



(22) Date de dépôt/Filing Date: 2000/05/02

(41) Mise à la disp. pub./Open to Public Insp.: 2001/11/02

(51) Cl.Int.⁷/Int.Cl.⁷ H01R 33/96, H04Q 1/14

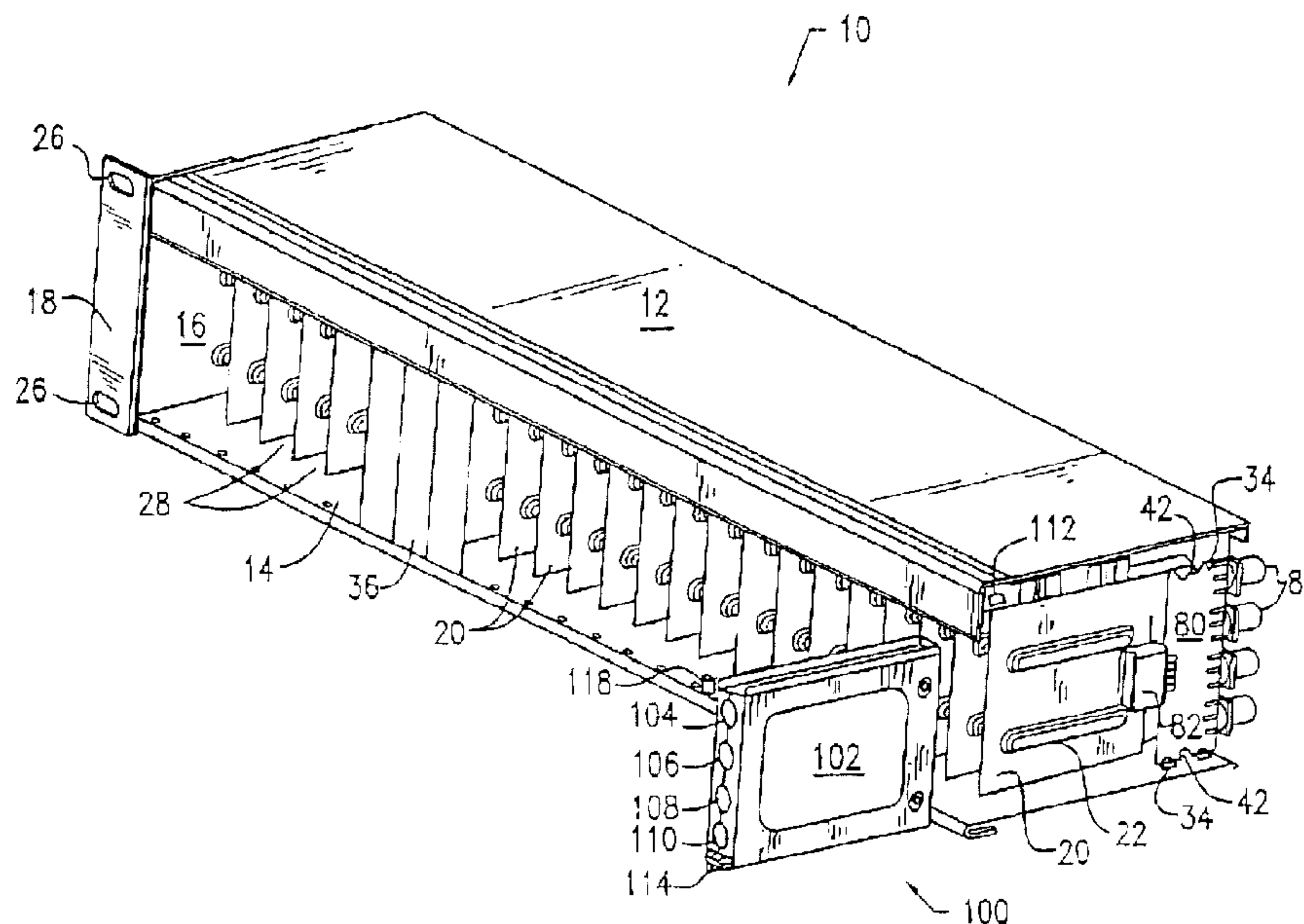
(71) Demandeur/Applicant:
THOMAS & BETTS INTERNATIONAL, INC., US

(72) Inventeur/Inventor:
KUTSCH, DUANE B., US

(74) Agent: MACRAE & CO.

(54) Titre : ENSEMBLE D'INTERCONNEXIONS SANS MODULE

(54) Title: MODULE-LESS CROSS CONNECT ASSEMBLY



(57) Abrégé/Abstract:

A telecommunication assembly having a plurality of slots for receiving a plurality of modules therein. The telecommunications assembly couples to a telecommunication network and includes a plurality of distinct backplane circuit boards secured therein for each coupling to one of the plurality of modules. Each of the plurality of distinct backplane circuit boards includes a bounding edge, a back side partially encompassed by the bounding edge, a plurality of first connectors coupled to the back side for receiving a telecommunication signal from the telecommunication network, a front side coupled to the back side, and a second connector mounted on the front side and spaced apart from the at least one jack for coupling to one of the plurality of modules. The telecommunication assembly is operable with one or more of the plurality of distinct backplane circuit boards removed from the assembly and the assembly allows for two pieces of telecommunications equipment to be connected without a module being installed in the assembly. In addition, a "make before break" circuit is provided between each backplane and coupling module.

Abstract

A telecommunication assembly having a plurality of slots for receiving a plurality of modules therein. The telecommunication assembly couples to a telecommunication network and includes a plurality of distinct backplane circuit boards secured therein for each coupling to one of the plurality of modules. Each of the plurality of distinct backplane circuit boards includes a bounding edge, a back side partially encompassed by the bounding edge, a plurality of first connectors coupled to the back side for receiving a telecommunication signal from the telecommunication network, a front side coupled to the back side, and a second connector mounted on the front side and spaced apart from the at least one jack for coupling to one of the plurality of modules. The telecommunication assembly is operable with one or more of the plurality of distinct backplane circuit boards removed from the assembly and the assembly allows for two pieces of telecommunications equipment to be connected without a module being installed in the assembly. In addition, a "make before break" circuit is provided between each backplane and coupling module.

Module-Less Cross Connect Assembly

Related References

5 This application is a Continuation-in-Part of co-pending U.S. Patent Application No. 09/282,344 titled "Telecommunication Assembly" filed March 31, 1999 and claims priority of Provisional Patent Application No. 60/100,845 filed September 18, 1998 and entitled "Digital Signal Cross Connect Panel Assembly and System".

Field of the Invention

10 In general, the present invention relates to assemblies, and, in particular, the present invention relates to a telecommunication assembly that performs a telecommunication cross connect function without any cross connect module installed in the telecommunication assembly. Further included in the present invention is a "make before break" circuit connection that exists between the circuit board of each backplane
15 and the card edge connector of each individual DSX module.

Background

A digital signal cross connect (DSX) module is a passive telecommunication module that is disposed between and couples together two active sections of telecommunication network equipment. DSX modules function as test access points allowing users to monitor
20 or reroute telecommunication signals running through the network equipment. Only occasionally does the need arise to test or reroute these signals.

Current telecommunication assemblies include a PCB backplane with permanently mounted connectors on the back, which serves as a back wall for each assembly, and
25 removable jack modules that connect to the backplane. A major disadvantage with these assemblies is that if one circuit on the PCB backplane becomes inoperable, the entire PCB backplane must be removed and replaced. this replacement makes the entire assembly inoperable for a given amount of time. Moreover, it is very costly to replace the entire backplane when only one of its hundreds of circuits goes "bad". In addition, many
30 assemblies cannot function without every jack module installed in the assembly because

the single backplane is not closed circuited. Further, the singular PCB backplane prevents jacks mounted thereon from easily coupling to the network equipment because they do not protrude outward in stair-step fashion without costly modifications to the connectors themselves.

5 In addition, the assemblies do not have DSX module guides, which also act as structural supports, thereby resulting in fragile assemblies. Self-closing doors are also not provided in current DSX assemblies to protect the interior of the assemblies when a particular DSX module is absent from a slot. Current designs have a removable plate that screws or snaps into position when the DSX module is removed. This is very cumbersome
10 and time consuming to operate.

 What's more, telecommunication assemblies of the present fail to provide a means for cross-connecting two different pieces of telecommunication equipment such as a multiplexor and a router when a module is not installed in the assembly. This failure is due to the cross connect in an out ports being contained within the module instead of the
15 backplane. This lack of cross-connecting functionality adds costs and complexity to present telecommunication assemblies.

 Further lacking in present telecommunication assemblies is a "make before break" circuit connection that exists between the backplane, which may be a printed circuit board, and the card edge connector of each individual cross connect module.

20

Summary

 A telecommunication assembly is provided that has a plurality of slots for receiving a plurality of modules therein. The telecommunication assembly couples to a telecommunication network and includes a plurality of distinct backplane circuit boards
25 secured therein for each coupling to one of the plurality of modules.

 While the preferred embodiment of the invention is utilizing a printed circuit board as the backplane, the invention is not limited thereto, but instead is more generally a backplane or module. For example, instead of a circuit board, the backplane may be a coaxial connection or any other type of make before you break module or arrangement.

30 Each of the plurality of distinct backplane circuit boards includes a bounding edge

and a back side partially encompassed by the bounding edge. A plurality of first connectors is coupled to the back side for receiving a telecommunication signal from the telecommunication network, a front side is coupled to the back side, and a second connector is mounted on the front side and spaced apart from the at least one jack for coupling to one of the plurality of modules.

