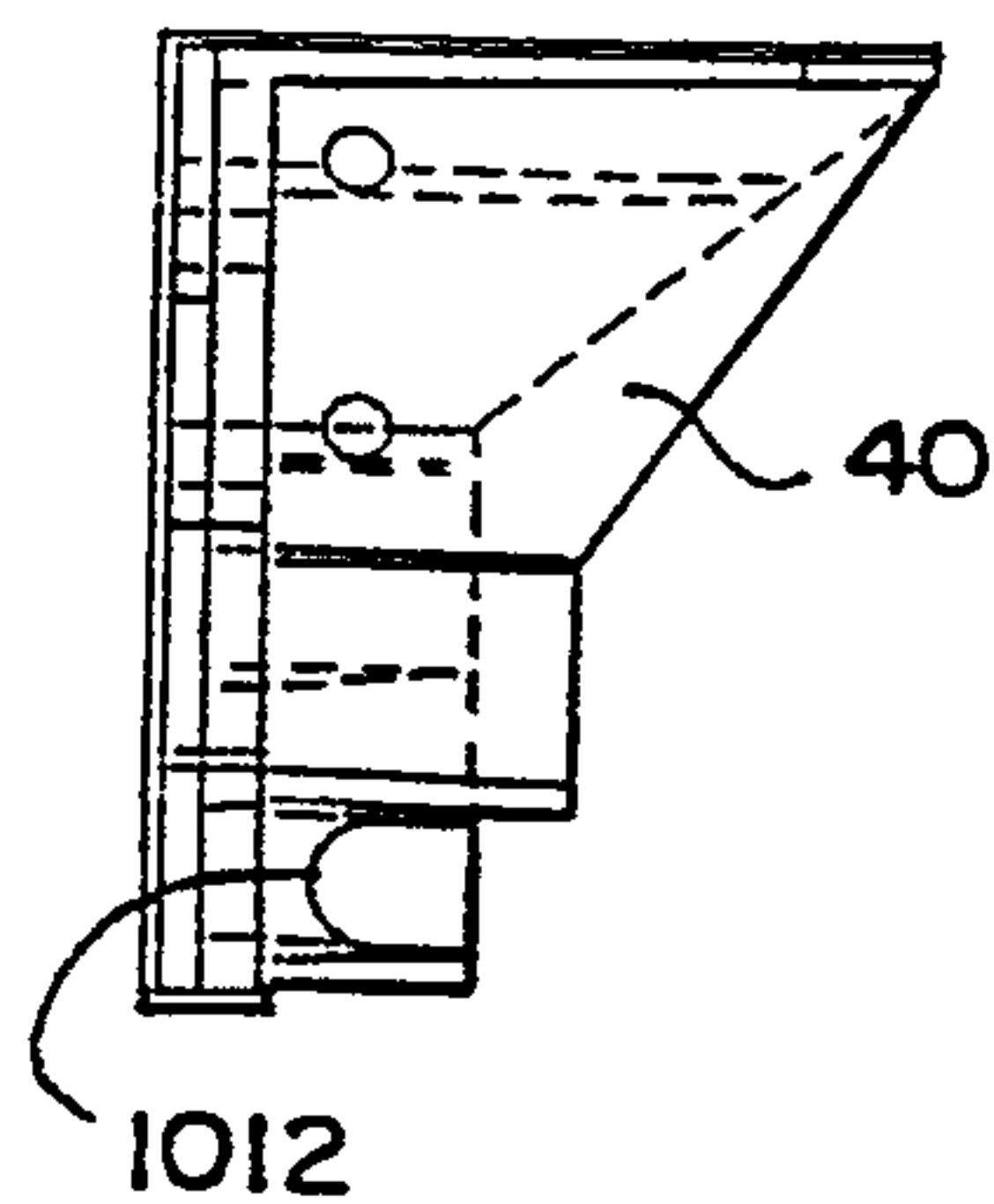
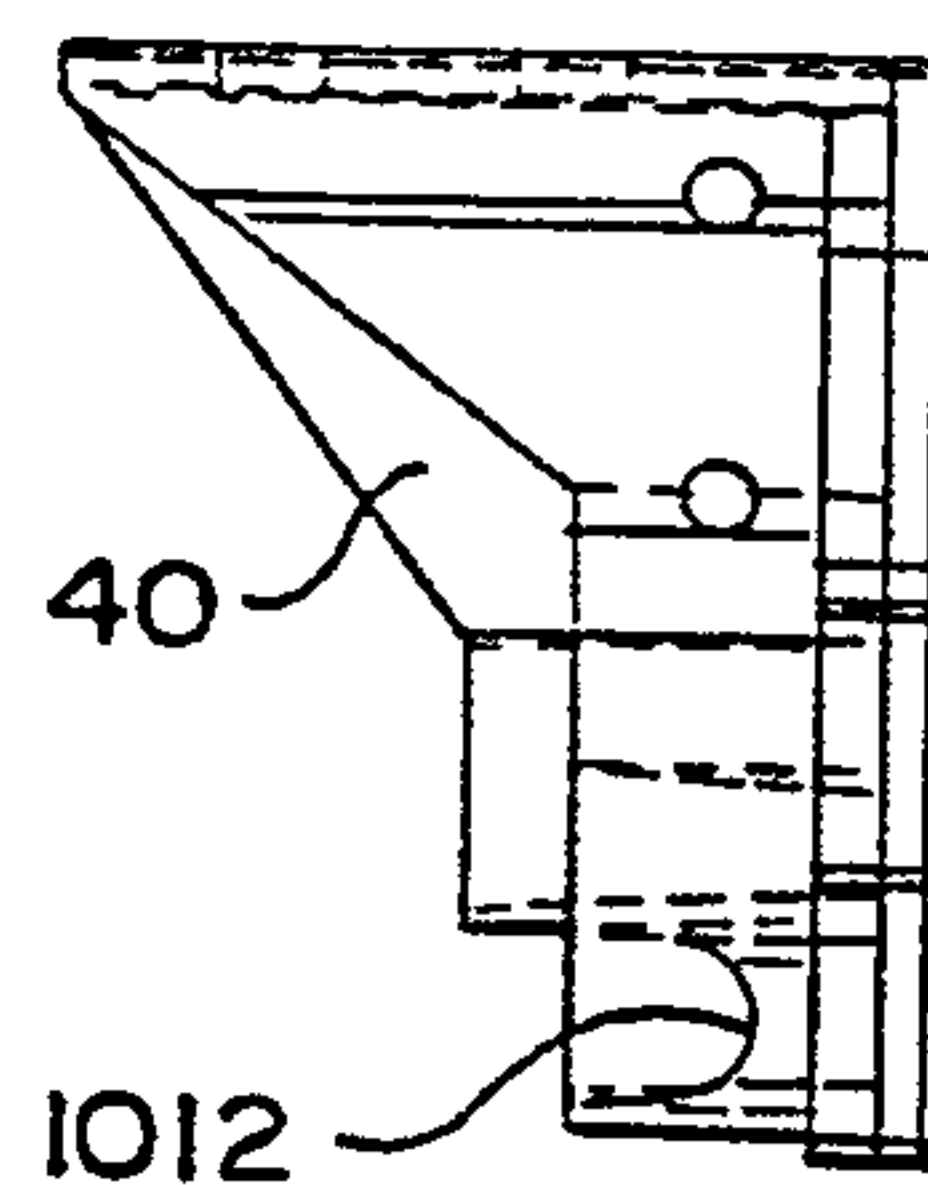


FIG. 43E



25/43

FIG. 44A

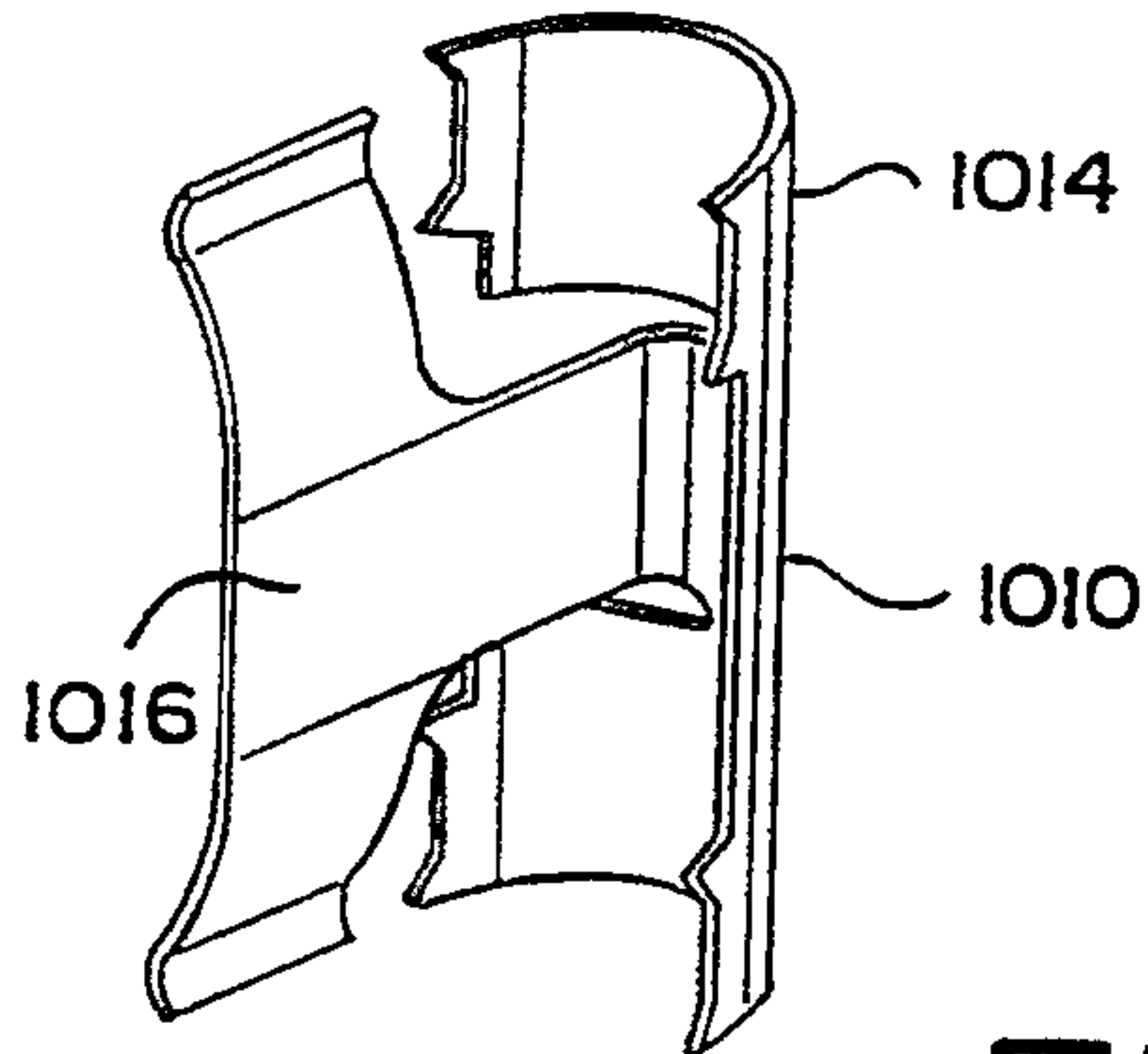


FIG. 44B

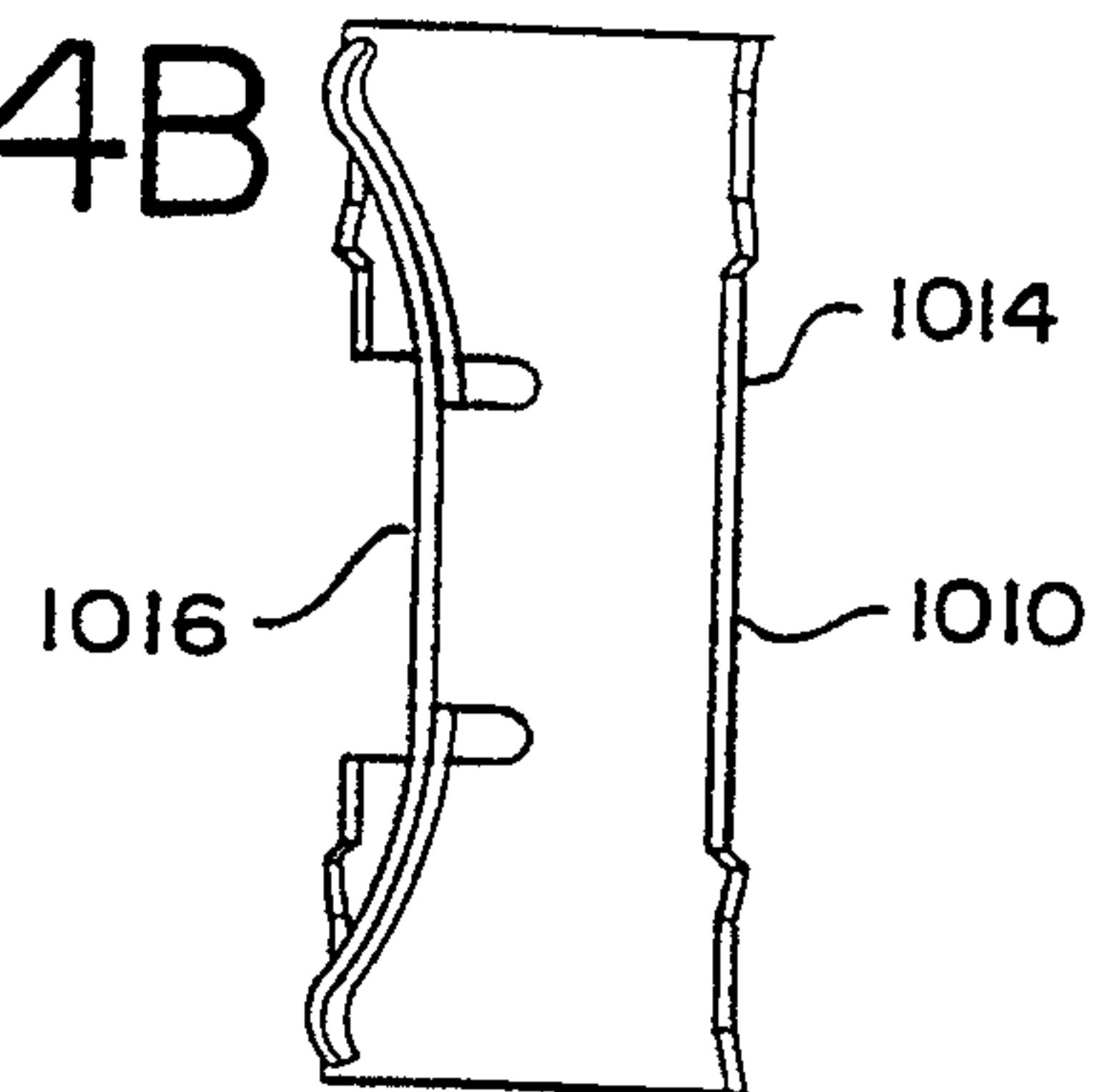


FIG. 45

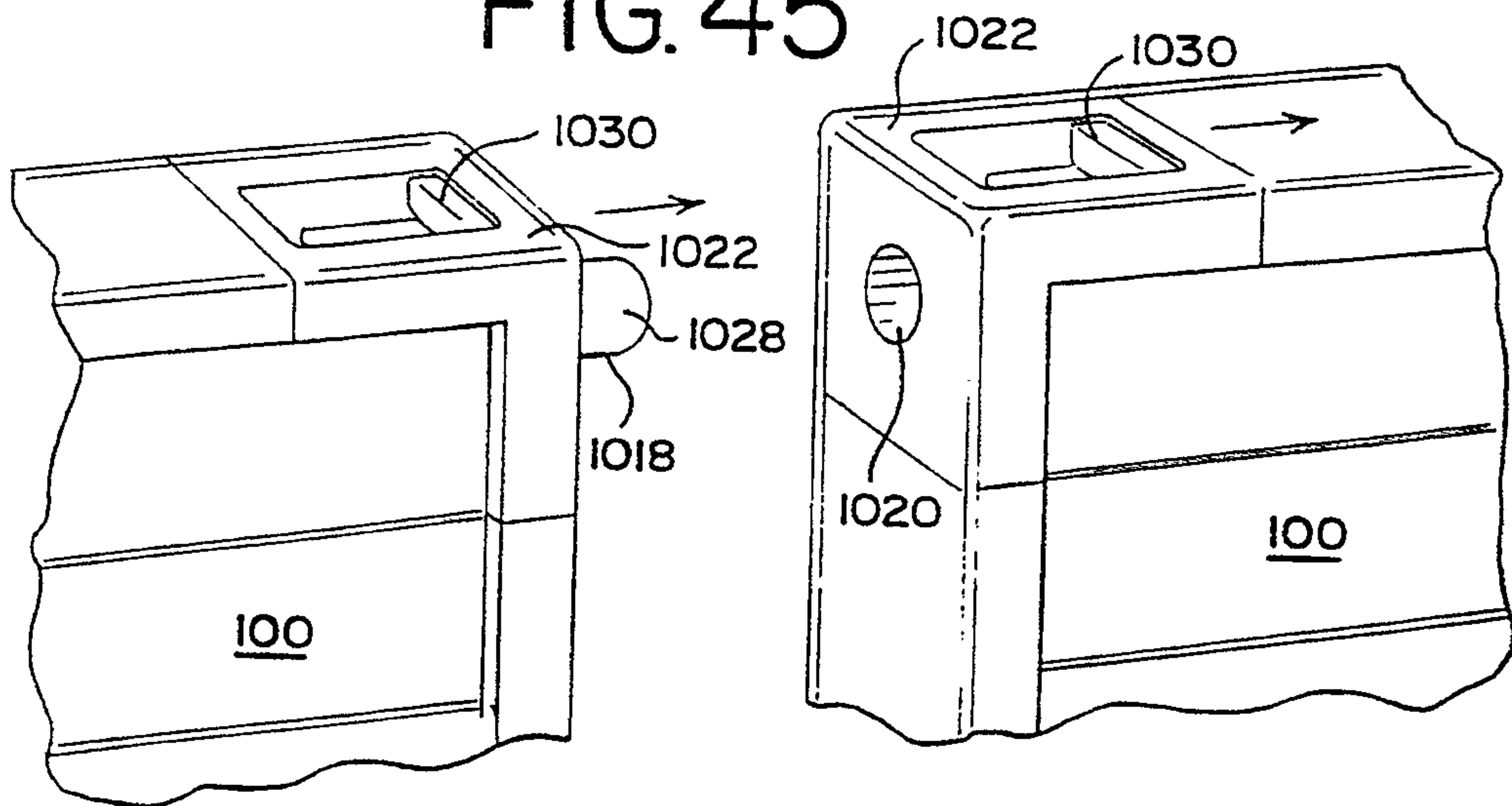


FIG. 46A

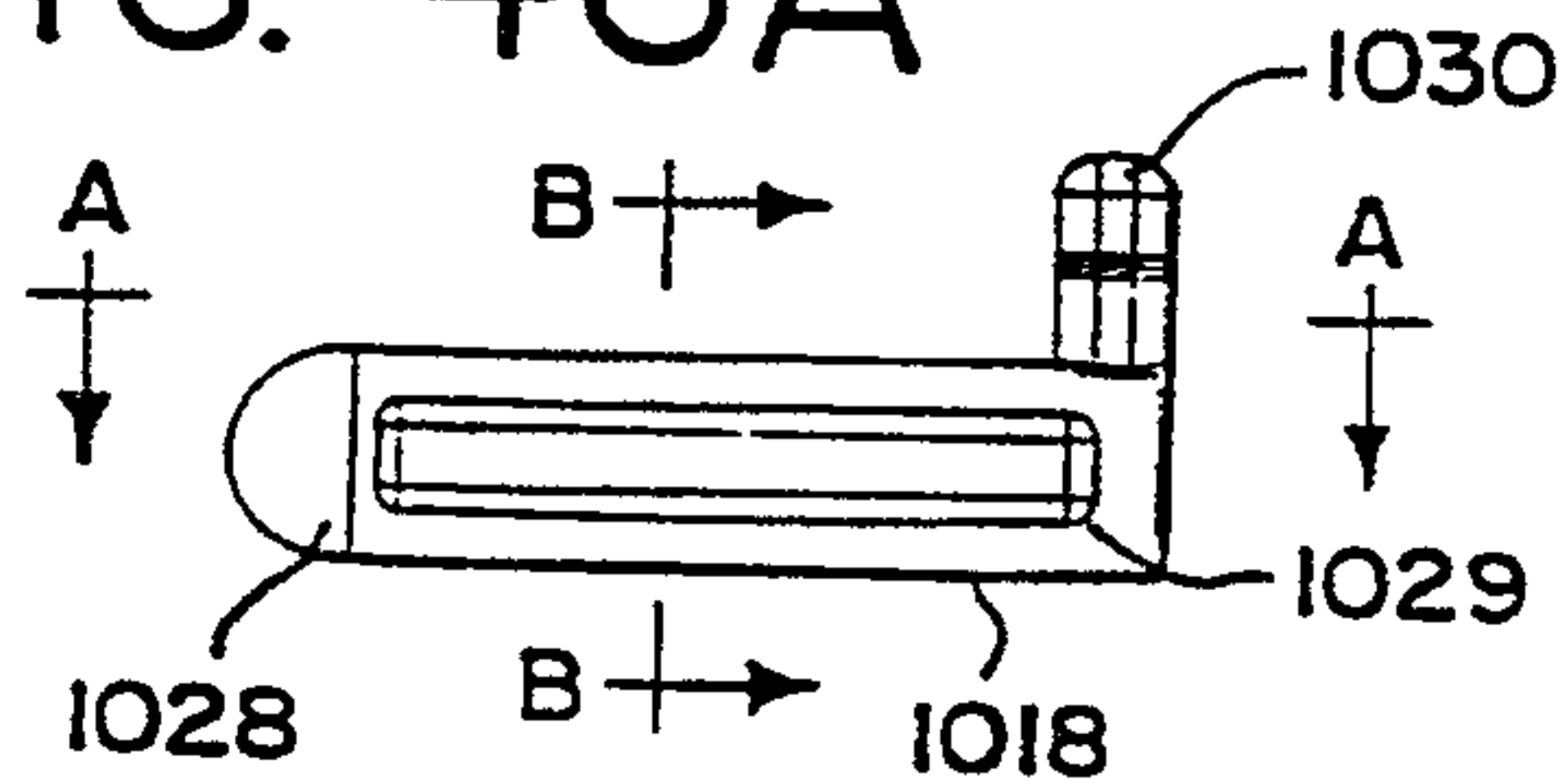


FIG. 46B

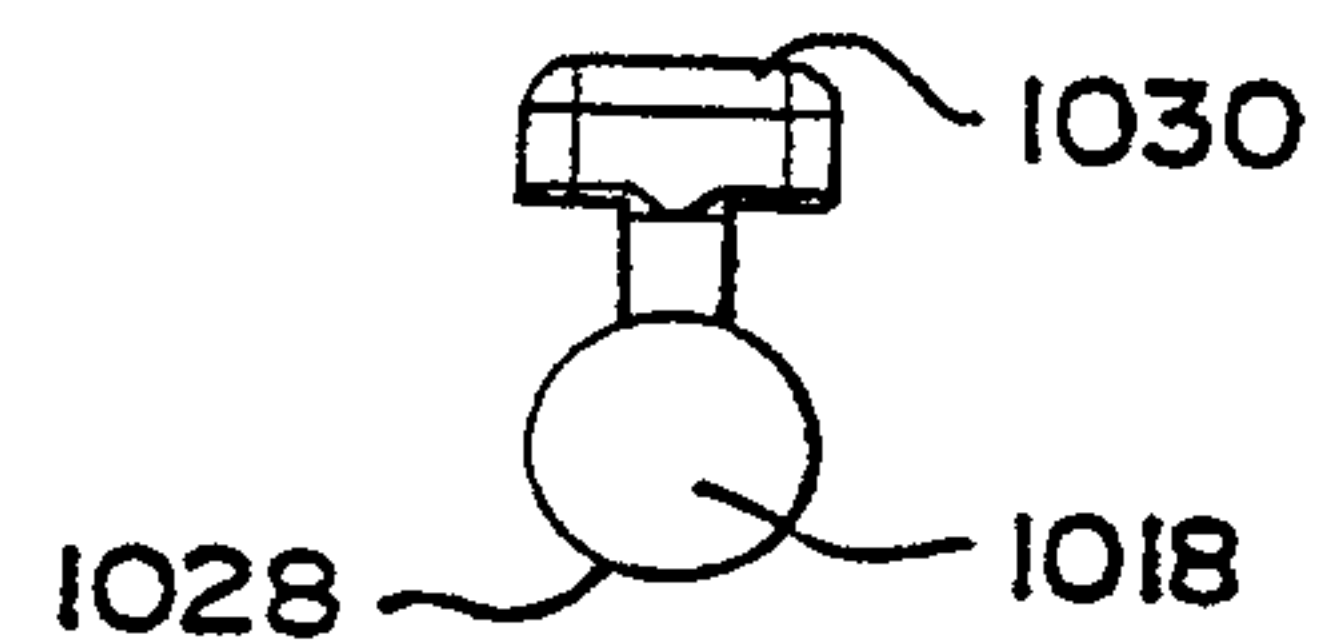


FIG. 46C

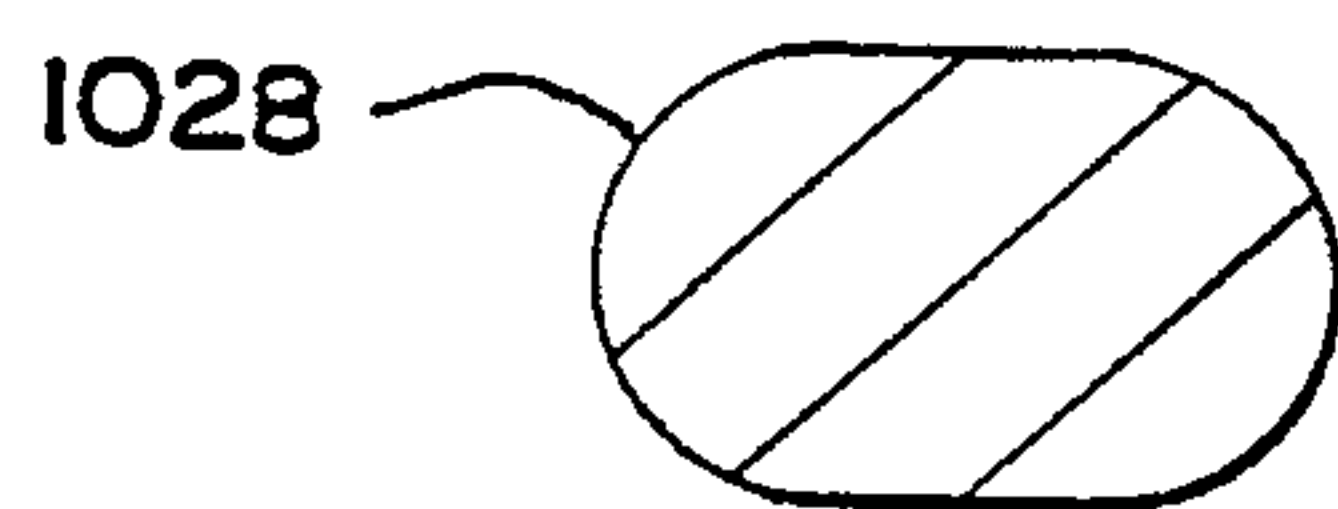
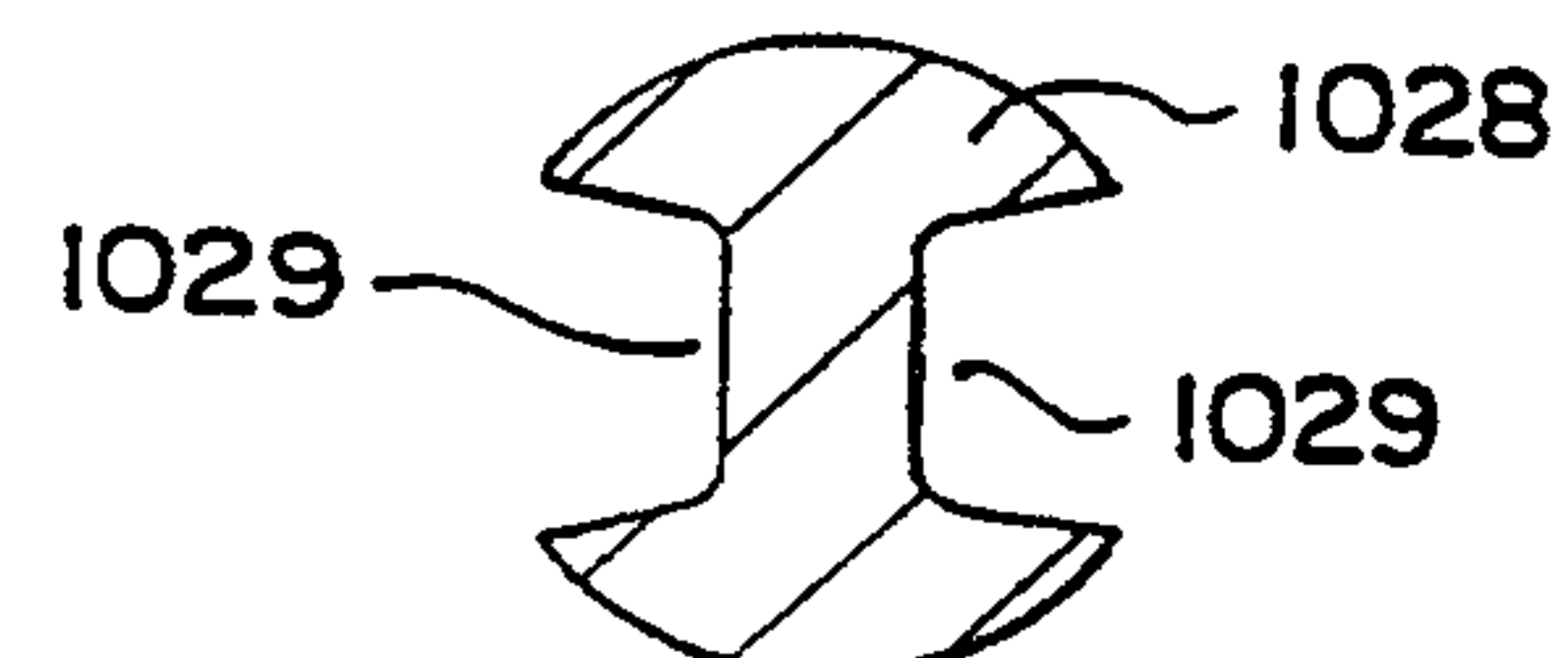


FIG. 46D



26/43

FIG. 47

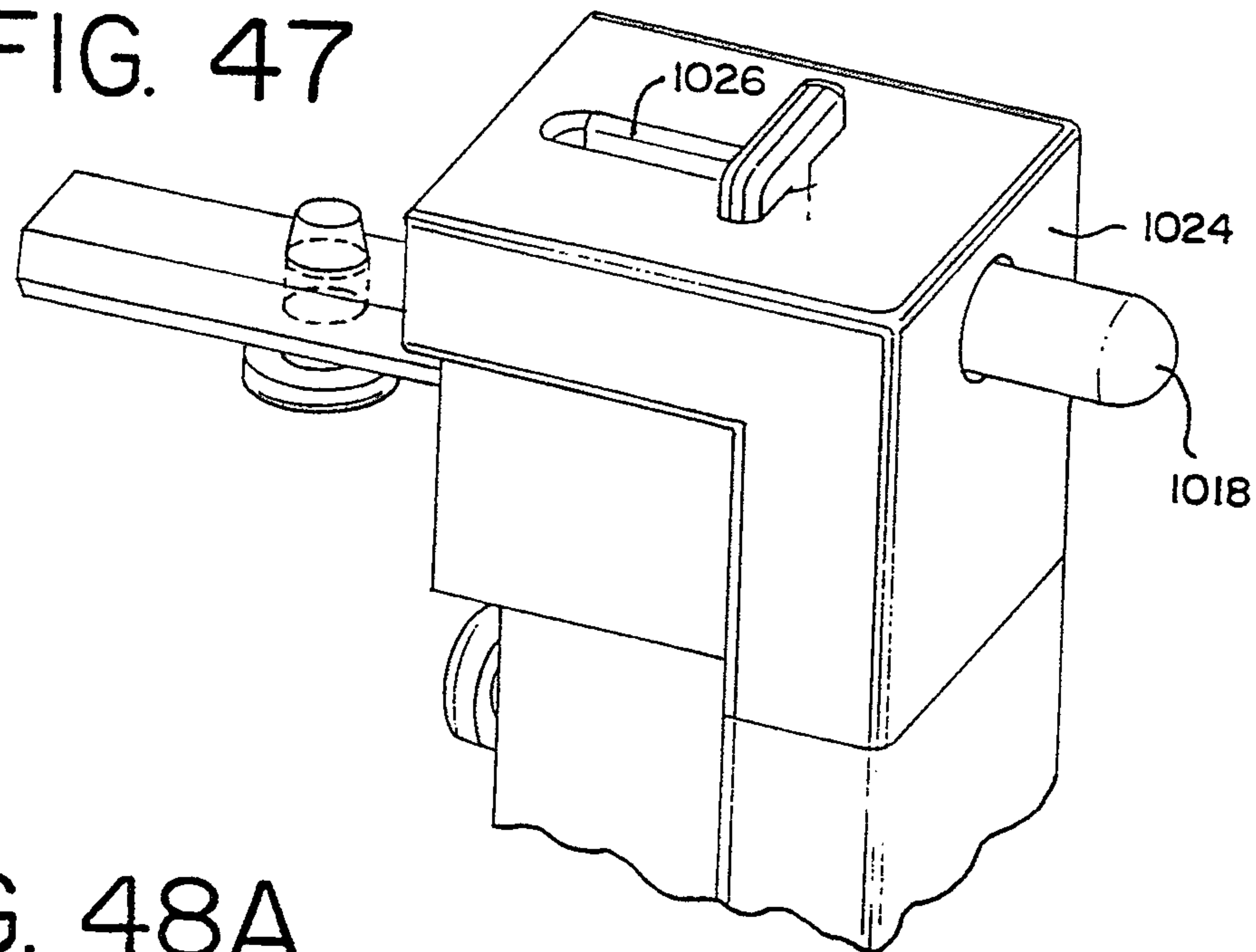


FIG. 48A

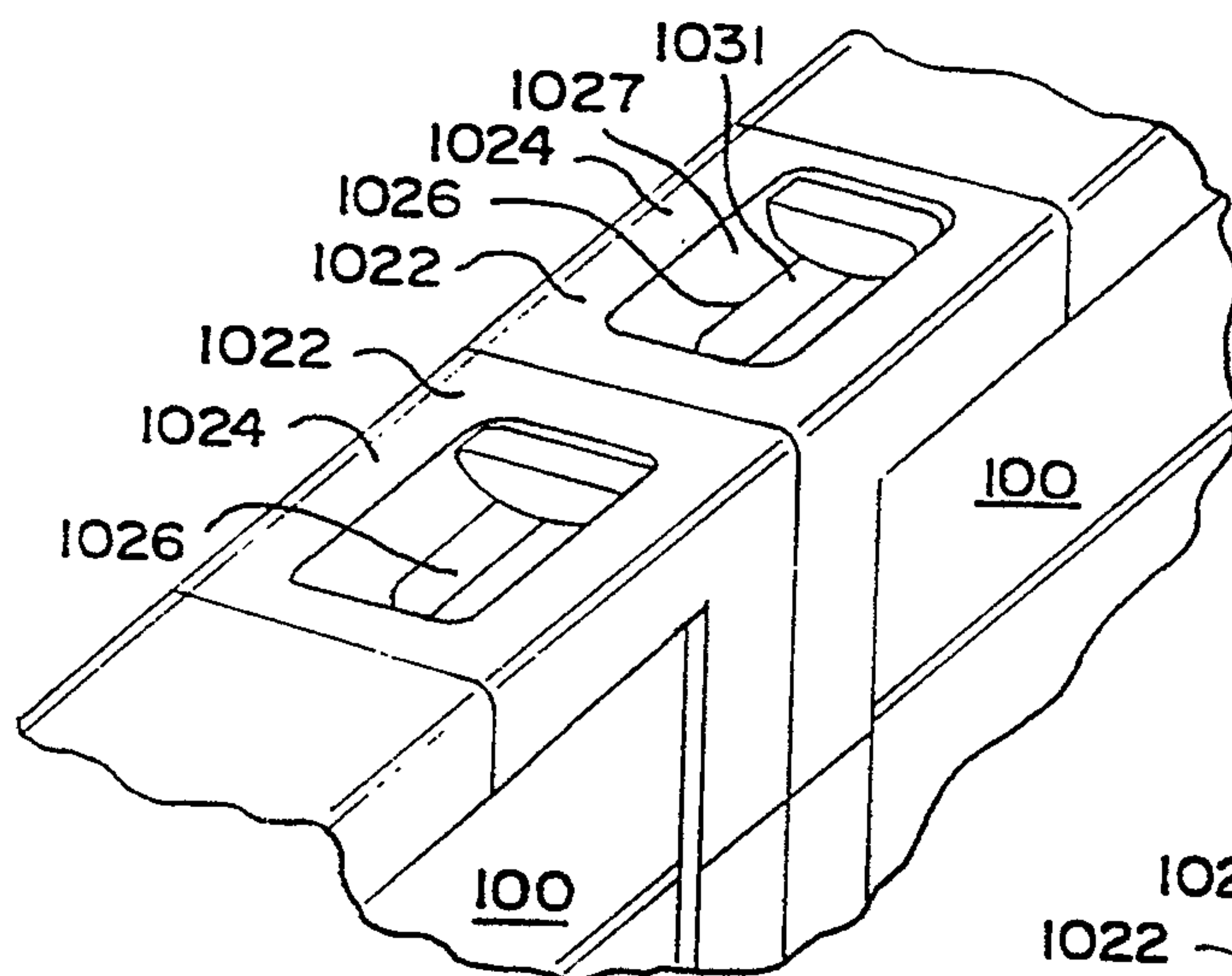
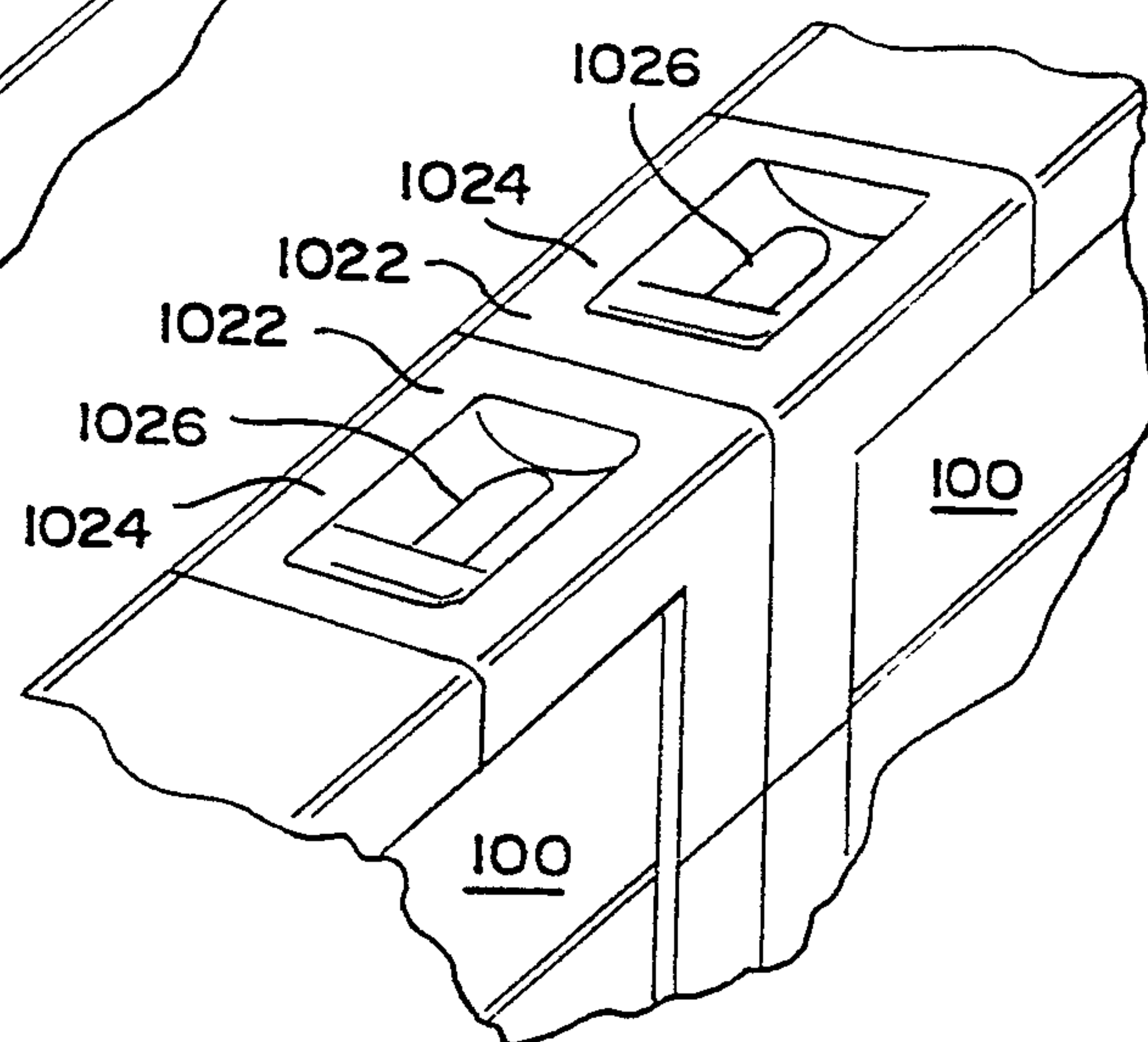