The telecommunication assembly is operable with one or more of the plurality of distinct backplane circuit boards removed from the assembly. What's more, the back side of each of the plurality of distinct backplane circuit boards is stepped, staggering at least one of the plurality of first connectors for easy access. The plurality of first connectors is coupled to the back side and is mounted to the bounding edge of the each of the plurality of distinct backplane circuit boards.

A pair of guide ridges is attached to the telecommunication assembly for guiding the plurality of distinct backplane circuit boards when installed in, and removed from, the telecommunication assembly. At least one notch is formed in the bounding edge of each of the plurality of distinct backplane circuit boards. A plurality of tines is coupled to the telecommunication assembly with at least one of the plurality of tines partially extending into one of the notches on the backplane circuit boards.

A plurality of stops is disposed on the telecommunication assembly against which the bounding edge of each of the plurality of distinct backplane circuit boards abuts. A plurality of guide walls is disposed in the assembly for defining the plurality of slots, serving to guide each of the plurality of modules into the telecommunication assembly, and providing structural support to the telecommunication assembly.

At least one projection or strip is disposed on each of the guide walls for aiding in guiding each of the plurality of modules into the telecommunication assembly. Each of the modules includes a flange mounted thereon for gripping by an operator. An aperture is disposed in the assembly for receiving a tab mounted on one of the modules upon insertion of each of the plurality of modules into one of the plurality of slots. Moreover, each of the plurality of distinct backplane circuit boards is secured in parallel with one of the plurality of modules when inserted into one of the slots.

Another feature of this invention is that the backplanes or modules, which are shown

in the preferred embodiment to be circuit boards, are complete and operational without the front modules being inserted or operationally connected to the corresponding backplane.

Still another feature of this invention is the operational connection between the front module (item 100 in the Figures) and the backplane is a make before you break connection, meaning that the operational connection between the two is made before the circuit is broken or interrupted.

Brief Description of the Drawings

Fig. 1 is a front perspective view of a digital cross connect assembly, a module, and a backplane circuit board therefor of the present invention.

Fig. 2 is a rear perspective view of a digital cross connect assembly, a module, and a backplane circuit board therefor of the present invention.

Fig. 3 is a side elevational view of a guide wall of the present invention.

Fig. 4 is a perspective view of the module inserted into the backplane circuit board of the present invention.

Fig. 5 is a side elevational view of the module of the present invention.

Fig. 6 is a perspective view of a card edge being inserted into a card edge connector of the backplane circuit board of the present invention.

Fig. 7 is a perspective view of a leaf spring member of the present invention.

Fig. 8 is a side elevational view of the backplane circuit board of the present invention.

Fig. 9 is a rear elevational view of the backplane circuit board of the present invention.

Fig. 10 is a circuit schematic of the backplane circuit board of the present invention.

Fig. 11 is a side elevational view of two guide ridges of the present invention.

Fig. 12 is a plan view of a spring hinge for a slot door of the present invention.

Fig. 13 is a schematic view of the backplane circuit board coupled between a first and a second piece of network equipment.

Detailed Description of the Preferred Embodiment(s)

The above and other features, aspects, and advantages of the present invention will now be discussed in the following detailed description and appended claims, which are to be considered in conjunction with the accompanying drawings in which identical reference characters designate like elements throughout the views. Shown in Fig. 1 is a telecommunication assembly 10, which is preferably a Digital Signal Cross Connect (DSX) assembly primarily constructed of metal, which has a first plate 12, a second plate 14, and two side walls 16 coupled between the first plate 12 and the second plate 14. Extending in perpendicular fashion from each of the side walls 16 is a retention bracket 18, as shown in Figs. 1 and 2, that has at least one attachment aperture 26 disposed therein for securing the telecommunication assembly 10 to a frame.

Shown in Figs. 1, 4 and 5 is a telecommunication module 100, such as a Digital Signal Cross Connect (DSX) module, which is releasably secured within a panel for allowing communication between a piece of telecommunications equipment and a telecommunications network, such as a telephone network. The DSX module is described in further detail in U.S. Patent Application No. 09/277,235, which is entitled "Telecommunication Jack Module Having Edge Mounted Jack and Switch Therefor" and that is wholly incorporated herein by reference. Preferably, the present module 100 receives a DS-3 signal, which is at a frequency rate on the order of 44.736 megabits per second, but could be a lower frequency signal such as DS-1 on the order of 1.544 megabits per second or higher frequency signal such as a DS-4 on the order of 274.176 megabits per second. The module 100 includes a hard plastic casing 102, preferably constructed of a thermo-plastic, to protect the contents of the module 100.

The module 100 has at least one jack such as a BNC for receiving a plug therein, but preferably has a plurality of WECO jacks including a first monitor jack 104, an output jack 106, an input jack 108, and a second monitor jack 110. The first monitor jack 104 and the second monitor jack 110 provide for the taking of samples of a signal from the telecommunications network and the output jack 106 and input jack 108 are for receiving the signal from, and inputting a signal to, the telecommunications network, respectively. When patching or monitoring is required to telecommunication network equipment, at least

one DSX module 100 is slid into a slot 28 of the panel assembly where it aligns with an individual PCB, which is connected to the network equipment, resulting in the DSX module 100 intruding or intercepting a telecommunication signal running through the network equipment.

5 While BNC jacks are referred to herein, the reference is by way of example only and any one of a number of currently known or to be developed jacks may be utilized within the contemplation of this invention, with no one in particular being necessary to practice this invention.

10 It will also be appreciated by those of ordinary skill in the art that while four jacks are shown in the preferred embodiment, this invention is not limited to four jacks, but instead may include others of a plurality, such as six jacks, for example. In a six-jack configuration, for example, additional jacks for cross-connect in and cross-connect out may be added to the module.

15 As is best shown in Figs. 1 and 4, a plurality of module guide walls 20 simultaneously direct the DSX module 100 upon insertion into the assembly and provide structural support for the assembly 10. The present DSX module 100 is fully enclosed in the plastic casing 102, which also provides the surface to guide the DSX module 100 into one of the slots 28 in the assembly 10. To aid in module insertion, one or more projections 24, such as those shown in Fig. 3, or one or more horizontal strips 22 are disposed on
20 each of the guide walls 20, as shown in Fig. 1, for aiding in guiding each of the plurality of modules 100 into the slots 28 of the telecommunication assembly 10. Moreover, the projections 24 and strips 22 are preferably pressed or stamped into the guide walls 20 and extended outward from the guide walls 20 a distance equal to the width of the hinges for the doors, as will be discussed below, such that the modules 100 have no interference
25 when slid into a slot 28. The guide walls 20 are preferably constructed of metal, such as stainless steel or tin.

Each of the modules 100 includes a grip 114 mounted thereon for gripping by an operator, as shown in Figs. 1, 4 and 5. Spaced apart from the grip 114 is a flange 118, which is also gripped by the operator, and an integrally formed tab 120. As shown in Fig.
30 4, a retention aperture 112 is disposed in the assembly for receiving the tab 120 upon

insertion of each of the plurality of modules 100 into one of the plurality of slots 28. To remove the module 100 from the telecommunication assembly 10, the grip 114 and flange 118 are squeezed toward one another thereby slidingly removing the tab 120 from the aperture disposed in the telecommunication assembly 10 as the module 100 is biased.

5 The grip 114, flange 118 and tab 120 are constructed of a hard plastic, which is also preferably a thermo-plastic similar to the casing 102 of the module 100. A spring arrangement is created on the module 100 because the flange 118 and integrally formed tab 120 extend outward from the casing 102 of the module 100.

Each slot 28 in the assembly 10 has a self closing swing door 36, as shown in Fig. 1, which covers the front of the slot when a DSX module 100 is not installed in a particular slot, thereby preventing environmental elements such as dirt from entering therein. The doors 36 have spring hinges 90, as shown in Fig. 12, for returning the doors 36 back to their normally closed positions. When a DSX module 100 is inserted into a slot 28, the associated door 36 is held open by abutting the module 100 thereby allowing an operator

10 to visually see that a module 100 is inserted into a particular slot 28. One side of each door 36 has an integrally formed rod 36a, which tapers at the top and bottom. Each of such tapered portions is inserted through one of the spring hinges 90. An extension 92 protrudes from the top and bottom of each spring hinge 90. The top extension is coupled to the assembly, while the bottom extension is biased against the swiveable door 36. A

15 spring force tension is created between the spring hinge 90 and the doors 36 upon insertion of a module 100 therein. This tension is relieved when the module 100 is removed from the slot 28.

The telecommunication assembly 10 couples to a telecommunication network and includes a plurality of distinct backplane circuit boards 80 secured therein for each coupling

25 to one of the plurality of modules 100. As is best seen in Fig. 6, each of the plurality of distinct backplane circuit boards 80 includes a bounding edge 94 and a back side 96 partially encompassed by the bounding edge 94. A plurality of first connectors, which is preferable BNC jacks 84 but could be any telecommunication adapter designed to attach

30 to a circuit board such as a card edge connector 82, WECO jack, or wire-wrap, are coupled

to the back side 96 of the circuit board for receiving a telecommunication signal from the telecommunication network. The BNC jacks 84 may be such as those manufactured by the Amphenol Company, having a URL at <http://www.Amphenol.com> or those manufactured by the Molex Company, or equivalent.

5 A front side 98 is integrally formed with the back side 96, and a second connector is mounted on the front side 98 and spaced apart from the at least one jack 84 for coupling to one of the plurality of modules 100. The second connector, which is preferably a normally closed, card edge connector 82 but could also be a plurality of BNC jacks 84, WECCO jacks, or wire-wraps, is mounted on the PCB, as shown in Figs. 4, 6, 8 and 9. The
10 card edge connector 82 receives a card edge 88 therein having electrical contacts on only one side of the edge 88. During normal operation the telecommunication signal loops through the normally closed, card edge connector 82 with negligible loss such that it can be monitored from either the first monitor jack 104 or the second monitor jack 110.

 Referring with particularity to Figs. 8, 9 and 10, the present invention further
15 provides a "make before break" feature wherein the connection or coupling of the card edge 88 of the module 100 to the card edge connector 82 is physically made before the operation of the normally closed circuit of the backplane circuit board 80 is broken. As stated above, the circuit of each of the backplane circuit boards 80 such that the X-OUT port has continuity with the OUT port and the X-IN port has continuity with the IN port, as
20 shown in Figs. 10 and 13. Once the card edge 88 is physically and electrically coupled to the card edge connector 82 which whereby will allow the module 100 and the network equipment 140 to be coupled to the particular backplane circuit board to be monitored via the module 100.

 The signal from the IN port of network equipment 140 is terminated to the IN port
25 of the backplane circuit board, the signal is transferred to the edge connector 82 via the PCB 80. The edge connector 82 provides shorting terminals that pass the signal through the edge connector 82 when there is no module inserted within. The signal is transferred back to the X-IN port of the backplane circuit board via PCB 80 and finally to the OUT port of the first piece of equipment 130. In addition, the signal from the OUT port of network
30 equipment 140 is terminated to the OUT port of the backplane circuit board, the signals is

transferred to the edge connector 82 via the PCB 80. The edge connector 82 provides shorting terminals that pass the signal through the edge connector 82 when there is no module inserted within. The signal is transferred back to the X-OUT port of the backplane circuit board via PCB 80 and finally to the IN port of the first piece of equipment 130.

5 It is important that the physical connection of the card edge 88 and card edge connector 82 be fully completed before the normally closed circuit is broken so that an electrical signal existing thereon is not inadvertently shorted to ground or that the circuit is prevented from being open circuited. To accomplish the physical seating of the card edge 88 into the card edge connector 82 before the circuit of the circuit board 80 is broken, a
10 gap 150 exists from the end of the card edge 88 to where the one sided electrical contacts 70 are mounted and also from the end of the card edge connector 82 to where its internal contacts are located, as shown in Fig. 6.

A significant feature of the present invention is that the telecommunication assembly
10 is operable with one or more of the plurality of distinct backplane circuit boards 80 removed from the assembly 10. What's more, the back side 96 of each of the plurality of distinct backplane circuit boards 80 of the present invention is stepped, staggering at least
15 one of the plurality of first connectors for easy access by an operator. This is best shown in Figs. 6 and 8.

The plurality of BNC jacks 84 coupled to the back side 96 of the distinct backplane
20 circuit boards 80 is mounted to the bounding edge 94 of the each of the plurality of distinct backplane circuit boards 80. This mounting is preferably accomplished by two legs 30 extending from each BNC jack 84 and "pinching" the PCB by friction fit or being soldered to grounding pads on the backplane circuit board. A center conductor 38 press fits against a landing pad on one side of the circuit board. Shown in Fig. 10 is the circuit diagram for
25 the backplane circuit boards 80, coupling the card edge connector 82 to the BNC jacks 84.

As is best seen in Figs. 1 and 4, each of the plurality of distinct backplane circuit boards 80 is secured in parallel with one of the plurality of modules 100 when inserted into one of the slots 28. This allows for a maximum number of distinct backplane circuit boards 80 and associated modules 100 to be installed in a fixed space in the assembly. In
30 addition, the edge mounted BNC jacks 84, instead of being board mounted, allow for the

backplane circuit boards 80 to be no thicker than the diameter of the BNC jacks 84 further allowing for a maximum number of distinct backplane circuit boards 80 and associated modules 100 to be installed in a fixed space in the assembly 10.

At least one notch 86 is formed in the bounding edge 94 of each of the plurality of distinct backplane circuit boards 80, as shown in Figs. 1, 4 and 6. A plurality of tines 42, as shown in Figs. 1, 4, 7 and 11, are coupled to the telecommunication assembly 10 with at least one of the plurality of tines 42 partially extending into the at least one notch 86 at such an angle that the tine 42 asserts little resistance as the backplane circuit board 80 is inserted into the assembly 10 and great resistance when the backplane circuit board 80 is removed from the assembly 10. In operation of the present invention, a screwdriver or extended implement is used to force the tine 42 from the notch 86 when the backplane circuit board 80 is removed from the assembly 10.

As shown in Fig. 7, a leaf spring member 40 of the present invention has a plurality of apertures 44 for attaching the leaf spring member 40 to the assembly 10. The plurality of tines 42 is integrally formed on the leaf spring member 40. In the preferred embodiment, one leaf spring member 40 is attached to the lower half of the assembly 10 and another to the upper half of the assembly 10 such that a tine 42 extends into an upper and lower notch 86 in each of the backplane circuit boards 80.

A pair of guide ridges 34 is attached to the telecommunication assembly 10 for guiding the plurality of distinct backplane circuit boards 80 when installed in, and removed from, the telecommunication assembly 10. The guide ridges 34 are preferably half-circle in shape, constructed of plastic or hard metal, and preferably there are two sets of guide ridges 34 for each backplane circuit board 80 with each set disposed on either side of the circuit board 80. As is best shown in Fig. 11, a plurality of metal or hard plastic stops 32 is disposed on the telecommunication assembly 10 against which the bounding edge 94 of each of the plurality of distinct backplane circuit boards 80 abuts. The plurality of stops 32 works most effectively when each of the distinct backplane circuit boards 80 is inserted into the front of the assembly, slid between the guide ridges 34, and subsequently abut the given stop 32. The guide ridges 34 and stop 32 are also preferably integrally formed with the assembly 10.

As mentioned above, the distinct PCBs 80 are slidably received parallel to each other in the telecommunication assembly 10 and centered to be in a parallel plane with an associated DSX module 100. Preferably, a plurality of BNC jacks 84 is mounted on each PCB 80 and protrude outward in stair-step fashion thereby allowing easy coupling to the network equipment. The PCBs 80 are individually removable. This is desirable to the operator because they do not need to fully load the telecommunication assembly 10 with PCBs until telecommunication network growth requires such.

Referring now with particularity to Figs. 4, 6 and 13, the individual PCBs 80 are shown that individually and in the aggregate form the backplane of the telecommunication assembly 10. As stated previously, only one PCB 80 is needed for the telecommunication assembly 10 to be operational. Moreover, the present invention also provides a module-less feature such that the telecommunication assembly 10 is enabled to cross-connect two separate devices of networking equipment to each other without any of the modules 100 being installed in the assembly 10.

Fig. 13 shows two devices of networking equipment 130, 140, such as a router and a multiplexer, being cross-connected via a single backplane circuit board 80. It is understood that the two devices of networking equipment could be any devices capable of communicating with each other via electrical signals and that are commonly used in telephone copper networks. To perform the function of cross-connecting the networking equipment 130, 140, the IN port on the first piece of networking equipment 130 is coupled to the X-OUT port on the backplane circuit board 80, which, in turn, is connected to the OUT port that is also contained on the backplane circuit board 80. Finally, the OUT port of the circuit board 80 is coupled to the OUT port of the second piece of networking equipment 140.

In addition, the IN port of the second piece of networking equipment 140 is coupled to the IN port of the backplane circuit board, which, in turn, is connected via the circuit board 80 to the X-IN port and finally to the OUT port of the first piece of networking equipment 130. The circuit diagram coupling the ports on the PCB 80 is also shown in Fig. 10. Such cross-connecting occurs without the need of a module 100 being disposed in the telecommunication assembly 10 or connected via the card edge connector 82 to the PCB

80. This function yields added versatility and greatly reduces costs over prior telecommunication assemblies.

5 Although the invention has been described in detail above, it is expressly understood that it will be apparent to persons skilled in the relevant art that the invention may be modified without departing from the spirit of the invention. Various changes of form, design, or arrangement may be made to the invention without departing from the spirit and scope of the invention. Therefore, the above-mentioned description is to be considered exemplary, rather than limiting, and the true scope of the invention is that defined in the following claims.

What is claimed is:

1. A telecommunication assembly disposed to receive a plurality of modules therein, the telecommunication assembly for coupling to a telecommunication network and comprising:

5 a plurality of distinct backplanes secured in the telecommunications assembly each for coupling to one of the plurality of modules, each of the plurality of distinct backplanes including:

a back side,

10 a plurality of first connectors coupled to the back side for receiving a telecommunication signal from the telecommunication network,

a front side coupled to the back side, and

15 a second connector mounted on the front side and spaced apart from the at least one jack, the second connector for coupling to one of the plurality of modules, wherein the second connector for coupling to one of the plurality of modules, wherein the second connector is a normally closed connector such that a circuit is formed and operable between the plurality of first connectors without a module being connected to the second connector.

20 2. The telecommunication assembly of claim 1 wherein the plurality of distinct backplanes is releasably secured within the telecommunication assembly.

25 3. The telecommunication assembly of claim 1 and further wherein the telecommunication assembly is operable with one or more of the plurality of distinct backplanes removed from the assembly.