FIG. 48B



27/43

FIG. 49

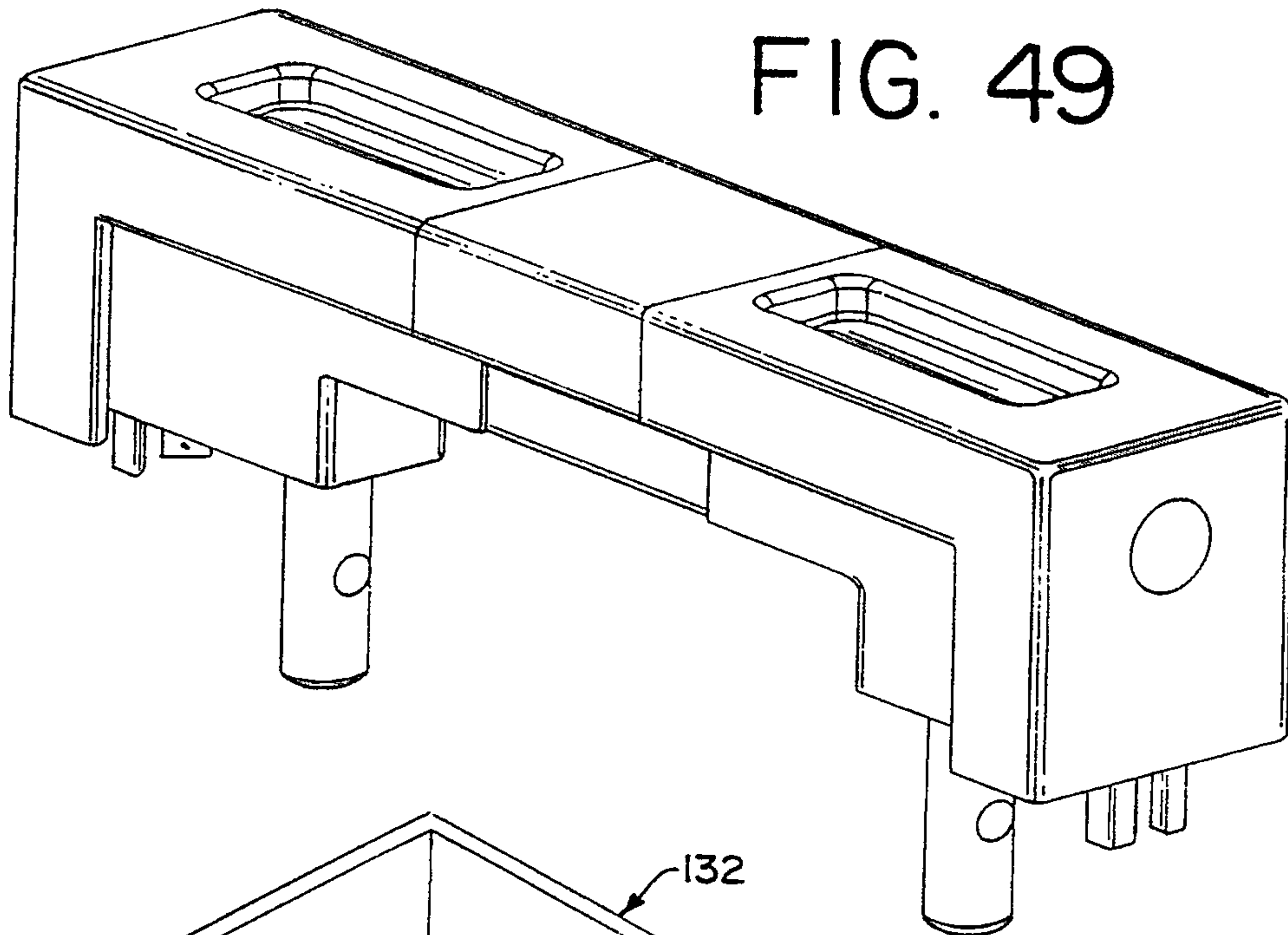


FIG. 50

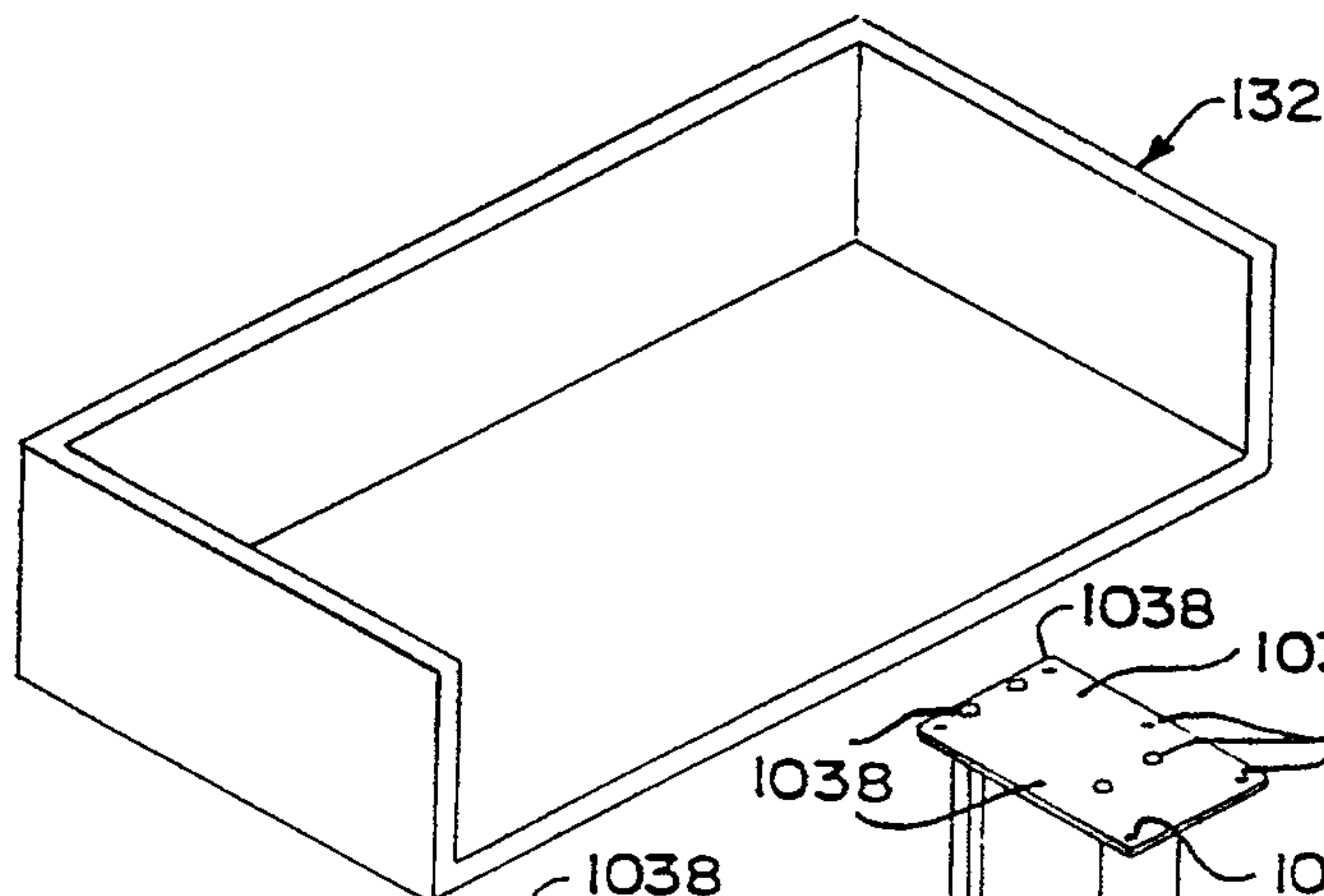


FIG. 51

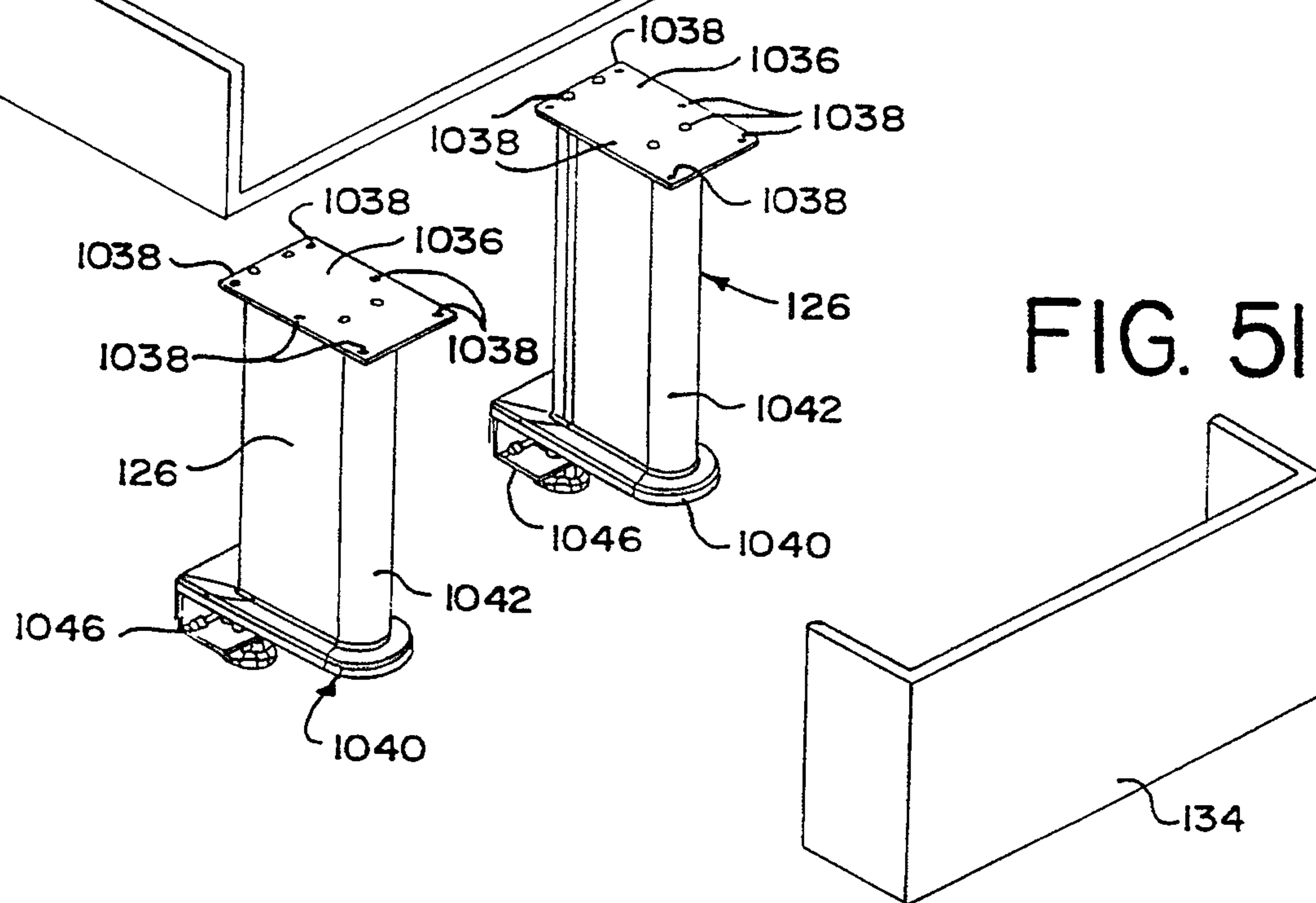


FIG. 52

28/43

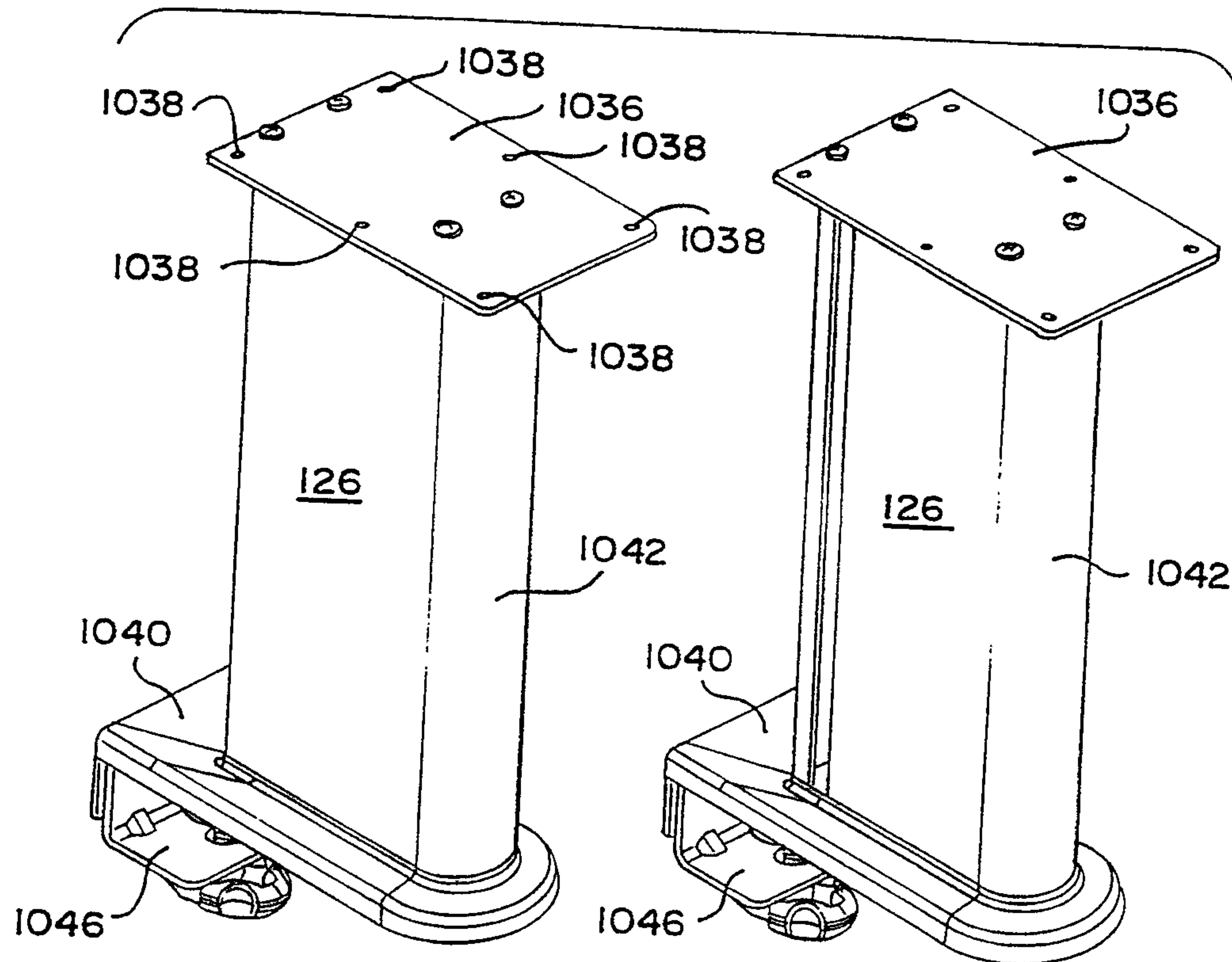


FIG. 53

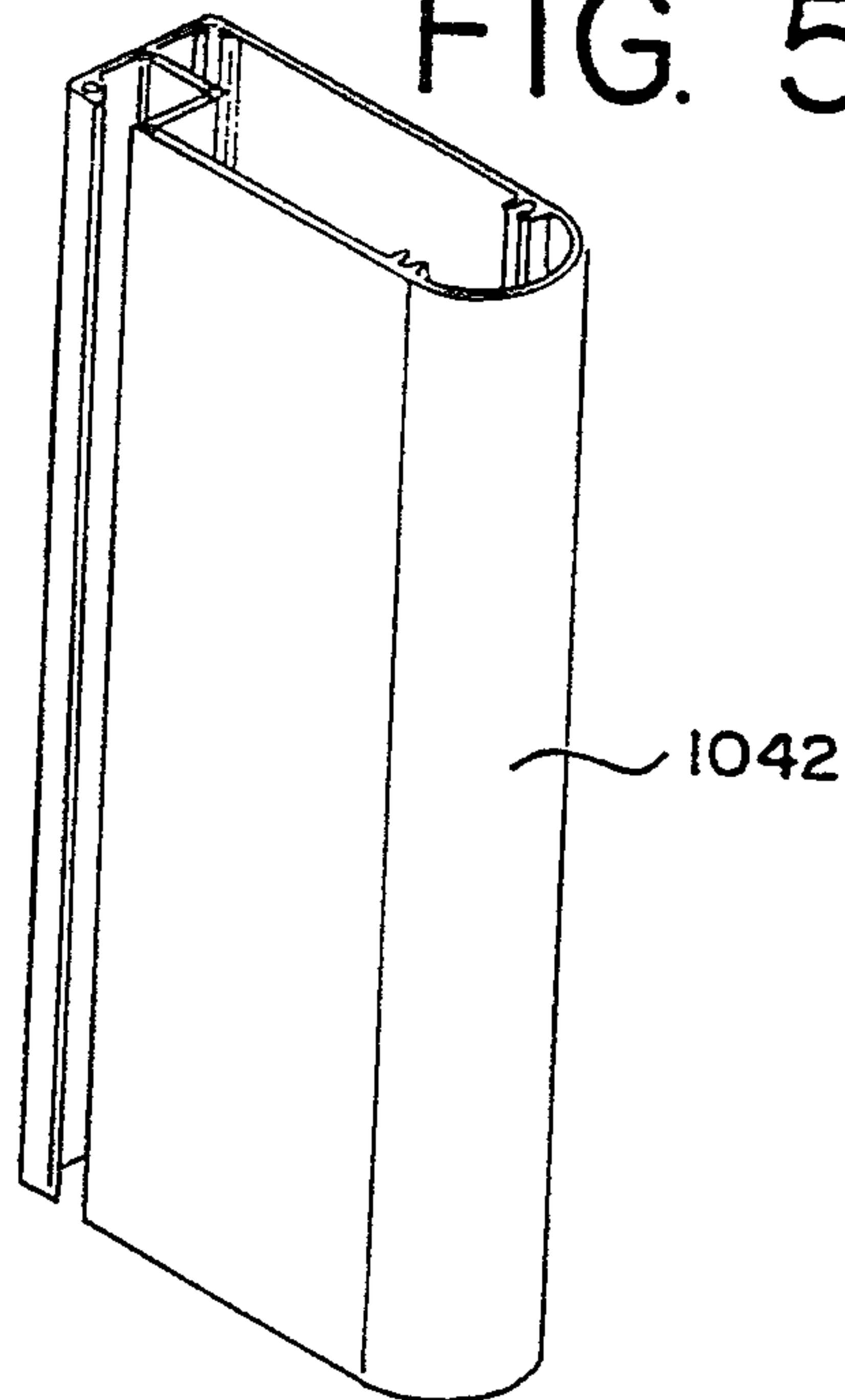
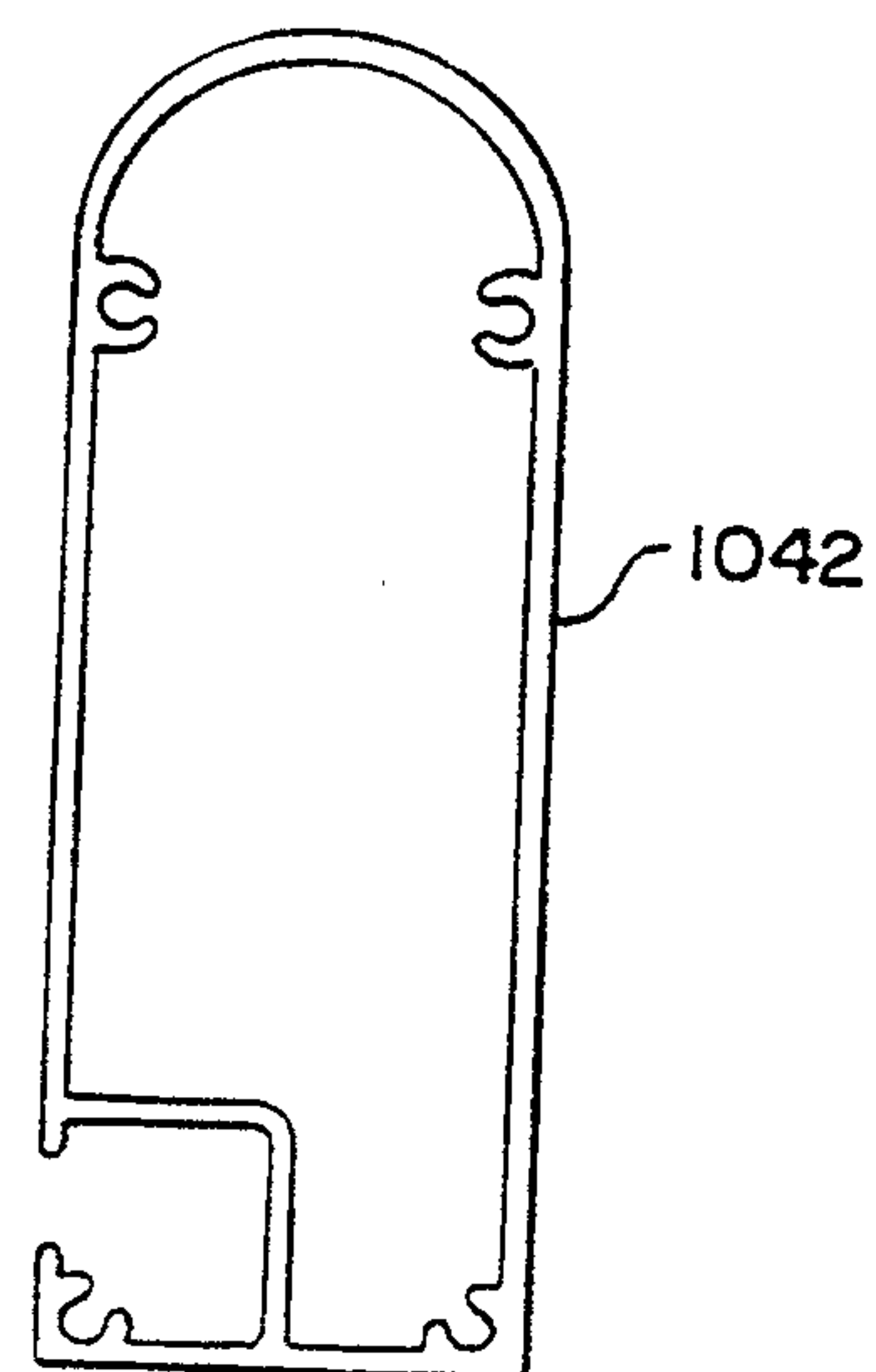


FIG. 54



29/43

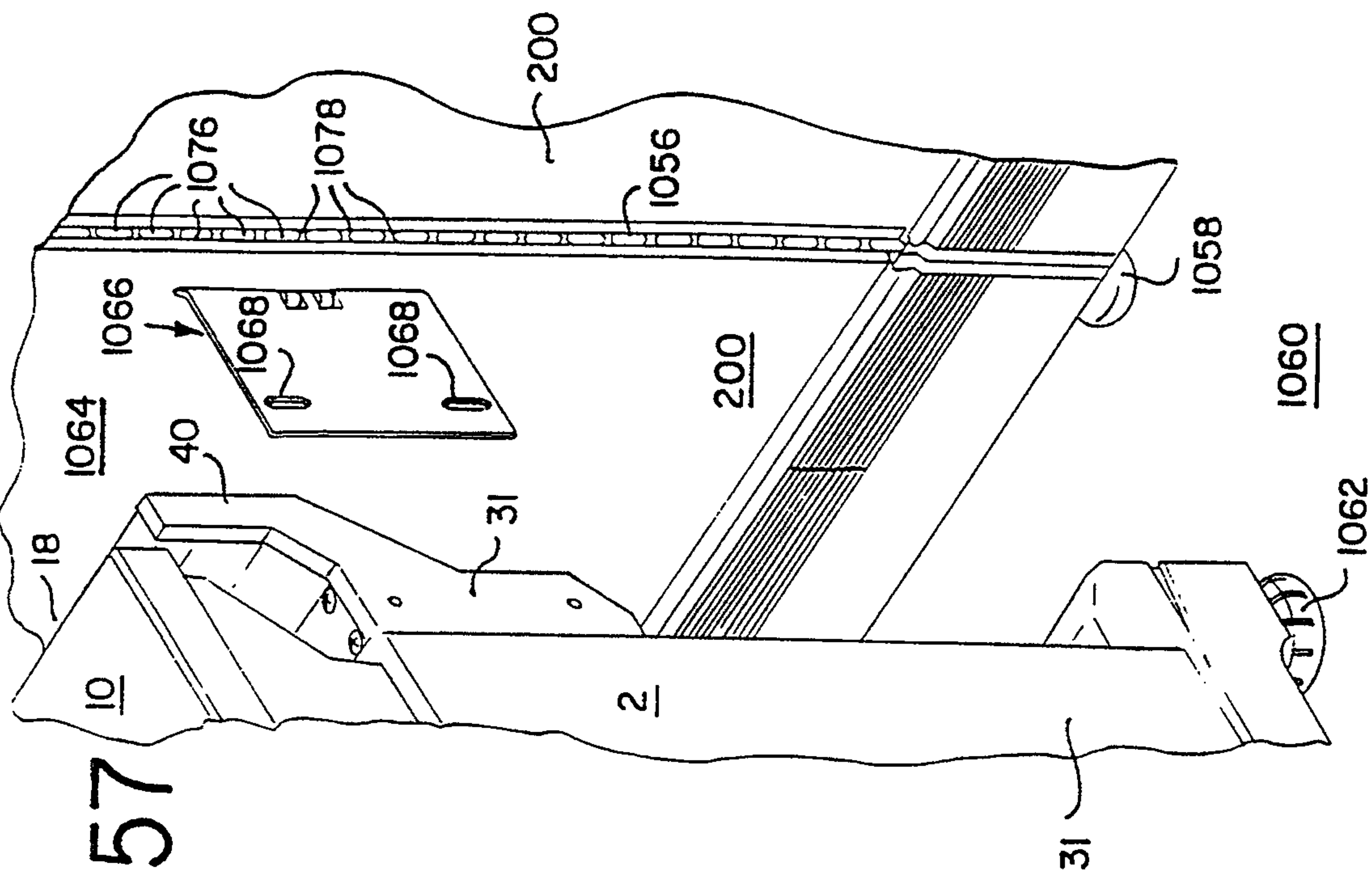


FIG. 57

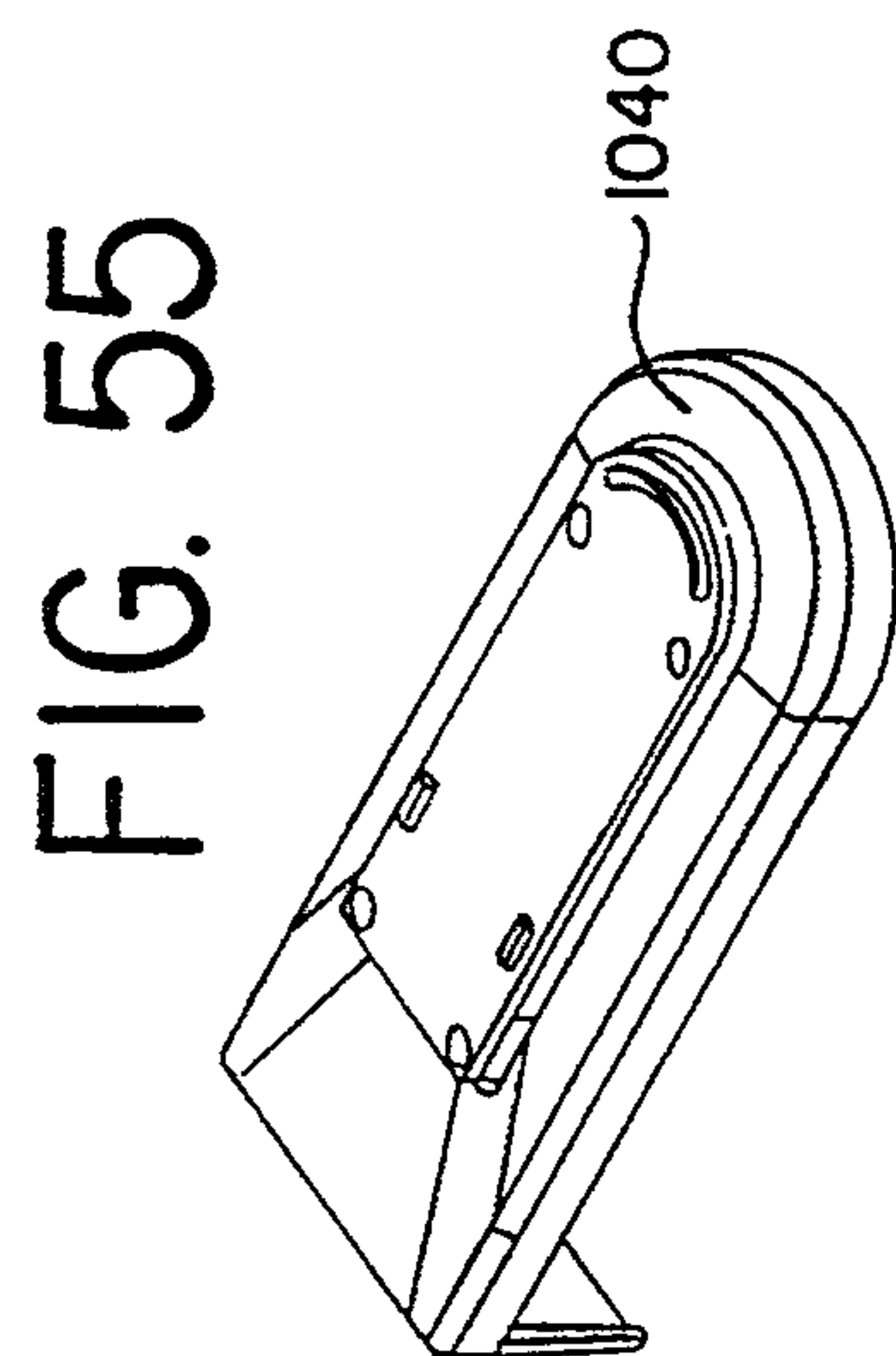


FIG. 55

FIG. 56

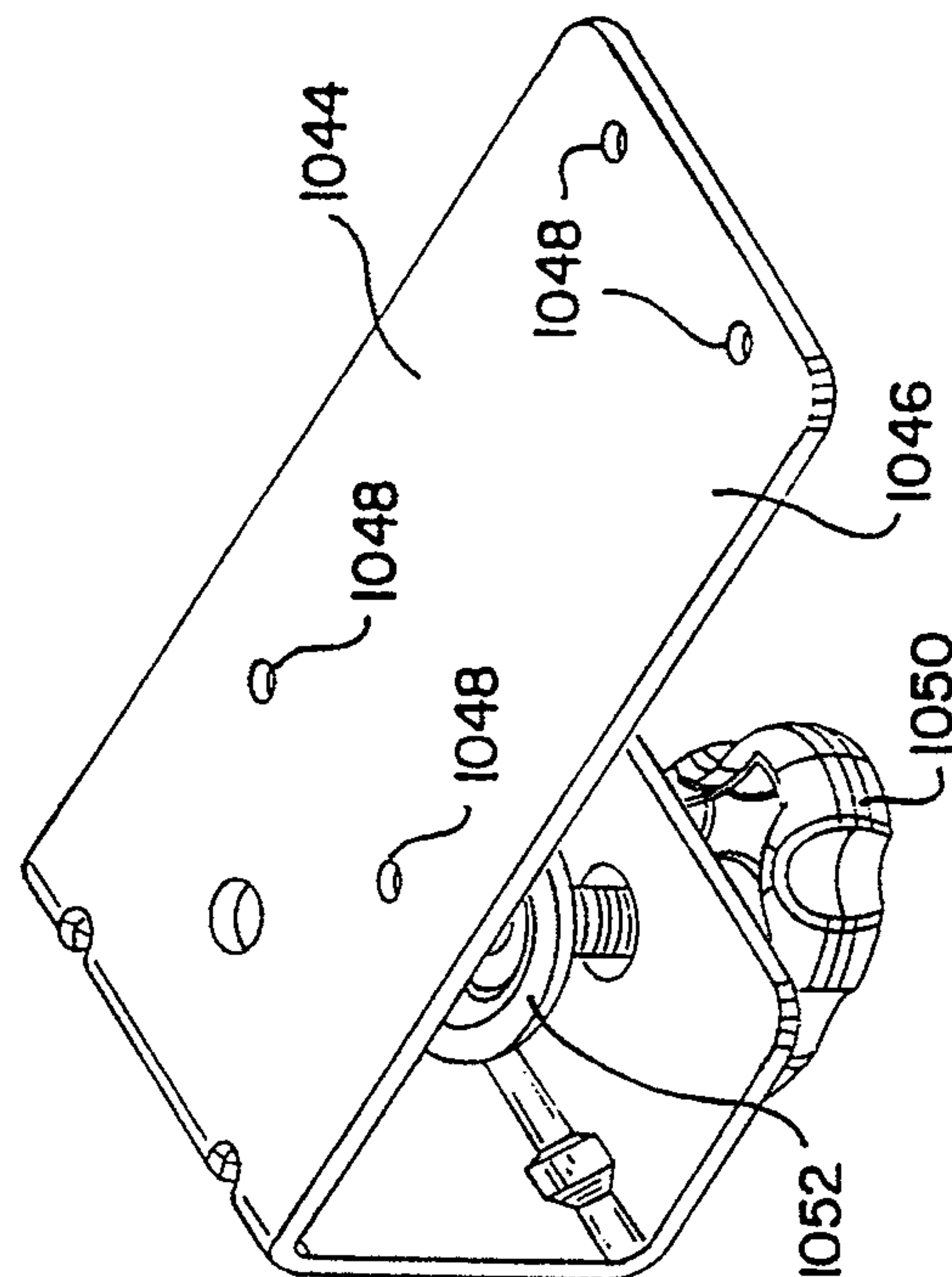


FIG. 58

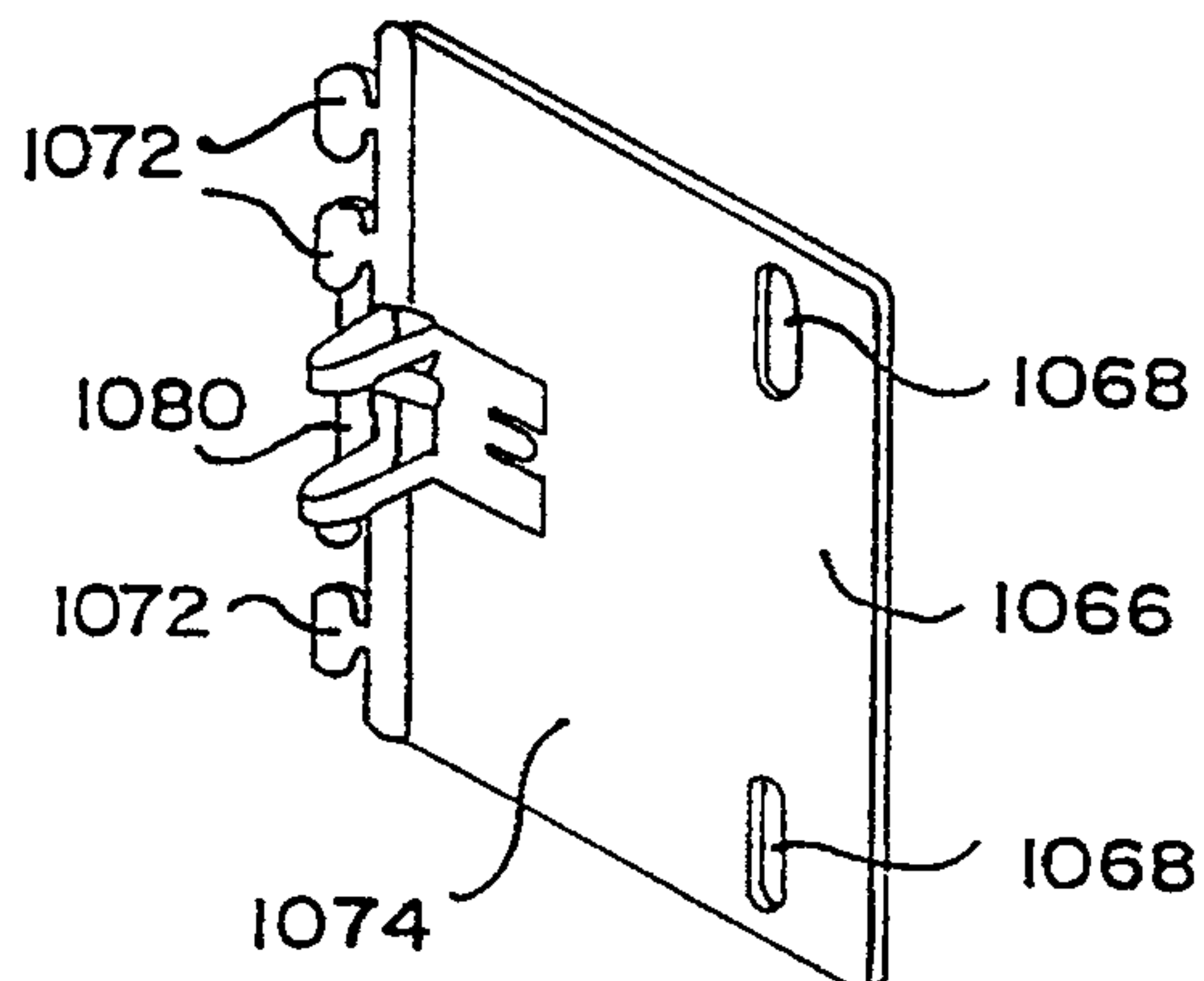


FIG. 59

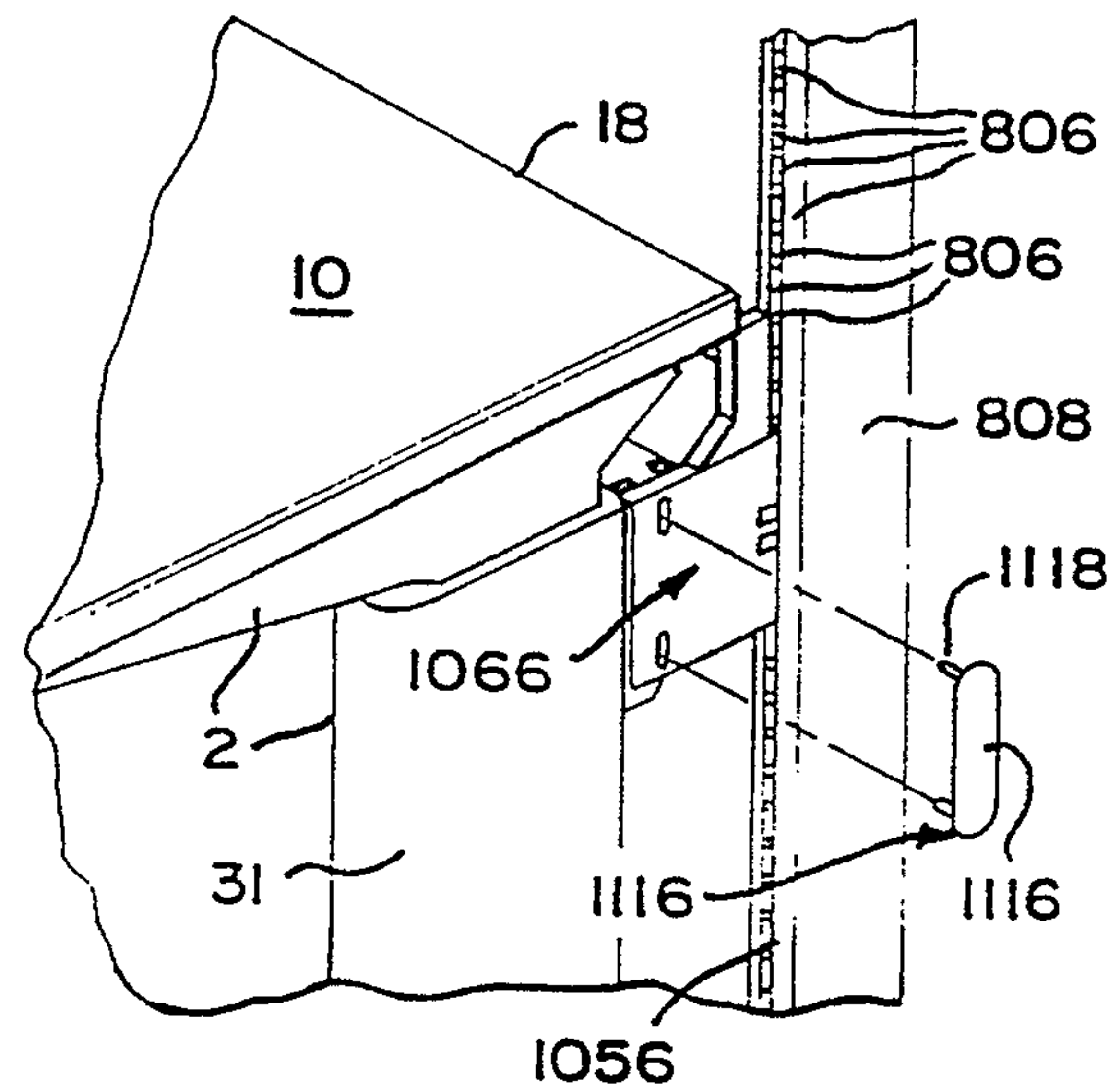


FIG. 60

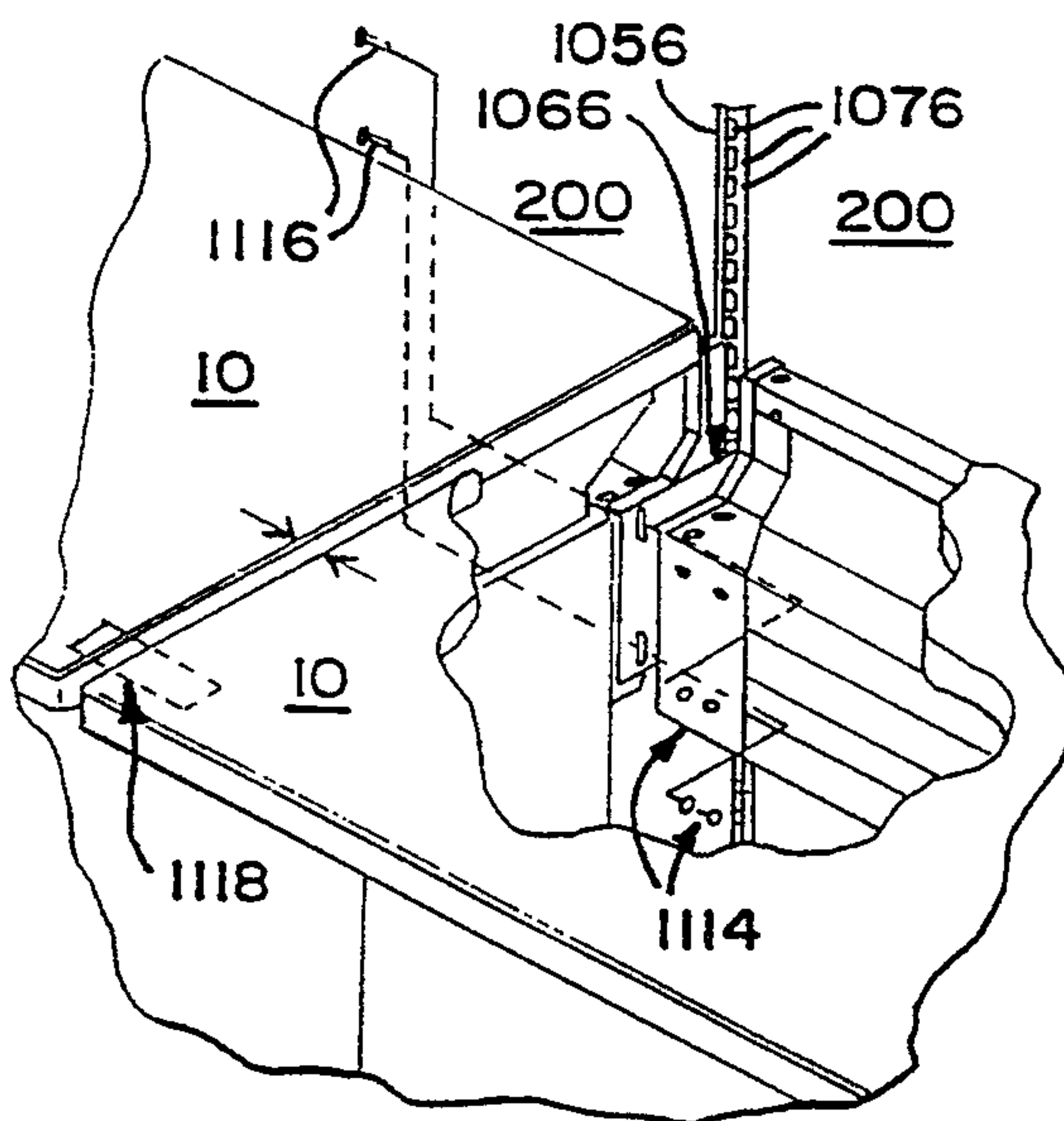
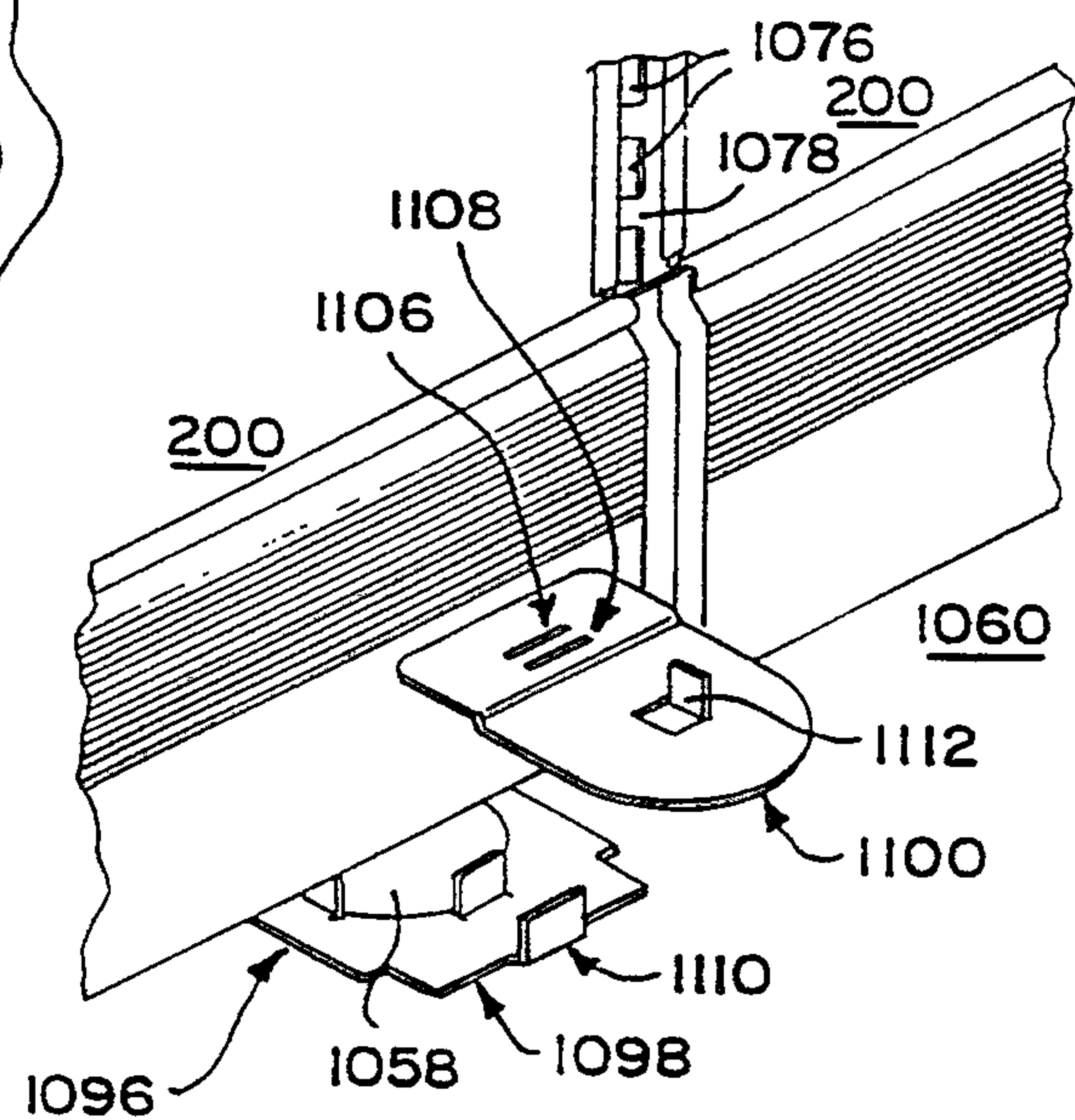
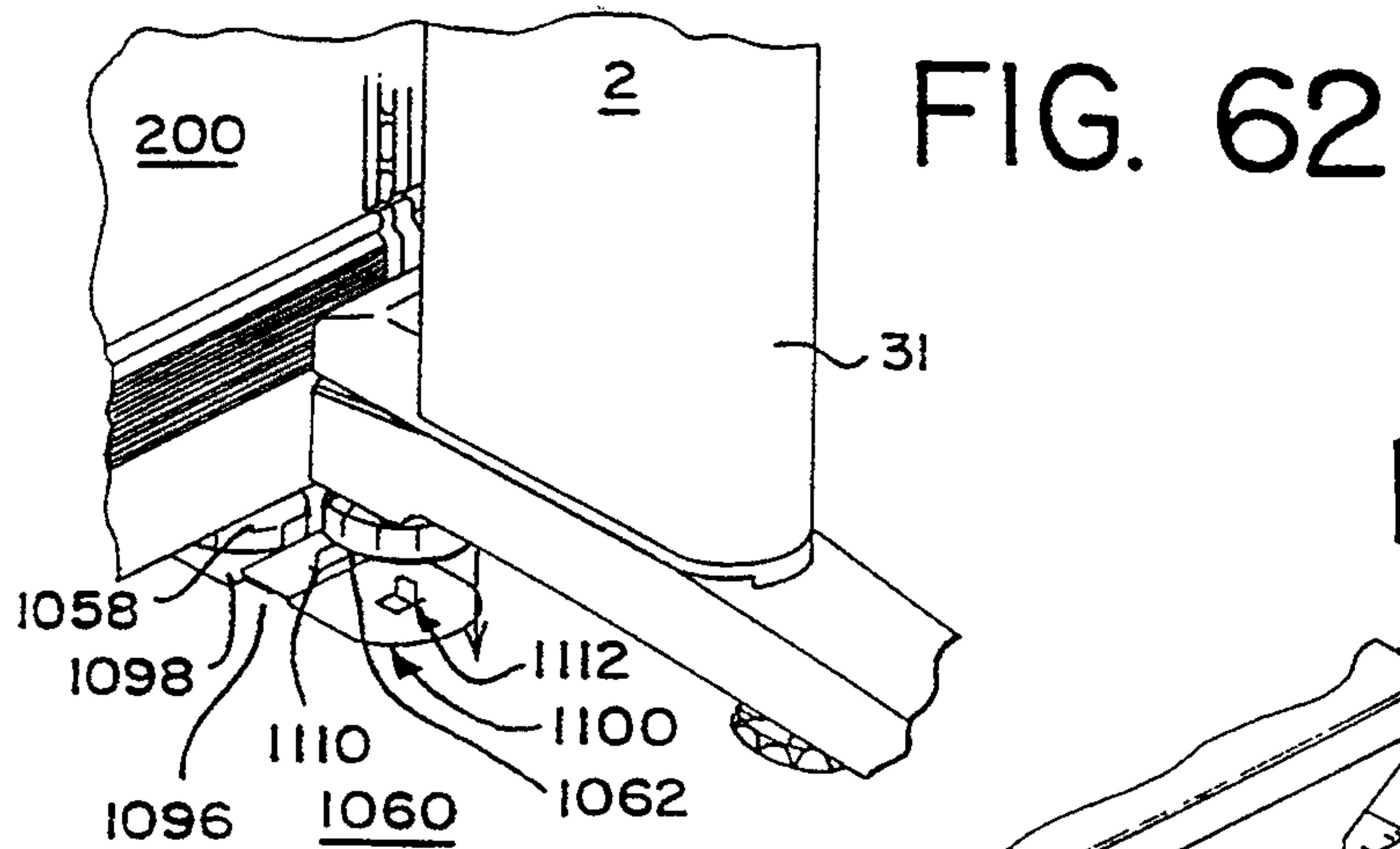
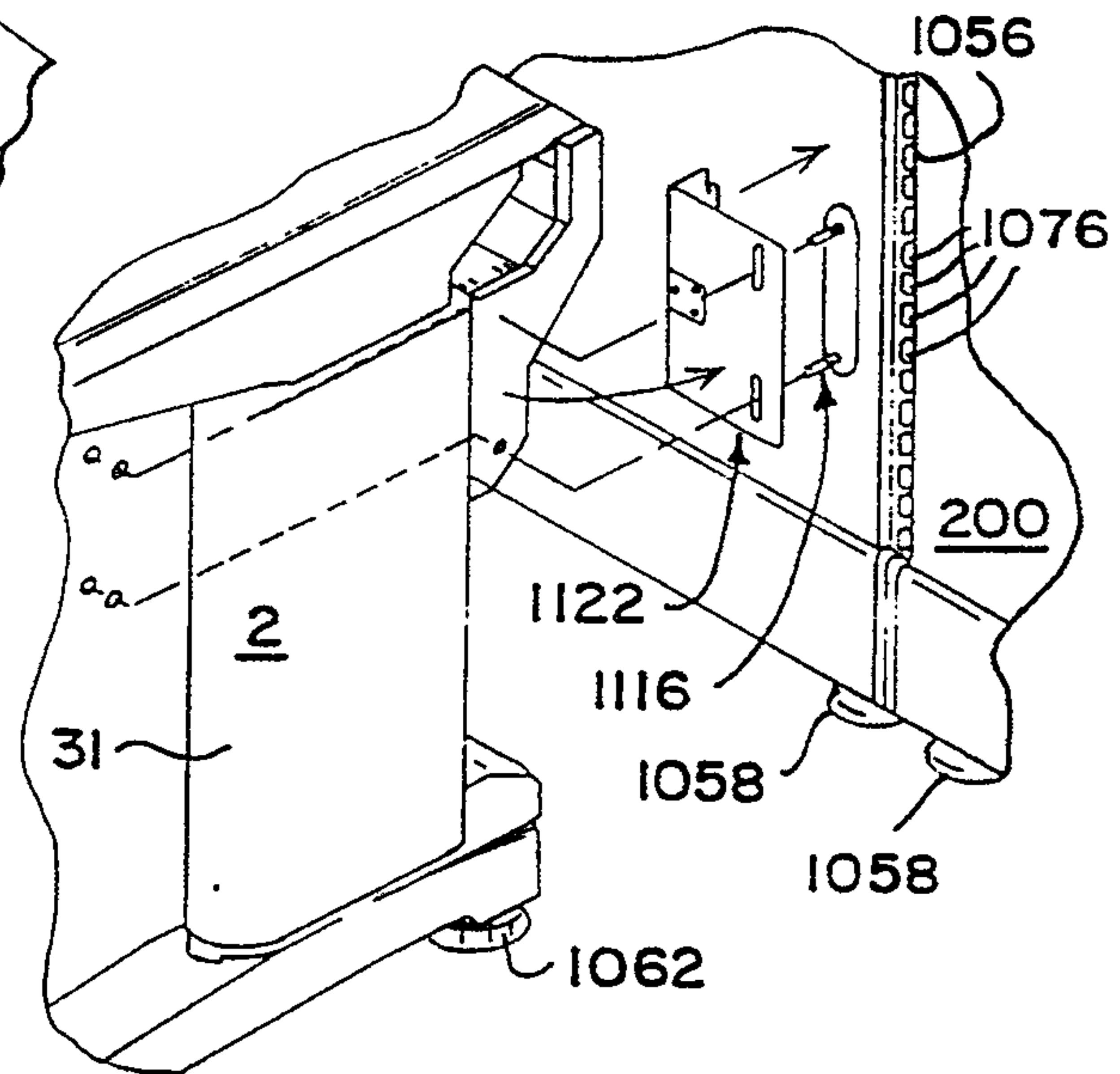
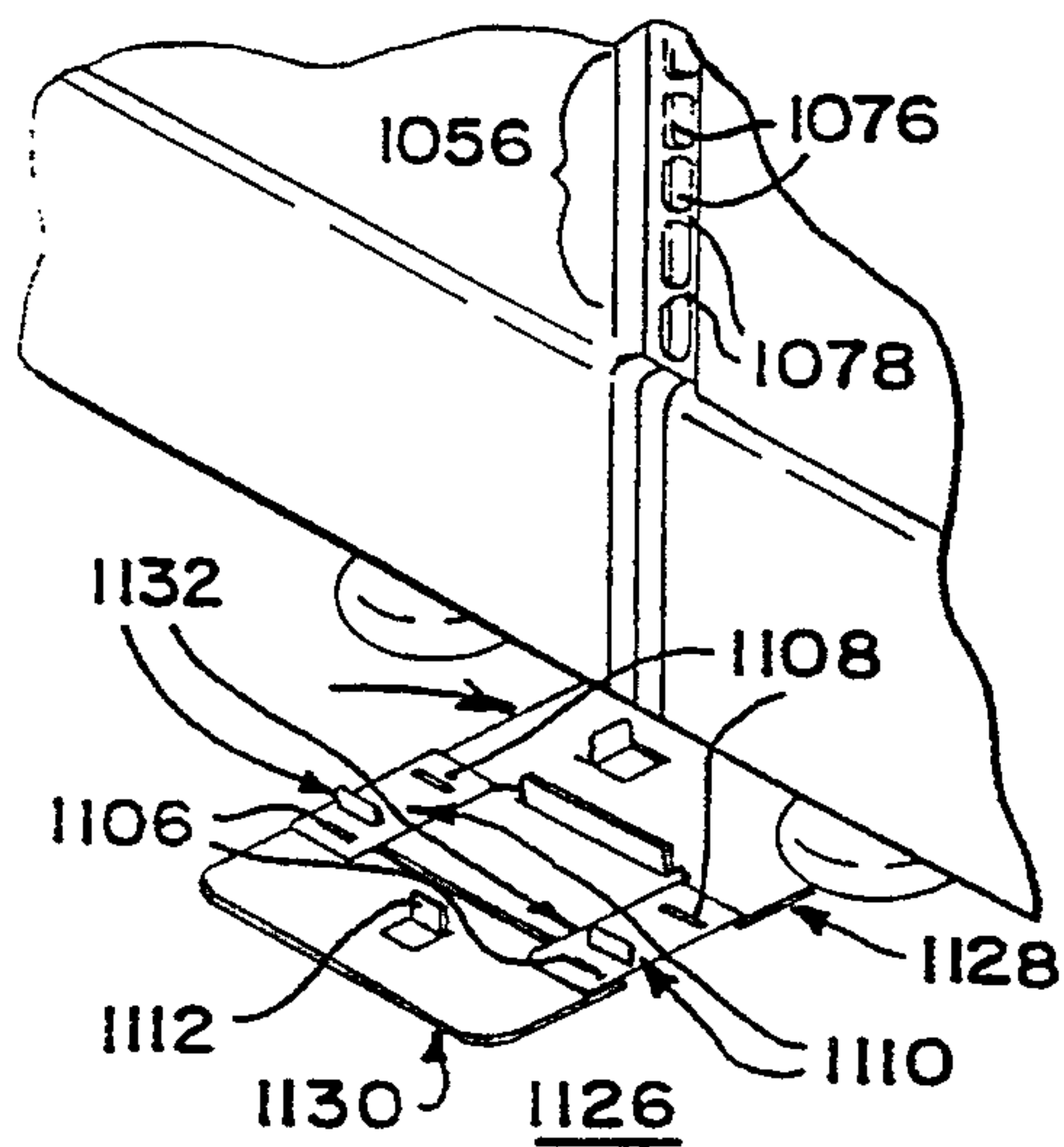
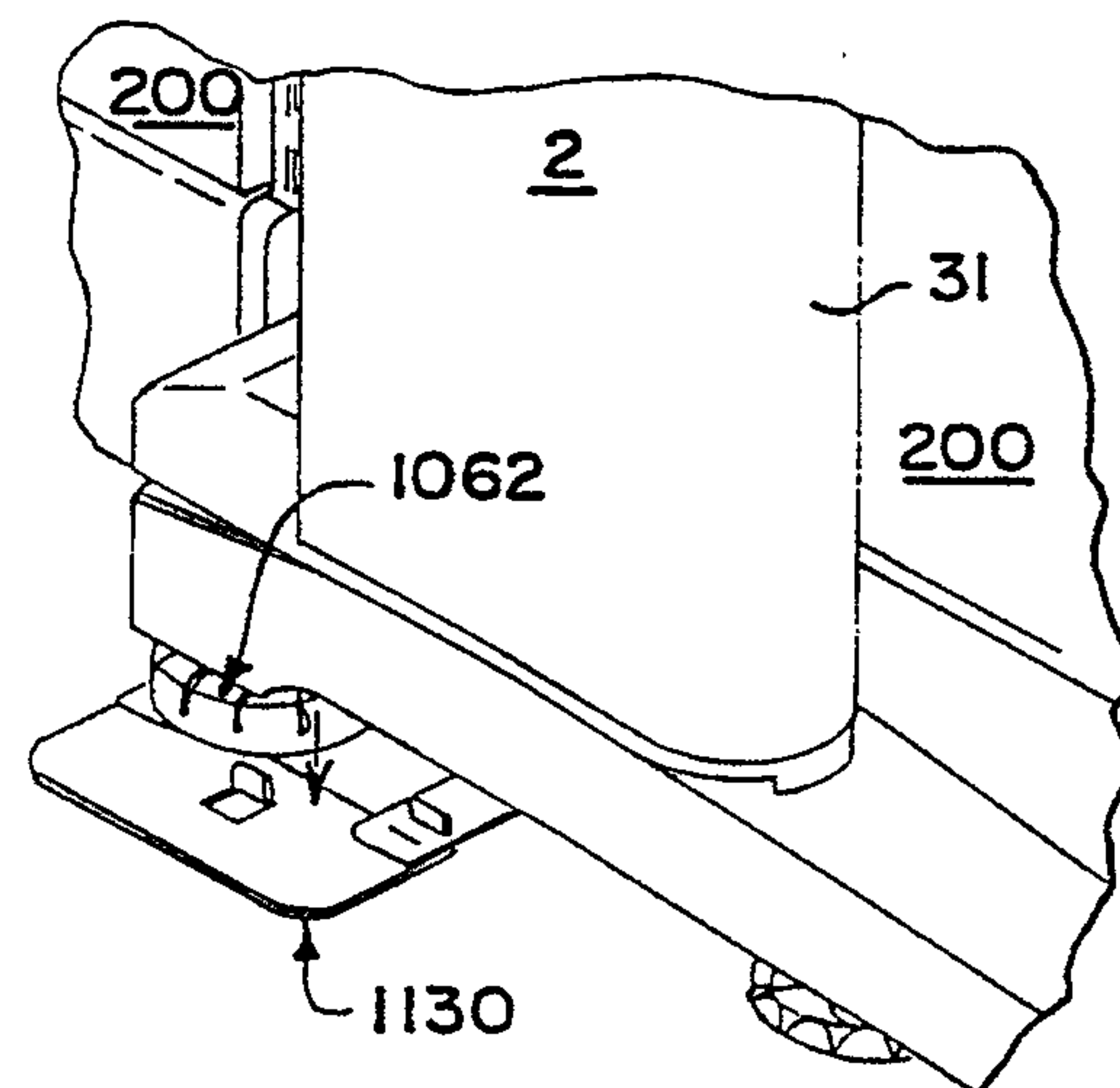