4. A telecommunication assembly disposed to receive a plurality of modules therein, the telecommunication assembly for coupling to a telecommunication network and comprising:

30 a plurality of distinct backplanes secured in the telecommunications assembly each for coupling to one of the plurality of modules, each of the plurality of distinct backplanes

including:

a back side;

a plurality of first connectors coupled to the back side for receiving a telecommunication signal from the telecommunication network;

5 a front side coupled to the back side;

a second connector mounted on the front side and spaced apart from the at least one jack, the second connector for coupling to one of the plurality of modules, wherein the second connector is a normally closed connector such that a circuit is formed and operable between the plurality of first connectors without a module being connected to the second connector; and further wherein the second connector is disposed to make an electrical connection to the module before the circuit between the plurality of first connectors is broken.

10

5. The telecommunication assembly of claim 4 wherein the plurality of distinct backplanes is releasably secured within the telecommunication assembly.

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6. The telecommunication assembly of claim 4 and further wherein the telecommunication assembly is operable with one or more of the plurality of distinct backplanes removed from the assembly.

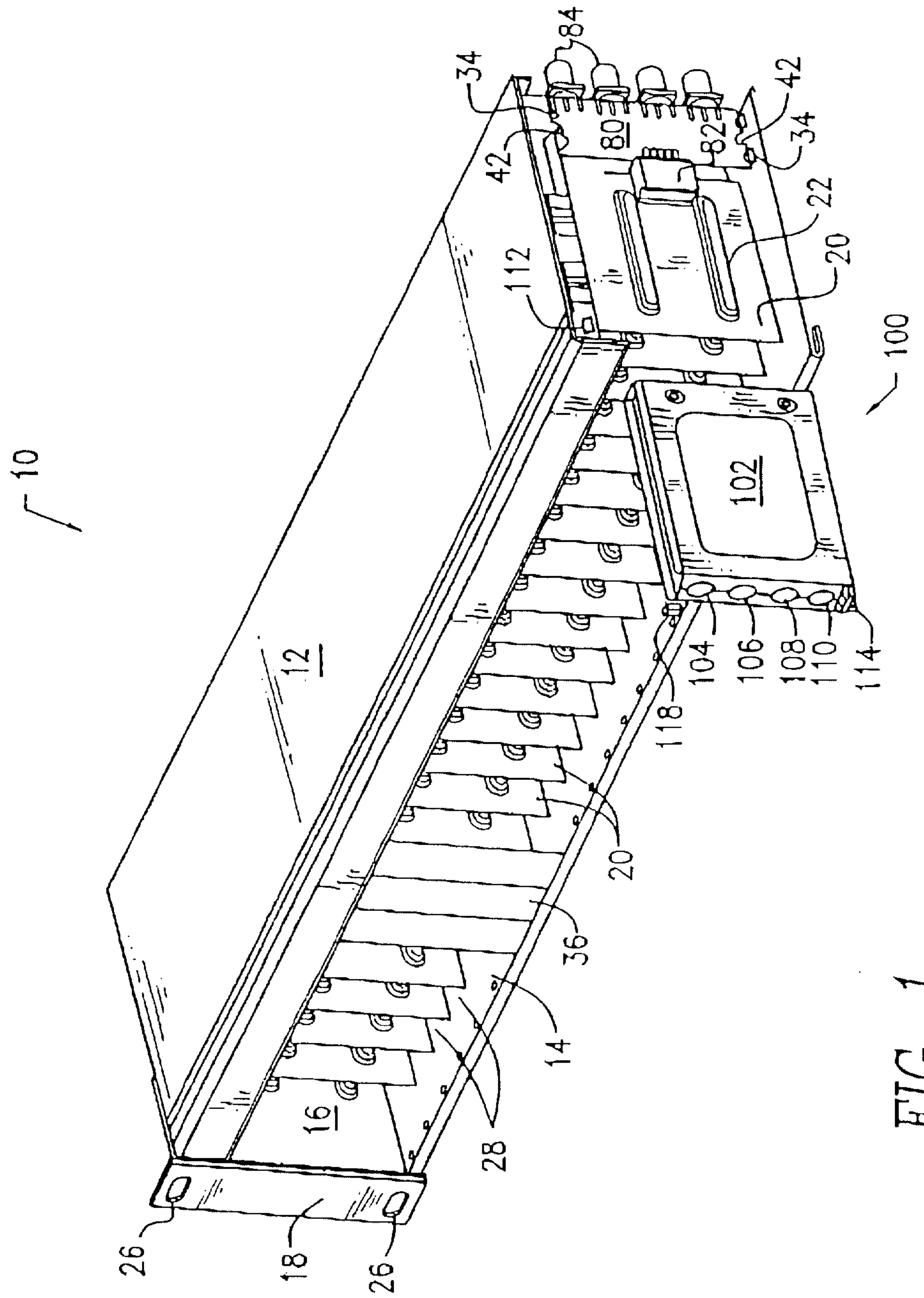


FIG. 1

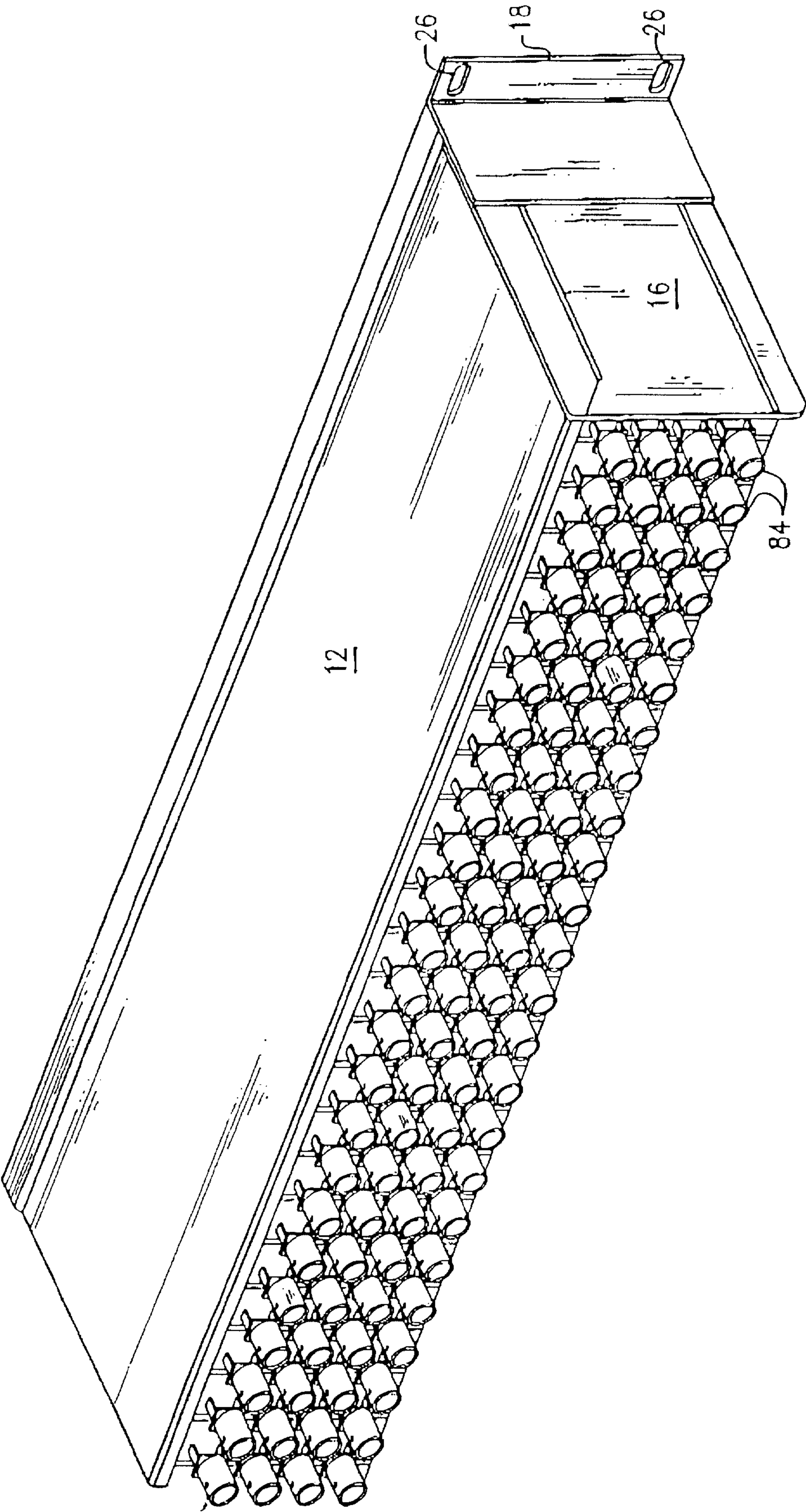


FIG. 2

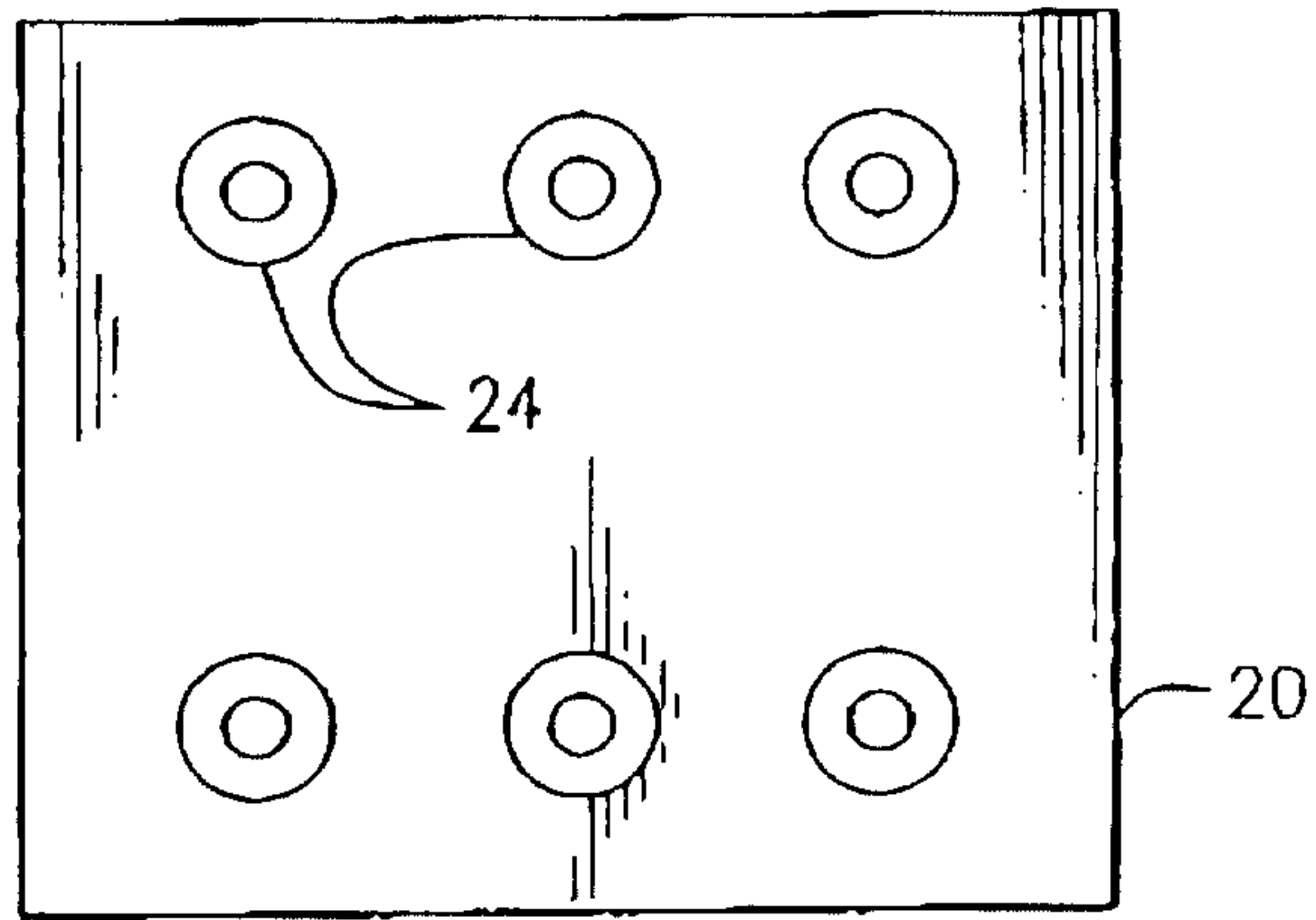


FIG. 3

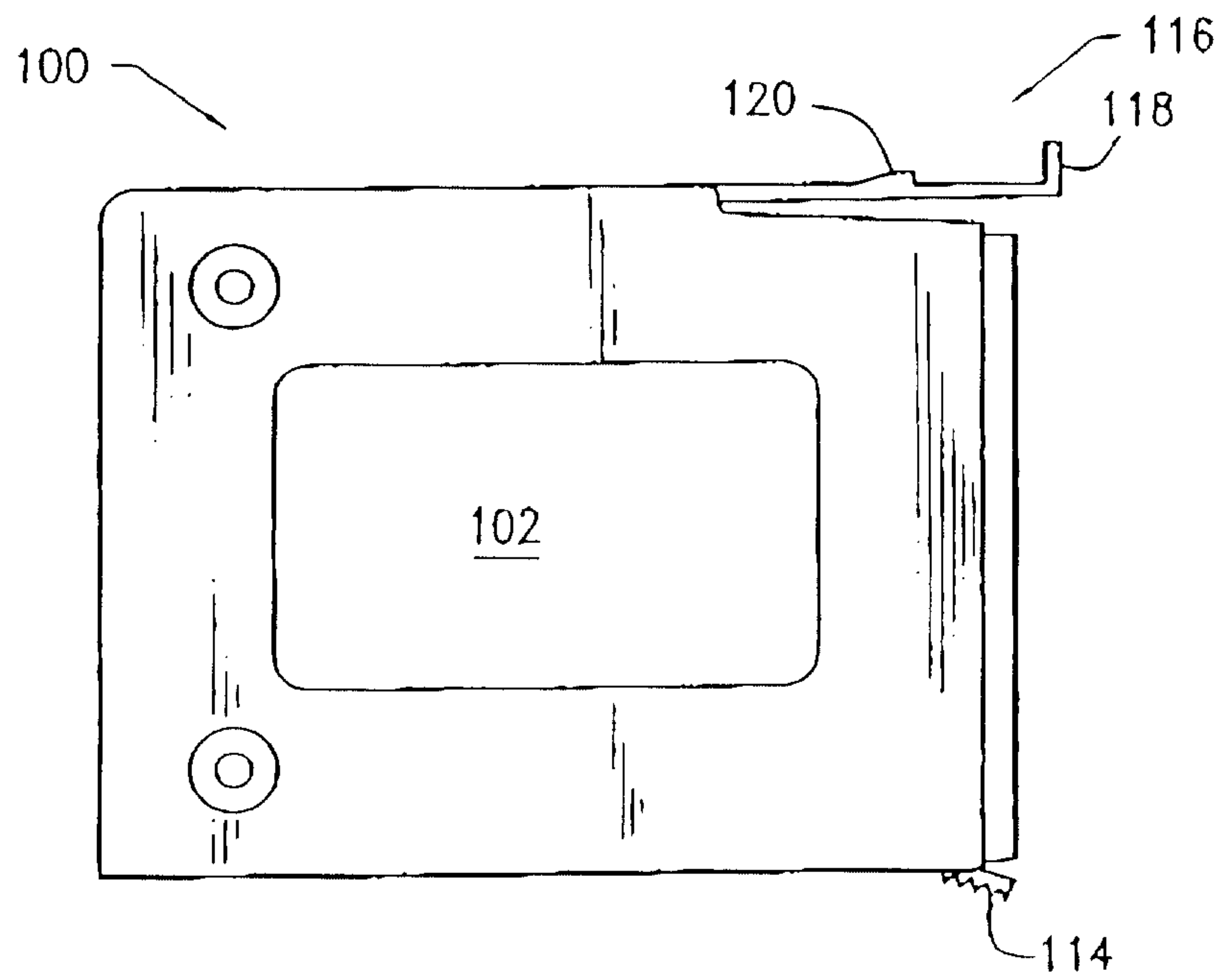


FIG. 5

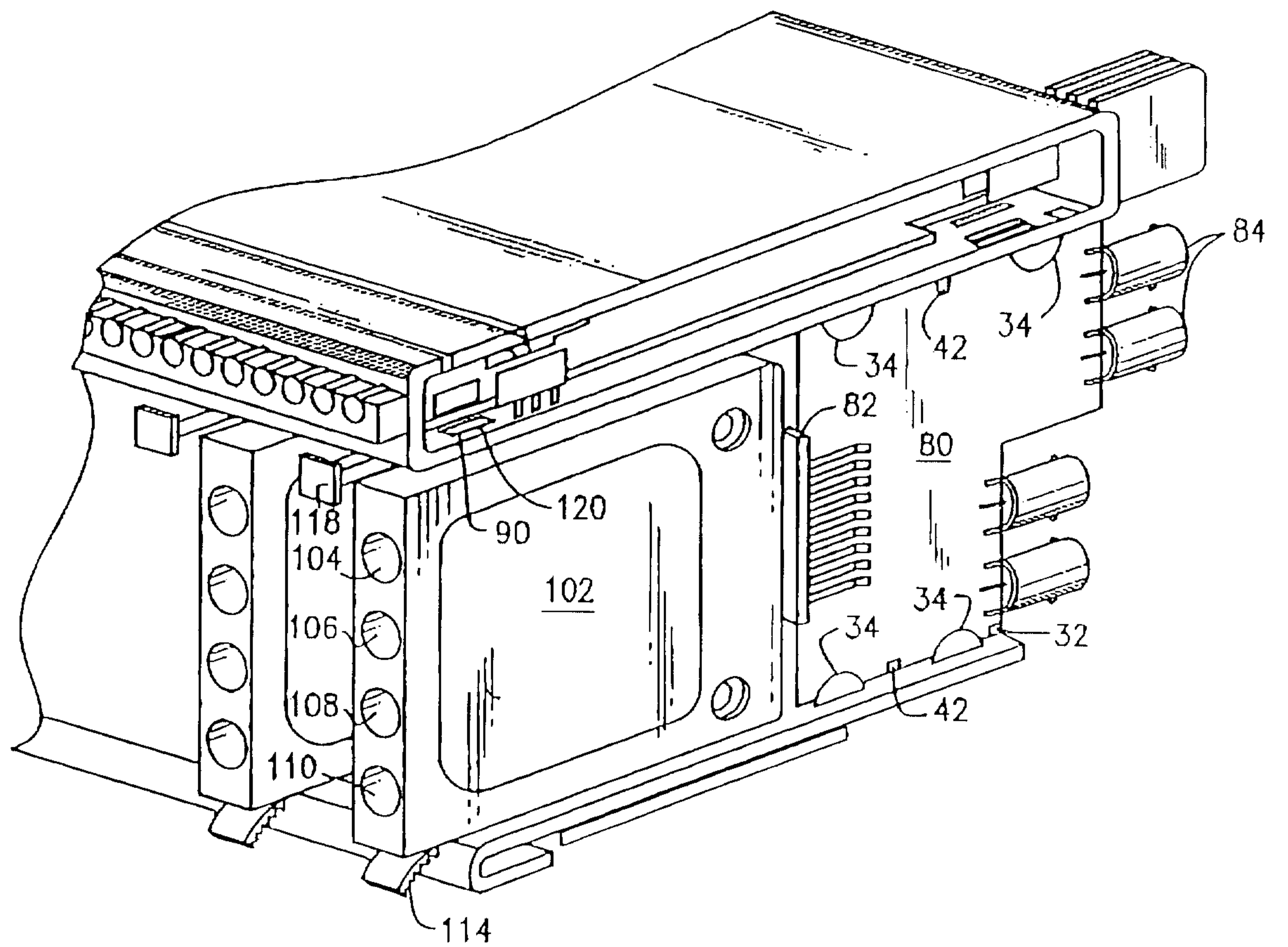