FIG. 61



31/43

**FIG. 63****FIG. 64****FIG. 65**

32/43

FIG. 66

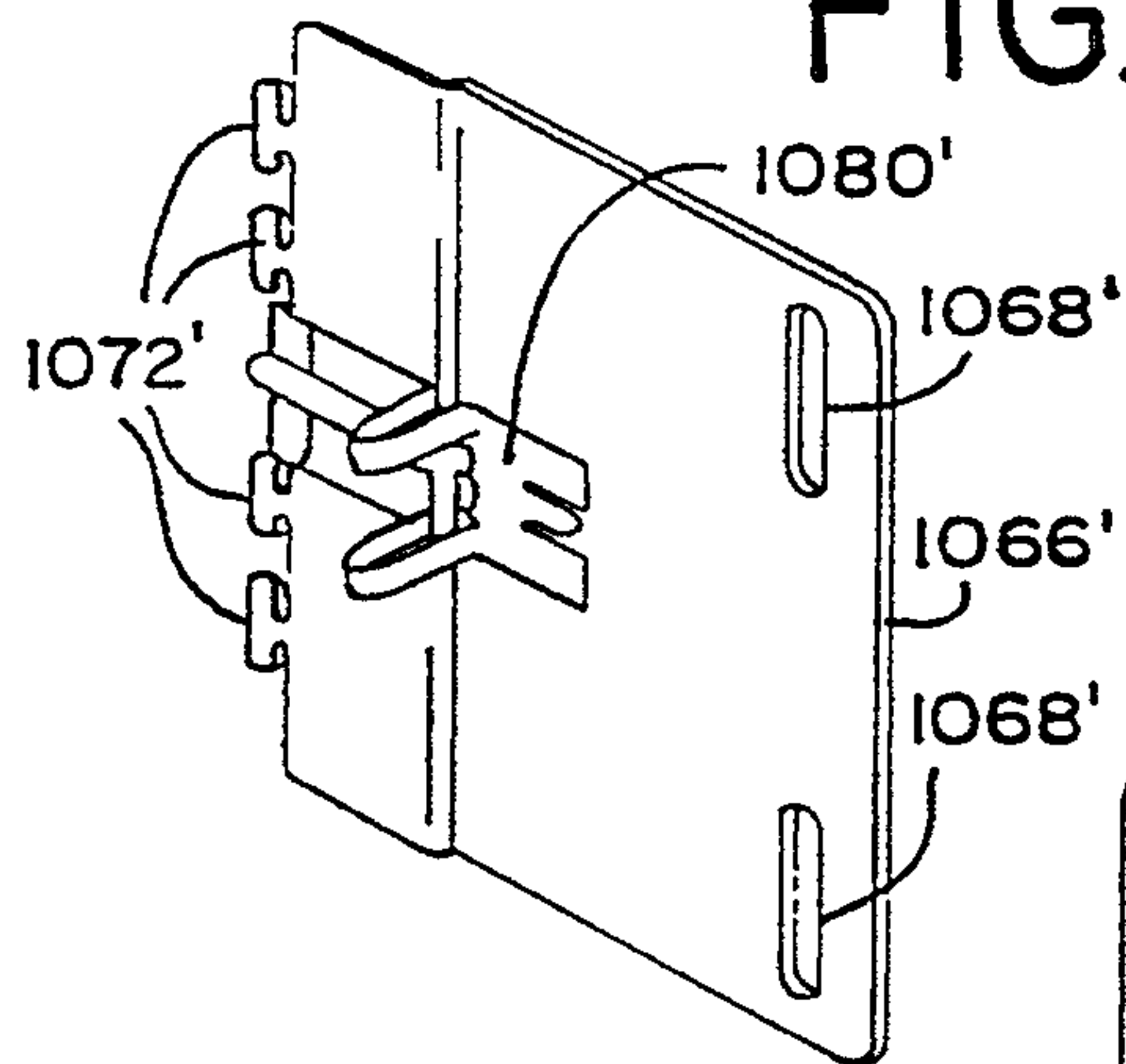


FIG. 67

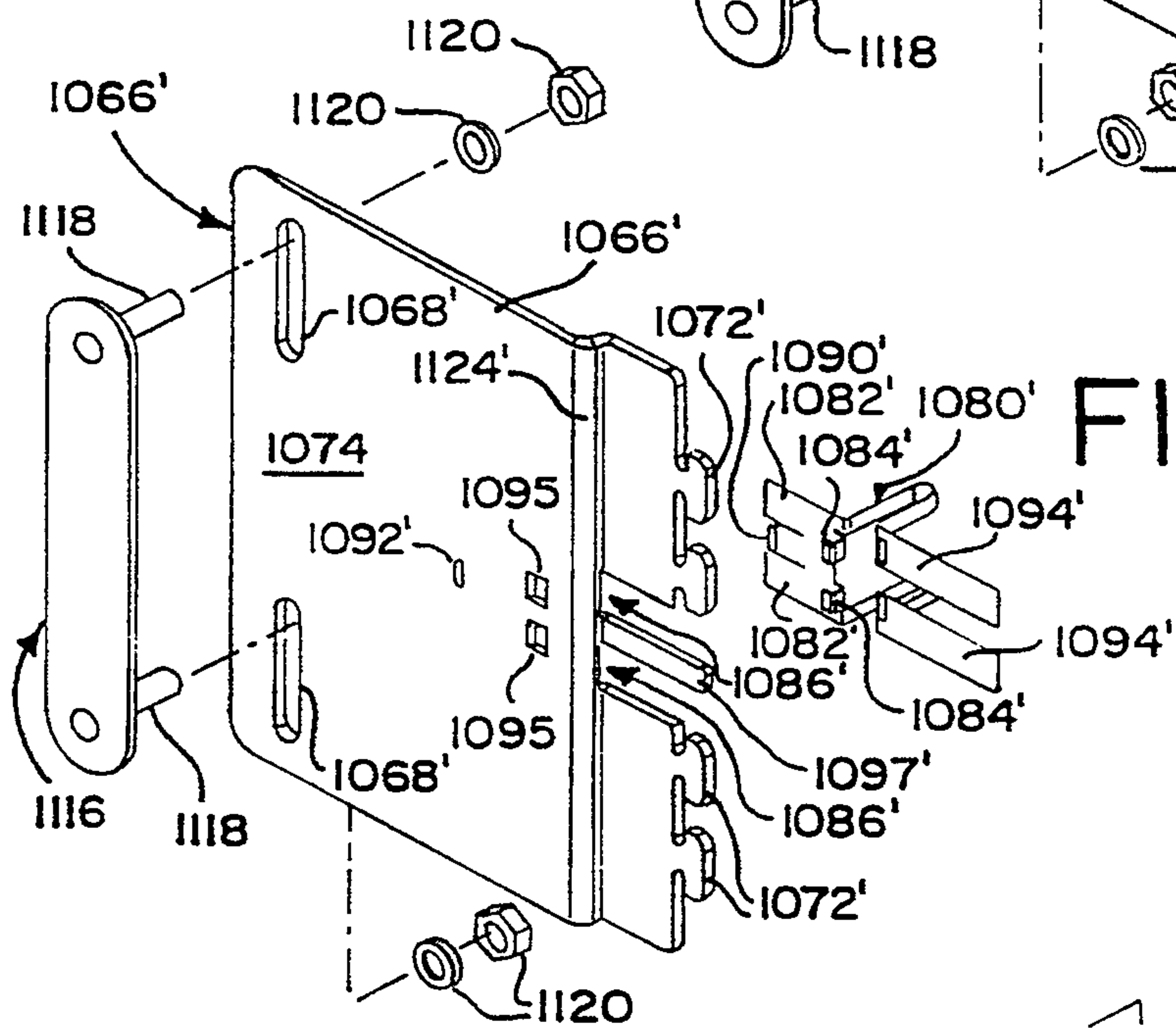
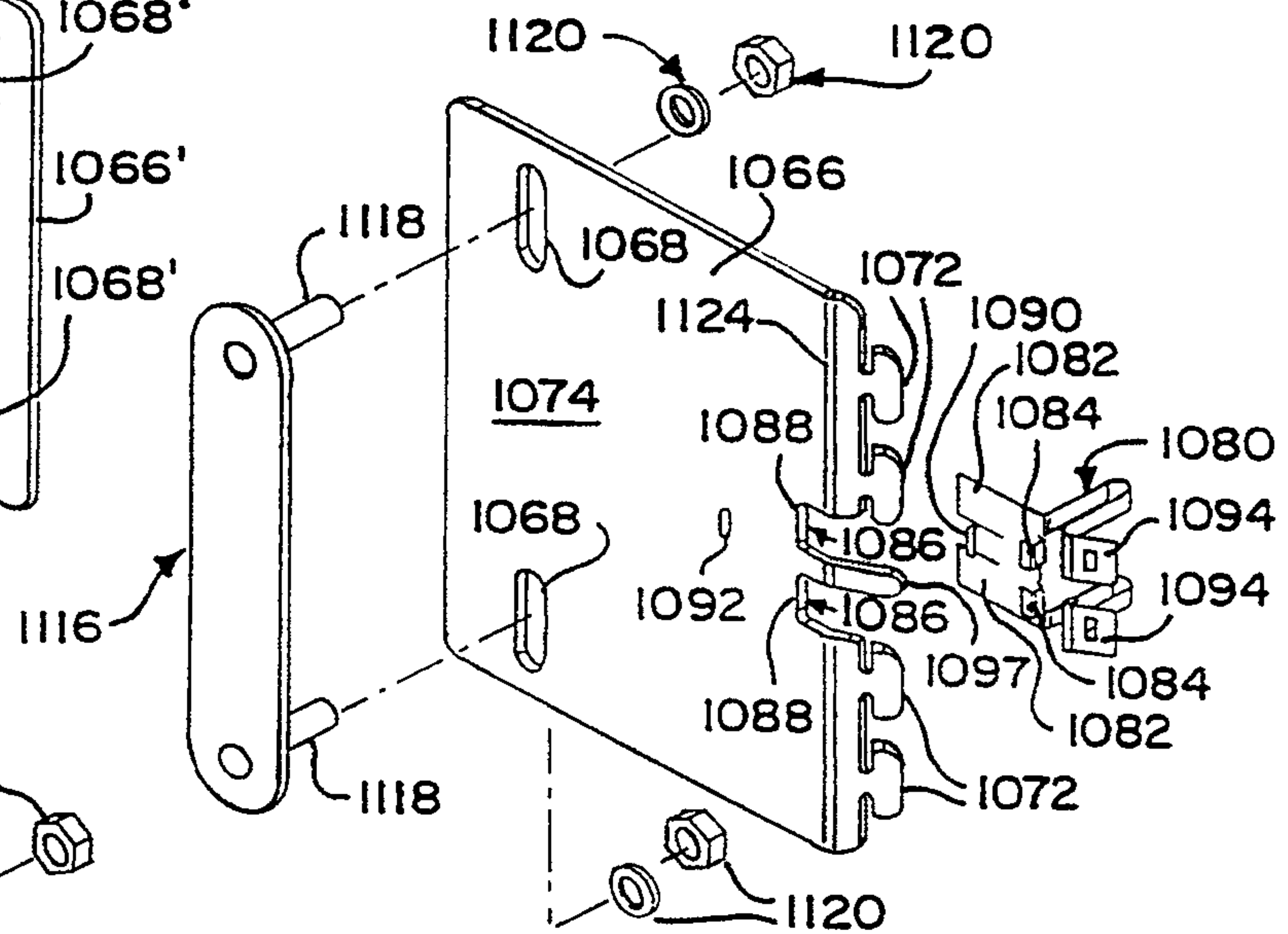
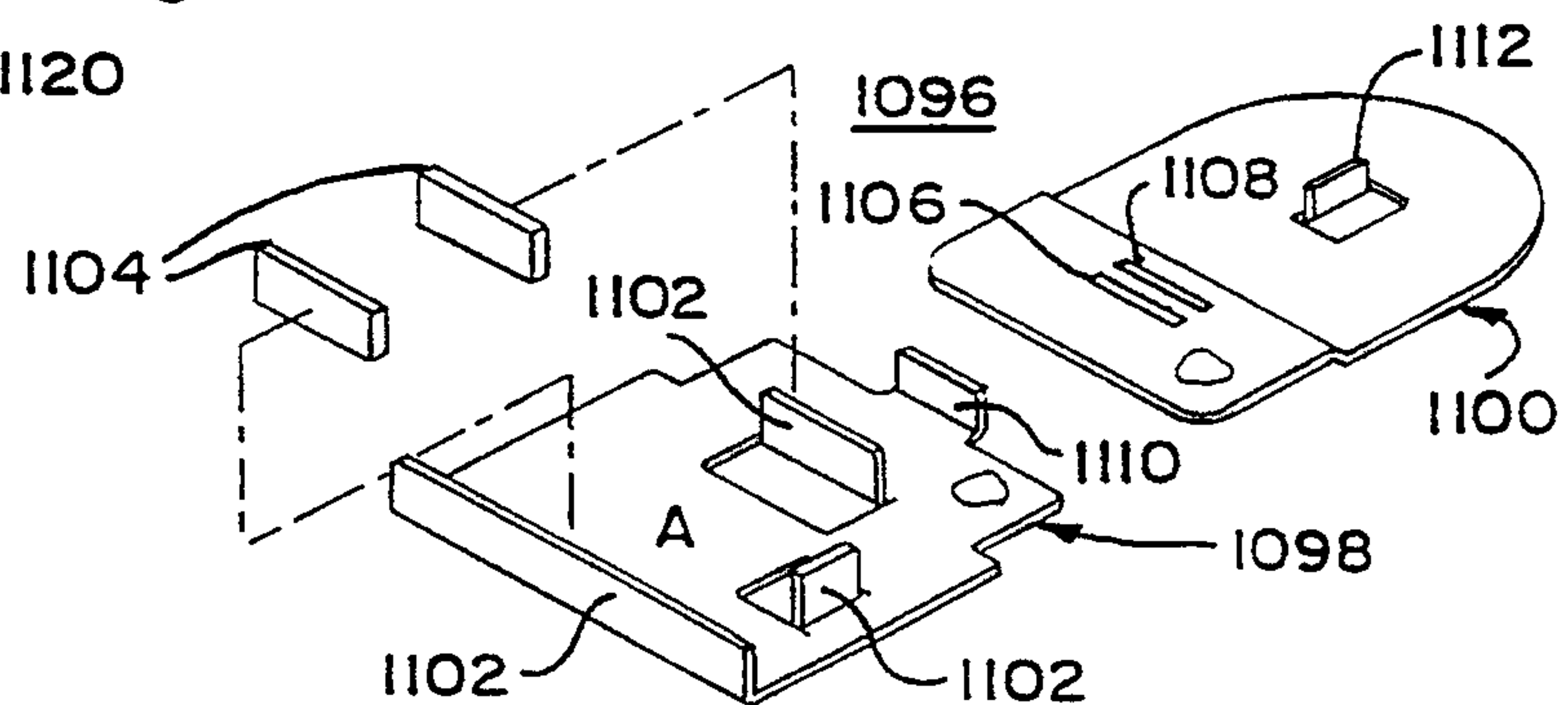


FIG. 68

FIG. 69



33/43

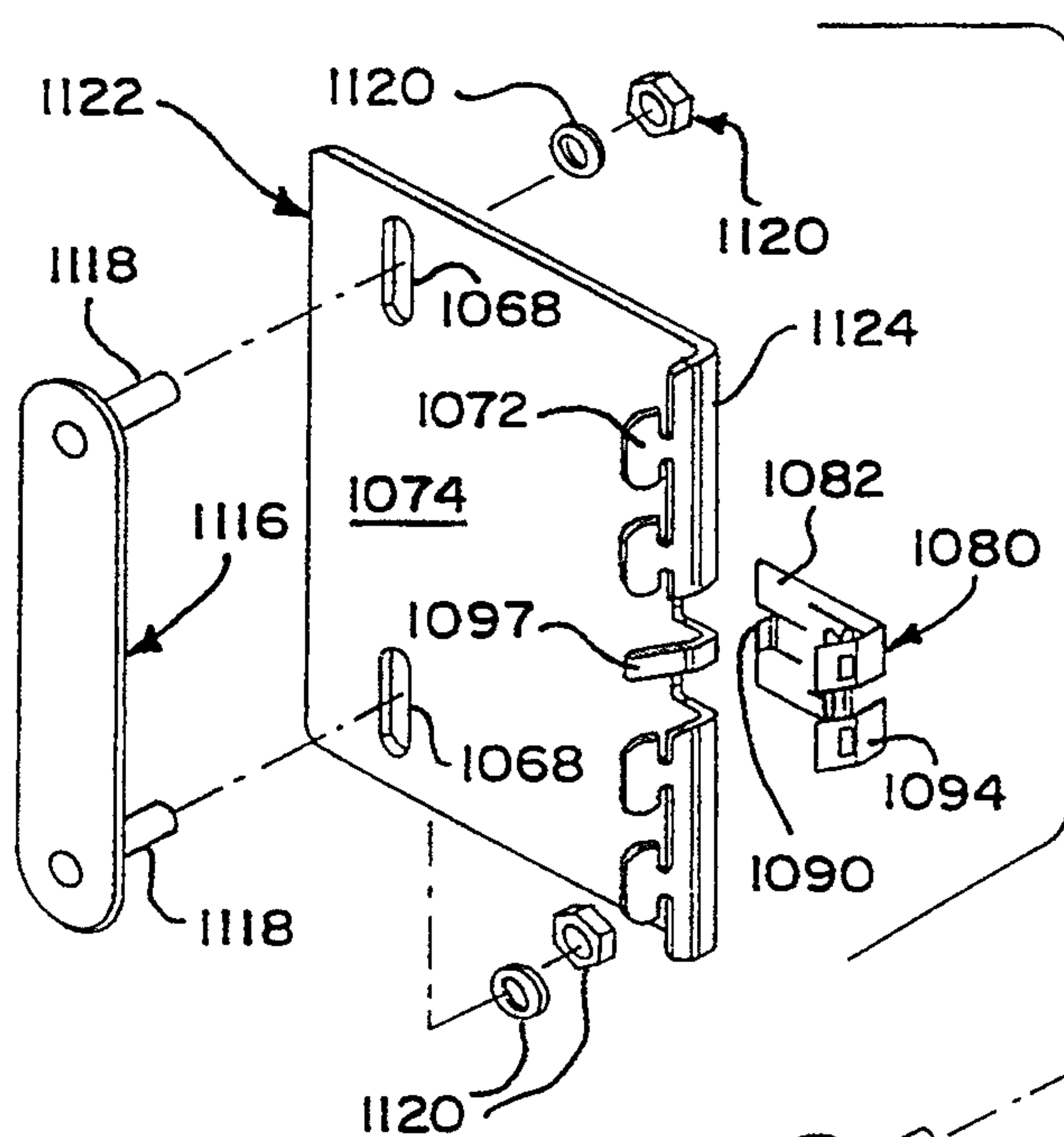


FIG. 70

FIG. 71

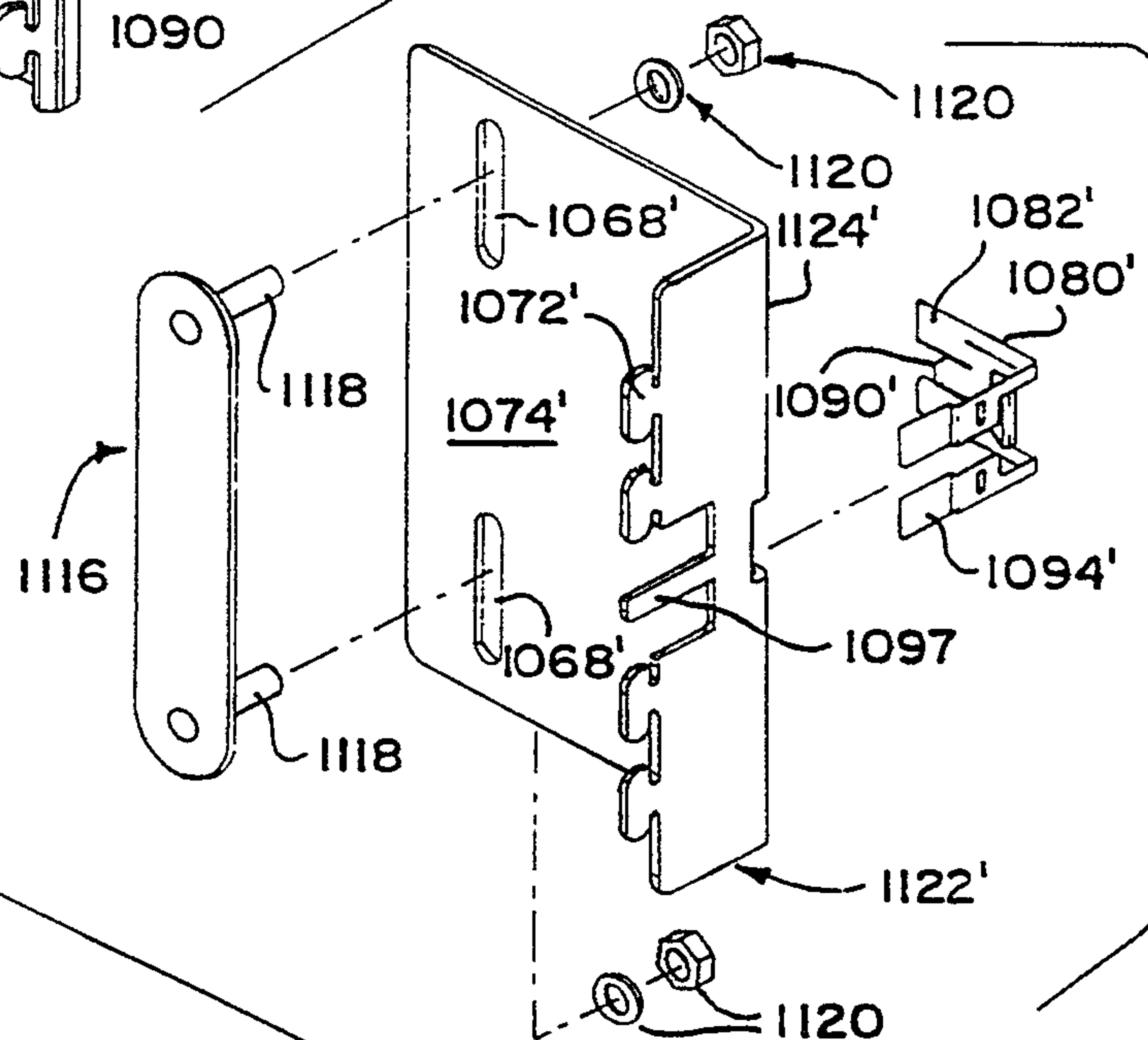
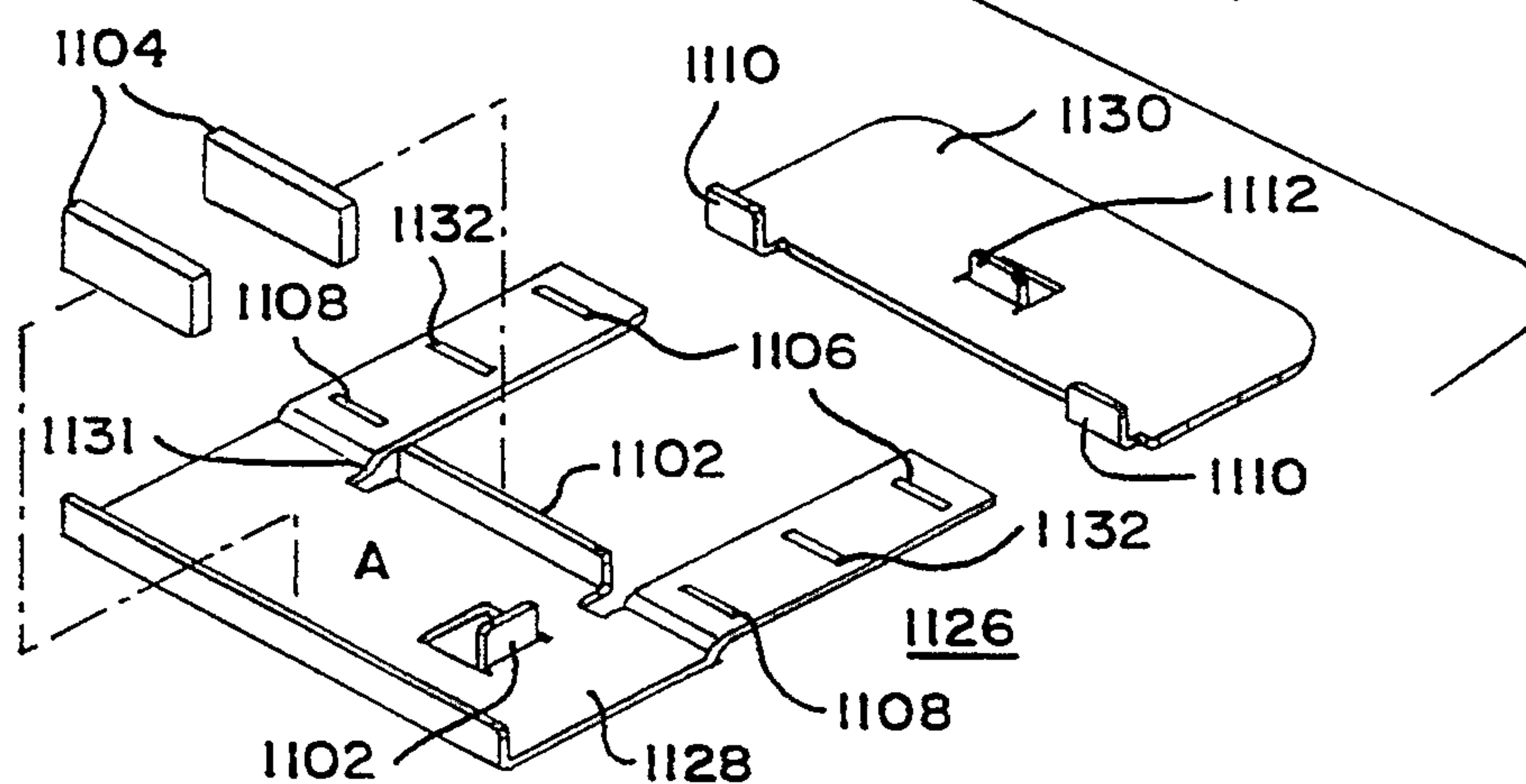


FIG. 72



34/43

FIG. 73A

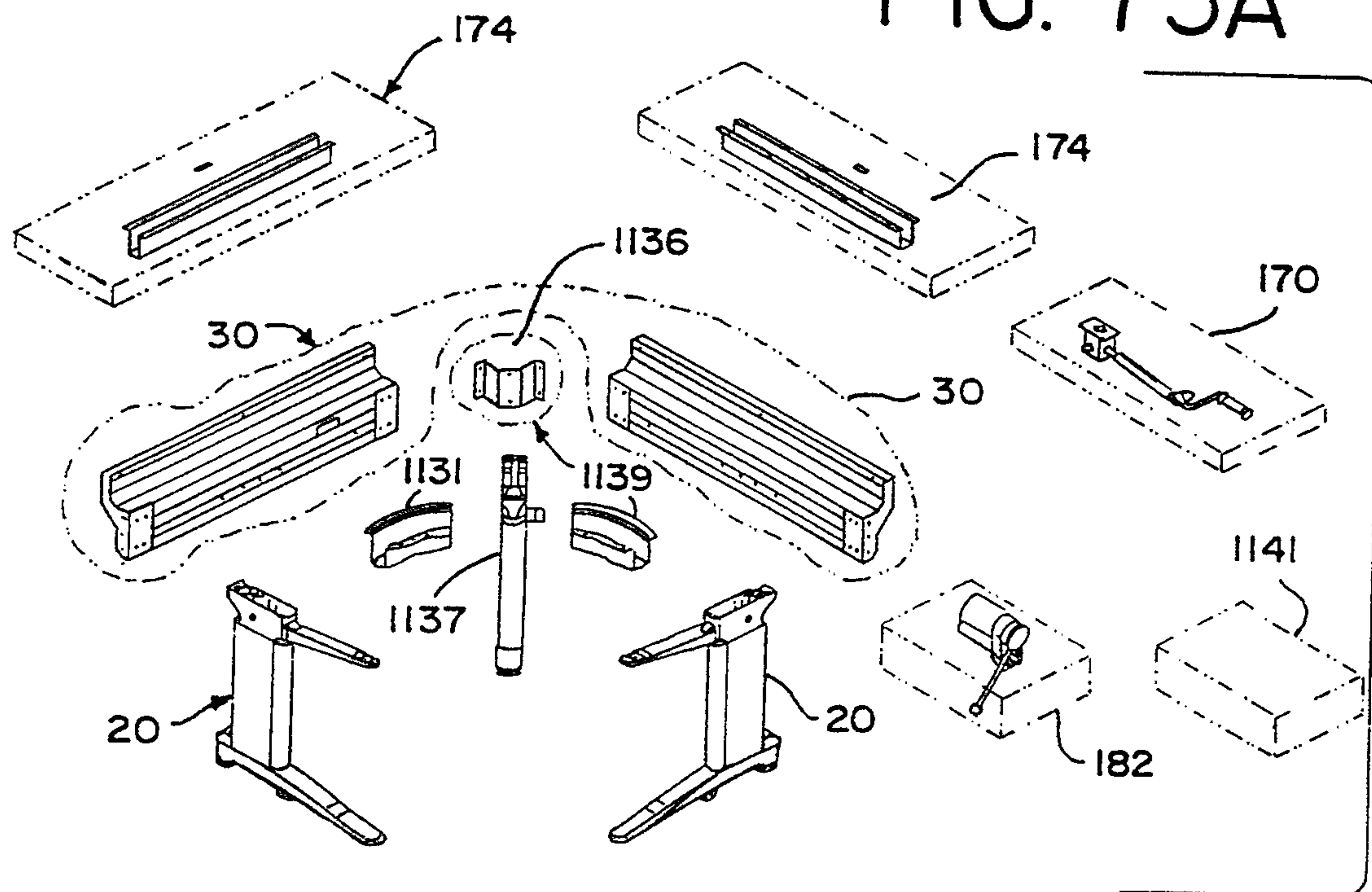
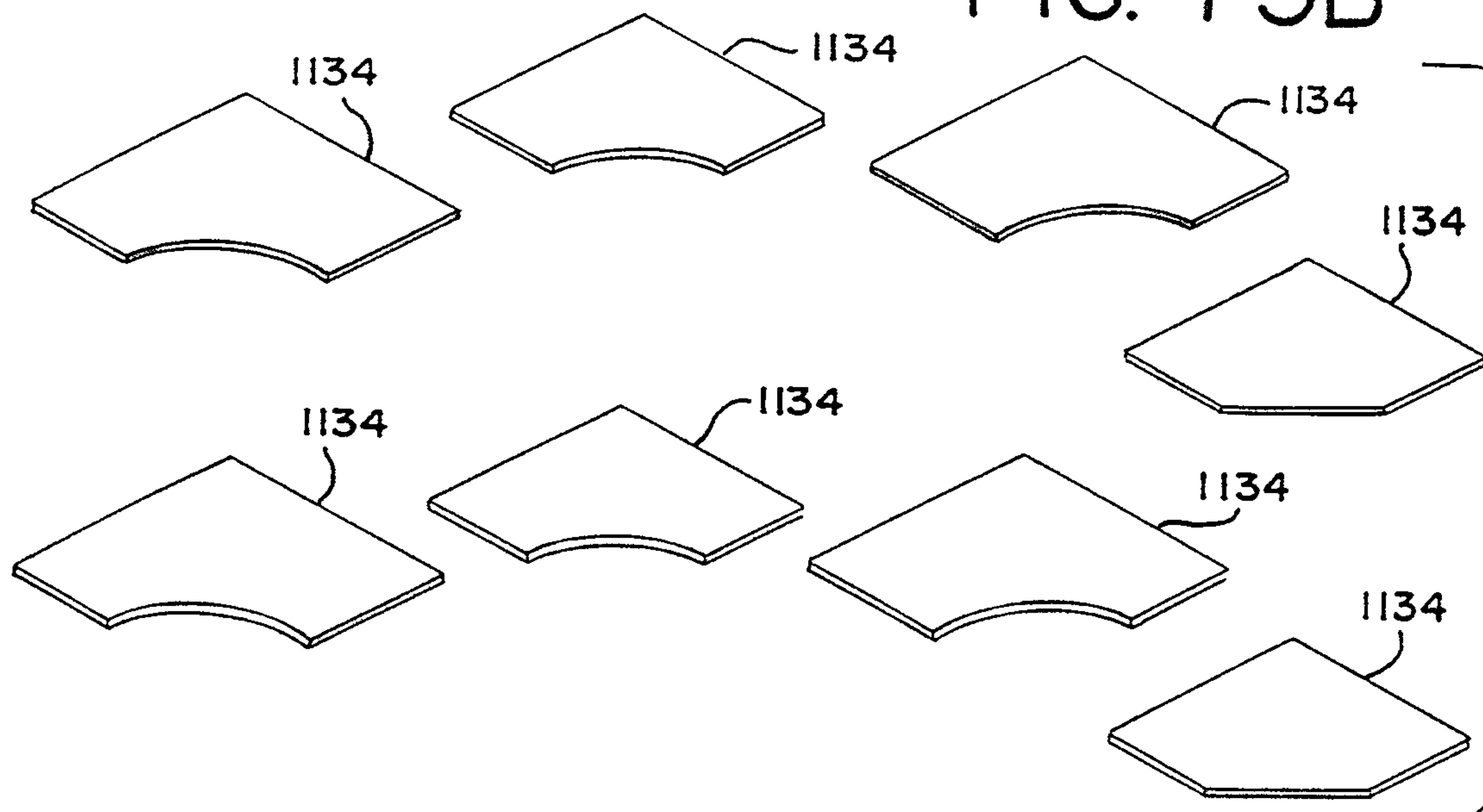


FIG. 73B



35/43

FIG. 74

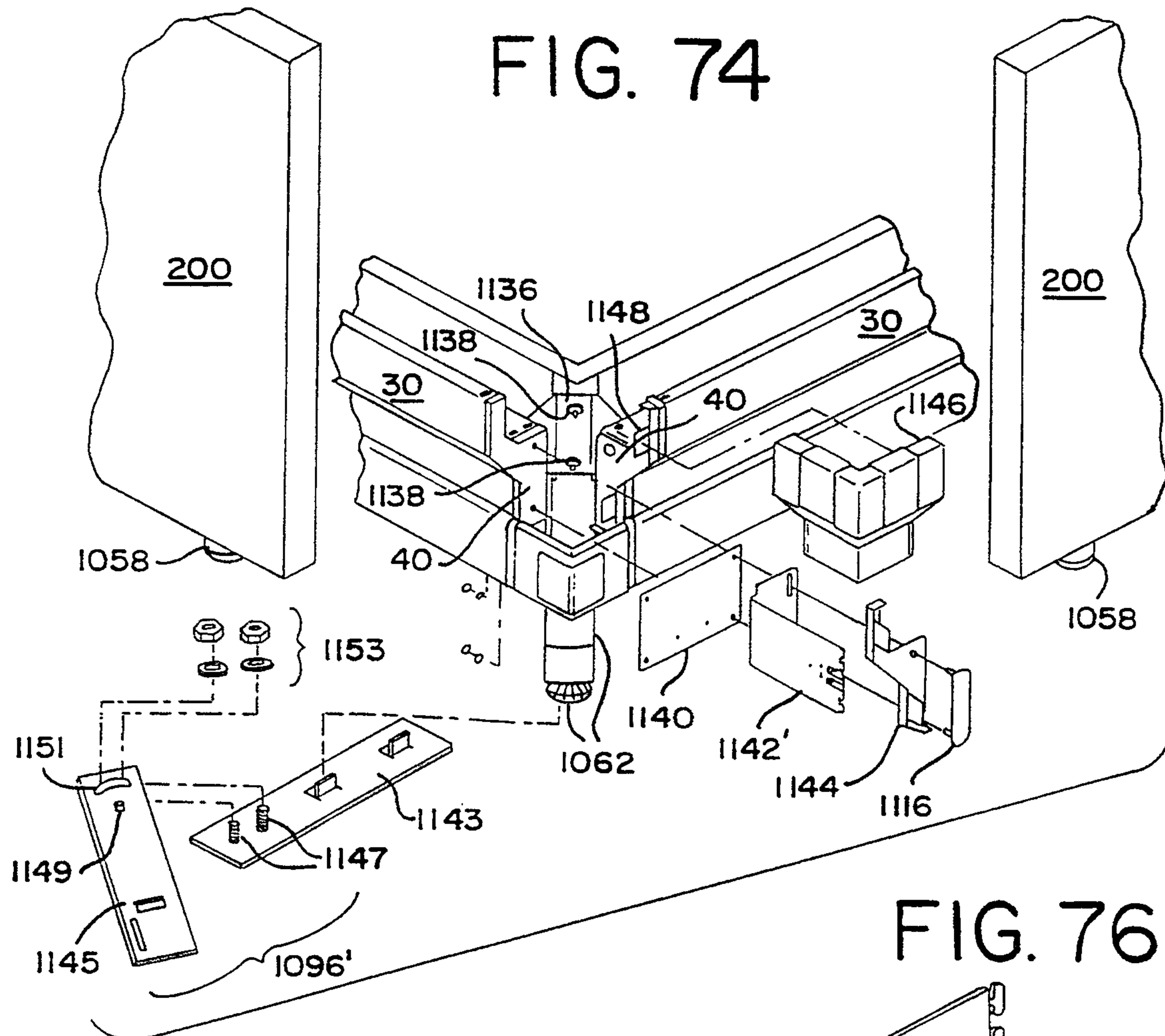


FIG. 76

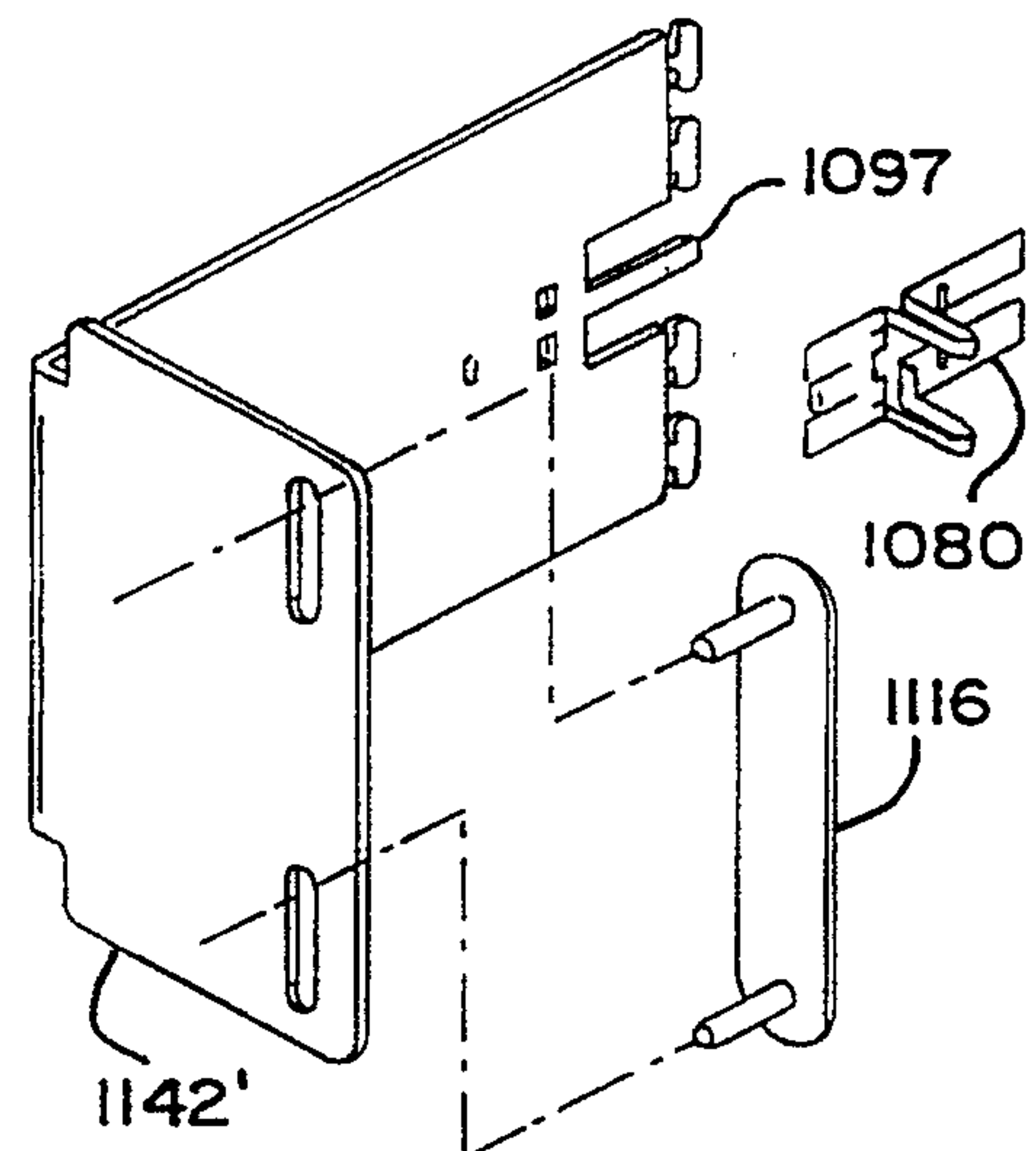
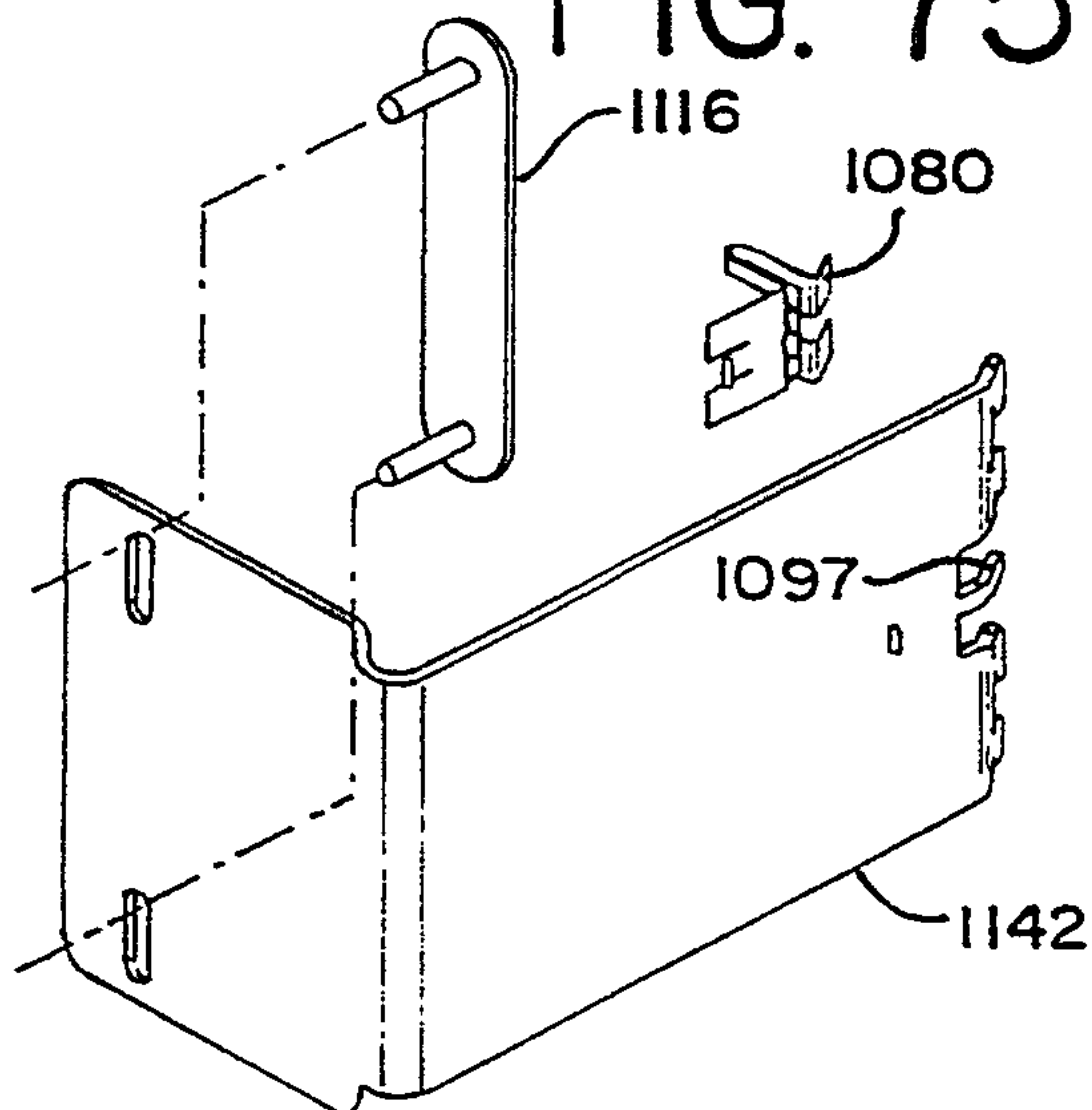


FIG. 75



36/43

FIG. 77

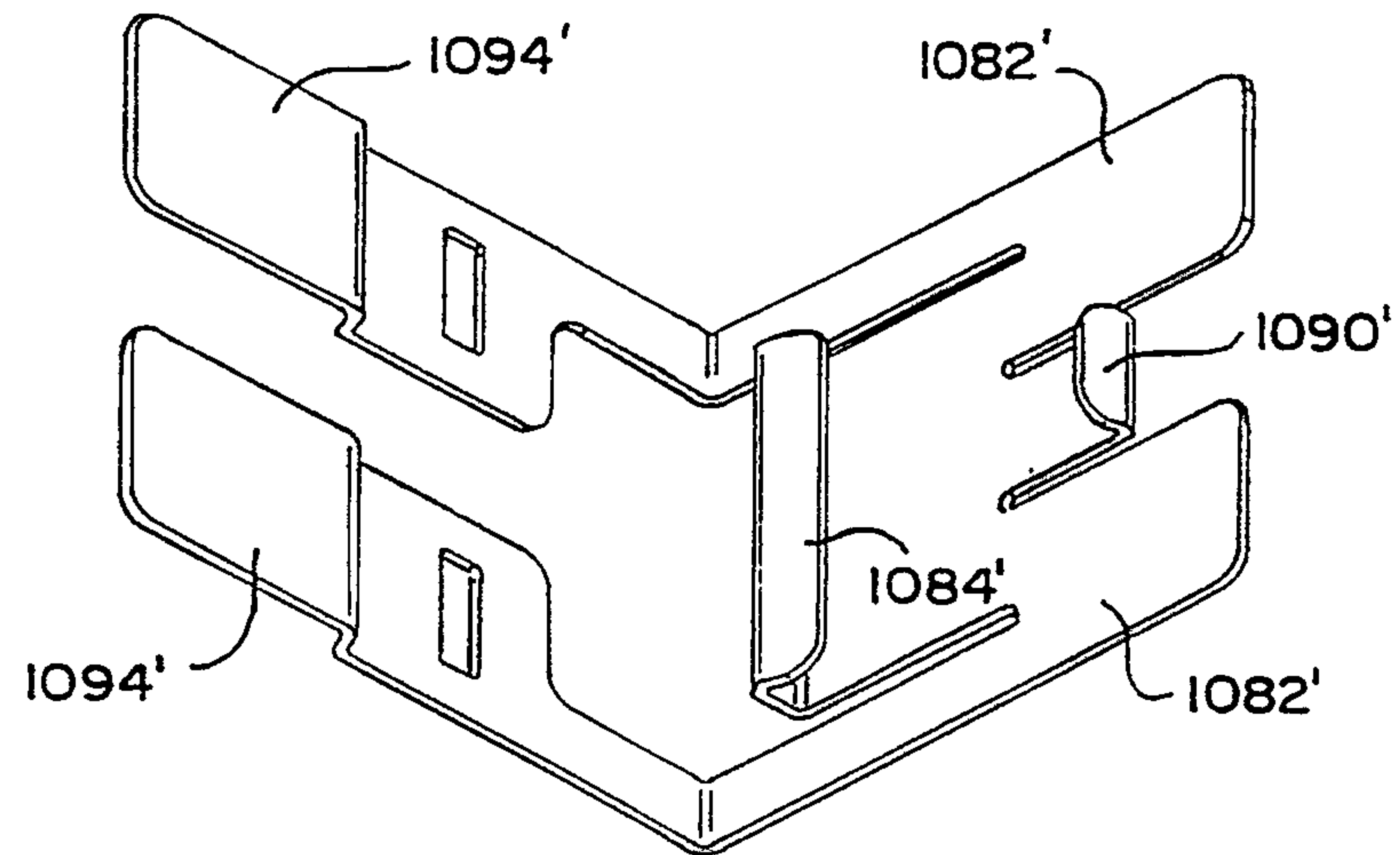


FIG. 78

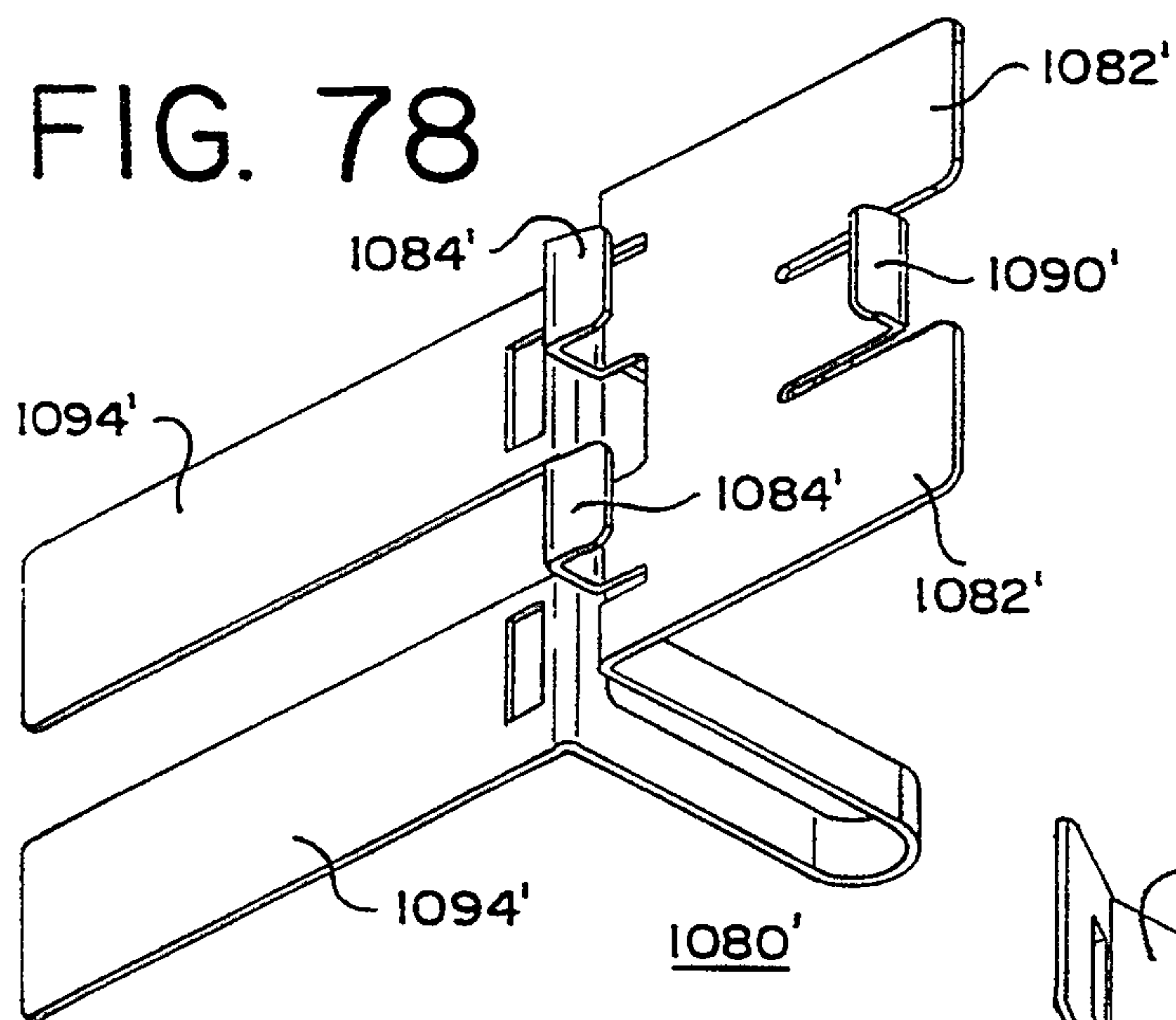
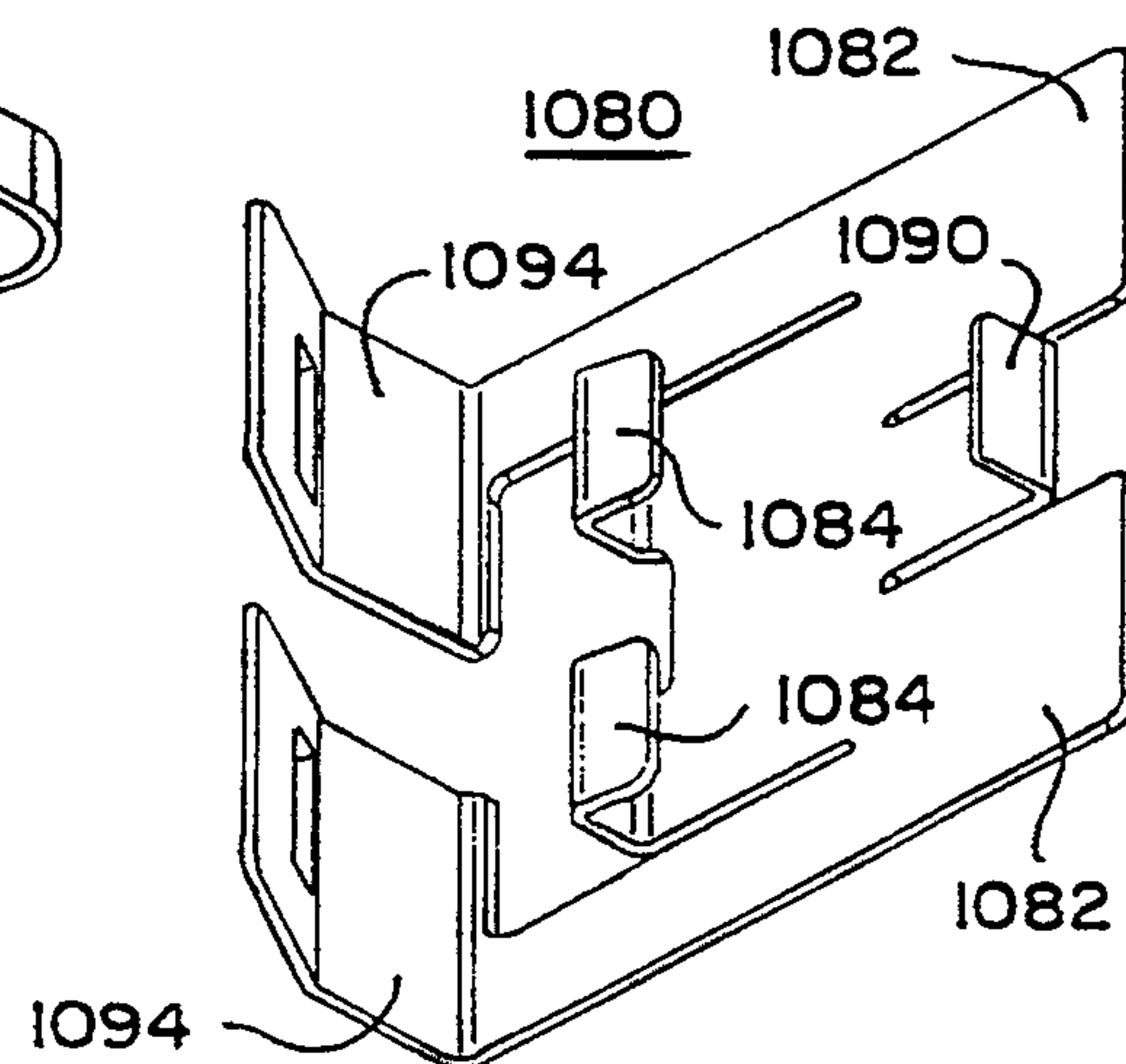