FIG. 4

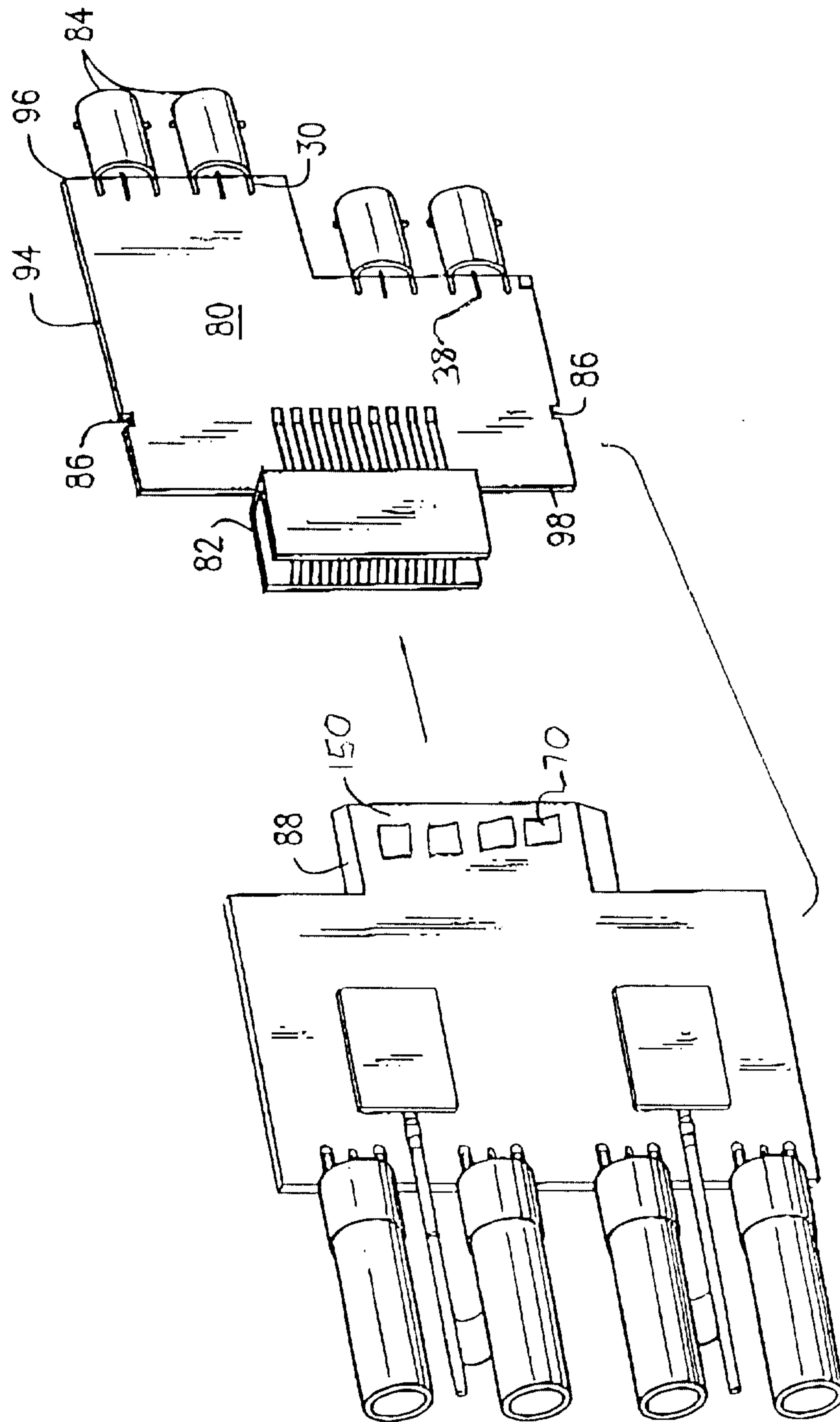


FIG. 6

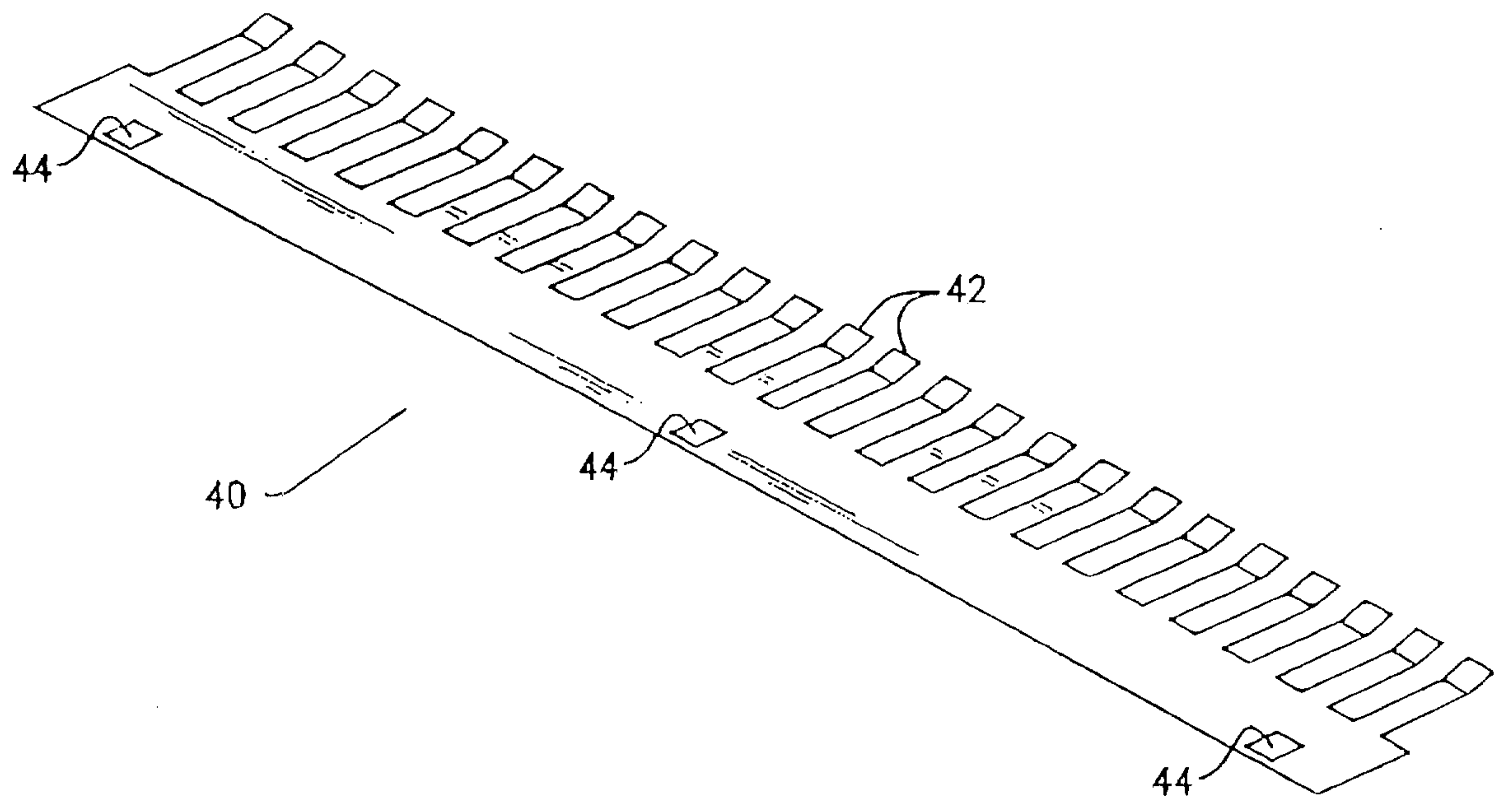


FIG. 7

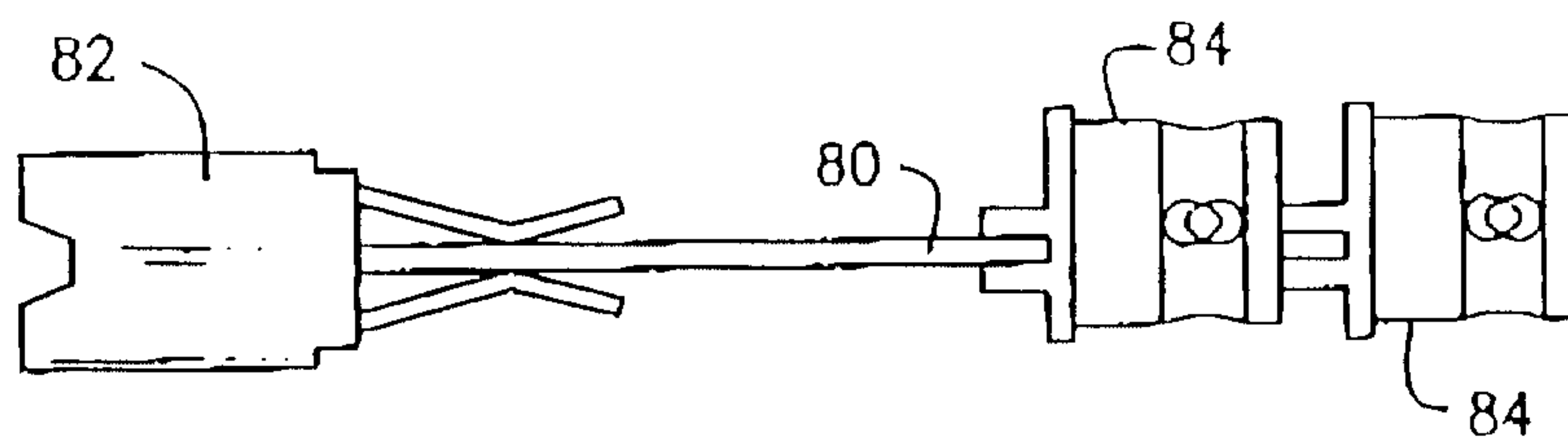


FIG. 8

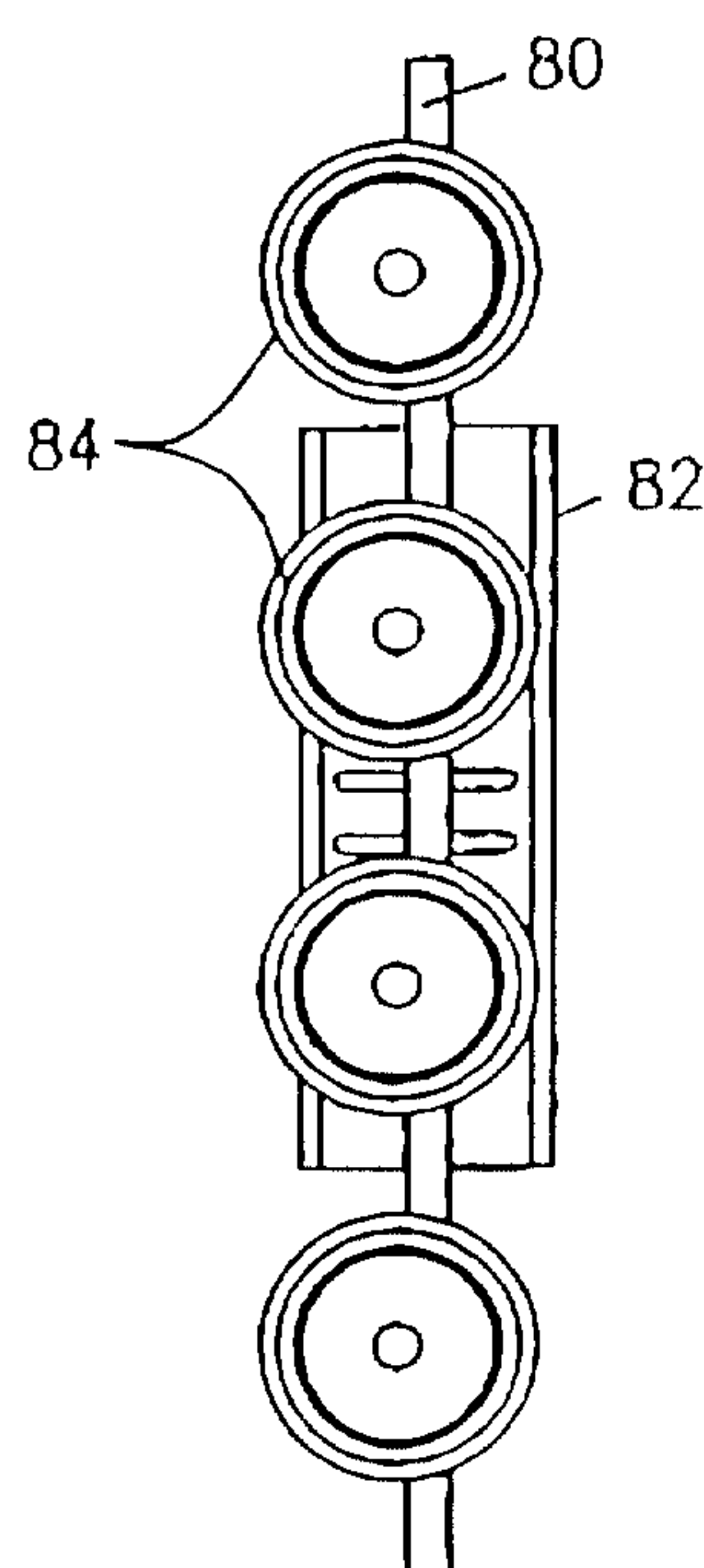


FIG. 9

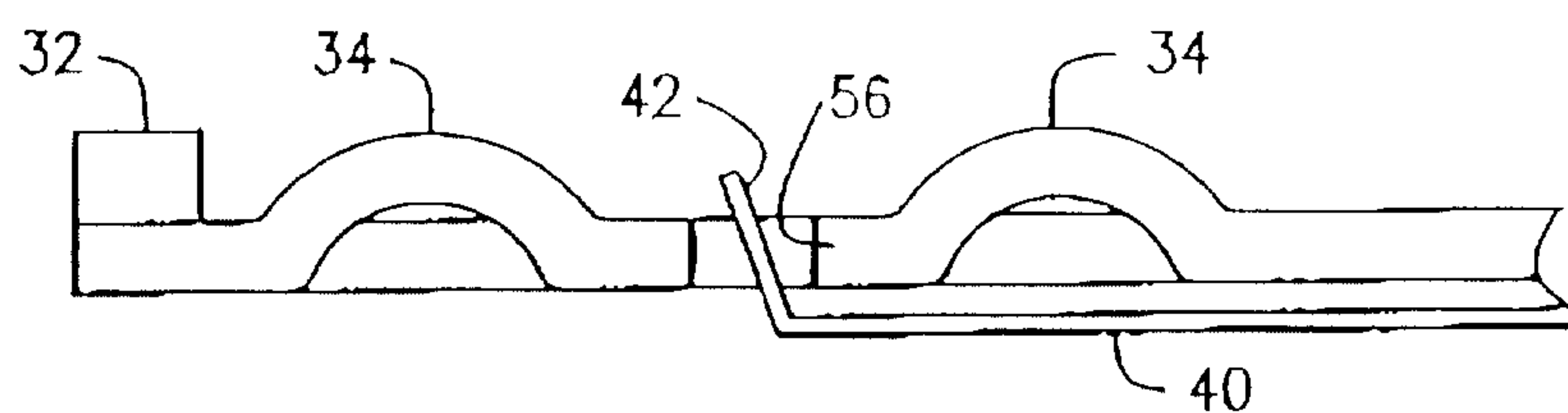


FIG. 11

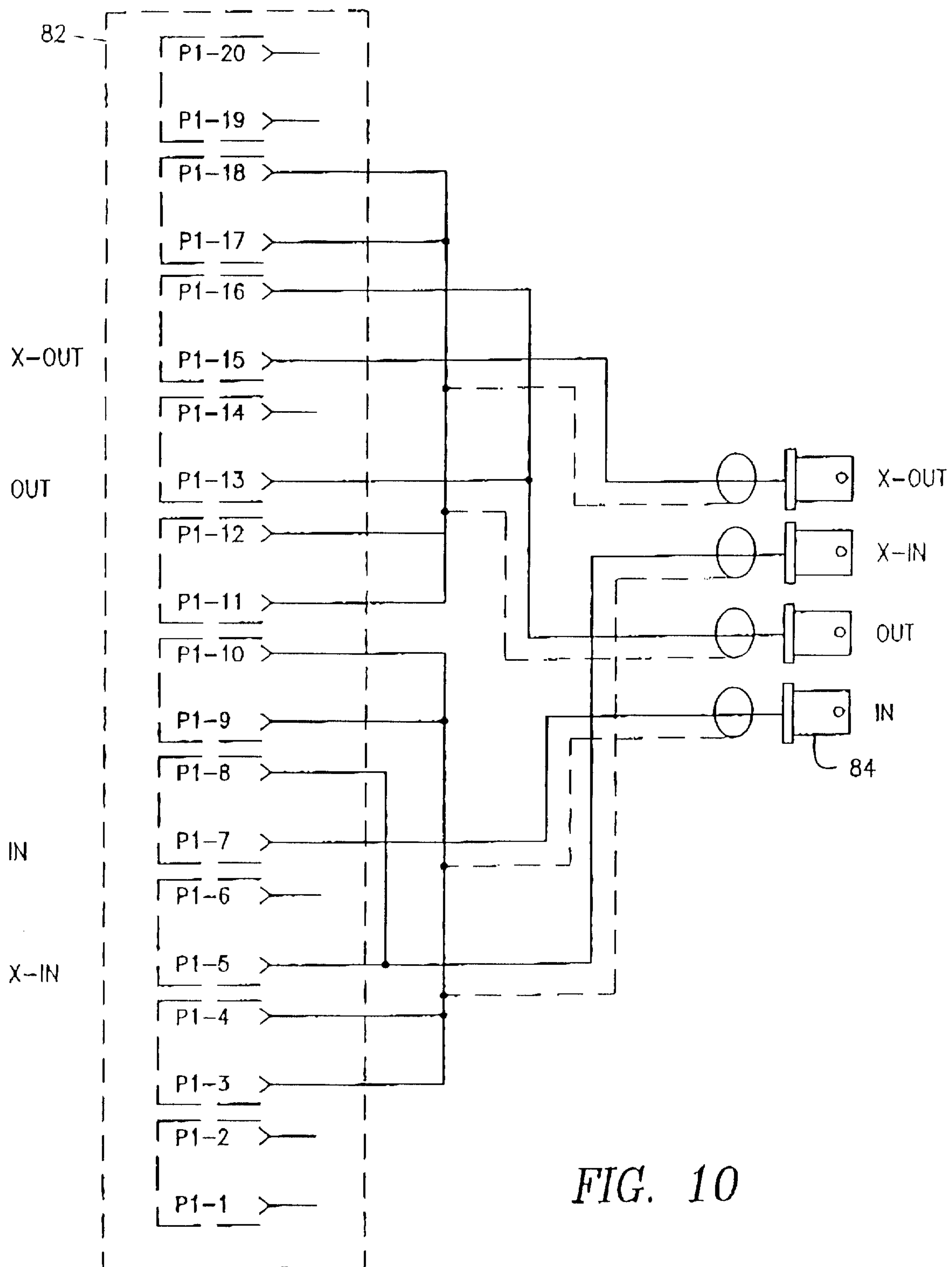


FIG. 10

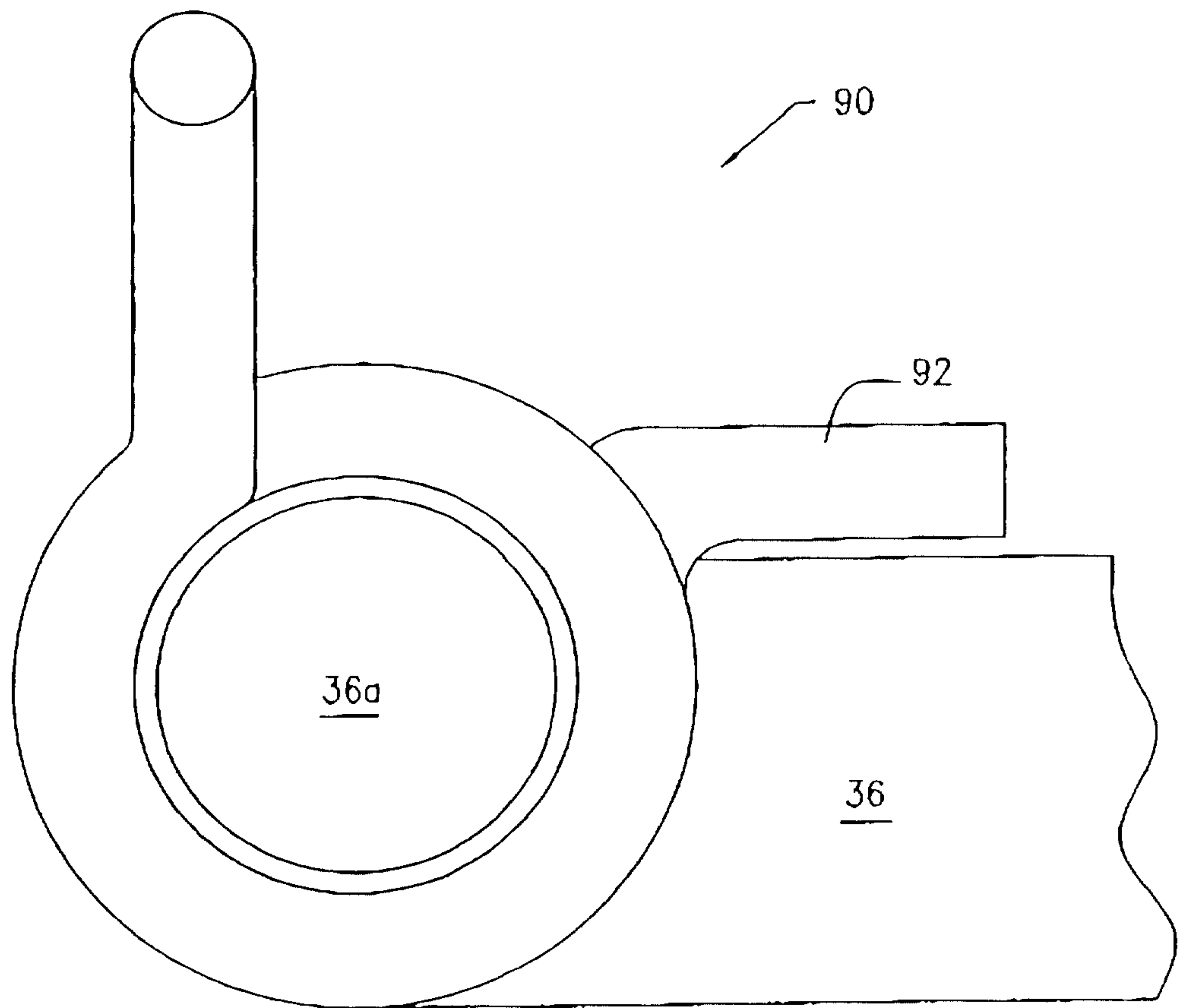


FIG. 12

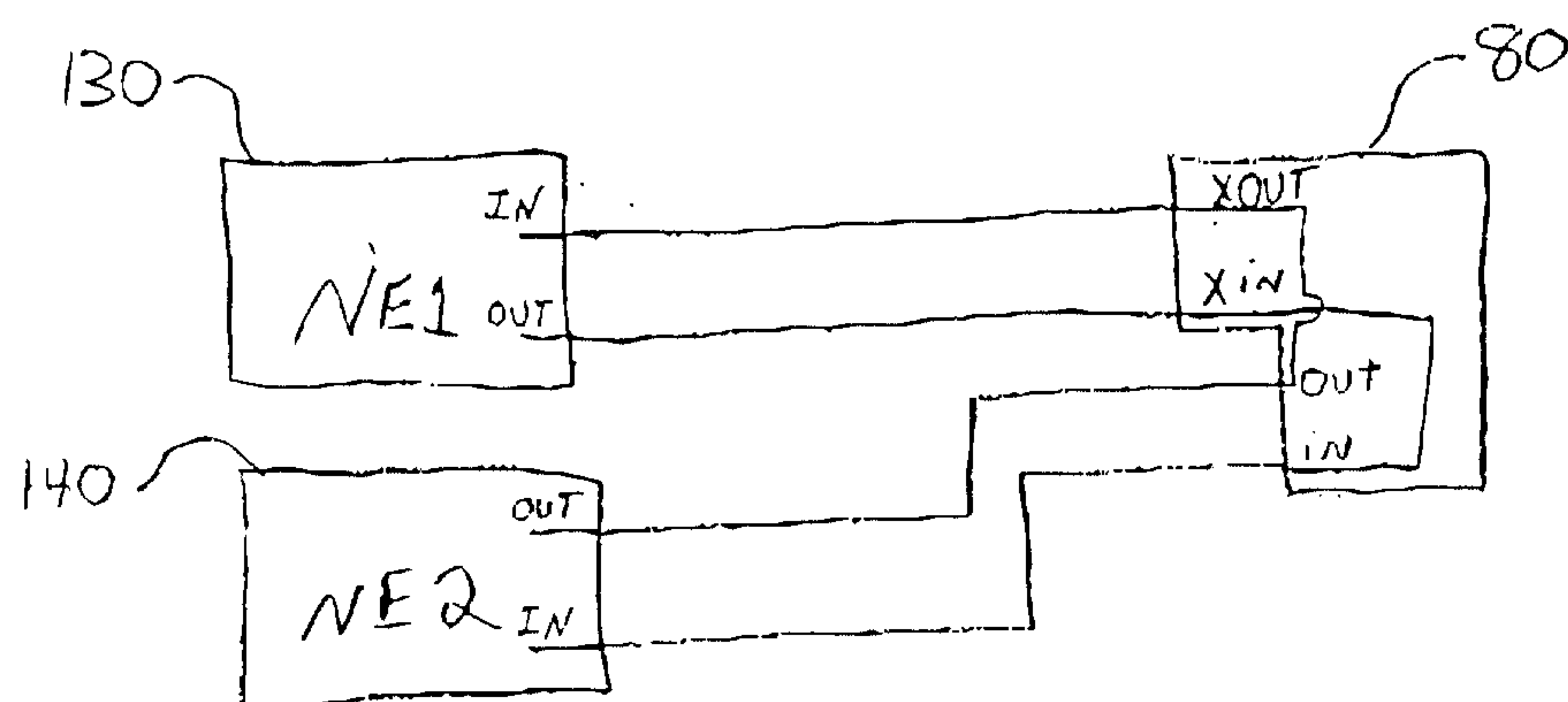


FIG. 13