FIG. 79



37/43

FIG.80

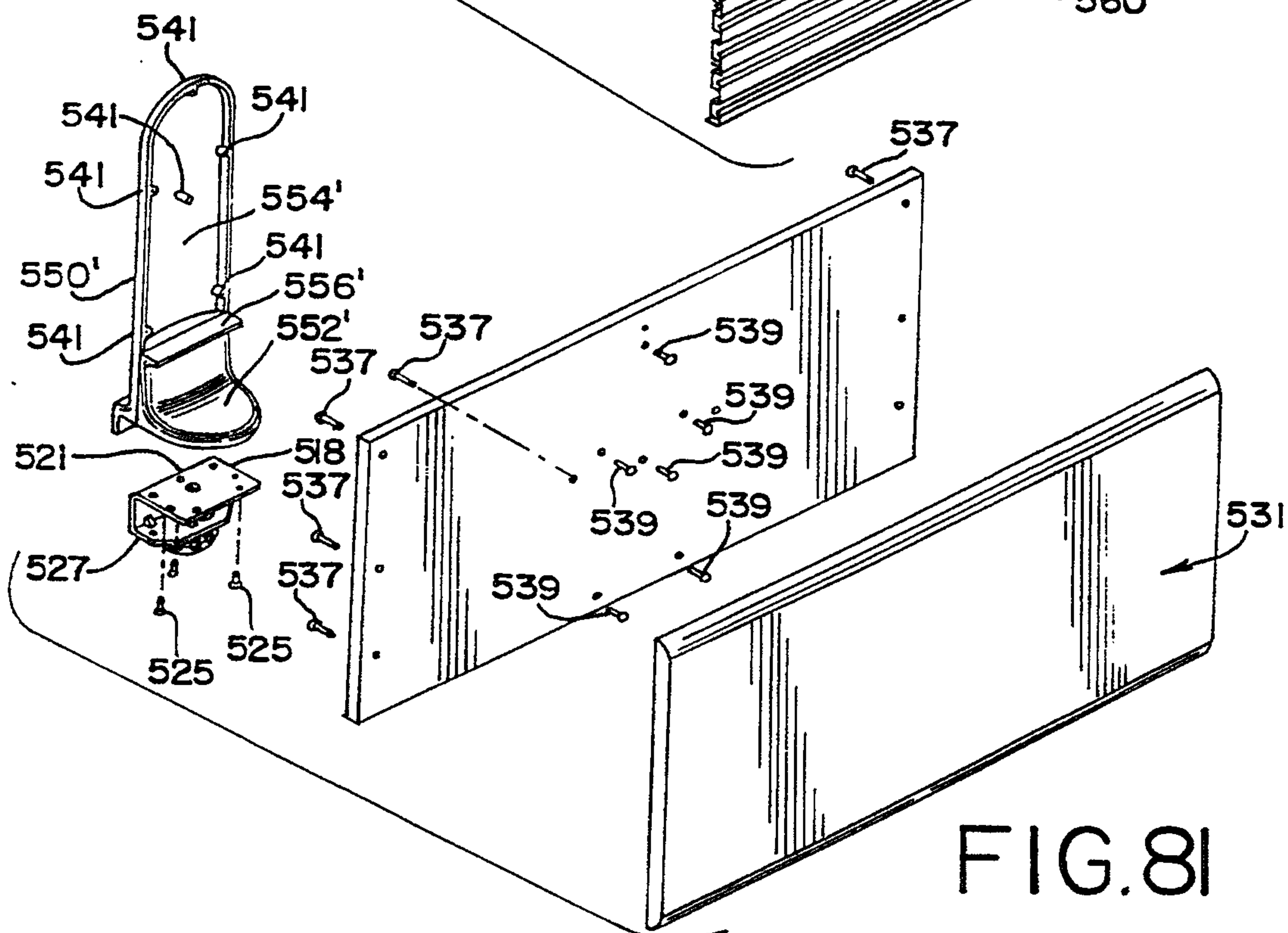
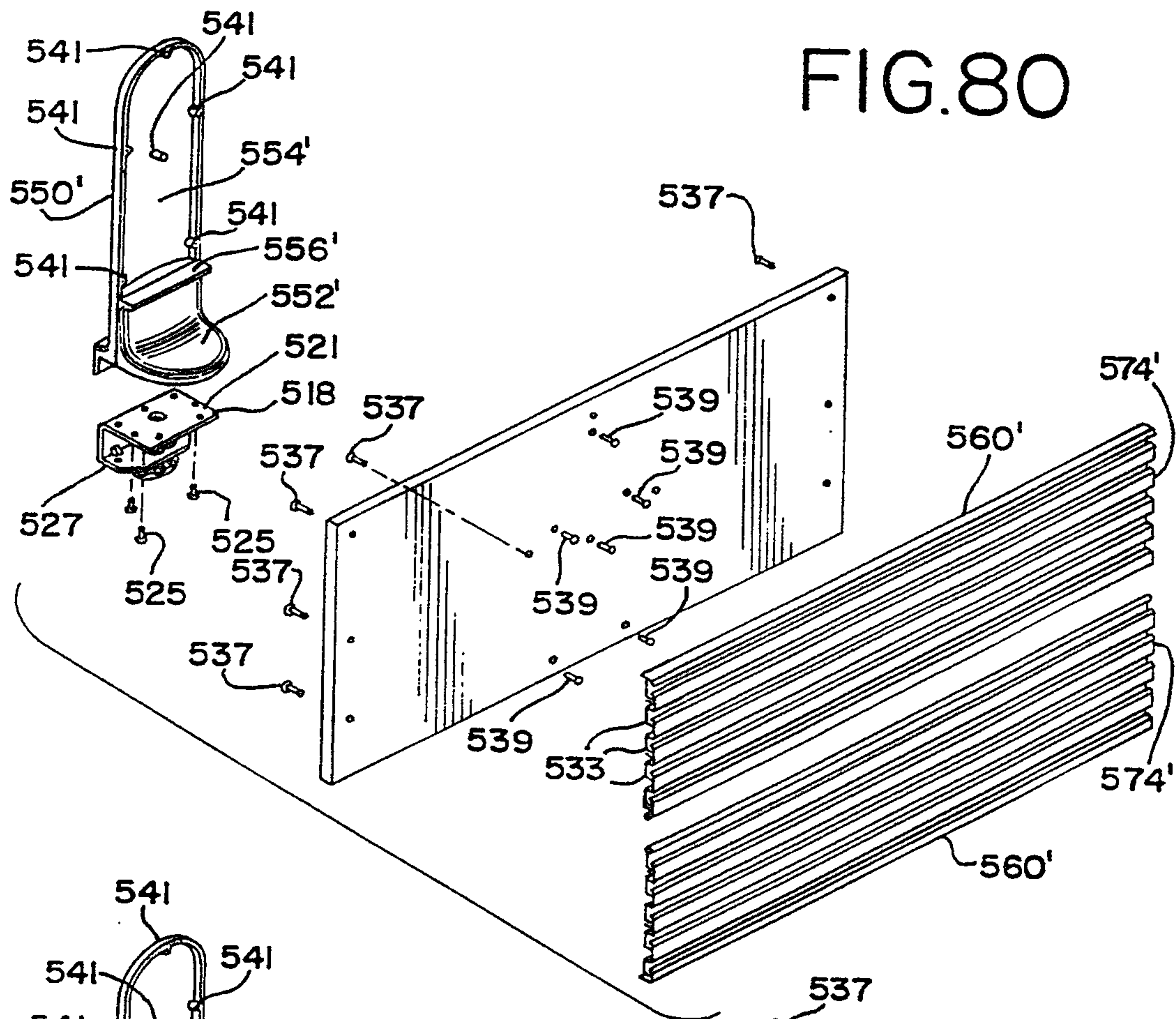


FIG.81

38/43

FIG.82

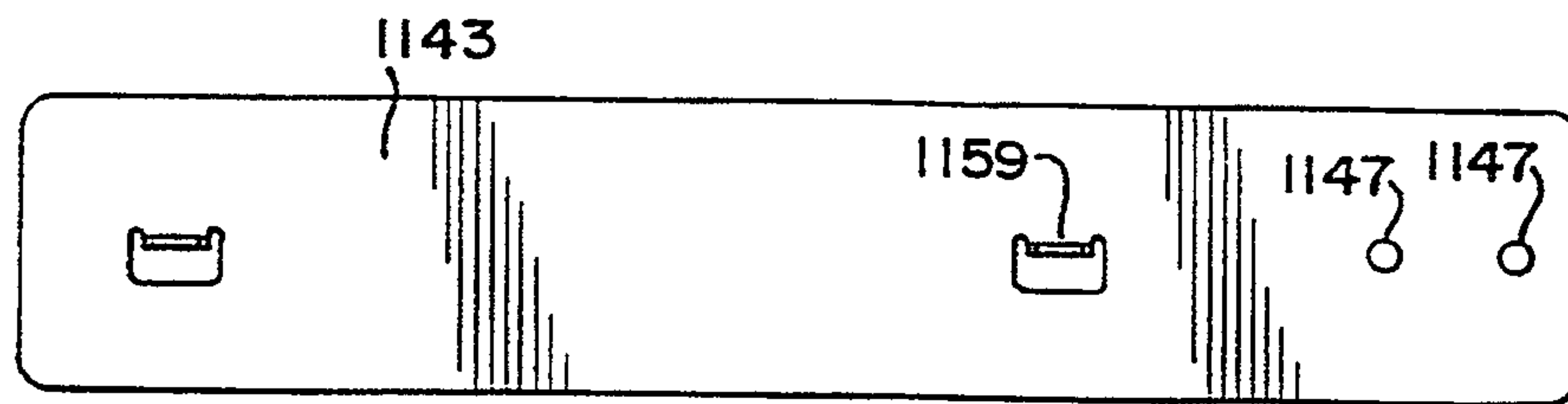


FIG.83

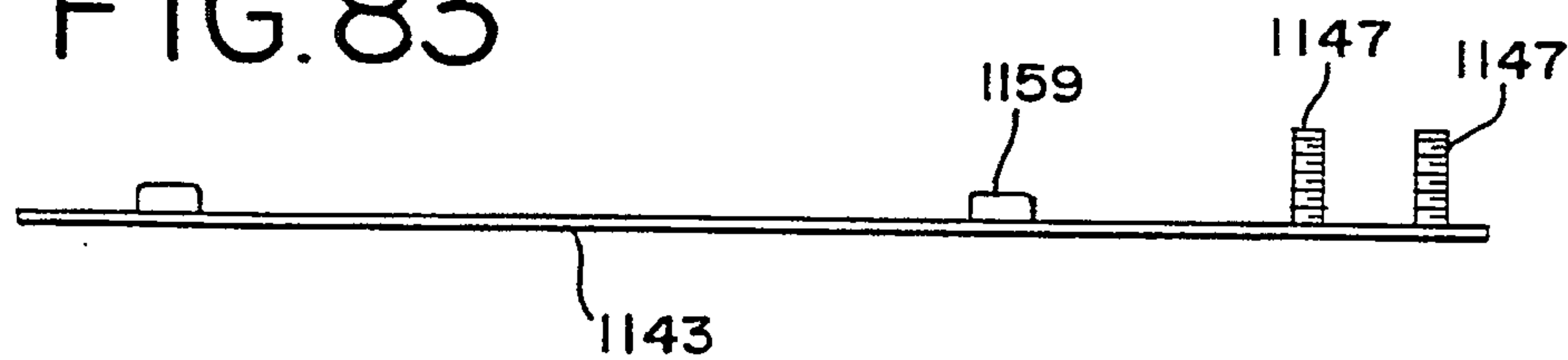


FIG.84

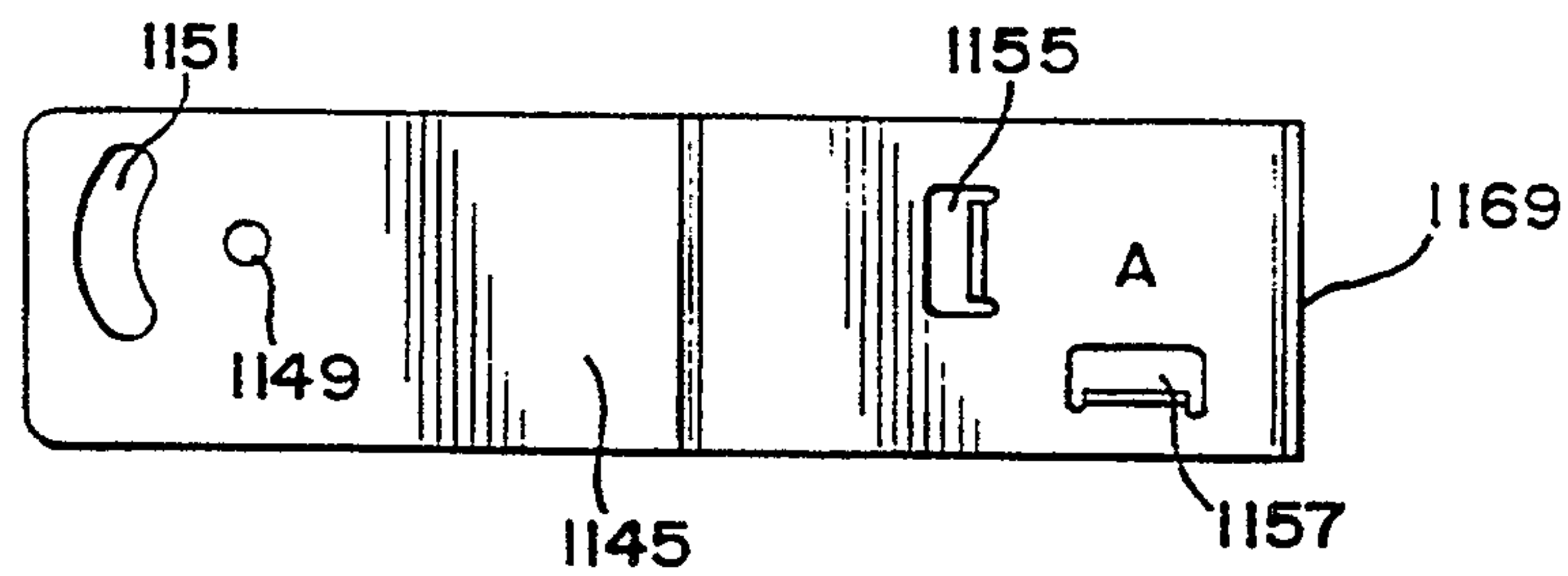
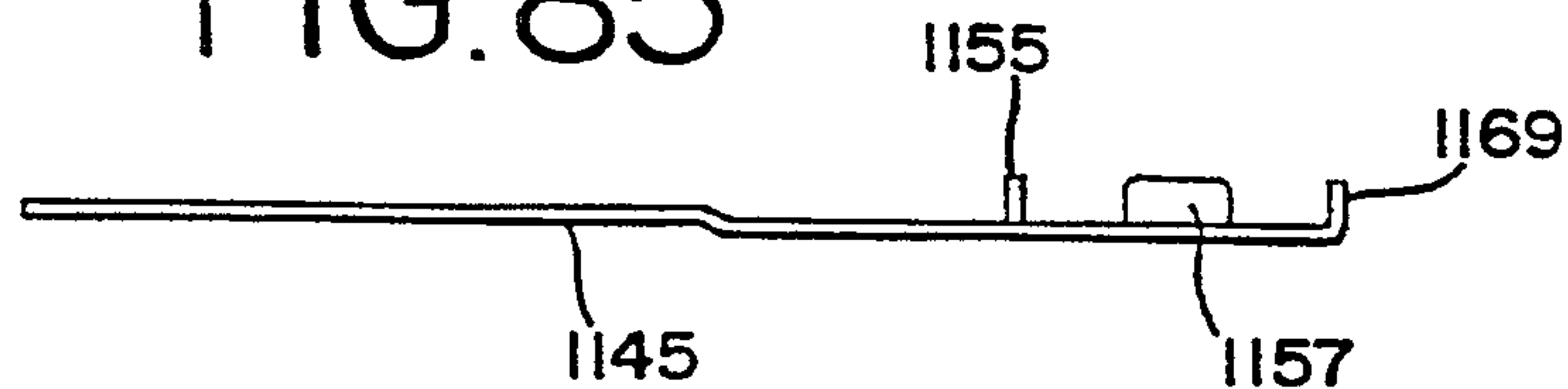


FIG.85



39/43

FIG.86

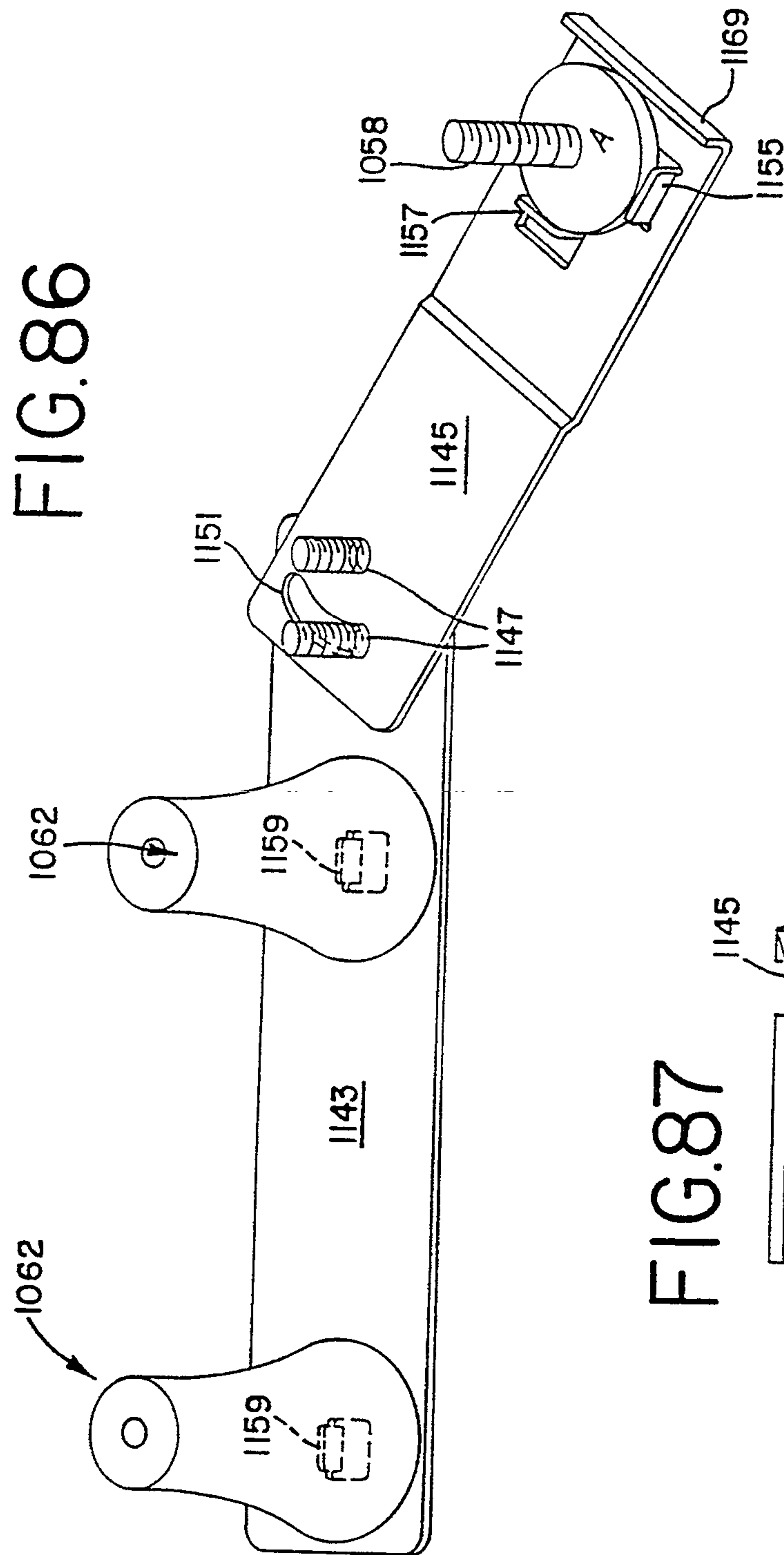
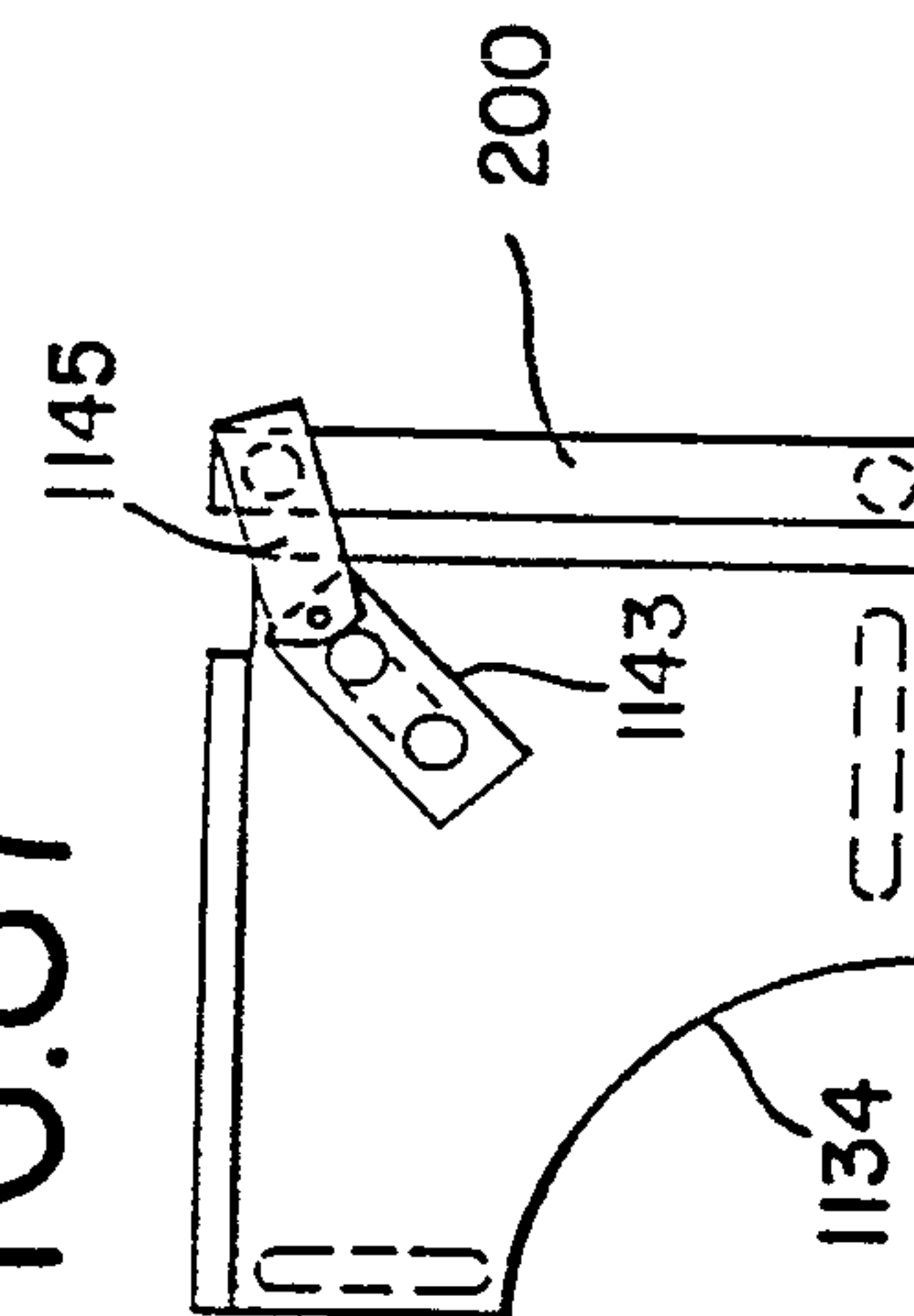
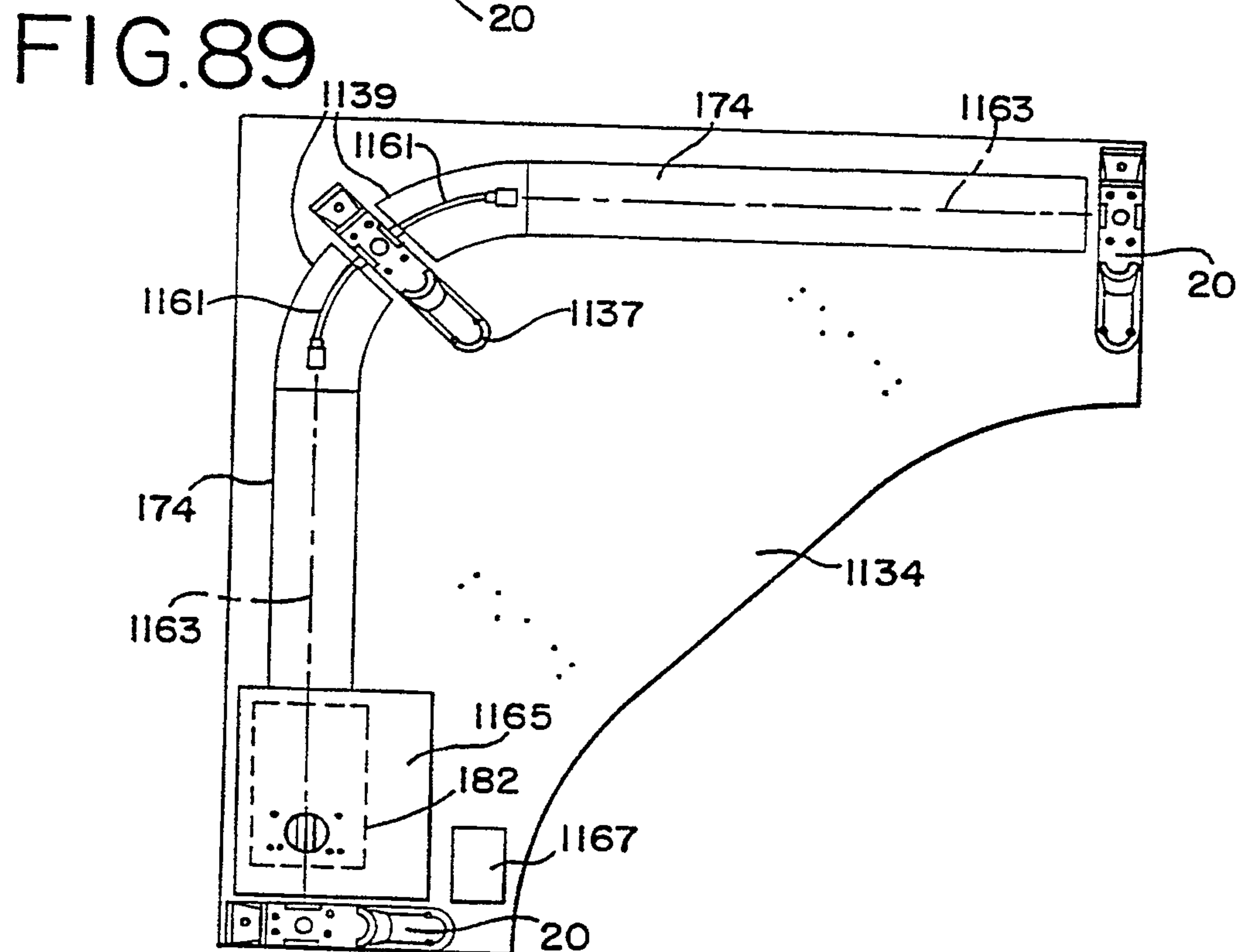
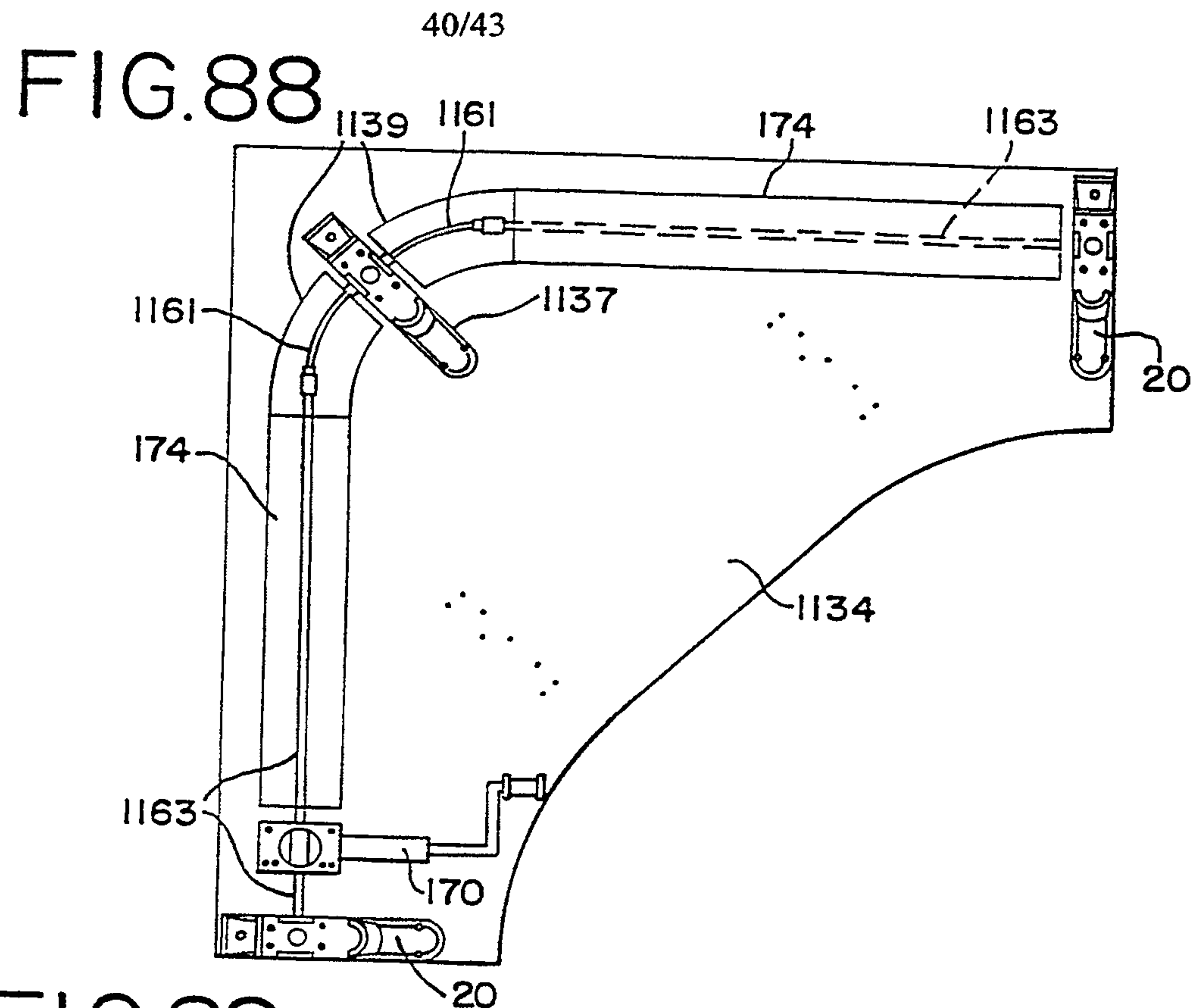
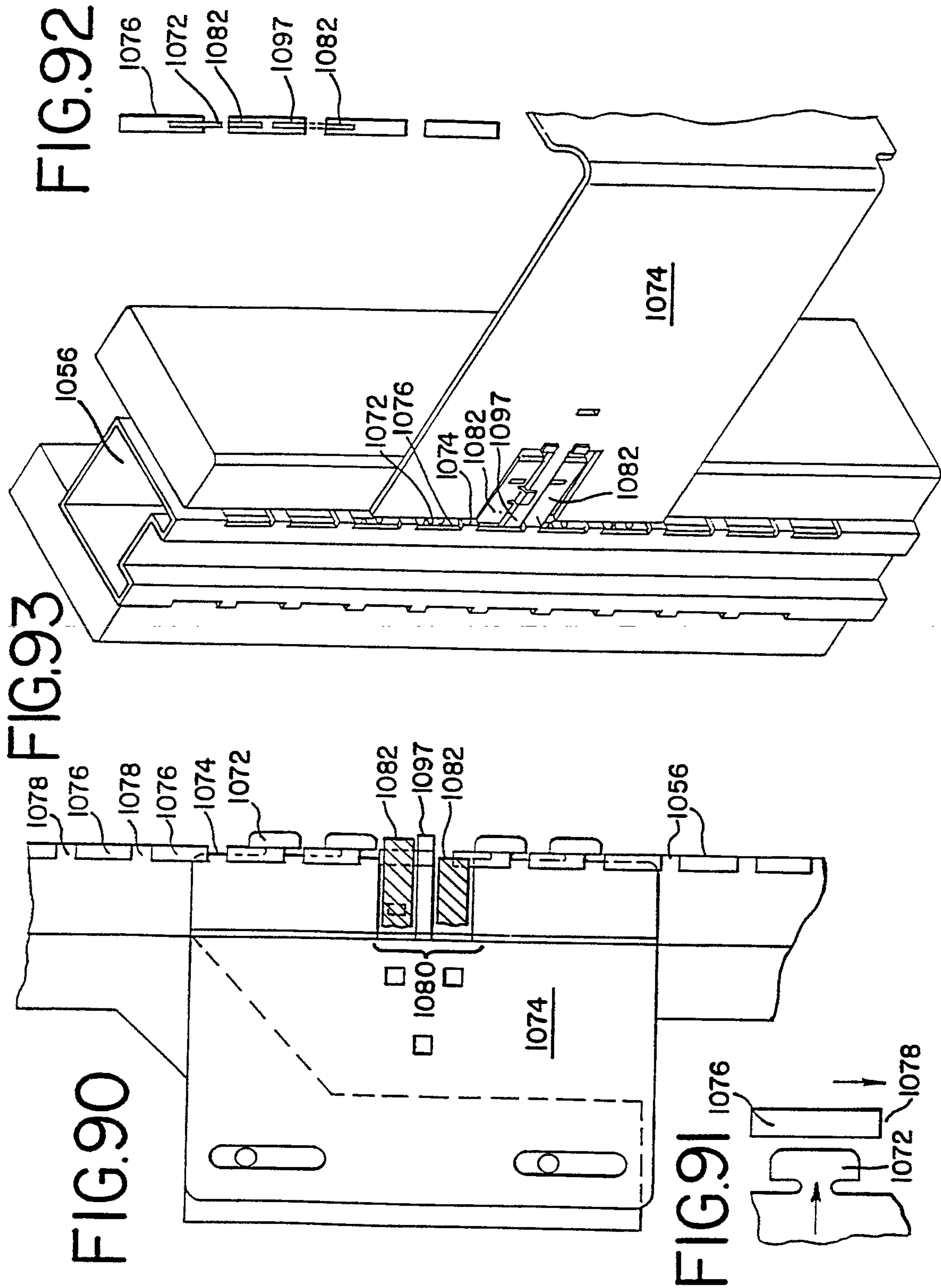


FIG.87





41/43



42/43

FIG.94A

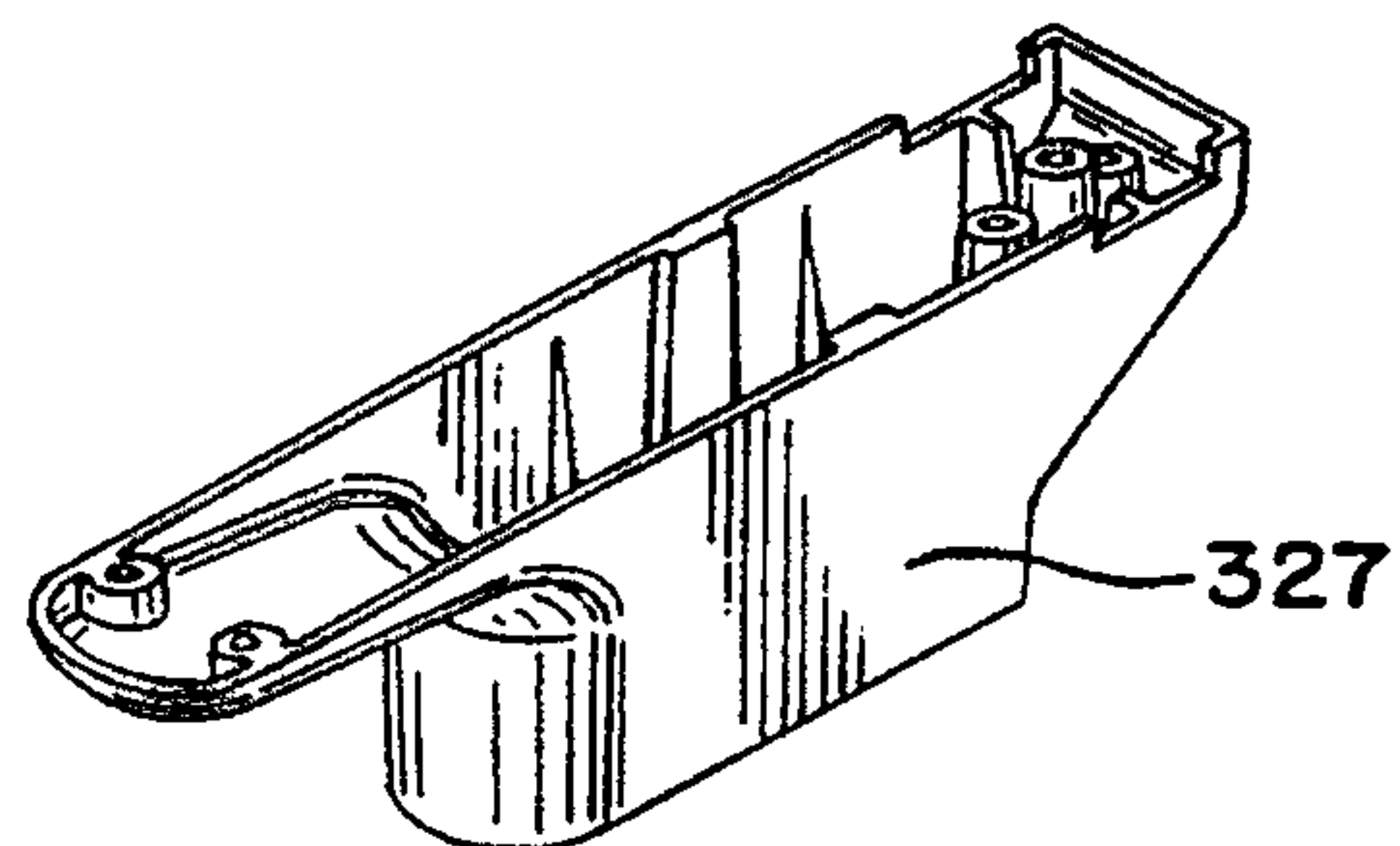


FIG.94B

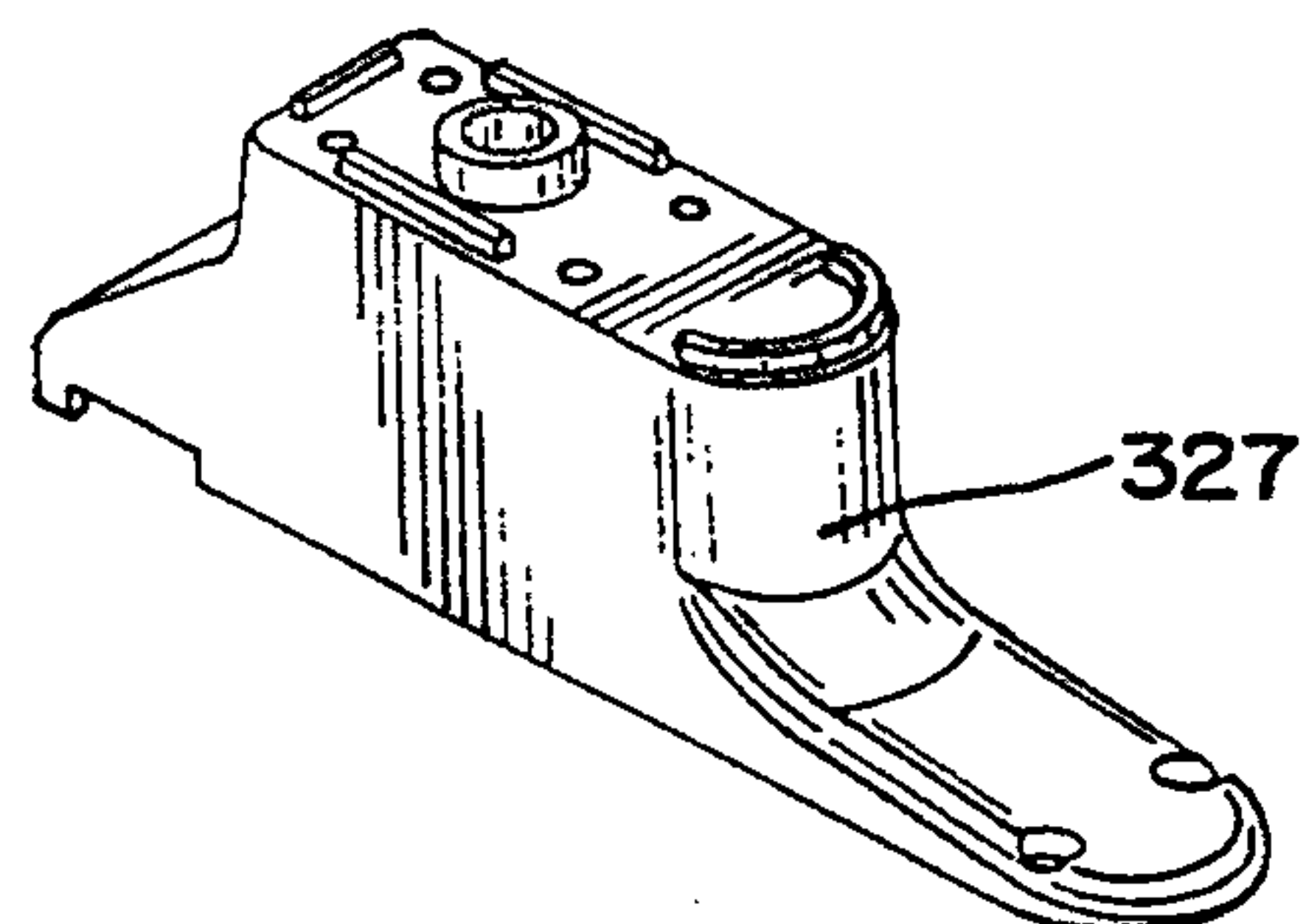
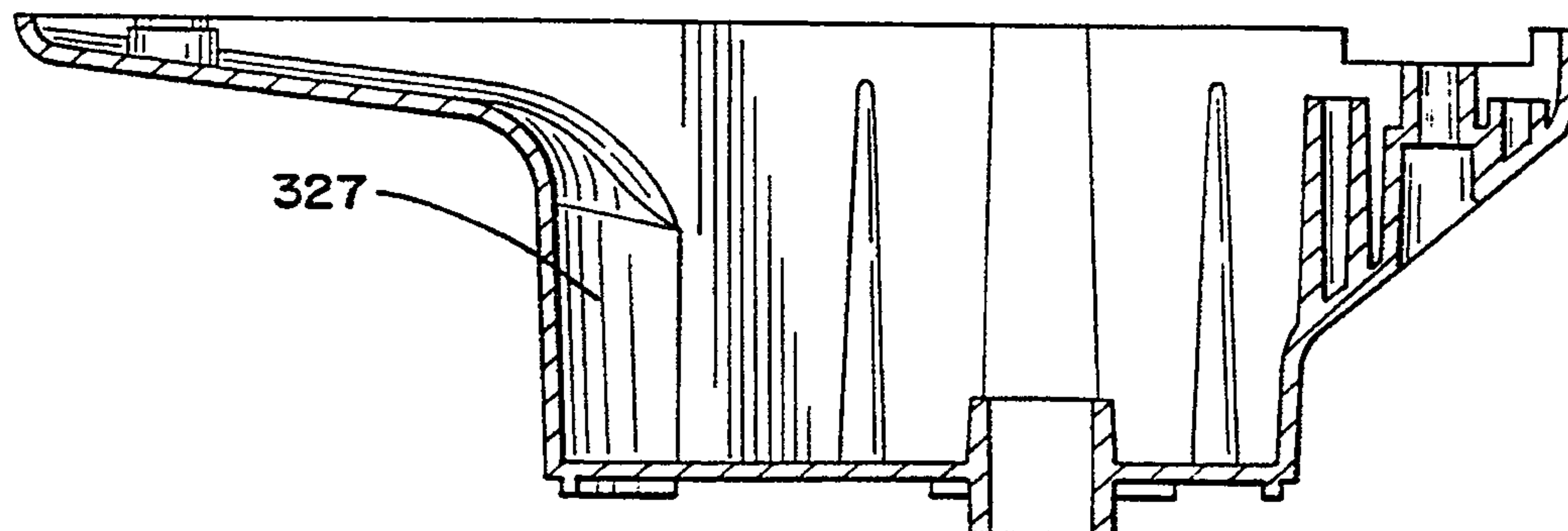


FIG.94C



43/43

FIG.95

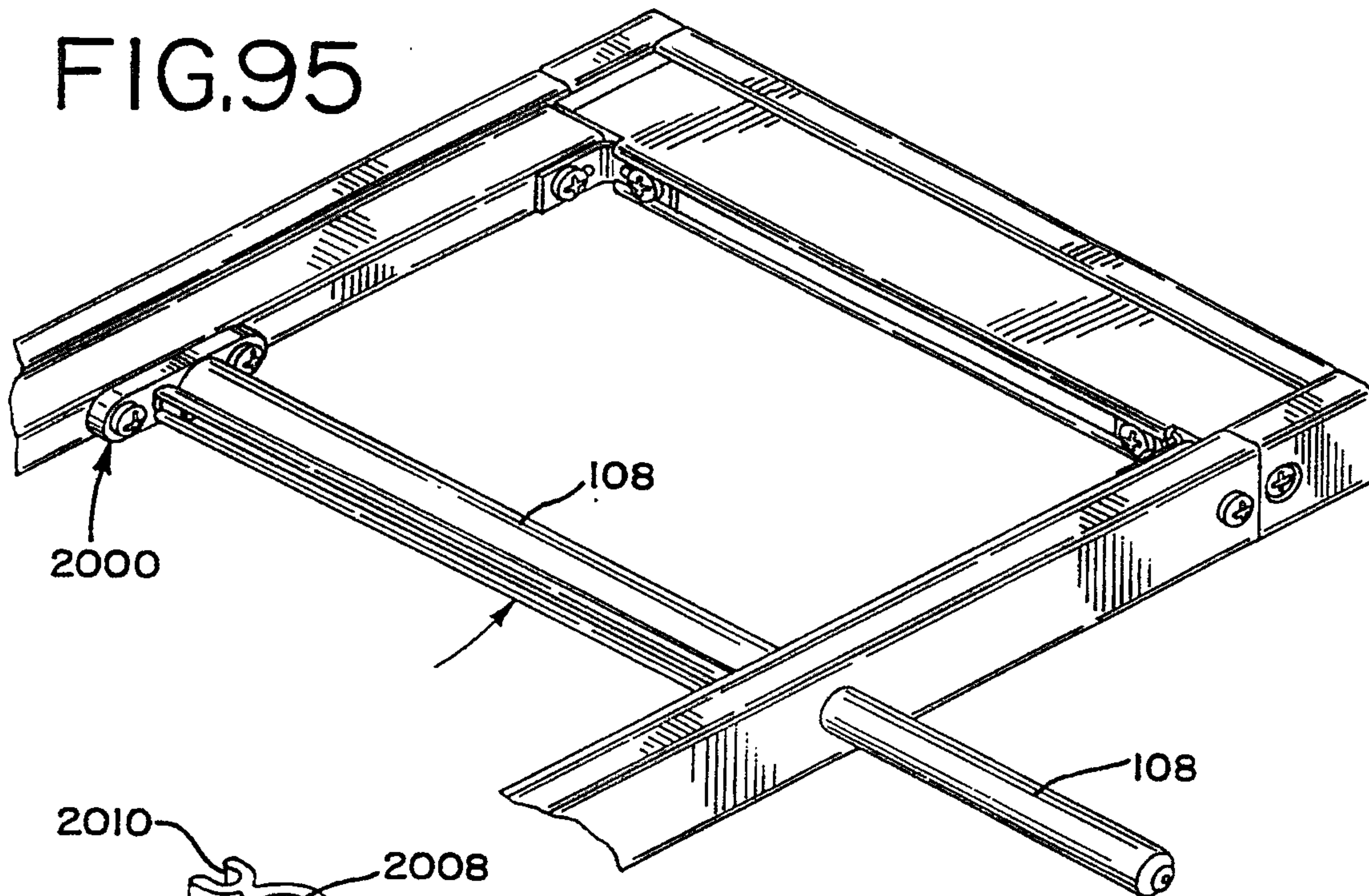


FIG.96

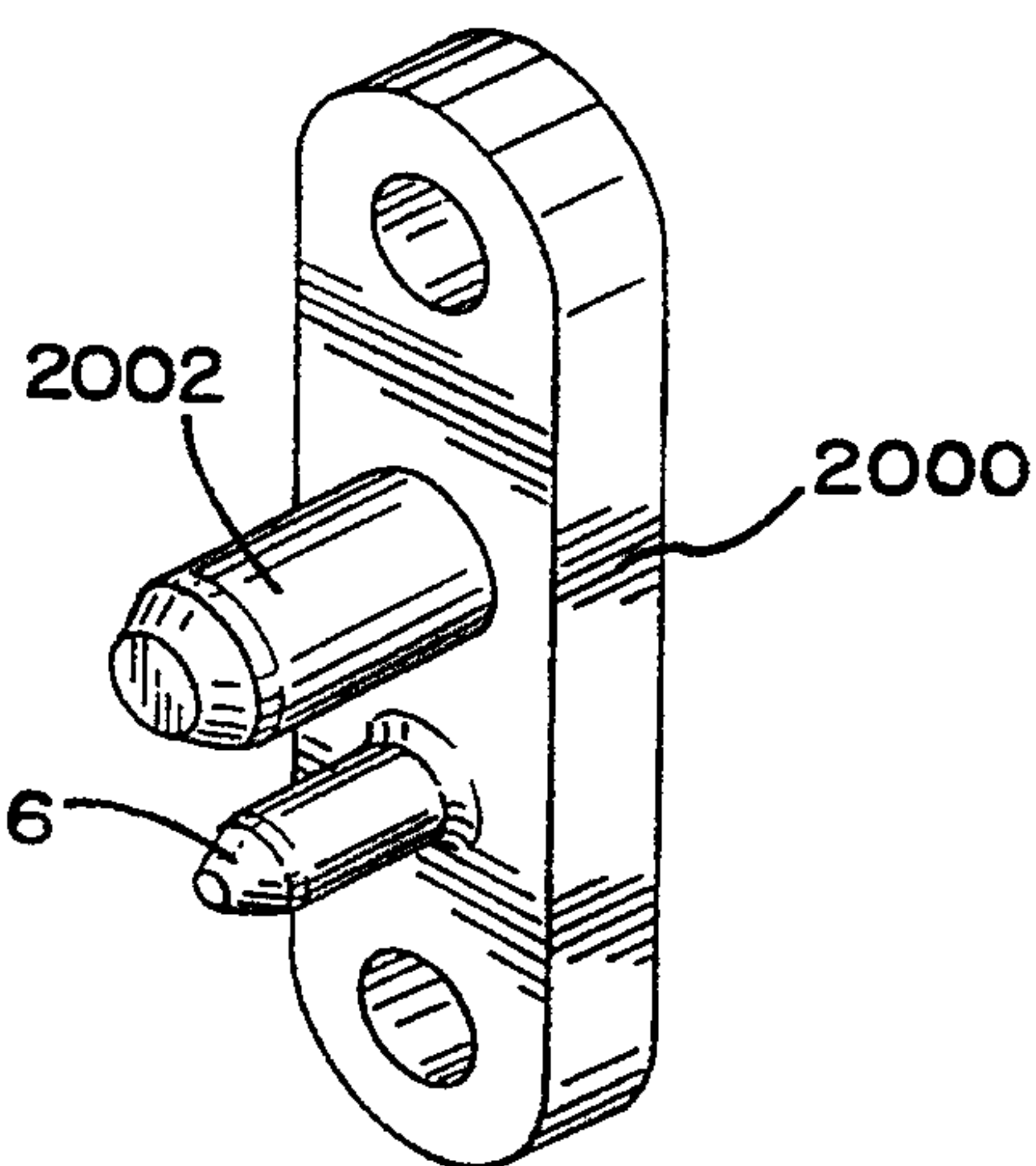


FIG.97

